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MEASUREMENT OF INFLATION FORECAST TARGETING. A PROPOSAL OF METHODOLOGICAL SOLUTION

Magdalena Szyszko

Introduction

Modern monetary policy focuses on inflation expectations. It is consistent with modern monetary theory: new neoclassical synthesis (NNS). NNS gives the background of monetary transmission mechanism. New Keynesian Phillips Curve, IS curve (production equation) as well as central bank's reaction function include economic agents' expectations. The NNS and its implications for monetary policy are broadly described in the literature (Goodfriend & King, 1997; Galí, 2008; Woodford, 2003). Central bankers are continuously searching for the tools that would enhance their opportunity to influence inflation expectations. Inflation targeting (IT) framework of monetary policy is an optimal solution for the central bank's functioning within the frames of NNS. IT constitutes various possibilities for shaping expectations of the public that is focusing on numerically set inflation target, **producing and publishing inflation forecast**, setting floating exchange rate regime, and, finally, ensuring central bank's independence and transparency. Possibility of shaping inflation expectations in the frameworks of IT is confirmed in theoretical (Eusepi & Preston, 2010) and empirical research (Strohsal & Winkelmann, 2015). However there are also research questioning such it (Kumar et al., 2015). Regardless some papers suggesting the central bank's ineffectiveness in shaping expectations, IT is perceived as the best way of implementing modern monetary policy.

One argues that the central bank's inflation forecast is one of the most important tools of supporting inflation expectations (Skořepa & Kotlán, 2003). Empirical research proves that there are interdependences between inflation forecast and inflation expectations (Szyszko, 2015). Other research (i.e. Brzoza-Brzezina & Kot, 2008; Geraats, 2009; Faust & Svensson, 2001) confirms the impact of the

forecast publication on the economy and its performance as well as on the central bank's ability to achieve its goals. The forecast also supports the Monetary Policy Committee (MPC) decision-making process. It offers at least concise framework for policy analysis but it can be even intermediate target for monetary policy.

The context of the central bank's inflation forecast is, however, quite complicated. It covers methodology of forecasting, the way in which the forecast is published and a possible impact of the forecast result on the central bank's decision on the interest rates. The forecast of inflation may even become intermediate target of monetary policy when the central bank implements inflation forecast targeting (IFT). There is wide research into the field of possible use of inflation forecast in monetary policy (presented in next section). The central banks' practice here also varies substantially.

The following paper is of methodological nature and it introduces the inflation forecast targeting index (hereafter: IFT index). It has been designed to measure IFT implementation. Verification of various hypotheses on the existence of the relation between the IFT and other aspects of monetary policy with the use of such index is possible. The IFT index gives also a concise framework of practical aspects of IFT. Such an index has not been presented in the literature up to now. The elaboration of IFT index is thus the main purpose of the following paper. Another goal is to discuss its possible implementations in the research as the index opens the possibility to further research on forecast usefulness in monetary policy.

One may ask a question at this point: the question on the validity of qualitative aspects measurement. The arguments in favor of such a measurement refer to the inflation forecast

importance for monetary policy, both in the decision making process and communication. This measurement makes it possible to draw profound conclusions on the relations and causality. It also opens the field for territorial and over-time comparison of the central banks' practice. That is why the literature gives numerous examples of qualitative aspects measures.

The following paper is divided into four sections. The first one presents the literature overview of the inflation forecast targeting, which is the basis for designing the IFT aspects. It also highlights the importance of inflation forecast for a modern central bank. The second section presents details on measuring transparency of the central bank. The literature in this case gives some solutions to the accepted ways of qualitative aspects measurement, including transparency. The third section is of methodological nature and it describes the tool (IFT index). The last section is on possible index implementation in empirical research.

The paper contributes to the literature on inflation forecast targeting and broadly on inflation targeting strategy. It also contributes to the discussion on measurement of qualitative aspects of monetary policy.

1. Inflation Forecast Targeting: Literature Review

The inflation forecast is an immanent part of a fully-fledged inflation targeting. A central bank produces its own forecasts, uses them in the decision-making process and reveals them to the public. Inflation targeting, which is perceived to be the best monetary policy strategy by the consensus of NNS, may become **inflation forecast targeting** (IFT), where inflation forecast is an intermediate objective of monetary policy. It is by definition a current variable which is the most correlated with the final goal, it is more controllable than the final goal, and it can be made more observable. It can also be made very transparent and facilitate the central bank's communication with the public (Debelle, 1997). Moreover, inflation forecast integrates a broad set of historical and current data as well as the expectations. It means that one variable – the forecast – includes the idea of analyzing various data, simultaneously giving the simplicity of following an intermediate target commitment. One argues that subscribing the

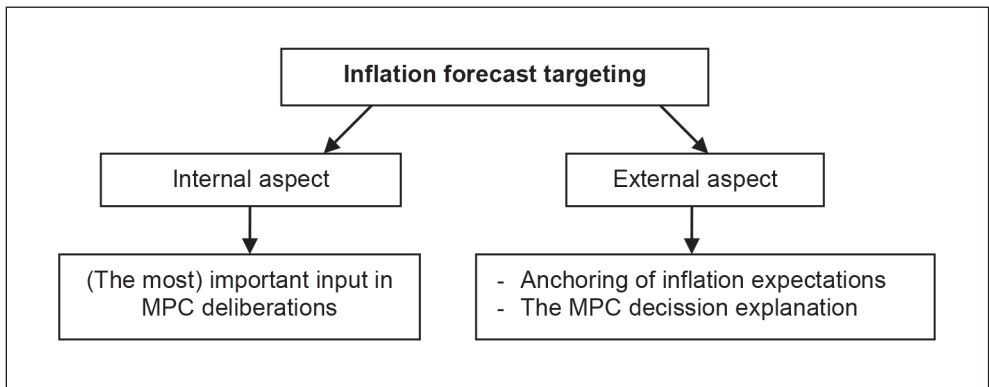
function of an intermediate target to the inflation forecast simplifies both implementing and monitoring monetary policy (Svensson, 1997). The idea of IFT has been broadly described in the literature. The main threads of this discussion are presented below.

The central bank's inflation forecast for the period of inflation forecast targeting horizon becomes an intermediate target. Hence the instrument should be set so as to make the inflation forecast equal to the inflation target. Following this rule is claimed to be the best central bank's practice. Ex post inflation may differ from the targeted level because of forecast errors (Svensson, 1996). The decision-making procedure of IFT is repeated by the monetary committee at any decision meeting. The forecasts and interest rate level are brought up to date if it is necessary. That is why IFT becomes a dynamic optimization procedure (Szyszko, 2013). The inflation forecast may become the input to the decision-making process of the central bank, even when the forecast is not published (implicit IFT). Revealing inflation forecast makes it possible to fulfill the external forecast function: the explanatory one – regarding the decision that has just been made and enhancing the central banks' ability to influence economic agents' expectations. This broader approach to IFT constitutes a concise framework for both the decision and its communication. That is why from the practical point of view, inflation forecast targeting encompasses two aspects (Fig. 1).

Inflation forecast targeting may also be perceived as a monetary policy rule (Woodford, 2012). As a rule, the IFT makes the decision making process more systematic and concise. It also facilitates the introduction of new members into decision-making body. Declaration on IFT implementation limits the possibility to influence the central banks' decision as such an influence, if in contradiction with the rule, can be easily captured by the public. Finally, any monetary policy rule makes the MPC decisions anticipation easier, which supports expectations formation.

The central bank may produce the inflation forecast under the assumption of constant central bank's rates (CIR) and the central bank's interest rates consistent with market expectations (ME). Such a forecast is called conditional (projection). Alternative option is interest rates endogenisation (unconditional

Fig. 1: Extended approach to IFT



Source: own

forecast). Forecasting methodology has been evolving over time from constant rate assumption to unconditional forecast. It is embodied in the discussion on the optimal level of the central bank's transparency and the way of signaling its intentions. Producing and revealing policy path – the central bank's interest rates consistent with the forecast is the next frontier in the central bank's transparency. Overruling the assumption on the constant central bank's rates brings the necessity to elaborate the MPC reaction function. It is mostly in line with the Taylor Rule which is an instrument rule. Its genuine specifications determine the changes of the central bank's interest rates as the result of the actual inflation deviation from the inflation target (inflation gap) and the deviation of the product from its potential level (output gap) (Taylor, 1993). Modern specification refers to inflation forecast or inflation expectations instead of actual inflation, which makes the rule forward-looking. The other possibility is a specific targeting rule which specifies condition for the forecasts of the target variables (inflation and output). The policy path should be set to ensure the equality of the marginal rates of transformation of the combination of output-gap forecast into the two-period-ahead inflation forecast and the marginal rates of substitution of inflation in period $t+j$, for the output gap in period $t+k$. Then, the monetary-policy problem consists of finding the combination of forecasts and instrument path consistent with the central bank's forecasting model (Svensson, 2003),

(Woodford, 2013). The specific targeting rule is used in the Bank of Sweden. Regardless of the severe criticism, the Taylor Rule or similar specifications of reaction functions are more often used by the central banks.

The discussion on revealing a policy path, especially in a numerical way (on the fan chart usually) is still quite vivid. Only several central banks do so, that is central banks of: The Czech Republic, New Zealand, Israel, Norway, and Sweden.

Decision making rule depends on the way how the central banks' interest rates are captured by the economic model. However, the starting point is the same: the instrument should be set to stabilize inflation on the targeted level in the monetary policy horizon (Leitemo, 2006). The simplest version is just a rule of thumb applicable to conditional forecasts: if the inflation target is above (below) the target within the monetary policy horizon, the main rate of the monetary policy should be raised (lowered). If the central path of inflation in the monetary policy horizon is on the targeted level – no interest rates change is required. This is how the IFT was described in the earliest literature on the subject (Svensson, 1997). When the forecast is produced, the central bank makes a decision on the next change of the interest rates and nothing else. It is conceptually easier than giving the whole path of interest rates. This approach is still used by the central banks producing conditional forecasts. However, a more developed rule requires optimal policy

path for the entire forecast horizon. It is possible, in the way consistent with the model, only with the interest rates endogenisation. Moreover, the MPC may discuss several interest paths for one forecast. It chooses the one that in its opinion is the best solution from inflation (and output) stabilization point of view (Svensson, 1999). When the policy path for a longer horizon is produced, the central bank's decision in line with the forecast means following the path. As it is relatively easily when the forecast is up to date, the policy paths for longer term is not obeyed. There is empirical research which confirms that the forecasts of interest rates had little or no informational value when the horizon exceeded two quarters (six months), although they were good in the next quarter and reasonable in the following one (Goodhart & Bin Lim, 2011). The reasons are obvious: in time the forecast and the policy path itself become stale. A new forecast with a new solution on interest rates appears. The central bank's decision procedures are not designed to make decisions on interest rates for subsequent periods as well.

The discussion on the central bank's transparency and its optimal level means nowadays deliberations on central bank's forecast relevance as well as publishing other information connected with forecasting procedures (assumptions, model, errors, risk assessment, policy path). Transparency is beneficial when it serves to simplify communication with the public and helps generate support for central banks to conduct the monetary policy optimally with an appropriate focus on the long-run objectives. However, it can complicate the communication process and weaken support for a central bank

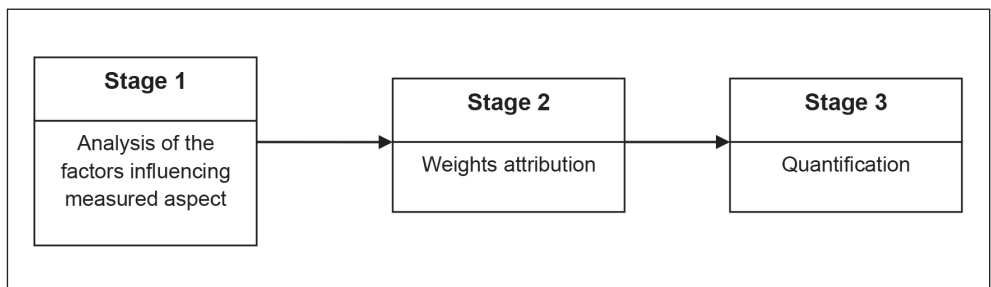
focus on the long-run objectives (Mishkin, 2004). The optimal level of transparency cannot be easily determined. The theoretical discussion on this issue is still in progress. The central banks' practices in this field are not unique and their choices are justified differently. However, the transparency level of the monetary policy is largely aligned. The public knows the main goal, instruments and main premises of the decision making process, including forecasts. Moreover, the monetary authority explains the decision which has just been made. The differences are mainly connected with the intentions of future actions demonstration.

The point of view presented in the paper is as follows: the more information on the forecast revealed, the better. This is institutional approach to transparency (Winkler, 2000). The understanding of the information is not examined. Focus on institutional transparency is commonly used in the research.

2. Measuring Transparency of Monetary Policy: Literature Review

A section on the transparency measurement offers a brief explanation of the need and the ways of such a measurement. Inflation forecast targeting is also a qualitative procedure. It is related to the central bank's transparency which is one of the institutional (qualitative) aspects of modern monetary policy together with independence, accountability and credibility. As transparency is of qualitative nature and is not directly observed, the problem of the measurement appeared here. Descriptive analyses are not enough as they are

Fig. 2: Measurement of qualitative aspects of monetary policy



Source: own

not sufficient for developed research, finding interdependences and causalities. Elaboration of the qualitative aspect measure facilitates the analysis of the relations between the level of their implementation and the central bank's

effectiveness or the economic performance. That is why, regardless of the reproaches of non-objectivity, measures of qualitative aspects are described in the literature and used in the research.

Tab. 1: Transparency measures – the examples

Authors	Factors coverage	Comment
Fy et al. (2000)	<ul style="list-style-type: none"> ▪ prompt public explanation of policy decision, ▪ frequency and form of forward-looking analysis provided to the public, ▪ frequency of bulletins, research papers, speeches 	Quite narrow approach to transparency. First approach to the measurement in the literature.
Bini-Smaghi & Gros (2001)	<ul style="list-style-type: none"> ▪ objectives, ▪ strategy, ▪ publication of data and forecasts, ▪ communication strategy 	Analysis of transparency and accountability.
Fracasso, Genberg, & Wyplosz (2003)	<ul style="list-style-type: none"> ▪ assumptions about key macroeconomic variables, ▪ the presentation of the policy-making process, ▪ the executive summary; ▪ expertise, completeness, writing style and information 	On the basis of Inflation Reports analysis; the authors delivered an overall rating of Inflation Reports; quantity, quality and accessibility of information is assessed.
Eijffinger & Geraats (2006)	<ul style="list-style-type: none"> ▪ political transparency (openness about policy objectives), ▪ economic transparency (openness about data, models and forecasts), ▪ procedural transparency (openness about the way decisions are taken, achieved mainly through the release of minutes and votes), ▪ policy transparency (openness about the policy implications, achieved through prompt announcements and explanation of decisions), ▪ operational transparency (openness about the implementation of those decisions, in other words about control errors and macroeconomic disturbances affecting their magnitude) 	This approach is frequently used in the literature (Dincer & Eichengreen, 2007), (Siklos, 2010) to cross-country and over-time comparison. Geraats taxonomy for transparency analysis was its background (Geraats, 2001). This measure is popular due to wide coverage of different aspects of transparency, consistency with inflation targeting and detailed description of the points attribution, which facilitates measurement. It is also inspiration for other measurements (Bajalan Raei, & Tehrani, 2012) and the basis for regression analysis (Crowe & Meade, 2008), (Dincer & Eichengreen, 2014).
Bajalan, Raei, & Tehrani (2012)	<ul style="list-style-type: none"> ▪ openness of the policy (based at the Eijffinger-Geraats index), ▪ clarity referring to presentation and analysis of information, ▪ honesty referring to the intentions of the information sender, ▪ common understanding referring to the linguistic code of both, the sender and receiver. 	More developed conceptual framework of the index. It tries to capture the possible gap between intentions of the sender and understanding of the information by the receiver.

Source: own on the basis of the literature given in the table

The way how the measurement is conducted is similar regardless of the authorship of the measure (Fig. 2). It starts with the identification of the factors that influence the measure. The empirical and theoretical research gives a background of such an analysis. Usually a broad set of factors is enumerated here. It makes it possible to capture the changes more exactly in comparison with a simple one to one identification. Then, the weights are attributed. Finally, the measurement itself takes place. Tab. 1 presents several examples of such measures.

IFT procedure is connected with the central banks' transparency in the field of revealing forecasting methods, decision-making procedures, decisions explanations and signaling central bank's intentions. This is why Tab. 1 presents several transparency measures. They refer to general transparency. They are all survey based measures – a questionnaire with factors affecting the transparency is used to quantify the level of transparency. Alternative measures of transparency refer to the market data: if the monetary policy is transparent, the news on central banks actions drive to less remarkable shifts in yields curves. This kind of measurement refers also to the central banks' news understanding. Standard measures do not capture understanding.

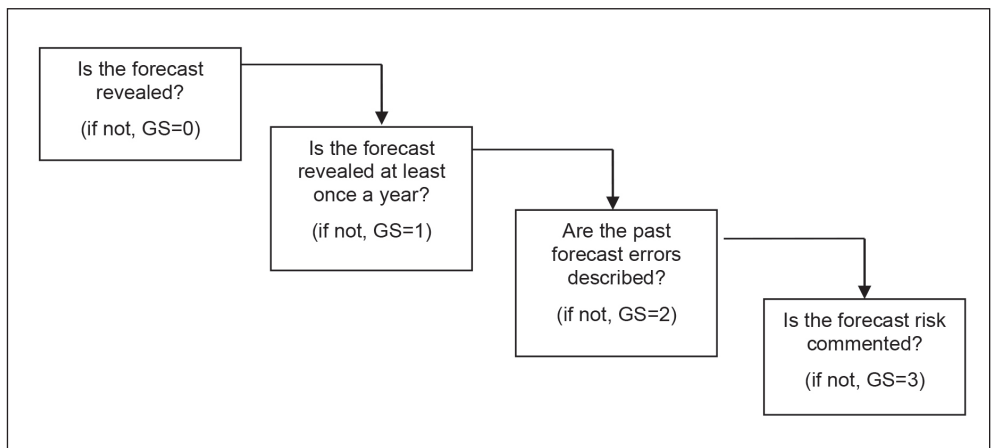
Transparency measures differs with the authors' different point of view and the goal

of the research. This subjectivity is most remarkable reproach to qualitative aspects measurement. Not the only one. It is also difficult to describe precisely what the points should be attributed. For example, one of the questions in Eijffinger-Geraats index is: *Does the central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?* And the ½ point answer is: *yes, but superficially.*

The qualitative indices are also not resistant to the changes. When Fry et al. (2000) index was developed there was no discussion on revealing the central banks' policy path. Nowadays the transparency on the field of goals is quite obvious. The discussion on the optimal transparency focuses on the central bank's intentions. Inflation forecast and IFT is in the center of the debate on optimal decision rules and communication of future actions. In the literature, there is no complex measure of IFT implementation to capture and compare it.

However, there is a proposal of measuring transparency of inflation forecast with a Guttman scale. Guttman scale makes it possible to discover intensity structure between several aspects (features, statement describing a variable). It is commonly used in sociological research. The starting point in scale elaboration is an assumption that a respondent that accepts advanced level (or aspect) of variable accepts the lower one as well. The scale offers

Fig. 3: Guttman scale for transparency of forecasting system



Source: Chortareas et al. (2002)

hierarchic arrangement of the variable' features. It is monotonic which means that the probability of accepting a statement on the scale is higher than accepting subsequent statement and lower than accepting the previous one. The scale organizes the features in such a sequence, that acceptance of a statement at any level means the acceptance of any statements which are on upper levels. The example of Guttman scale for transparency of inflation forecast is presented in Fig. 3.

The scale may be modified and enlarged with respect to its monotonic character. Main reproach to this measure is that forecasting procedures and the way how the forecast is published do not impose any hierarchy. The central bank may publish any element of forecasting system except the forecast. Capturing the sequence of the element is not necessary and may be binding. IFT elaborated in the following section offers alternative approach to measuring IFT, conceptually closer to monetary policy transparency measures.

3. IFT Index – Conceptual Frameworks

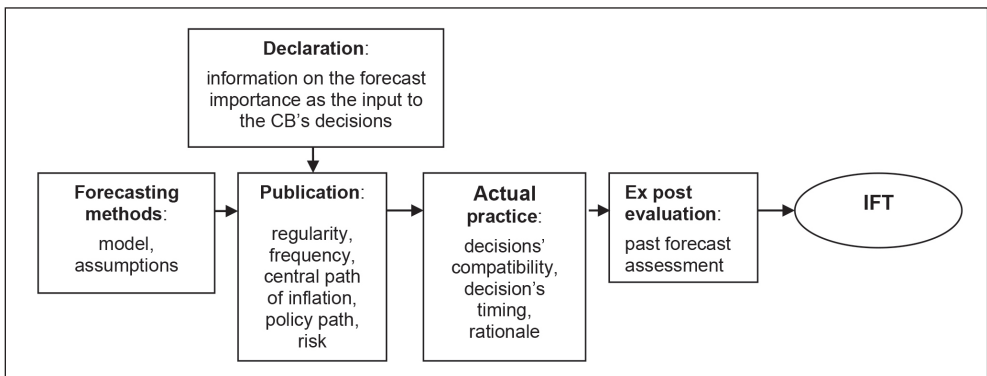
The IFT index elaborated here distinguishes 5 aspects of IFT. They are presented in Fig. 4. While designing the components of IFT, it was assumed that IFT means several aspects of revealing the forecast as well as using the forecast as the input into MPC deliberations. That is why the aspects cover:

- *forecasting methodology*: including model that reveals the framework of the MPC

analysis as it describes transmission mechanism of the monetary policy, and information on the assumptions for the cut-off day of the forecast; producing the forecast is the first step in IFT implementation;

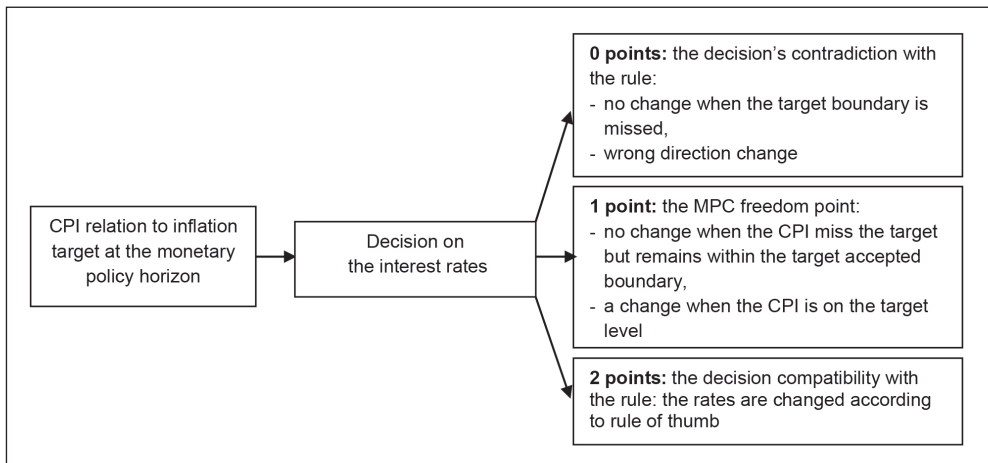
- *declaration*: just prior to publishing the first forecast (usually in the same document), the central bank should inform the markets what is the role of the forecast in the monetary policy; public announcement opens the field for treating the forecast as the intermediate target;
- *publication*: to shape inflation expectations or to become intermediate target (for the MPC and under the public control) the forecast should be revealed; the regularity of the publication and its higher frequency enhance the possibility to influence expectations; it also means that the central banker has the most up to date forecast possible; the way how the forecast is published (central path of inflation alone or with the policy path) depends on the central banks' interest rate endogenisation and the central bank's will to reveal its next possible steps;
- *actual practice*: crucial aspect of IFT, it checks the central bank's decisions consistency with the inflation forecast, in other words, it verifies whether the rule is actually implemented, the way how the decision compatibility with the forecast is checked is described in Fig. 5 and 6; this aspect covers also decision timing – the analysis whether the central bank takes

Fig. 4: IFT index aspects



Source: own

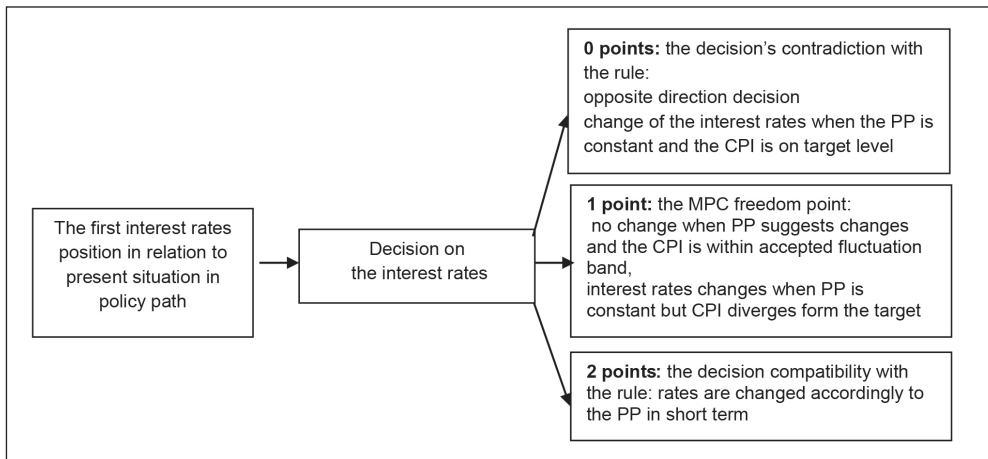
Fig. 5: The MPC's decisions compatibility for conditional forecast



Source: own

Note: CPI – central path of inflation – the most probable inflation level during the forecast horizon

Fig. 6: The MPC's decisions compatibility for unconditional forecast



Source: own

Note: CPI – central path of inflation – the most probable inflation level during the forecast horizon
PP – policy path

the wait and see position, and the forecast in decision explanation (press releases, minutes, rationale of the decision);

- *ex post evaluation*: refers to the past forecasts and may be done either by

comparison of the two subsequent forecasts or by ex post forecast errors; it explains why the decision made previously was not optimal (shocks), what happened in the economy between two forecasting rounds

Tab. 2: IFT index points' attribution rules – Part 1

	Evaluation	Possible options	How to attribute the points
Forecasting methodology	Forecasting model	0 – none ½ – general or partial description 1 – published	Points are attributed for forecasting model's publication in any central bank's document. 1 point – transmission equations are published (without parameters). Actualization when the model's change occurs. When there are several models employed – the main medium-term forecasting tool is considered.
	Assumptions	0 – none ½ – some/different 1 – published	0 – there is no information on interest rate assumption. 1 – the central bank publishes also regularly the other assumptions on exogenous variables. ½ – the way of presenting assumptions changes over time.
Publication	Regularity	0 – no 1 – yes	1 – the same publication schedule in subsequent years. If the schedule is changed, point is not attributed at the first time when the change occurs.
	Frequency	0 – once a year ½ – 2-3 times per year 1 – at least quarterly	If the forecast is produced with higher frequency, the MPC has more up to date input to decision making deliberations.
	Central path of inflation	0 – no 1 – descriptively 2 – numerically	The most important information. Qualitative information refers to the relation of the forecast in monetary policy horizon to the inflation target. Quantitative publication of the central path of inflation (CPI) may be presented on the chart.
	Policy path	0 – no ½ – descriptively 1 – numerically	Qualitative information: description of the next change of the interest rates. Quantitative information: a fan chart with policy path (PP).
	Risk analysis	0 – no 1 – yes	One point is attributed in case of: fan chart with the central path of inflation publication, probability distribution publication, risk description (qualitative), alternative scenario.
Declaration	Information on the forecast importance for the MPC	0 – none ½ – not explicitly 1 – yes	Information on the forecast role in monetary policy. ½ – when it is given descriptively (ex. <i>forecast is one of the inputs...</i>). 1 – for the declaration on the greatest forecast importance or more detailed description of information relevant to decision-making process.

and it presents the forecasts accuracy (which has the impact on their credibility).

The IFT index covers a broad context of IFT implementation. Central banks are free to draw their own solutions in this field, that is why, to enable the same way of points attribution, the detailed way of attributing points with the explanation is given in Tab. 2.

Points attribution for decisions comparability depends on the assumption on the interest rates. It should also consider that the IFT is just a flexible rule for the monetary policy. It means that there is no formal obligation of following the message of the forecast. For many reasons the MPC may ignore the message of the forecast. This may happen when the staff owns the forecast. It means that the MPC is not engaged in the forecasting

Tab. 2: IFT index points' attribution rules – Part 2

	Evaluation	Possible options	How to attribute the points
Actual practice	Decision compatibility	0 – no 1 – partial 2 – yes	Information with the highest weight. The way of compatibility assessment depends on the forecast. For 1 point answer: not following the message of the forecast when it is accepted in terms of the target definition (the MPC freedom point). Detailed solution for describing points at that stage is given below the table.
	Decision timing	0 – when the forecast is produced 1 – in subsequent months	1 point is attributed for: <ul style="list-style-type: none"> ▪ making decision when the forecast is up to date, ▪ no interest rate change in the period between two forecasting rounds. If the decision follows the message of the forecast but in subsequent months – no points 0 – the decision is not in line with the forecast regardless of the decision timing.
	Forecasts in decision's rationale	0 – none $\frac{1}{2}$ – only CPI 1 – communication focused on the forecast	Reference to forecast in decision rationale: $\frac{1}{2}$ if only the central path for inflation is described, 1 for dominating role of the forecast in communication (CPI, risk, alternative scenarios).
Ex post evaluation	Past forecast assessment	0 – none $\frac{1}{2}$ – one out of two possibilities 1 – both descriptions	$\frac{1}{2}$ is attributed for publication of: <ul style="list-style-type: none"> ▪ two subsequent forecasts comparison, ▪ past forecast errors analysis.

Source: own

process. Due to extraordinary shocks, the model inadequacy may be temporarily higher in MPC opinion. The qualitative approach to data analysis may prevail during the MPC deliberations. The system of goals of the central bank embodies also the output. Inflation targeting is implemented in a flexible way. Temporarily, the output stabilization may become main concern for the central bank. Finally, the MPC may take wait and see position and observe economic situation. Therefore, there is no naive and automatic reaction of the central bank in line with the forecast. The points attribution must also consider the fact that no change of the interest rates is also a decision. Fig. 5 and 6 present the points attributing schemes. The first one refers to the conditional forecast (constant interest rate) and the second one covers endogenous interest rates case.

If considering central path of inflation it is necessary to compare it to the inflation target

in the monetary policy horizon (MPH): 4 to 6 quarters ahead from the forecast starting point. CPI may vary during the monetary policy horizon. In order to calculate the IFT index it is necessary to choose the exact point of time for assessing CPI/target relation. Considering the beginning of MPH is necessary when the examination covers also expectation as it is consistent with the survey question on expectations. The second approach refers to the further part of the MPH. Comparing CPT/target relation here means that the central bank has more time to influence economy and the economy has more time to absorb shock occurring when the forecast is produced.

The IFT index due to its division into 5 aspects makes it possible to produce an additional measurement. When ignoring *actual practice* aspect, it delivers the possibility to measure only transparency of the forecasting

system. Additional analysis of the *decision compatibility* (according to Fig. 5 and 6) alone, shows the central bank’s commitment to the rule.

The IFT index offers the opportunity to cross-country and over-time comparison. It delivers

consistent framework of IFT implementation analysis. It is a useful tool of verification of the relationships between IFT implementation and central bank’s effectiveness and credibility or its ability to influence expectations of consumers, business and experts. It makes it possible to

Tab. 3: Sample description

Feature	BoE	CNB
Inflation targeting introduction	1992 (since 1998 independence in decisions on interest rates)	1998
First forecast publication	January 1998	April 2001
Research period	Jan 1998 – Dec 2014	Apr 2001 – Dec 2014
Interest rate assumption	CIR, ME, both are published, ME as the first one since Aug 2004	CIR, since July 2002 endogenous
Number of forecast	68	55
Number of decisions	203	136

Source: own

Tab. 4: Mean results on IFT index

Feature	BoE	CNB
Mean IFT index	9.38 (67%)	11.85 (85%)
IFT σ	1.1	1.6
Mean transparency	7.36 (74%)	8.27 (83%)
Decisions compatibility	0.84 (42%)	1.80 (90%)

Source: own

compare the decision-making procedures and the central bank’s attachment to IFT. Thus, it offers the possibility for further research.

4. Possible Implementation of the IFT Index

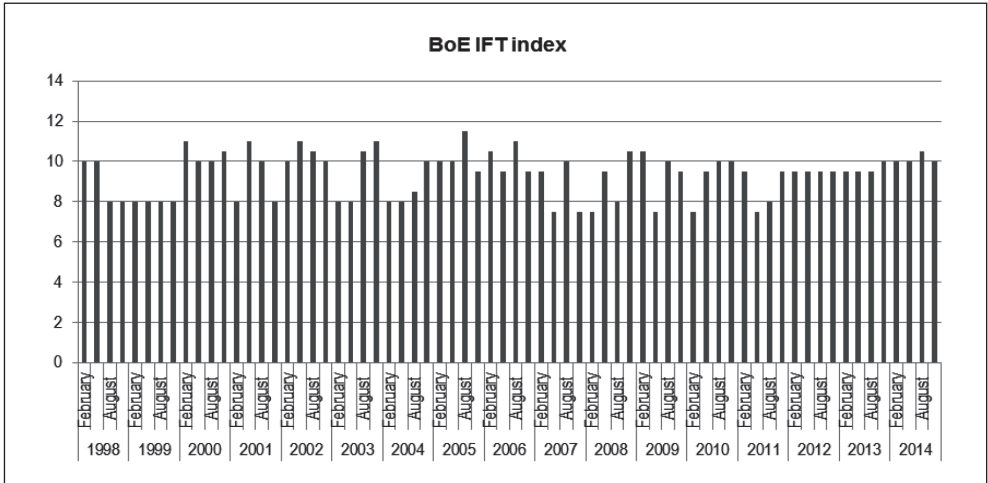
The final section presents briefly the IFT index for two central banks: the Bank of England (BoE) and the Czech National Bank (CNB). They are both inflation targeters with quite a long history of inflation forecast implementation. The sample is described in Tab. 3. Both central banks refer to the forecast in the monetary policy. They use different interest rate assumptions.

Tab. 4 presents mean values of the index for both countries. The CNB was more consistent in IFT implementation with the

mean index value of 85%. It also outperforms the BoE on the field of forecasting system transparency. The difference in decisions’ compatibility between the central banks’ is remarkable: according to the methodology presented in section 3, the BoE decisions covered IFT logic only in 42% in comparison to 90% in the case of the CNB.

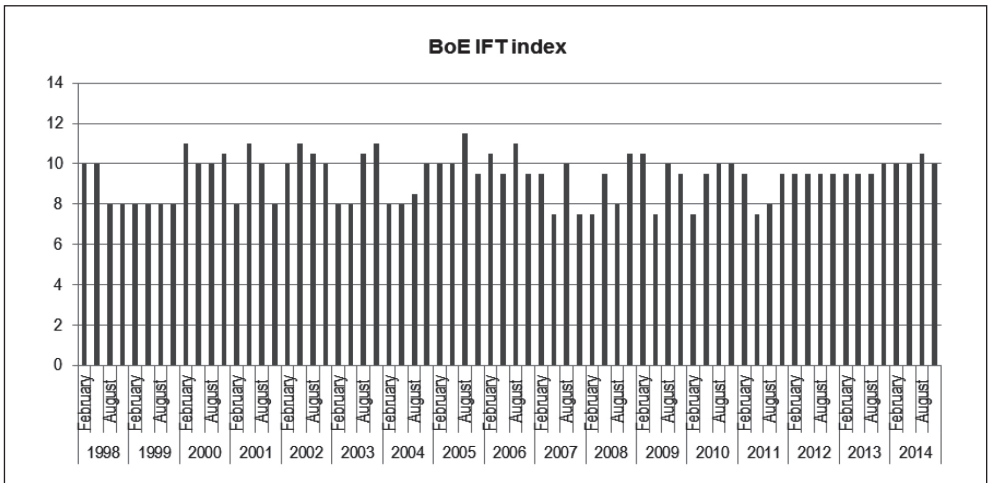
Fig. 7 presents the evolution of the IFT index of the BoE during the research period, Fig. 8 – IFT index for the CNB. Fig. 7 does not capture any substantial change in IFT implementation. Its fluctuations are due mainly to decisions’ compatibility or non-compatibility with the forecast and irregular publication of additional information. Fig. 8 captures remarkable institutional change in inflation forecast targeting. At the beginning of 2008

Fig. 7: IFT index of the Bank of England in 1998-2014



Source: own

Fig. 8: IFT index of the Czech National Bank in 2001-2014



Source: own

the CNB switched to DSGE model (Dynamic Stochastic General Equilibrium Model) at the same time revealing numerically policy path. The enhanced transparency (covering also risk description) resulted in higher IFT index.

The Bank of England used the forecast in the research period in a similar way. The level of IFT was just in line with its declaration on the forecast importance in the monetary policy. The BoE did not switch to interest rates endogenisation. Its communication after the MPC meeting covered the message of the forecast, however, the forecast never gained a central position in the decision explanation.

The CNB commitment to IFT was really strong. The central bank followed the message of the forecast even in the most turbulent period of financial crisis eruption in Europe. Its attitude is confirmed by the analysis of the point attribution to the timing. The CNB made decisions on the interest change (if such a change was necessary) just after producing the forecast. It did not take wait and see position. The CNB communication on the decision also focused on the forecast. Not only was the central path of inflation and policy path presented but also balance of risk. During the MPC meetings in the months in which there was no forecast, the MPC discussion focused on the assumption divergence from the starting point level and its possible impact on the central path for inflation.

Conclusions

The paper presents a conceptual framework of the analysis and measurement of inflation forecast targeting. No consistent IFT index has been presented in the literature up to now. The need for such a measurement is obvious as according to the modern monetary theory, monetary policy needs to be forward-looking. The best way to implement forward-lookingness is the reference to the forecast in the monetary policy. The central bank's forecast of inflation (and other variables) facilitates a decision-making process. It may even become the monetary policy intermediate target, at least implicitly (without such a declaration). It also draws the framework for the central banks discussion. On the other hand, publishing the forecast and information on forecasting system may enhance the central bank's impact on expectations.

The IFT index covers all aspect of the forecast use. However, it is possible that after some time additional questions will be needed. The first proposal on measuring central bank transparency covered goals and decisions publication. Nowadays this seems obvious. The policy path publication differentiates the central banks. The next step in transparency is also possible. The example is publication of bilateral exchange rate forecast done by the CNB since 2009. The index may evolve with the evolution of the monetary policy.

The researchers have always searched for tools for verification relations existence. IFT index is such a tool. It is easily applicable as the way of point attribution is consistent with the practice of modern central banks. Up to now the index has been used to compare the level of consistency in the inflation forecast targeting and the interdependences of the forecast and inflation expectations of consumers (Szyszko, 2015). Measurement of the IFT requires the reading of Inflation Reports (or equivalent documents) and central bank's statements. It draws a broader context for monetary policy and its implementation in the central bank covered by the examination.

The need of IFT index elaboration is obvious also in the light of the on-going discussion on the central bank's options for signaling its intentions. Various versions of forward guidance are discussed including quantitative forward guidance which takes form of policy path publication in a numerical way (Svensson, 2015; Woodford, 2013). This paper opens the discussion not on the need of IFT measurement but on possible improvements of the index.

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Abstract

MEASUREMENT OF INFLATION FORECAST TARGETING. A PROPOSAL OF METHODOLOGICAL SOLUTION**Magdalena Szyszko**

The paper offers a methodological solution to measuring inflation forecast targeting (IFT). IFT is a central bank's procedure which consists in: producing its own inflation forecast, revealing its results and making interest rates decisions on the basis of the forecast. Inflation forecast targeting is implemented, to some extent, by any central bank implementing inflation targeting framework. It facilitates the forward-looking attitude of the central banker. This forward-lookingness facilitates the expectations shaping and goals achievement. The literature on IFT is broad but it does not cover a concise framework for IFT analysis and measurement. The following contribution fills in this gap. It presents the IFT index. The idea of its elaboration is in line with any monetary policy qualitative aspects measurement: 5 aspects of IFT are distinguished, each of which having a system of points attribution described. These aspects are: forecasting methodology, declaration on the forecast role in the monetary policy, forecast publication, actual central bank's practice and ex post forecast evaluation. Actual central bank's practice covers the assessment of the central bank's decision compatibility with the message of the forecast. The multivariate scheme of assessment which considers central bank's flexibility in the decision making process – guaranteed by the framework of the inflation targeting – is elaborated. The other IFT aspects' evaluations consist in the analysis of the information revealed. The IFT can be divided into two sub indices: one covering only the forecasting system transparency and the other one – for decisions compatibility check. The IFT index and sub-indices are universal in the sense of considering the IFT broadly on the basis of various central bank's practice. The index can be used to cross-country and over time comparison – such an example is also presented in the paper. It also makes it possible to verify the hypotheses on the central banks' consistency in implementing IFT – measured by IFT index – and the central banks' performance.

Key Words: Inflation forecast, inflation forecast targeting, inflation forecast targeting measurement.

JEL Classification: E58, E52, B410.

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THE METHODOLOGY OF DIGITAL SHADOW ECONOMY ESTIMATION

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Introduction

Although following the Regulation No. 549/2013 of the European Parliament and of the Council of 21 May 2013 on the European system of national and regional accounts in the European Union (EU Commission, 2013), EU Member States are not obliged to measure the scopes of non-observed economy in the European system of national accounts, the economists and statisticians stress the need to estimate the scopes of this phenomenon to have reliable and comparable data on the structure and trends of both national and regional economies. In accordance with provision (3) of the Regulation No. 549/2013 of the European Parliament and of the Council of 21 May 2013 (EU Commission, 2013), "citizens of the Union need economic accounts as a basic tool for analysing the economic situation of a Member State or region. For the sake of comparability, such accounts should be drawn up on the basis of a single set of principles that are not open to differing interpretations. The information provided should be as precise, complete and timely as possible in order to ensure maximum transparency for all sectors" (p. 1).

According to the approximate estimations of the report of the global management consulting firm *AT Kearney* (Schneider & Kearney, 2013), non-observed economy in Europe today is worth more than 2.1 trillion euro. In the context of non-observed economy, an important focus is being placed on the soaring scopes of non-observed activities online. Nevertheless, the reliable methodologies that would allow to estimate the actual scopes of this economic phenomenon have not been developed. Bossler and Holt (Bossler & Holt, 2012) note that absence of the methodologies purposefully developed to estimate the size of non-observed economies online is the key hindrance that complicates investigation and prevention of the cases of

illegal activities online. In addition, minding the fact that digital shadow economy is a structural part of the overall shadow economy, it can be presumed that the publically announced figures of the scopes traditional shadow economy may lose their accuracy since the indicators of digital shadow economy are not included in the methodologies of traditional shadow economy estimation. With reference to the report of the OECD (OECD Statistics, 2002), "complete coverage of economic production is a vital aspect of the quality of the national accounts. This exhaustiveness is hard to achieve because of the difficulties in accounting for certain types of productive activities" (p. 3). What is more, differences in estimation methodologies as well as absence of the methodologies to cover all the areas of shadow economy (including digital shadow economy) make it difficult to compare the situation in developed market economies with other economies, or between themselves.

Thus far, scientific studies on the methodologies of shadow economy estimation have covered the comparative analysis of different estimation methods (Georgiou, 2007; Schneider et al., 2015; Schneider & Williams, 2013 etc.), the comparative analysis of causal variables incorporated in the most popular estimation methods (Buehn & Schneider, 2012; Teobaldelli, 2011; Teobaldelli & Schneider, 2012 etc.), and differences in the results that are obtained by employing one or another estimation method (Schneider & Buehn, 2013; Schneider et al., 2015). Yet the methodologies that would allow to consider the indicators of digital shadow economy have not been developed. Hence, the real size of digital shadow economy remains unestimated, and the perception of how the problems of digital shadow economy can be dealt with remains relatively vague (Holt et al., 2010; Mayayise & Olusegun Osunmakinde, 2014). For the

reasons explicated above, the development of the methodology that would incorporate the indicators of digital shadow economy could enable to estimate more accurate scopes of the overall shadow economy, and could supplement currently available methodologies of traditional shadow economy estimation. In accordance with provision (11) of the Regulation No. 549/2013 of the European Parliament and of the Council of 21 May 2013 (EU Commission, 2013), “the possible use of new, automated and real-time data collection methods should be explored” (p. 2). As a result, the following scientific problem is formulated: how to estimate the scope of digital shadow economy?

This article *is aimed* to develop the methodology of digital shadow economy estimation. For the fulfilment of the defined aim, the following **objectives** have been raised: 1) to ascertain whether the indicators of digital shadow economy are included in non-observed economy estimates in national accounts and traditional methodologies; 2) to propose the indicators of digital shadow economy; 3) to develop and introduce the methodology of digital shadow economy estimation. **The methods** of the research include systematic and comparative analysis of the scientific literature and adjustment of the MIMIC model.

1. Are the Indicators of Digital Shadow Economy Included in Non-Observed Economy Estimates in National Accounts and Traditional Methodologies?

In order to develop a method, which can be employed for estimation of the scopes of digital shadow economy, at first it is purposeful to find out whether any indicators of digital shadow economy are included in non-observed economy estimates in national accounts and traditional methodologies, which are most commonly employed to measure the magnitude of traditional shadow economy.

With reference to the report of the United Nations Economic Commission for Europe (UNECE, 2003), non-observed economy refers to all productive activities that may not be captured in the basic data sources used for national accounts compilation. The above-mentioned activities are treated as production irrespective of being illegal or not,

i.e. irrespective being registered at tax, social security, statistical and other public authorities. Illegal economic actions shall be considered as transactions when all units involved enter the actions by mutual agreement. Thus, purchases, sales or barter of illegal drugs or stolen property are transactions, while theft is not.

The EU Member-States are free for making a choice of methods to ensure exhaustiveness of their national accounts. What is more, the EU legislation does not require to measure the size of non-observed economy, but requires to ensure the exhaustiveness of estimated GDP and GNI. For this reason, the size of non-official economy is included in the estimations of GDP.

With reference to the data of *Eurostat* (Eurostat Database, 2016), the participants of non-observed economy can be categorized as the ones acting in different sectors of economy:

- Informal sector (T6 – unregistered units);
- Illegal sector (T7 – unregistered units);
- Other sectors (T8 – other types of units under coverage).

With reference to Schneider and Buehn (2013), Schneider and Williams (2015) and Schneider et al. (2013), the activities of informal sector cover trade, transport, agriculture, construction, repair and renovation of dwellings, repair of motor vehicles and household appliances, private lessons and other personal services. According to Juškienė (2015), the sources used to obtain the data about the scopes of activities in informal sector include HBS, LFS, special purpose surveys, opinion polls, tax and other administrative data.

The activities of illegal sector are considered to be particularly difficult to measure due to difficulties to detect them. These activities include thefts, organised crime, paid protection, prohibited manufacturing and sale of products and/or services, smuggling, dummy transactions, bribery, smuggling, etc. (Schneider et al., 2015).

The main sources employed to obtain the data about the scopes of the activities of this type include police reports, reports of custom authorities, reports of tax inspectorates, crime statistics, public opinion polls and other data (e.g. internet, radio, TV, newspapers), experts' estimates and assumptions (Juškienė, 2015). With reference to OECD (2002) and Juškienė (2015), estimations are made not only for non-declared productive activities, but also for illegal activities, for instance, illegal production,

import, sales, consumption of illegal drugs, prostitution, trade in illegally produced audio and video products, theft, smuggling, etc. Due to the difficulties of measurement, in many cases, the approximate estimates of illegal activities can be regarded only as indicative rather than accurate (Juškienė, 2015; OECD Statistics, 2002; UNECE, 2003). With reference OECD (2002), only five EU Member-States include the estimates of illegal economy in their published estimates of GDP: Bulgaria – the estimates of drug consumption, Czech Republic – the estimates of prostitution and sales of stolen goods, Estonia – the estimates of prostitution, trade in drugs and audio-video products, Slovakia – the estimates of trafficking, distribution of drugs and prostitution, and the UK – the estimations of smuggled alcohol drinks and tobacco products.

Nevertheless, the general share of these estimates cover the data which is not included in the official statistics not only because activities are illegal, but also for many other reasons, e.g. no obligation to provide the data is established or reliable data is not available. With reference to the recommendations of the EU statistical system in Eurostat (2016), the following types of non-exhaustiveness of the official statistics (i.e. non-exhaustiveness of national accounts) are distinguished:

- N1 – Producer should have registered (underground producer),
- N2 – Illegal producer,
- N3 – Producer is not obliged to register,
- N4 – Registered legal person is not included in statistics,
- N5 – Registered entrepreneurs is not included in statistics,
- N6 – Misreporting by the registered producers,
- N7 – Other statistical deficiencies in the data.

As it was noted by Juškienė (2015), not all above-mentioned types of non-exhaustiveness of national accounts refer to hidden activities of producers; they may also be caused by inaccuracies of the reported data, lack of obligation for particular economic agents to register their activities, and so forth. However, lack of the data from digital sector is not included in the list of the types of non-exhaustiveness of the official statistics, neither any indicators of digital shadow economy (whether the ones reflecting non-registered production or illegal

economic actions online) are included in the estimates of non-observed economy while presenting the figures of GDP in national accounts.

Further in the research, we will analyse whether any indicators of digital shadow economy are included in the traditional methods of shadow economy estimation. According to Williams (2006), minding the fact that shadow activities by their nature are hidden from public authorities, estimation of their actual scopes is a potentially perplexing and difficult task. Thus far, the methods used to measure the scopes of traditional shadow economy have ranged from direct surveys to indirect methods that are based either on statistical traces or employment of proxy indicators (Juškienė, 2015; OECD Statistics, 2002; Schneider & Buehn, 2013; Williams, 2009; Williams & Nadin, 2012; Żelazny, 2015, etc.). The variables employed in different types of direct, indirect methods and latent variable models have been summarised in Tab. 1.

Direct approaches are based on qualitative data, which are collected by employing sample surveys (e.g. consumers' surveys, business surveys, special purpose surveys, micro-surveys of informal sector), interviews and in-depth interviews (e.g. interviews with tax auditors, representatives of the authorized public authorities, experts from free market institutes, etc.), expert evaluations, in-depth audits, and compliance methods (Augustinaitis et al., 2009; Juškienė, 2015; Schneider & Buehn, 2013; Schneider et al., 2015; Williams, 2009; Miciuła, 2015). Sample surveys, different types of interviews, micro-surveys and compliance methods are considered as microeconomic methods since they are aimed at investigation of agents' behaviour, changes in business resources, market structures, and differences between the volumes of consumption and income distribution (Schneider & Buehn, 2013; Williams & Nadin, 2012; Williams et al., 2007). The key advantages of direct approach methods in terms of their applicability for estimation of the scopes of shadow economy are their ability to disclose the detailed information about the plausible structure of shadow economy (Schneider et al., 2015) and involve different agents (e.g. consumers, entrepreneurs, representatives of public authorities, tax auditors, independent experts of economics, etc.). The information in Tab. 1

Tab. 1: Summary of the variables employed in different methods of shadow economy estimation – Part 1

Method (category)	Variables	Scientific sources
Sample survey (direct)	Characteristics of shadow economy participants, shadow economy determinants, types of goods and services the most commonly traded in shadow economy	Williams et al., 2009; Williams and Nadin, 2012; Williams and Nadin, 2013; Gasparėnienė et al., 2017
Interview (direct)	Characteristics of shadow economy participants, shadow economy determinants, shadow economy channels	Fethi et al., 2006; Williams and Nadin, 2012; Putniš and Sauka, 2014
Expert evaluation (direct)	Prognosticated total size of shadow economy as a percentage of GDP, prognosticated size of shadow economy in particular sectors or sector groups, sectors with the largest scopes of shadow economy, characteristics of shadow economy participants, types of goods and services the most commonly traded in shadow economy	Augustinaitis et al., 2009; Williams and Nadin, 2012
Micro-survey (direct)	Business income, expenditure, tax rate, the share of taxes in the total expenditure, electricity consumption quantities	Georgiou, 2007
In-depth audit (direct)	Overall tax rate, the share of taxes in the total business and household expenditure, tax return, national account exhaustiveness	Schneider and Buehn, 2013; AT Kearney, 2013; Schneider et al., 2015; Juškiene, 2015
GDP discrepancies (indirect)	National income and national expenditure	Williams et al., 2007; Georgiou, 2007; Sookram et al., 2009; Hatipoglu and Ozbek, 2011; Schneider et al., 2015
Transaction method (indirect)	Velocity of money, the value of total transactions, prices, official GNP	Williams, 2009; Schneider and Buehn, 2013; Putniš and Sauka, 2014
Currency ratio method (indirect)	Currency demand, proportion of wages and salaries in national income, income per capita, interest rate (paid on savings deposit), ratio of cash holdings to deposit accounts, average tax rate, the number of the issued credit and debit cards as a substitute for cash	Georgiou, 2007; Fethi et al., 2006; Williams and Nadin, 2012; Schneider and Buehn, 2013
Electricity consumption method (indirect)	Electricity consumption, GDP; electricity consumption in households per capita, real consumption of households without electricity consumption per capita, real price of consumption of 1kWh of residential electricity, relative frequency of months with the need of heating, the ratio of energy sources other than electric energy, the ration of the sum of paid personal income, corporate profit and taxes on goods and services to GDP, the ratio of public social welfare expenditures to GDP, the sum on number of dependants over 14 years and of inactive earners	Kaufmann and Kaliberda, 1996; Lacko, 1998; Schneider and Buehn, 2013; Schneider and Buehn, 2016

Tab. 1: Summary of the variables employed in different methods of shadow economy estimation – Part 2

Employment (labour) discrepancies (indirect)	Total labour force rate, labour participation rate	Sookram et al., 2009; Schneider and Buehn, 2013; Schneider et al., 2015
National accounting aggregates (indirect)	Gross output, value added, illegal transactions with tobacco, alcohol, drugs and sexual services, production, imports, intermediate and final consumption, exports	AT Kearney, 2013; Juškienė, 2015
MIMIC (latent variable model)	Share of direct taxation, share of indirect taxation and social security contribution, state regulation, tax morale, unemployment quota, GDP per capita, employment quota, average working time per week, change of local currency per capita	Schneider and Buehn, 2013; Trebicka, 2014; Schneider et al., 2015; Schneider and Buehn, 2016
DGE (latent variable model)	Household utility, consumption and leisure, household capital units, returns to scale production, total factor productivity, tax rate	Elgin and Oztunali, 2012; Elgin and Schneider, 2013

Source: own

shows that the methods of direct approach basically consider household (characteristics of shadow economy participants, shadow economy determinants, types of goods and services the most commonly traded in shadow economy, shadow economy channels), business (business income, expenditure, tax rate, the share of taxes in the total expenditure, tax return, electricity consumption quantities) and general economic (prognosticated total size of shadow economy as a percentage of GDP, prognosticated size of shadow economy in particular sectors or sector groups, sectors with the largest scopes of shadow economy) indicators. In spite of a wide range of the indicators, direct approach methods earn much scientific criticism for flaws and unreliability of the data (e.g. representatives of hidden population groups may be afraid or unwilling to disclose the truth (Schneider & Buehn, 2013) as well as for sensitivity of the final results to formulation of the questions (Schneider et al., 2015), and applicability only for small-scale studies rather than for acquisition of the general results in an industry, a state or a region (Herwartz et al., 2015). What is more, as it was noted by Williams et al. (2006), final demand usually accounts for just two-thirds of total spending. Hence, employment of direct approach methods may determine data inaccuracies, in particular for estimations of the scope of shadow economy, which are expressed

in numbers since these numbers reflect just subjective opinion of the respondents, but are not based on any objective criteria. Inclusion of any digital shadow economy indicators has not been observed.

In the absence of direct survey methods and with a view to avoiding data inaccuracies or dependency on subjective opinions, economists rely on indirect approach methods, which, contrary to the above-described direct approach methods, are macroeconomic methods since they are based on comparison of different general economic and non-economic indicators, such as GDP, unemployment rate, the number of small and medium enterprises in an industry, household budget data, etc. (Schneider & Buehn, 2013; Schneider et al., 2015; Simionescu et al., 2017; Sookram et al., 2009; Williams et al., 2007, Ključnikov et al., 2016). Indirect approach methods lean on quantitative data, and the most common indirect methods, which are most commonly employed for estimations of the magnitude of shadow economy, cover income and expenditure methods (e.g. GDP discrepancies, income/expenditure discrepancies, consumer expenditure, input-output comparisons (including ratios of input to output in an industry), the commodity flow, per capita output and value added data, etc.) (Schneider & Buehn, 2013; Schneider et al., 2015; Sookram et al., 2009; Williams et al., 2007 etc.) and non-monetary

methods (labour input method, (un)employment rate discrepancies, population censuses, ranking, electricity consumption method, detection-controlled estimation, the number of small and medium enterprises, comparisons of the data on similar activities from various data sources, etc.) (Kaufmann & Kaliberda, 1996; Lackó, 1998; Schneider & Buehn, 2013). The data in Tab. 1 shows that indirect approach methods are based on evaluation of general economic indicators (national income and national expenditure balance, consumption rate, value added, imports, exports, prices, interest rate, proportion of wages and salaries in national income, income per capita, average tax rate, corporate profit and taxes on goods and services to GDP, the ratio of public social welfare expenditures to GDP, the sum on number of dependants over 14 years and of inactive earners, the ratio of the sum of paid personal income), general monetary indicators (velocity of money, currency demand), money turnover indicators (ratio of cash holdings to deposit accounts, the value of total bank transactions, the number of the issued credit and debit cards), electricity and energy consumption indicators (overall electricity consumption, electricity consumption in households per capita, real consumption of households without electricity consumption per capita, real price of consumption of 1kWh of residential electricity, relative frequency of months with the need of heating, the ratio of energy sources other than electric energy) and labour market indicators (total labour force rate, labour participation rate). With reference to Schneider and Buehn (2013), the main advantage of the methods of indirect approach is that their ability to provide an insight in the indicators, which reflect the changes in the magnitude of shadow economy over the time. Nevertheless, indirect methods are criticized for the provision of crude and unreliable estimates, a narrow scale of applicability, data disparities and discrepancies (Schneider & Buehn, 2013; Schneider et al., 2015; Williams, 2009; Williams, 2010; Williams & Nadin, 2012). The indicators of digital shadow economy are not included in indirect methods of shadow economy estimation.

Finally, latent variable models consider the mixture of general economic (GDP per capita), taxation (share of direct taxation, share of indirect taxation and social security contribution), legal (state regulation), societal

(tax morale), labour market (employment quota, unemployment quota, average working time per week) and monetary (change of local currency per capita) indicators (i.e. MIMIC model) (Schneider & Buehn, 2013; Schneider et al., 2015; Trebicka, 2014; Galloppo et al., 2015) or are based on a two-sector (household and business) dynamic general equilibrium which unites such indicators as household utility, consumption and leisure, household capital units, business returns to scale production, total factor productivity, and tax rate (Elgin & Oztunali, 2012; Elgin & Schneider, 2013). Among many possible advantages of these models is consideration of a comparatively wide dataset (Elgin & Schneider, 2013). However, they are criticised for reliance on the use of national income statistics (Elgin & Schneider, 2013), inability to distinguish the causes of non-observed economy (Schneider et al., 2015), and high probability of double counting (Juškieienė, 2015). The indicators of digital shadow economy are not included in latent variable models of shadow economy estimation.

Summarising, although the size of non-official economy is included in the estimations of GDP, and scientific literature offers a variety of the methodologies developed to estimate the size of traditional shadow economy, no indicators of digital shadow economy (whether the ones reflecting non-registered production or illegal economic actions online) are included in the estimates of non-observed economy while presenting the figures of GDP in national accounts. Similarly, no determinants of digital shadow economy are incorporated in traditional methods of shadow economy estimation either in international or national methodologies. Hence, the methods of traditional shadow economy estimation do not reflect the share of digital shadow economy in the overall size of shadow economy. For this reason, in order to complement the theory of shadow economy, it is purposeful to identify the plausible indicators of digital shadow economy.

2. Proposed Indicators of Digital Shadow Economy

Scientific literature lacks the studies on the topic of digital shadow economy. Gasparėnienė and Remeikienė (2015) identified the differences between traditional and digital shadow economies. The authors established that strive

for profit and resources is characteristic to both traditional and digital shadow economy. The profits (revenues) earned in both economies are invested in merchandise, technics and other means that ensure business continuity. Another similarity is that in both traditional and digital shadow payments are and can be performed not only in cash.

The results of the expert evaluation on plausible indicators of digital shadow economy in Lithuania (the results of the evaluation have not still been published) revealed that an approximate size of digital shadow economy can be reflected by employing such indicators as volumes of payments in cryptocurrencies (e.g. Bitcoins), non-cash transfers via online payment platforms, and monetary value of the parcels for which no custom duties are paid.

By their scopes in the finance market, Bitcoins can be treated as the most widely spread cryptocurrency. With reference to the definition, proposed by the European Central Bank (Vanini, 2012), Bitcoin is an unregulated digital currency. To a certain extent, it resembles electronic money, in particular, software money, which in contrast to hardware money, can be used on the Internet. As the other kinds of cryptocurrencies, Bitcoins employ crypto techniques, and the software of the open code allows to control and change Bitcoin codes. Bitcoin network is composed of numerous computers linked by the Internet. This network allows to perform the number of sophisticated mathematical procedures that influence the demand for Bitcoins in the market and promote the certainty of transfers (Ciaian et al., 2016). With reference to Galdikienė (Duygun Fethi et al., 2006), Bitcoins are gaining their popularity in the countries with high inflation or strict restrictions of capital movement. Following the data of the European Central Bank (Vanini, 2012) and the results of the research, carried out by Eyal and Siner (2014), Siddik et al. (2016) usage of cryptocurrencies in international settlements is linked to particular risks, such as loss of money in cryptocurrency exchange, steals of money from the digital wallet, lack of protection while using a cryptocurrency as a payment method, fluctuations of value which may significantly drop and even reach zero, obligations to comply with particular tax regulations, etc. The findings of the European Bank were confirmed by Simser (2015), who notes that the usage Bitcoins is linked to higher

risks of steals and losses. Nevertheless, the author disproves anonymity as one of the features attributable to Bitcoins.

Štivilis and Laurinaitis (2008) note that electronic settlements are the phenomenon of e-banking in 21st century. In general innovations had the impact on banking sector (Stachova et al., 2017; Cicekli, 2016). Rapid development of IT alongside the strive of commercial banks to bring a bank closer to a customer have determined the spread of electronic settlements (Slozko & Pelo, 2014; Musa, 2010). A comprehensive research conducted by Zandi et al. (2013) disclosed that usage of e-payments determines nearly 0.8 percent of GDP increase in developing countries, and 0.3 percent of GDP increase in developed countries. With reference to Štivilis and Laurinaitis (2008) and Zandi et al. (2013), financial operations in virtual space should be considered as an important determinant of economic growth. Non-cash payments are beneficial since they provide a faster access to financial resources and reduce the scopes of shadow economy. Nevertheless, some researchers note that non-cash payments via online platforms not only fail to reduce the scopes of shadow economy, but also make preconditions for digital shadow economy (Lithuanian Free Market Institute (LFMI, 2013). Such assumptions are made minding appearance of some alternative measures of settlement (for instance, "Revolut" payment cards) in financial markets.

3. Estimation of the Multitude of Digital Shadow Economy

In spite of some criticism (Elgin & Schneider, 2013; Juškienė, 2015; Schneider et al., 2015), MIMIC latent variable model is considered the most comprehensive methodology of shadow economy estimation. Hence, we can adjust it to estimation of the multitude of digital shadow economy. Digital shadow economy is considered as a latent variable, which, on one side, is related to the set of observed indicators (this way, the changes in the multitude of digital shadow economy are revealed), and on the other side – to the set of causal variables, which have a considerable impact on the multitude of the researched phenomenon. When a sufficient quantity of indicative and causal data is available, the model is developed by employing pretty standard procedures of econometrics.

Digital shadow economy ($\hat{\eta}$) is a scalar variable, which is linearly described by a set of directly observed variables X_1, X_2, \dots, X_q and scalar random noise (ζ).

$$\hat{\eta} = Y_1 X_1 + Y_2 X_2 + \dots + Y_q X_q + \zeta \quad (1)$$

Latent (hidden) variable ($\hat{\eta}$), in turn, directly describes endogenous variables Y_1, Y_2, \dots, Y_p , which are dependent on the levels of scalar noise $\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p$:

$$\begin{aligned} y_1 &= \lambda_1 \hat{\eta} + \varepsilon_1 \\ y_2 &= \lambda_2 \hat{\eta} + \varepsilon_2 \\ &(\dots) \\ y_p &= \lambda_p \hat{\eta} + \varepsilon_p \end{aligned} \quad (2)$$

Structural noise (ζ) and estimation errors ε have a normal distribution and are linearly independent. Then, the following marking is introduced:

- $X^T = (x_1, x_2, \dots, x_q)$ – observed exogenous variables (causes);
- $Y^T = (Y_1, Y_2, \dots, Y_q)$ – structural parameters (structural model);
- $y^T = (y_1, y_2, \dots, y_p)$ – observed endogenous variables (indicators);

- $\lambda^T = (\lambda_1, \lambda_2, \dots, \lambda_p)$ – structural parameters (estimation model);
- $\varepsilon^T = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p)$ – estimation errors;
- $v^T = (v_1, v_2, \dots, v_p)$ – standard deviation of estimation errors.

Formulas (1) and (2) can be rewritten as:

$$\hat{\eta}_t = Y^T x_t + \zeta_t \quad (3)$$

and

$$y_t = \lambda \hat{\eta}_t + \varepsilon_t \quad (4)$$

It is presumed that $E(\zeta \varepsilon^T) = 0$, $E(\zeta^2) = \sigma^2$, and $E(\varepsilon \varepsilon^T) = \Theta^2$.

Θ_{pxp} refers to a diagonal matrix with v , which is located in its diagonal.

The model can be converted into a reduced form, i.e. a function of observed variables:

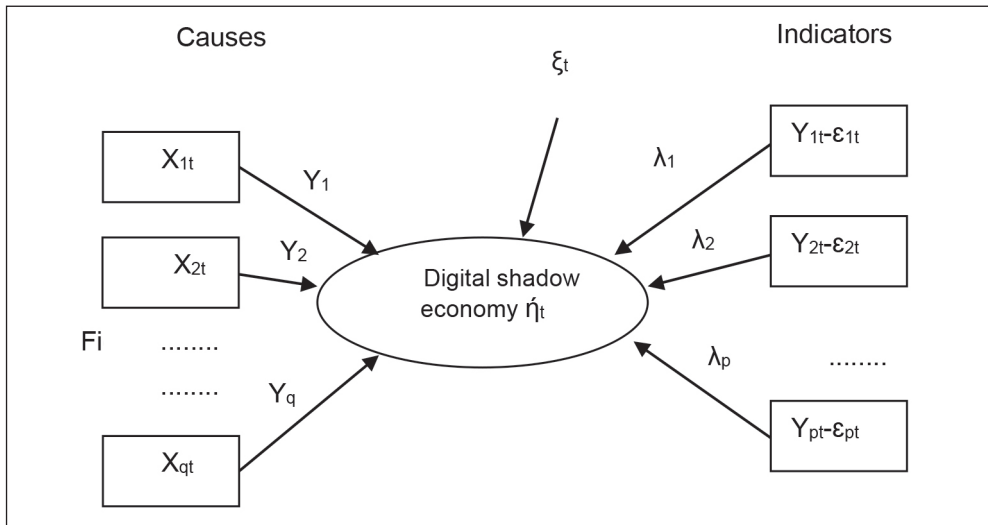
$$y = \lambda(Y^T x + \zeta) + \varepsilon = \Pi x + v \quad (5)$$

Here $\Pi = \lambda Y^T$, and $v = \lambda \zeta + \varepsilon$.

This way, the matrix of model covariation is developed:

$$\Sigma = (\lambda(Y^T \Phi Y + \psi)) / \Phi Y \lambda^T + \Theta \lambda Y^T \Phi / \Phi \quad (6)$$

Fig. 1: General structure of the MIMIC model



Source: own

Latent (hidden) variable (η) is invisible, and its value remains unknown. The other parameters of the model have to be evaluated by analysing the links between the observed variables in the dispersion and covariation. The main aim is to find the values of parameters Y and λ , and the estimate Σ .

Interaction between causal variables X_q , multitude of shadow economy (i.e. latent variable η), and indicative variables Y_p over a particular period has been depicted in Fig. 1.

In this research, the structural model is related to latent variable η (the index of shadow economy) and its causal determinants X_q (X_1 – access to the Internet and a computer in households; X_2 – non-cash payments; X_3 – introduction of innovative market instruments (e.g. “Revolut” card)). Considering a random variable ζ , it can be expressed as:

$$\eta = Y_1 X_1 + Y_2 X_2 + Y_3 X_3 + \zeta \quad (7)$$

On the other hand, the estimation model links latent variable η with its indicators (Y_1 – non-cash money transfers via online platforms; Y_2 – frequency and amounts of payments in

cryptographic currencies; Y_3 – parcels for which no taxes (or custom duties) are paid (i.e. non-cash settlements are made)) by considering random errors ε :

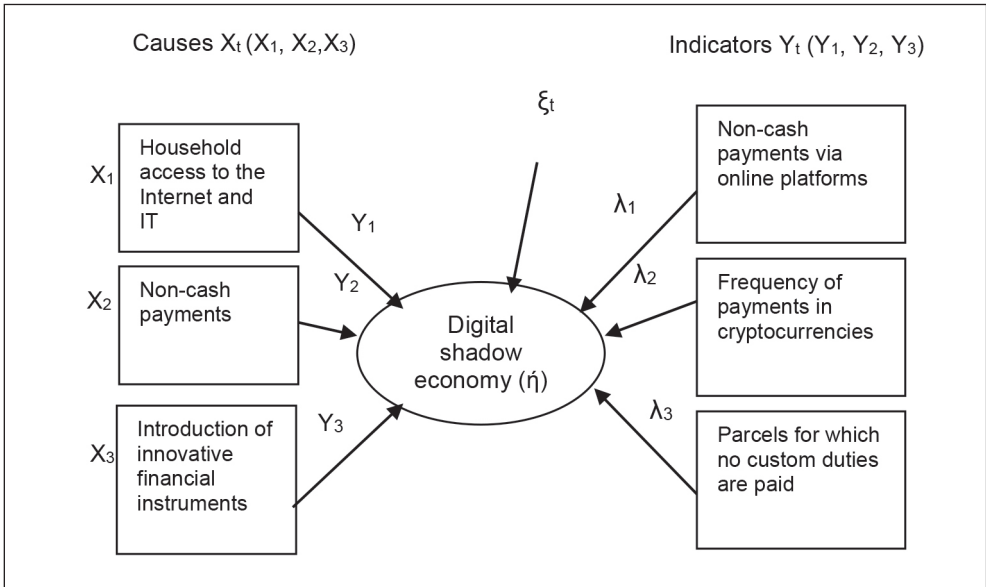
$$\begin{aligned} y_1 &= \lambda_1 \eta + \varepsilon_1 \\ y_2 &= \lambda_2 \eta + \varepsilon_2 \\ y_3 &= \lambda_3 \eta + \varepsilon_3 \end{aligned} \quad (8)$$

By incorporating the above-described variables, we can develop an exemplary MIMIC 3-1-3 model (see Fig. 2).

Numbers 3-1-3 mark that 3 causal variables, and 3 indicators are included in the model.

Household access to the Internet and IT, non-cash payments, and introduction of financial innovation are considered as the basic causes of digital shadow economy. With reference to the statistical data, over the first quarter of 2016, 72 percent of Lithuanian people had their personal computers at home; 73 percent of Lithuanian people had access to the Internet. In comparison to 2015, these figures grew by 4 and 5 percent respectively, which shows that an increasing number of Lithuanian population rely on online settlements while

Fig. 2: General structure of MIMIC 3-1-3 for estimation of the size of digital shadow economy



Source: own

paying for various goods/services (Lithuanian Department of Statistics, 2016). Non-cash payments (credit transfers, direct online debits, payments in debit cards, e-money, e-transfers, etc.) are promoted by central banks with the aim to reduce the size of shadow economy. Nevertheless, the economic estimations reveal the opposite trends: according to LFMI (2013), “the statistics show that a positive correlation between shadow economy as a part of GDP, and the size of e-settlements per capita can be observed in the EU member states, although the correlation is not unambiguous, and some exceptions, for instance, Estonia, can be found” (p. 2). Since the impact of non-cash payments as of a measure of shadow economy reduction has not been proved, they can be attributed to the causes of digital shadow economy. Finally, digital shadow economy can be considered to be caused by introduction of innovative financial instruments. Financial markets have started to accept payment cards (e.g. “Revolut”), which allow to cash money for free both in Lithuania and abroad; the cards are issued without cost, and they assure a comparatively high level of safety. However, the factor of convenience often makes online settlement platforms a favourable environment for transfers of “dirty money”. For instance, “Revolut” consumers have to confirm their identities only in case contributions to the account exceed 1,000 euro. Therefore, it is a perfect opportunity to make transactions related to non-taxable income.

The main indicators that could explain the size of digital shadow economy include non-cash payments via online platforms (e.g. *Payza*, *Paysera*, *PayPal*, etc.), frequency of payments in cryptocurrencies, and monetary value of the parcels for which no custom duties are paid. With reference to non-official statistics (LITAWeb, 2013) from June to December 2015, 10.46 percent of Lithuanian consumers chose payments by *Paypal*; the share of contributions collected by *Paypal* amounted to 11.53 percent. From January to October 2016, payments by *Paypal* were chosen by nearly 12.2 percent of Lithuanian consumers, and the share of contributions collected by *Paypal* exceeded 15.62 percent. Hence, the statistical data above reveal the trends of the rapid spread of online payment platforms.

Another indicator of digital shadow economy is frequency of payments in cryptocurrencies.

A cryptocurrency is a unit of online settlements. It does not have any physical shape; it is maintained electronically and generated by consumers themselves. There are no particular people or institutions that are engaged in issuance of cryptocurrencies. Bitcoins are considered to be the most popular cryptocurrency all over the world. Since introduction of Bitcoin in 2009, the price of this cryptocurrency remained comparatively stable until January 2013, when it reached its maximum value of approximately 20 U.S. dollars. Afterwards, a monthly price growth could be observed until October 2013, when the price reached 198 U.S. dollars. This nearly tenfold increase in Bitcoin value proved to be insignificant in comparison to the price rally in November 2013, when the threshold of 1,100 U.S. dollars per coin was broken. Since then, the Bitcoin price remains in a downtrend, and Bitcoin was valued at 430.05 U.S. dollars as of December 2015. As of February 2015, there were 329 Bitcoin ATMs worldwide. The countries with the highest number of Bitcoin ATMs covered United States (111), Canada (61), Australia (20) and United Kingdom (19) (Statista Database, 2016). In Lithuania, payments in Bitcoins are also getting increasingly popular. Unfortunately, the statistical data on the value of payments in this cryptocurrency are hardly available.

The third indicator of digital shadow economy is monetary value of the parcels for which no custom duties are paid. For instance, if a person orders a good from a third country and pays for it in Bitcoins, he or she gets this good via customs. If no custom duties are paid for delivery (import) of this good, then the monetary value of such parcels can be considered as an indicator of digital shadow economy.

Conclusions

Summarising, the following conclusions can be made:

1. The analysis of the scientific literature has revealed that traditional methods of shadow economy estimation do not include the indicators that would allow to measure the size of digital shadow economy. This inaccuracy distorts the official figures of the magnitude of shadow economy since a substantial share of shadow activities are transferred to electronic spaces in the form of electronic money.
2. The analysis of most commonly employed shadow economy estimation methods has

disclosed that in spite of some criticism, the MIMIC model can be considered the most comprehensive method of shadow economy estimation since it covers both causals and indicators of the researched phenomenon.

3. Causal variables, which can explain the spread of digital shadow economy, include household access to the Internet and IT, non-cash payments, and introduction of innovative financial instruments. The indicators of digital shadow economy cover non-cash payments via online platforms, frequency of payments in cryptocurrencies, and monetary value of the parcels for which no custom duties are paid.
4. In order to empirically verify applicability of the new model, which is proposed for estimation of the size of digital shadow economy, the numerical values of the above-mentioned causal variables and indicators are necessary. Unfortunately, official statistical databases do not contain all types of the data. In some cases (e.g. concerning frequency of payments in cryptocurrencies), the data are not accumulated at all. Hence, for further research in this area, the authors are going to focus on accumulation of the necessary statistics, which would allow to verify practical applicability of the new model and specify the size of the overall shadow economy in particular countries.

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Abstract

THE METHODOLOGY OF DIGITAL SHADOW ECONOMY ESTIMATION**Ligita Gasparėnienė, Yuriy Bilan, Rita Remeikienė, Romualdas Ginevičius,
Martin Čepel**

The article introduces a new methodology of digital shadow economy estimation, which is based on the principles of the MIMIC method. This new methodology complements traditional methodologies of shadow economy estimation with such a component as digital shadow economy.

Our analysis of the most popular today methods of shadow economic estimation proves that, despite some of its drawbacks, the MIMIC model can be treated as the most comprehensive and appropriate method for such calculations since it takes into account both causal and indicators of shadow economy.

As the causal variables here, as applied to digital shadow economy, we use household access to the Internet and IT overall, the volume of non-cash payments and the use of most advanced financial instruments. While as the indicators of the digital shadow economy spread we use: the volume of non-cash payments at online platforms, the frequency of cryptocurrency payments, and the cost of parcels to which customs duties have not been applied.

For further empirical verification of the model proposed here, numerical values of both causal variables and indicators would be necessary. Unfortunately, official statistical sources are unable to provide such data in full volume, especially when it comes to cryptocurrencies and other informal payments. Thus, in our further research we plan to not only prove the practical applicability of the offered here model for estimations of digital shadow economy size as well as overall size of shadow economy on the examples of particular countries, but also to accumulate the necessary statistics for such calculations.

Key Words: *Shadow economy, digital shadow economy, indicators of shadow economy, causal variables, MIMIC model.*

JEL Classification: G34, M12.

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TYPES OF BANK LOANS AND THEIR IMPACT ON ECONOMIC DEVELOPMENT: A CASE STUDY OF THE CZECH REPUBLIC

Jan Černohorský

Introduction

In this article, we discuss the relationship of banks, or loans provided by them, and economic development. We decided to investigate this relationship as banks in today's economies play a significant role as a vital institution in the financial markets, where there is a distribution of monetary funds from surplus entities to deficit entities. A necessary precondition of a functioning economy, in its present mostly mixed form, is a functioning and stable banking system. Currently, uncovered money is to a great extent the money generated by private banks, mainly in the form of loans.

In these turbulent times, when economies are growing and declining at faster intervals than were customary in previous decades, this is very much a contemporary issue. It is due to the fact that the rate of growth/decline in lending, due to the importance and size of the financial markets and the form of the uncovered money issued, significantly influences the economic cycle. As reported by Černohorský (2015), banks provide loans to businesses and households for their consumption and investment and thus support the economy. What is important is the duration of a loan, as particularly long-term investments contribute to long-term economic growth. For this reason, we decided to examine the impact of total loans, as well as dividing them into loans to non-financial businesses, loans to households, mortgage loans and consumer loans. The importance of credit access to banks is also compounded by the financial and economic crisis which most of the developed countries experienced in recent years. The consequence of this crisis today is an abnormal situation on the financial markets, which is reflected in negative interest rates, foreign exchange intervention and quantitative easing by central banks. They are trying to use these unconventional monetary policies

to restore the impaired credit channel of the monetary policy transmission mechanism.

The main idea of this article is expressed by the hypothesis that the development of various types of bank lending has a positive effect on economic development. We will examine the validity of this hypothesis using selected statistical and mathematical methods as presented below.

The aim of this article is to assess the impact of the development of different types of loans in the banking sector on economic development, based on the example of the Czech Republic. In achieving this set goal, we shall begin with the hypothesis that economic performance increases with the growth of the rate of various types of loans.

1. Theoretical Background

In the past, the relationship of the financial system and economic growth was examined by a number of renowned economists. Schumpeter (1912) emphasised the strong influence of banks on economic growth by encouraging innovation. Providing loans for these innovations and investments leads to the growth of business operations and thus to economic growth. In contrast, Lucas (1988), in more modern times, refers to an excessive influence of banks on the economy in a negative sense. Robinson (1952) considers that banks have a passive impact on economic development. As can be seen, even in the past these distinguished economists held different views on the impact of the banking sector on economic development. It is still the same today, as evidenced by subsequent research.

Our paper is based on the transmission mechanism of monetary policy as it is understood both in economic theory and applied in practice in the enforcement of monetary policy by central banks. In particular,

we follow the logic of the credit channel of the monetary policy transmission mechanism. This is based on the change in the interest rates set by the central bank, which affect interbank interest rates and in the end also the market interest rates offered to clients. If we consider declining interest rates, this results in a higher demand for loans from banks by companies and households. These loans are used for corporate investment and household consumption (or from a macroeconomic point of view also for investments through the purchase of real estate). At the same time, the amount of money in circulation is growing. The increase in consumption and investment thus contributes to the growth of the economy. In the case of increasing interest rates, the change in the given variables is the opposite or it may, for example, result not only in a decrease, but also in a decline in the growth rate, of the given quantities. A definite factor in support of this process is the central banks monitoring and striving to influence the rate of lending to a certain extent in order to support economic growth or to ensure that the economy doesn't get overheated.

The effect of the amount of money issued as bank loans on economic development is highlighted by the main proponent of monetarism, Milton Friedman (1968). As well, Friedman and Schwartz (1963) came to the conclusion that the correlation coefficients between the change in money and the nominal output range from 0.79 to 0.92 per survey period. They quantify the time delays in the effectiveness of monetary policy in a range of 12-24 months, with the maximum growth in the amount of money being in advance of 18 months ahead of the peak of economic growth. The minimum amount of money growth, according to his calculations, will be reflected in the economy in the form of a recession earlier, with an interval of approximately 12 months. Also, the money supply is understood as an autonomous exogenous quantity given by the central bank, which affects other macroeconomic variables.

The logic of this approach is supported by Miskhkin (2016), who, in addition to the credit channel, also defines other channels of monetary policy action. Kaufmann and Kugler (2010) also estimate real GDP on the basis of the development of M3, including the aspect of cointegration of the given variables. This idea

is supported by Holtemöller (2004), who sets the time delay of the monetary policy tools on product changes at six quarters. For this he uses integration and cointegration analysis.

Currently, the connection between bank performance (measured, for example, in the form of lending rate) and economic performance is much closer. This is due to the enormous scale of globalised and also local financial markets due to the size of the economies and their impact on business activities. Today there is a higher degree of interconnectivity of financial markets and economic development. The final proof is certainly the financial crisis in the USA. It developed primarily in the banking sector and spilled over into a public finance crisis and an economic downturn in the economically important countries in the world and Europe. Therefore examining the relationship between bank lending and economic development has gained importance. Among the various works various indicators of lending are used to measure economic performance.

These contributions can be divided into three basic groups. The most significant in terms of numbers is the group of economists who believe in the positive impact of bank loans on economic development. Levine and his co-economists in their works (Levine & Zervos, 1998; Beck, Levine, & Loayza, 2000; Beck & Levine, 2004) examined various combinations of the effects of the liquidity of stock markets and banks (collectively, financial intermediation) on economic growth, capital accumulation and increased productivity. All the above, according to the authors, is positively influenced by the activities of banks. Armeanu et al. (2015) tested the effects of credit expansion on sustainable economic growth. They see a greater effect with loans to legal entities rather than to natural persons. The importance of loans to legal entities (companies) acts over a longer period, because their investments lead to further growth. Banu (2013) focused on the question of whether an economy, specifically the Romanian economy, would be capable of economic growth in the absence of lending. Without the loans provided to the private sector, the Romanian economy would not grow, as no new projects would arise. Conversely, very low dependence was found between loans to the public sector and economic growth. Kelly et al. (2013) began with a range of data from 10 years for the economy of Ireland, which was significantly affected

by the financial crisis specifically because of the banking sector. Despite this significant fluctuation, Kelly finds a positive impact of lending activities on growth in the economy. As well, Ermisoglu et al. (2013) investigated whether data on loans would be an appropriate forecast for the development of gross domestic product (GDP). They stressed the importance of loan data in terms of a minimum delay. Again, they found a positive effect; i.e., they state that using the variable “credit incentives” in GDP prediction models increases their accuracy.

The results of a further study by Cetorelli and Gamber (2001) show that the banking sector facilitates access to credit for “young” firms, thereby supporting the pace of economic growth, as investments by new firms are more likely to be involved in innovative technologies. Bencivenga and Smith (1993) conclude that the banking sector can also reduce excessive credit limitation through reduced monitoring costs and thus ensure accelerated economic growth in a country. Levine (2005) shows the link between the operation of the financial system and economic growth.

On the other hand, there are studies that show a negative relationship between bank loans and economic development as measured by GDP growth. Leitaó (2012) came to this conclusion based on an analysis of macroeconomic variables (economic growth, trade balance and inflation) and bank loans. He concluded that inflation is negatively correlated with economic growth. The main idea behind the study is that excessive credit growth tends to weaken a banking system and increase inflationary pressures, thereby undermining economic growth. Mian et al. (2015) based their study on an analysis of the relationship between household debt and GDP. According to their results, the growth of household debt in relation to GDP predicts a lower growth in production and higher unemployment rates in the medium term. As well, an increase in household debt will result in consumption growth and worsening current account balances as a result of the increased import of consumer goods. Koivu (2002) published a study based on data from 25 transitional economies in the years 1993-2000. In his work, he concluded that an increase in lending does not accelerate economic growth. The causes are a series of banking crises in these economies and fiscal restraint. He also stressed that these results are non-standard

with economic findings primarily due to specific conditions in transition economies. Ibáñez-Hernández et al. (2015) came to the conclusion that the high growth in lending leads to instability in the financial sector and thus negatively affects economic development.

There are also studies that do not indicate any significant relationship between the loans provided and economic growth. For example, Takats and Upper (2013) investigated the effect of bank loans on economic growth after the financial crisis on the basis of data from 39 financial crises that had been preceded by a credit boom. They found that a declining amount of bank lending to the private sector does not necessarily hinder economic recovery after a financial crisis. In these crises, changes in the rate of bank lending, either in real terms or in relation to GDP, do not correlate with growth during the first two years of recovery. In the third and fourth year, the relationship becomes statistically significant, but still remains insignificant in economic terms. De Gregorio and Guidotti (1995) found a positive correlation between the growth rate of bank loans to the private sector and the growth of GDP, but the impact varies in different countries. In Latin American countries, the relationship is actually negative. Their rationale was the recent financial liberalisation in these markets combined with a poor level of regulatory framework. They also emphasise that the main method whereby the growth of lending affects economic growth is primarily that these loans must be provided for effective projects; i.e., not a critical amount of these loans.

Based on the list mentioned above, it is clear that studies are prevalent which confirm the logic of the credit channel of the monetary policy transmission mechanism and show a positive relationship between the growth of lending and the growth of the economy. This corresponds to the current prevailing theoretical knowledge of bank contributions through money issuance by providing bank loans to grow the economy.

As well, we are aware of the interdependence of the effects of bank loans and the development of the economy in both directions (i.e., acting as a multiplier and accelerator). However, in this article we have focused on the impact of bank loans on the development of the economy. A two-way relationship is also taken into account in the discussion of the results achieved.

2. Methods

This article focuses on examining the relationship between two variables – loans granted and economic development. It is clear that in economic practice, there are a number of factors which affect economic development. We have drafted our analysis on the basis of the *ceteris paribus* condition, which simplifies the real relationship, but is still suitable for examining the relationship of two variables. In the final discussion, we also define the factors that will otherwise definitely have an impact on the development of the economy.

In this work we have decided to use cointegration analysis; i.e., a method that distinguishes short and long term relationships of time series. This is a relatively modern method used in many of the studies mentioned above and studies of central banks. The result of this is whether the time series are cointegrated or not. Cointegration means that the deviation in the directions of the development of the time series can only be short-term, and there is a limit beyond which the deviation may not continue. The time series are then in equilibrium and have a long-term relationship between them; i.e., they have a common element that can be examined (Arlt & Arlt, 2007). The advantage of this method over traditional statistical methods is that it identifies any apparent regression.

The analysis model selected is designed in accordance with professional analyses and based on the specific characteristics of the time sequence. The model is created for testing delays of the dependent variable of GDP and stationarity testing, including necessary adjustments of data by differencing. Cointegration is then tested and the final test is to perform Granger causality.

The first step is the need to test the time sequence on the optimum order of delays for the dependent variable GDP. To determine the delay, we used a calculation using Akaike's information criterion (AIC) in the equation below:

$$AIC(M) = \ln \sigma_a^2 + 2M/T \quad (1)$$

where M defines the number of parameters in the model, σ_a^2 is the residual variance, and T is the number of observations. The best range of delay is the one where the information criterion reaches the lowest values. The test outputs of the best range of delay are applied in the following tests.

An important prerequisite before testing cointegration is to verify the stationarity of the time sequence being input to the model. Stationarity of the time series is required in order to estimate the regression model. In the case of non-stationary data and modelling using the least squares method, the analysis could have distorted outcomes and could present an apparent regression. In the case of non-stationary time sequence, adjustment should be made using differentiation of the original data. A stochastic process is a time-ordered set of random variables, which in theory may be viewed as a function of mean value, variance, covariance and correlation functions. A stochastic process is thus referred to as stationary if the characteristics of the random variable are time constant.

These conditions are formally written as follows (Arlt et al., 2007):

- Mean value function:

$$\mu_t = E(X_t) \quad (2)$$

- Variation function:

$$\sigma_t = D(X_t) = E(X_t - \mu_t)^2 \quad (3)$$

- Covariance function:

$$\gamma(t, t - k) = E(X_t - \mu_t)(X_{t-k} - \mu_{t-k}) \quad (4)$$

- Correlation function:

$$\rho(t, t - k) = \frac{\gamma(t, t - k)}{\mu_t \sigma_{t-k}} \quad (5)$$

where X_t is the dependent variable, $E(X_t)$ is the mean value $D(X_t)$ is the variance. Stationarity verification is performed using the extended Dickey-Fuller test (ADF test) to test the hypothesis of the existence of a unit root. The test is based on regression of the first differences of the time sequence based on their own delayed values, or the delayed differences. In practice there are three forms of the ADF tests: without a constant, with a constant, and last is with a constant and a trend. The selection is made through the lowest Akaike criteria. Evaluation is based on an assessment of the null hypothesis when it is tested at a significance level of 0.05, if the time sequence has a unit root. Then we may say that the time sequence is non-stationary.

Verification of the null hypothesis is evaluated based on the calculated p-values. In testing, we assume that the generating process has the form (Artl et al., 2007):

$$\Delta X_t = (\emptyset_1 - 1)X_{t-1} + \sum_{i=1}^p \alpha_i \Delta X_{t-1} + e_t \quad (6)$$

where we test that $\emptyset = 0$ (variable contains a unit root), X_t is the dependent variable, p is a delay and e_t is a residual component. In the event that it is a non-stationary time sequence, it is necessary to adjust the time sequence by using the first difference. Based on the new values of the time sequence we decide on its stationarity.

If the input time sequences are non-stationary and after adjustment by differentiation, they acquire stationarity of the same order, it is possible to perform a cointegration analysis. When the above conditions are met, the Engle-Granger test (EG test) will be applied on the time sequence to determine the cointegration of the time sequence. This test is based on testing the estimated residues of the cointegrating regression for the presence of a unit root. Cointegration regression will be performed using the smallest squares method. In accordance with the Engle-Granger theories in the next step, random components are tested using the ADF test for the presence of unit roots.

Evaluation of this test is identical to the ADF test mentioned previously, including the selection of the type of regression model by the lowest AIC. We will test the null hypothesis that the time sequences are not cointegrated at a significance level of 0.05. If the p -value for the residues tested is higher than the level of significance of 0.05, we will not reject the null hypothesis and the tested time sequences are not cointegrated. The variables are then tested for a possible mutual causal link between the tested series on the basis of Granger causation.

The coefficient of determination observed, or the corrected (adjusted) coefficient of determination describes the closeness of the connection. The resulting value can be interpreted in terms of percentage, while indicating what percentage the changes in the response variables are dependent on changes in the explanatory variables. The coefficient of determination indicates the quality of the regression model; expressed more precisely,

it indicates what percentage of variance of the response variables is explained by the model and how much remains unexplained.

The final test is to test the causal link between the time sequences, using the Granger causality analysis. Granger defined the concept of causality in the practical use of vector autoregression models (VAR models) for restricted and unrestricted regression. The basic idea is that when a series X affects a series Y , then the series X should improve predictions for the series Y (Hendl, 2012). VAR models are based on a comparison of residues of individual models differing in the number of delays. The most suitable model is chosen of a type that has a minimum value of AIC. For the Granger causality test we will use the null hypothesis that the variable X does not affect the variable Y under Granger's conditions. The basic models take the following form (Hušek, 2007):

$$Y_t = \sum_{i=1}^p \alpha_i Y_{t-i} + u_t, \quad (7)$$

$$Y_t = \sum_{i=1}^p \alpha_i Y_{t-r} + \sum_{i=1}^p \beta_i X_{t-i} u_t, \quad (8)$$

where α_i and β_i are the coefficients of the variables X_t and Y_t are time sequence variables, p is the delay and u_t is the random component. The first equation estimates the dependent variable based on its own delayed values, the second equation adds to its own delayed values the delayed values of the first variable. The test is conducted using VAR models in which an interaction of up to eight delays is tested. We reject the null hypothesis if the p -value is less than the significance level of 0.05. Hnízdo (2015) further explains the issue in detail.

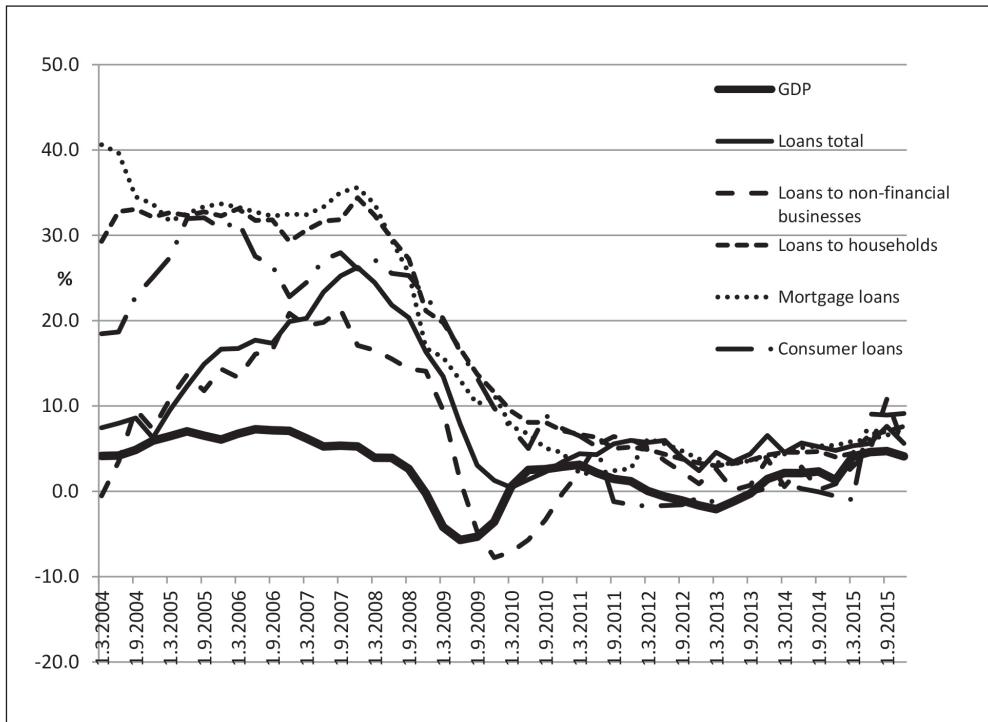
3. Data

Data on loans are taken from the Czech National Bank (ČNB) database. These are loans to non-financial businesses, loans to households, mortgage loans, consumer loans and total loans. All variables are in the form of relative annual change in a quarterly frequency. These data are seasonally adjusted for the time period 2004-2015. The time series is based on financial market developments and changes in the Czech economy. One reason for setting this series is the fact that before 2004 there were significant changes in the banking sector in the Czech Republic, which changed the ownership structure, and the government had intervene to

stabilise the banking sector and clear the debts of declining large banking companies. The data are shown in the following table. Development of the economy is measured using standard indicators of gross domestic product in the Czech Republic, reported in the statistics of

the Czech Statistical Office and also referred to in the database of the Czech National Bank. Again, for comparative purposes, these variables are in the form of relative annual changes in a quarterly frequency. These data are shown in the following figure (Fig. 1).

Fig. 1: Development of GDP and selected types of loans (annual change in %)



Source: Czech National Bank (2016)

Fig. 1 shows the strong growth of all components of loans granted in 2005-2008, household loans and mortgages from an earlier period. This is related to the rapid growth of the economy, including exports, which are, among other things, driven by investment activity. This is widely funded by loans provided to businesses as well as by mortgage loans. In addition, interest rates have fallen sharply at this time, contributing to a greater willingness particularly among households to incur debts. Another factor is undoubtedly the demographic development, where a significant

portion of the population in this period dealt with their housing needs. After 2008, on the other hand, the effects of the financial crisis in developed countries begin to show. These have manifested themselves in the Czech Republic in the economic crisis and the decline in investment and credit activity resulting from a crisis of confidence; i.e., due to the caution of banks in granting loans.

Variables are examined in absolute values and in inter-annual changes. Tab. 1 shows descriptions of the variables used.

Tab. 1: Definition of the variables used in the analyses

Variable	Macroeconomic value	Unit	Source
Y	Gross domestic product	bn. CZK	ČNB
Uc	Total loans	bn. CZK	ČNB
ΔY	GDP growth	%	ČNB
ΔUc	Total loan growth	%	ČNB

Source: own

Tab. 2: Results of optimum order of delay

Order of Delays	AIC for ΔY
1	3.41229
2	2.94612
3	2.99098
4	3.03142

Source: own

4. Results

As mentioned above, we are interested in whether there is cointegration among the selected variables. That is, whether the given time series evolve similarly over the long term. This is, from an economic point of view, the underlying idea of the credit channel of the monetary policy transmission mechanism. In the short term, based on the interpretation of the cointegration analysis, some discrepancies may occur.

Based on the model chosen, an optimum order of delay is tested, as well as data stationarity, cointegration test and subsequently the Granger causality test is performed.

For this model, we first determined the optimum delay order on the basis of AIC (according to Formula 1) for GDP in absolute terms as well as inter-annual changes. The results are shown in the Tab. 2.

Based on the lowest value of AIC, we can conclude that for the dependent variable GDP, the optimum delay is that of the second order. The semi-annual delay identified will be reflected in subsequent tests. We will proceed to verify the **stationarity** of the time sequence. The findings of stationarity in the time series will be made using the extended Dickey-Fuller test (see formula 6). A null hypothesis is used for

the ADF test when the time sequences tested are not stationary. Stationarity test results of the series in absolute values and inter-annual changes to GDP and total loans are shown in the Tab. 3.

The results of the ADF unit root test indicate that the original data for all time sequences are non-stationary. Non-stationarity of the time series means that apparent correlation could occur for the correlation analysis. Stationarity for all time sequence was achieved only after their differentiation and the time sequences are therefore integrated in stage I (1); see Part 2 of the Tab. 3.

Based on the results shown above, we can proceed to the cointegration test. The cointegration test is performed using the Engle-Granger test (see formula 2). This test requires non-stationarity of the original time sequence and the same degree of integration. Both conditions are shown in Tab. 3. The null hypothesis for cointegration is that the time sequences tested are not cointegrated. The type of test chosen is based on the lowest value of the Akaike criterion.

Testing cointegration relationships for variables in absolute values is performed using the EG test, where the model is chosen with a constant and trend based on the lowest value of

Tab. 3: Results of ADF stationarity test for total loans and GDP

Model	p-value	Evaluated result of ADF test
Test with constant		
ΔY	0.6492	Time sequence is non-stationary
ΔU_c	0.7910	Time sequence is non-stationary
ΔU_p	0.5196	Time sequence is non-stationary
ΔU_d	0.8450	Time sequence is non-stationary
ΔU_h	0.4006	Time sequence is non-stationary
ΔU_s	0.8225	Time sequence is non-stationary
Test with constant		
First difference ΔY	0.01756	Time sequence is stationary
First difference ΔU_c	0.00427	Time sequence is stationary
First difference ΔU_p	0.00007	Time sequence is stationary
First difference ΔU_d	0.00010	Time sequence is stationary
First difference ΔU_h	0.00068	Time sequence is stationary
First difference ΔU_s	0.00006	Time sequence is stationary

Source: own

Tab. 4: Results of the E-G cointegration test in annual changes

Model	Variable	AIC	p-value	H0:
2 delays with constant	ΔY	239.4507	0.0693	Not rejected
1 delay with constant and trend	ΔU_p	232.1227	0.4894	Not rejected
1 delay with constant and trend	ΔU_d	231.2742	0.2772	Not rejected
1 delay with constant and trend	ΔU_h	228.4799	0.1836	Not rejected
1 delay with constant	ΔU_s	237.2326	0.1728	Not rejected

Source: own

AIC, which amounts to 1,121.736. The resulting calculated values for determining cointegration are listed in the Tab. 4.

Based on tests, we will not reject the null hypothesis of non-cointegration of the time sequence, as the calculated all p -values are higher than the specified significance level of 0.05. For this reason, in both cases, the test series is non-cointegrated. In the following test, causality is performed using a VAR model (see formula 3 and 4). For the Granger tests of time causality, a null hypothesis is set, that the development of bank loans does not affect the economic cycle and therefore has no impact on

the forecasts of the GDP. Tests are performed for eight quarterly delays, where any causality can be assumed. Test results for inter-annual changes of quarterly values are given in the following table (Tab. 5).

Causal relations of the development of loans to GDP are shown at a significance level of 0.05 at two, four and eight quarterly delays. Based on the calculated p -value, it is possible in three cases, to decide to reject the null hypothesis at a significance level of 0.05. From the economic point of view it means that the development of bank loans in the form of relative annual changes (for total loans)

Tab. 5: Results of Granger causality in annual changes – total loans

Null hypothesis	Delay	p-value	H ₀ :
ΔU_c does not causally act on ΔY	1	0.1843	Not rejected
ΔU_c does not causally act on ΔY	2	0.0070	Rejected
ΔU_c does not causally act on ΔY	3	0.2816	Not rejected
ΔU_c does not causally act on ΔY	4	0.0086	Rejected
ΔU_c does not causally act on ΔY	5	0.3925	Not rejected
ΔU_c does not causally act on ΔY	6	0.4210	Not rejected
ΔU_c does not causally act on ΔY	7	0.1402	Not rejected
ΔU_c does not causally act on ΔY	8	0.0176	Rejected

Source: own

causally act within the meaning of Granger causality on the development of GDP, with a certain time lag.

The following table (Tab. 6) shows the results of the Granger causality in quarterly inter-annual changes between developments in loans to non-financial businesses and GDP growth.

Causal relations of the development of loans to non-financial businesses to GDP are shown at a significance level of 0.05 at two, four and eight quarterly delays. Based on the calculated *p*-value, it is possible in three cases, to decide to reject the null hypothesis at a significance level of 0.05. From the economic point of view it means that the development of bank loans in the form of relative annual changes (for loans to non-financial businesses) causally act within the meaning of Granger causality on the development of GDP, with a certain time lag.

The Tab. 7 shows the results of the Granger causality in quarterly inter-annual changes between developments in loans to households and GDP growth.

Causal relations of the development of loans to households to GDP are shown at a significance level of 0.05 at one, two, four and six quarterly delays. Based on the calculated *p*-value, it is possible in four cases, to decide to reject the null hypothesis at a significance level of 0.05. From the economic point of view it means that the development of bank loans in the form of relative annual changes (for loans to households) causally act within the meaning of Granger causality on the development of GDP, with a certain time lag.

The Tab. 8 shows the results of the Granger causality in quarterly inter-annual changes between developments in mortgage loans and GDP growth.

Tab. 6: Results of Granger causality in annual changes – loans to non-financial businesses

Null hypothesis	Delay	p-value	H ₀ :
ΔU_p does not causally act on ΔY	1	0.5110	Not rejected
ΔU_p does not causally act on ΔY	2	0.0039	Rejected
ΔU_p does not causally act on ΔY	3	0.4321	Not rejected
ΔU_p does not causally act on ΔY	4	0.0172	Rejected
ΔU_p does not causally act on ΔY	5	0.6775	Not rejected
ΔU_p does not causally act on ΔY	6	0.8680	Not rejected
ΔU_p does not causally act on ΔY	7	0.0769	Not rejected
ΔU_p does not causally act on ΔY	8	0.0458	Rejected

Source: own

Tab. 7: Results of Granger causality in annual changes – loans to households

Null hypothesis	Delay	p-value	H ₀ :
ΔU_d does not causally act on ΔY	1	0.0467	Rejected
ΔU_d does not causally act on ΔY	2	0.0015	Rejected
ΔU_d does not causally act on ΔY	3	0.4962	Not rejected
ΔU_d does not causally act on ΔY	4	0.0012	Rejected
ΔU_d does not causally act on ΔY	5	0.0507	Not rejected
ΔU_d does not causally act on ΔY	6	0.0148	Rejected
ΔU_d does not causally act on ΔY	7	0.1800	Not rejected
ΔU_d does not causally act on ΔY	8	0.1981	Not rejected

Source: own

Tab. 8: Results of Granger causality in annual changes – mortgage loans

Null hypothesis	Delay	p-value	H ₀ :
ΔU_h does not causally act on ΔY	1	0.1308	Not rejected
ΔU_h does not causally act on ΔY	2	0.0031	Rejected
ΔU_h does not causally act on ΔY	3	0.6881	Not rejected
ΔU_h does not causally act on ΔY	4	0.0024	Rejected
ΔU_h does not causally act on ΔY	5	0.9042	Not rejected
ΔU_h does not causally act on ΔY	6	0.0809	Not rejected
ΔU_h does not causally act on ΔY	8	0.0461	Rejected

Source: own

Tab. 9: Results of Granger causality in annual changes – consumer loans

Null hypothesis	Delay	p-value	H ₀ :
ΔU_s does not causally act on ΔY	1	0.5113	Not rejected
ΔU_s does not causally act on ΔY	2	0.3063	Not rejected
ΔU_s does not causally act on ΔY	3	0.8347	Not rejected
ΔU_s does not causally act on ΔY	4	0.3192	Not rejected
ΔU_s does not causally act on ΔY	5	0.9337	Not rejected
ΔU_s does not causally act on ΔY	6	0.6910	Not rejected
ΔU_s does not causally act on ΔY	7	0.7653	Not rejected
ΔU_s does not causally act on ΔY	8	0.7132	Not rejected

Source: own

Causal relations of the development of mortgage loans to GDP are shown at a significance level of 0.05 at two, four and eight quarterly delays. Based on the calculated p -value, it is possible in three cases, to decide to reject the null hypothesis at a significance level of 0.05. From the economic point of view it means that the development of bank loans in the form of relative annual changes (for mortgage loans) causally act within the meaning of Granger causality on the development of GDP, with a certain time lag.

The Tab. 9 shows the results of the Granger causality in quarterly inter-annual changes between developments in consumer loans and GDP growth.

Causal relations of the development of consumer loans to GDP are not shown at a significance level of 0.05 at any quarterly delays. On the basis of the p -values calculated above, we will not reject the null hypothesis at a significance level of 0.05. From the economic point of view it means that the development of bank loans in the form of relative annual changes (for consumer loans) causally did not act within the meaning of Granger causality on the development of GDP.

More detailed economic commentary on the above calculations, including a discussion of the consistency of our calculations with economic theory and the practical implications, is given in the next chapter.

5. Discussion

Based on the calculations shown above, we can conclude that the examined model was statistically confirmed; i.e., development of bank loans in the form of relative annual changes causally operates within the meaning of Granger causality on the development of GDP, with a certain time lag. Thus the set hypothesis is confirmed, namely that the development of bank loans positively correlates with the development of the economy.

The only type of loan where we do not refuse the null hypothesis for any delay are consumer loans. This means that the development of consumer loans does not affect the development of the economy. In economic terms, it is logical mainly from two perspectives. First, the volume of consumer loans in the economy does not reach the same levels as loans to non-financial businesses and mortgage loans, thus they do not have the same

impact on economic development. Second, the development of consumer loans responds more to the development of the economy. Businesses require consumer loans in times when the economy is thriving or is expected to continue to thrive and economic entities will be able to repay the loans.

For all other types of loans – loans to non-financial businesses, loans to households, mortgage loans and total loans – the statistically most significant time lag is two and four quarters, when we reject the null hypothesis. For three types of loans, excluding mortgages, a time delay of 8 quarters is statistically significant. A time delay of the effect of loans on economic development of two four quarters best corresponds to the expectations of the transmission mechanism of monetary policy. Central banks typically consider the time delay of the effectiveness of their monetary/policy instruments in an interval of 4-6 quarters.

Conclusions demonstrated by our calculations correspond to current standard economic thinking. This is also represented in the majority of the articles stated above – see the first group of authors in the section Theoretical Basis. Of course the authors worked with various defined variables, however, the findings of their studies and ours are essentially the same. Other authors who came to the same conclusions from the viewpoint of the effects of various types of loans are Ermisoglu et al. (2013) and Armeanu et al. (2015), who found that business loans have a higher impact on GDP growth than loans to households. It is a question of the length of the loans and the resulting investment in businesses. Furthermore, our results concerning mortgage loans were consistent with the findings of Kelly et al. (2013), where a dependence was demonstrated that the expansion of mortgage loans also promotes the growth of GDP. On the other hand, in the Czech Republic today risks are beginning to appear associated with a higher rate of lending, which corresponds more to the conclusions of those economists who say that a negative relationship exists between lending growth and economic performance, namely in the form of a risk of over-indebtedness (Leitao et al., 2012; Ibanez et al., 2014). Not only in the Czech Republic is there mainly an increase in the provision of 100% mortgages; i.e., a situation where a mortgage loan is provided in the amount of the secured real estate. Another

issue may be the growth of credit card loans, however, this issue has not been substantially quantified in the Czech Republic.

From the point of view of the practical use of our results, we can recommend the central bank to adequately influence the amount of money in circulation issued through commercial credits. We have shown that, apart from consumer credit, all other analysed loans have a certain impact on the development of the economy, and always with a certain time lag. This confirms the functioning of the credit channel of the transmission mechanism in the Czech Republic.

Leaving aside the minor studies showing either negative or no relationship between loans and economic development, we must also mention the important factors that undermine the positive relationship of the variables examined.

We can divide these into economic and non-economic. Among the economic factors we may definitely include active monetary and fiscal policies. Both of these policies under conditions such as those of the Czech Republic and under the conditions of developed countries in recent years have recently been very proactive. Monetary policies in response to the financial crisis have employed so-called Unconventional monetary tools in three different forms. The first is that of quantitative easing, secondly, setting negative interest rates – both with indirect influence on a weakening exchange rate. The third form was a direct weakening of local currencies through foreign exchange interventions, which was implemented by the central bank in the Czech Republic. A more detailed comparison of all these tools was made by Černožorská and Flosová (2014), who summarises that the greatest benefits of this policy, outside the Czech Republic, are increased liquidity of financial markets, but it is not a sufficient condition to resolve the fundamental problems. However, the use of these tools has led to the promotion of economic growth. Fiscal policies of developed countries have also responded to the financial crisis with a huge degree of expansion to restrain the decline of the economies. The Czech Republic was the exception in this regard, because the first reaction of the government at the time was a significant tightening of fiscal conditions in the form of an increase in indirect taxes and a reduction in government spending, which

led to a relatively sharp economic decline in the early years. Later however, another political administration implemented, and is still implementing, an expansionary fiscal policy. Another economic factor is the dependence of the domestic non-banking entities on domestic financial resources. The vast majority of domestic entities still procure loans from domestic banks (particularly households). A certain percentage of loans to businesses come from foreign banks, but in the context of the entire Czech banking sector, this is not particularly striking. The problem was rather lower functionality of the credit transmission mechanism away from the central bank to commercial banks. Owing to the systemic liquidity surplus, banks had little interest in newly issued money from the Czech National Bank, as they had no way to assess it.

Among the most important non-economic factors we must include the confidence of businesses in future development. This confidence is strongly influenced by the statements of politicians. This is also related to the political cycle when politicians implement an expansionary fiscal policy before an election, basically regardless of the needs of the economy (for more, see Černožorská & Černožorský, 2009). Conversely, after an election, they implement unpopular measures such as raising taxes and reducing government spending. In the Czech Republic, except for a brief period of restrictive fiscal policy in and after 2009, a rather expansionary fiscal policy has been exercised.

Based on the results of our study and related comments, it is necessary to continue with further research, especially from the point of view of the bi-directional impact of the variables in question, the inclusion of other variables, including the extension to other countries with a longer time series of suitable indicators.

Conclusion

The aim of this article was to examine the impact of the development of different types of loans in the banking sector on economic development. The main idea of the article is based on the hypothesis that economic performance increases with the growth of the rate of various types of loans. We investigated the validity of this hypothesis using selected statistical and mathematical methods. The model is built on testing delays dependent

the variable of GDP, and the stationarity test, including the necessary adjustments of data by differencing. Cointegration is then tested and the final test is to perform Granger causality. We began with data from the Czech Statistical Office or the Czech National Bank from the period 2004-2015. All figures are in the form of relative annual changes for each quarter. The result of our calculations confirms that different types of bank loans have an impact on the development of the economy as measured by GDP development. The only exception is consumer loans, where this relationship was not confirmed. We explain it rather that consumer loans are dependent on economic development. Other types of loans – loans to non-financial businesses, loans to households, mortgage loans and total loans – influence the development of gross domestic product. The statistically most significant time lags appear to be two and four quarters, which correspond to the practical considerations of monetary policy, instrument settings, and their effect on the economy. Of course it is necessary to take into account a variety of economic and non-economic factors which partially dissipate this influence.

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TYPES OF BANK LOANS AND THEIR IMPACT ON ECONOMIC DEVELOPMENT: A CASE STUDY OF THE CZECH REPUBLIC

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This article aims to evaluate the impact of the development of different types of loans in the banking sector on economic development. We will begin with the hypothesis that economic performance increases with the growth of the rate of various types of loans. We will first look at research of current scientific knowledge in respect to bank loans and economic development. The basic idea of this article is the hypothesis described above, determined on the basis of standard economic findings and based on the results of a majority of related studies. The development of loans provided can be quantified based on data from the Czech National Bank as total loans and divided into loans to non-financial companies and households, as well as mortgage loans and consumer loans. The development of the economy can also be quantified using data from the Czech Statistical Office on the development of the gross domestic product. The period selected is the years 2004-2015. To determine the relationships between selected variables, we have used statistical methods that respect the specific characteristics of the selected time series, namely the Engle-Granger causality test. Prior to testing, it was necessary to adjust the data as stationary and then test cointegration. An optimum order delay was also determined using the Akaike information criterion. The calculated results, except for consumer loans, confirm the hypothesis regarding the positive impact of the rate of loans provided on economic growth, particularly with a six-month time lag. We have obtained results that correspond to standard economic knowledge and results of most previous studies.

Key Words: Banks, bank loans, economic cycle, Engle-Granger causality.

JEL Classification: G34, M12.

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THE KNOWLEDGE AND USE OF THE BALANCED SCORECARD METHOD IN BUSINESSES IN THE SLOVAK REPUBLIC

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Introduction

One of the management tools that is gaining popularity in business practice is the Balanced Scorecard (BSC). The BSC was developed by Robert Kaplan and David Norton in 1992 as an alternative to traditional performance measurement approaches that focus solely on financial indicators and are based purely on a business's past performance. During the years the Balanced Scorecard has evolved from its early use as a simple performance measurement framework to a full strategic planning and management system. It can be defined as a strategic planning and management system that is used to align business activities to the vision and strategy of the businesses, to improve internal and external communications and to monitor organization performance against strategic goals. The BSC can be understood as a management system which is structured according to the logic of the management circle ("plan-do-check-act") (Kaplan & Norton, 2010).

1. Balanced Scorecard – A Strategic Management Tool

The Balanced Scorecard is a management system (not only measurement system) that enables businesses to clarify their vision and strategy and translate them into action. It provides feedback around the internal processes and external outcomes in order to continuously improve strategic performance and results. When fully implemented, the Balanced Scorecard transforms strategic planning from an academic exercise into the (nerve) centre of an enterprise (Kaplan & Norton, 2007).

The aim of the Balanced Scorecard is to direct, help manage and change in support of the longer-term strategy in order to manage

performance. The scorecard reflects what the businesses and the strategies are all about. It acts as a catalyst for bringing the "change" element within the businesses. BSC creates a comprehensive framework which considers the following perspectives and tries to get answers to the following questions: 1. Financial perspective (how do we look at shareholders?); 2. Customer perspective (how should we appear to our customers?); 3. Internal business processes perspective (what must we excel at?); 4. Learning and growth perspective (can we continue to improve and create value?).

This tool is considering not only the financial results, which are important, but also those factors which actually drive businesses towards future success. The Balanced Scorecard lays stress also on other areas which are required to "balance" the financial perspective in order to get a total view of the businesses performance and improve the same (Evans, 2002). The framework tries to bring a balance and link between the financial and non-financial indicators, tangible and intangible measures, internal and external aspects and leading and lagging indicators.

The main benefit of managing with a combination of financial and non-financial information is that the use of leading, non-financial indicators facilitates proactive control and the ability to take a preventive action (De Waal, 2013). A balanced set of key financial and non-financial (CSF) critical success factors and KPIs (key performance indicators) enables management to focus on the really important issues that drive business performance and to monitor the achievement of strategic goals more closely. Using non-financial information improves the analytical skills of managers because they can identify the root causes of financial performance.

Lesáková (2004) states that the BSC method is not just a grouping of important indicators of performance evaluation. Its consistent application provides a modern way of management, because it helps to align the business activities with the business processes of creating the company's value.

Synek et al. (2011) look at the BSC as a method of strategic management whose role is to align the interests of management with the interests of employees and the strategic goals with the operational management. The authors support exploitability of this method for linking the strategy with the daily decision making process.

Armstrong (2007) compared the method to a waterfall. The author claims that the BSC method passes through the businesses as a waterfall to ensure the measurement of the activities that contribute to the achievement of the overall businesses strategy. The idea captures the essence of the current importance of the BSC method in the strategic management of the company.

There are several authors who deal with the BSC method in the strategic business management and the problems emerging through its implementation in business (De Waal, 2013; Evans, 2002; Gavurová, 2012; Horváth & Partners, 2002; Kaplan & Norton, 2007; Lang, 2007; Karabašová, 2010; Virtanen, 2009 and others).

Proper understanding and implementation of the Balanced Scorecard method brings a number of benefits to businesses that are presented in literature. The authors of the BSC (Kaplan & Norton, 2007) see the major contribution of this method mainly in the implementation of the business's vision and strategy into its objectives and measurements. The method connects the vision and the strategy with the daily decision making process. The BSC method facilitates the communication and understanding of the strategy across the business and helps to align individual goals of the employees with the business's objectives. These arguments are presented by Kaplan and Norton (2007), who state that the measurements should be used in a way other than a classical tool for revising the behaviour and past performance. The authors argue that the measurements in the BSC should serve mainly as an aid in formulating the corporate strategy, communicating it and

aligning individual, corporate and departmental initiatives towards the achievement of the common goal.

In the year 2002 Kaplan and Norton formulated the main benefits of the BSC method resulting from the cooperation of different stakeholders in the business. First, they state that the method provides a clear picture of the corporate strategy which is understandable for the employees. Due to that the strategy becomes part of the daily activities of the employees. As the second benefit they indicate that BSC helps companies to define strategic partnerships with target customers and to focus attention on customers. Third, unless the businesses have set a strategy which includes strong partnerships with suppliers, the BSC assists in their maintenance through the monitoring of the performance in the internal business processes perspective. And fourth, the authors state that for businesses it is usually important to maintain good relationships with the community where the business is located. Determination of good relations is reflected in the perspective of internal business processes.

Based on the article "How a Balanced Scorecard can help your organization" (Balanced Scorecard Institute, 2012), we can conclude that the BSC can help businesses particularly in the following areas:

- to increase focus on strategy and results,
- to break communication noises between departments,
- to increase understanding of customer needs and flexibility to respond to them,
- to improve businesses performance by measuring the important areas,
- to assist the management in making better decisions based on analysis of relevant performance indicators,
- to assist the management with more effective planning of time and resources,
- to assist the management and employees to concentrate on important tasks.

Gavurová (2011) points out that the main benefits of the method lie mainly in helping to implement the strategy into everyday practice, then in simplifying communication and creating a uniform communication platform, in assisting to measure and enhance the performance and in supporting the explanatory power of the traditional performance indicators. Horváthová (2012) adds another benefit of implementing the BSC method, specifically the benefit of

increasing the loyalty of customers as well as employees who are a presumption for the growth of its value.

There are many benefits and challenges to the Balanced Scorecard. The primary benefit is that it helps businesses translate strategy into action. By defining and communicating performance metrics related to the overall strategy of the businesses, the Balanced Scorecard makes the strategy come alive (De Waal, 2013). It also enables employees at all levels of the businesses to focus on important business drivers. In the article entitled "The Balanced Scorecard" (Balanced Scorecard Institute, 2013) the key benefits of using a Balanced Scorecard include: better strategic planning, improved strategy communication and execution, better management information, improved performance reporting, better strategic alignment and better organisational alignment.

2. Aim, Material and Methodology

The aim of the paper is to present the results of primary research focused on finding the current state of the knowledge and use of the Balanced Scorecard method in businesses in the Slovak Republic. On the basis of the research results will be formulated presumptions to improve the state of utilizing the BSC method by Slovak businesses.

With regard to the aim, there were formulated the following six hypotheses:

H1: We assume that more than 50% of Slovak businesses do not know the Balanced Scorecard method.

H2: We assume that less than 50% of Slovak businesses utilize the Balanced Scorecard method as a strategic management tool.

H3: We assume that more than 50% of businesses applying the Balanced Scorecard method in the Slovak Republic are large businesses.

H4: We assume that the Balanced Scorecard method is implemented in the Slovak Republic mainly by businesses with foreign capital participation.

H5: We assume that the main reason for low utilization of the Balanced Scorecard method in practice is its difficult construction.

H6: We assume that the main reason for implementing the Balanced Scorecard method is the enrichment of business performance evaluation by non-financial measures.

The research was realized in the period from September 2014 to December 2014. We used the method of questioning with a questionnaire to obtain data. We distributed the questionnaire in the electronic form to small, medium and large businesses operating in the territory of the Slovak Republic. For the distribution and collection of questionnaires was used the Google Docs. Questionnaire which consisted of closed, semi-closed and opened questions.

The sample of businesses was compiled by random selection. We received fully filled questionnaires from 290 respondents, from which 6 questionnaires were eliminated due to incompleteness of responses. The remaining 284 questionnaires were subject to statistical processing. We verified the representativeness of the research sample by using the criterion of territorial representation of businesses in research.

The research sample consisted mainly of businesses located in the region of Bratislava (27.96%), which was caused by the highest concentration of businesses in the region of Bratislava. The second most numerous representation had businesses from the region of Banská Bystrica (12.90%), then businesses from the region of Žilina (11.47%), Košice (10.75%), Trenčín (10.39%), Prešov (10.04%), Trnava (9.32%) and Nitra (7.17%).

We verified the representativeness of the research sample by a chi-square test. Based on the level of significance $\alpha = 0.05$, the p-value accounted for 0.128, which means that the research sample was representative with respect to the location of the business unit.

What concerns the distribution of businesses by size in the research sample, there were represented all kinds of businesses: small businesses (73.45%), medium businesses (20.00%) and large businesses (6.55%).

Regarding the sector representation, the research sample consisted of service businesses (67; 23.59%), manufacturing businesses (41; 14.44%), commercial businesses (34; 11.97%), construction businesses (24; 8.45%), public organizations and organizations of public administration (20; 7.04%), banks and businesses providing financial services (14; 4.93%) and others (84; 29.58%).

The data obtained via the questionnaire research were processed by using the MS Excel program and SPSS statistical program. We provided the statistical testing of data

on the level of significance of 5% ($\alpha = 0.05$). The validity of the formulated hypotheses was evaluated by an exact binomial test (testing the validity of H1, H2 and H5) and the Spearman Coefficient (verifying the validity of hypotheses H3 and H4).

In order to achieve our main objective, we used also other research methods, namely the method of analysis, synthesis, induction, deduction, abstraction, generalization as well as statistical methods.

3. Results and Discussion

The results of the questionnaire research pointed to a low familiarity with and usage of the Balanced Scorecard method in Slovak businesses. We found out that only 13.73% (39) respondents know exactly what the Balanced Scorecard method is and have implemented the method, 9.15% (26) respondents know the method, but have not implemented it yet, 77.11% (219) respondents do not know the method or did not answer the question (see Tab. 1).

Tab. 1: Knowledge of the Balanced Scorecard method by businesses in the SR

Knowledge of the Balanced Scorecard method	Number of Responses	
	Total	Percentage
Yes, we know exactly what the BSC method is and we have implemented the method in our business	39	13.73
Yes, but we do not utilize the method	26	9.15
We do not know it	56	19.72
No, but we would like to learn more about the method	77	27.11
No, we are even not interested in the method	86	30.28
Total	284	100.00

Source: processed according to the results of questionnaire research

Most businesses responded that they did not know what the Balanced Scorecard method is and even they were not interested to learn about it (30.28% respondents, i.e. 86 businesses). 77 businesses (27.11%) did not know the method, but would like to learn more about it. These businesses were mostly small businesses.

Based on the research results, we verified the validity of H1, in which we assumed that more than 50% of Slovak businesses do not know the Balanced Scorecard method. We verified the validity of this hypothesis by a binomial test and found out that the p-value (0.00) is lower than the level of significance α (0.05). This confirmed the presumption that in the Slovak Republic there is a low number of businesses that know the Balanced Scorecard method.

In respondents who expressed that they exactly know what the Balanced Scorecard method is, we wanted to know from what sources they learned about the method. The question was designed in a way that provided

respondents more options to answer. Our respondents acquired the knowledge about the Balanced Scorecard method mainly from various forms of education (80.39% respondents), then from previous practical and personal experience (11.76% respondents) and from references from other businesses (7.84%).

We wondered how many respondents implemented the Balanced Scorecard method in the business. We found out that from 284 respondents there are only 39 respondents (13.73%) using the Balanced Scorecard method as a strategic management tool, out of which 23 (58.97%) are businesses of large size (250 and more employees). In order to verify H2 we used a binomial exact test. On the basis of p-value (0.012), which is lower than the level of significance α (0.05), we acknowledge the validity of H2, which says that the Balanced Scorecard method is utilized as a strategic management tool by less than 50% of Slovak businesses.

H3 was verified through the Spearman coefficient. We assumed that there exists

a dependence among the studied features (i.e. the size of business and utilization of the Balanced Scorecard method). Based on the results of the Spearman coefficient verified on the level of significance α (0.05), we can conclude that there exists a direct medium dependence ($r = 0.514$) among the studied features. This supports the fact that the implementation of the Balanced Scorecard method is proportionally dependent on the size of business. This means that the larger a business is, the higher the probability of implementing the Balanced Scorecard method in it is.

H4 was verified through the Spearman Coefficient as well. The sample was created from the respondents who have implemented the Balanced Scorecard method: 19 of them (48.72%) were businesses with exclusively Slovak ownership, in 8 of them (20.51%) a majority of ownership was Slovak, in 5 businesses (12.82%) there was 50% of foreign ownership, in 5 businesses (12.82%) a majority of stake was owned by a foreign owner and 2 businesses (5.13%) were fully owned by a foreign owner. With this hypothesis we examined the dependence between business ownership and implementation of the Balanced Scorecard method. Based on the results of the Spearman Coefficient, the level of p-value (0.634) is higher than the level of significance α (0.05), which means that implementing the Balanced Scorecard method does not depend on the proportion of domestic

and foreign owners of a business.

The evaluated hypotheses related to the size of businesses and structure of owners. A separate group of businesses is represented by businesses that know the method, but do not implement it. This group comprises 7 businesses considering the implementation of the Balanced Scorecard method in the near future, 2 businesses having past experience with implementing the method and 18 businesses knowing the method but not having interest to implement it.

The reasons of businesses for lack of interest to implement the method were examined within H5 and they are presented in Tab. 2 below.

Among the most common reasons for disinterest in implementing the Balanced Scorecard method are lack of familiarity with the method, use of other strategic management tools, not performing strategic management (strategic planning) and other reasons like the size of business (applies mostly to small businesses), scope of business (industry in which a business operates, pointless use of new methods and ways of managing the business; some businesses stated that they utilize BSC mostly as a performance measurement tool.

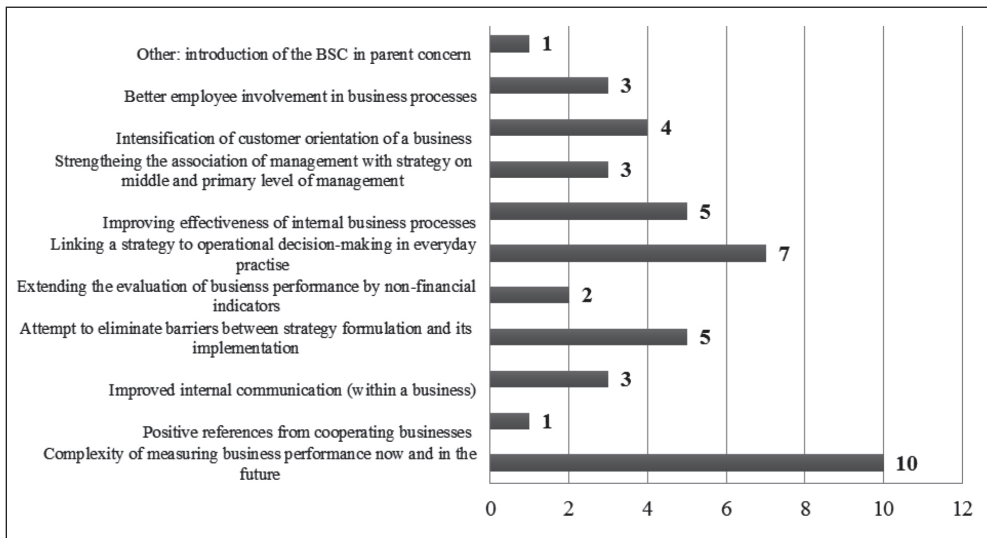
We examined the difference between the frequencies of two main reasons concerning the disinterest in implementing the BSC method by the means of SPSS program. To evaluate the significance of difference we used a binomial test which confirmed that there is no significant

Tab. 2: Reasons of disinterest to implement the BSC method by Slovak businesses

Reasons for disinterest in implementing the BSC method	Number of Responses	
	Total	Percentage
The business applies intuitive management	3	4.62
The business uses other tool/tools	11	16.92
Lack of financial means	0	0.00
Difficulty with the construction of BSC	2	3.08
Lack of time	4	6.15
Lack of familiarity with the method	15	23.08
We do not perform strategic management, we manage a business according to the current situation on the market	9	13.85
Other	21	32.31
Total	65	100.00

Source: processed according to the results of questionnaire research

Fig. 1: Reasons for implementing the Balanced Scorecard in a business



Source: processed according to the results of questionnaire research

difference between these two reasons (the level of significance $\alpha = 0.05$ is lower than the p -value = 0.405). The most frequent reason why businesses decide not to implement the Balanced Scorecard method is lack of familiarity with the method; however, there are also other reasons. This means that it is not possible to accept H5.

On the other hand, the most frequent reason to implement the BSC method (with businesses that know the method) was the complexity of measuring business performance (10 respondents, i.e. 20.73% of answers). The reasons for implementing the BSC method are presented in Fig. 1.

Among the most frequently introduced reasons for implementing the Balanced Scorecard method is linking the strategy to operational decision making in everyday practice (7 respondents; 14.51%), improving the effectiveness of internal business processes (5 respondents; 10.36%), attempting to eliminate barriers between the strategy formulation and its implementation (5 respondents; 10.36%) and intensifying customer orientation of the business (4 respondents; 8.29%) and other (13 respondents; 26.95%). One of the other reasons for implementation of the BSC was

that the method was implemented in the parent concern. Based on the research results, the presumption formulated in H6 was not confirmed.

A separate part of empirical research was aimed at identifying the main benefits and main problems associated with the implementation of the BSC in Slovak businesses.

The businesses had a choice of more options (maximum was limited to 3 options) to answer the question on the main benefits of implementing the BSC method.

The results of the research showed that the main benefits of implementing the BSC method in businesses in the Slovak Republic were improved performance measurement and evaluation of business processes (30.00%), support of strategic objectives through operational and short-term objectives (20.00%) and introduction of periodical evaluation of strategic objectives (16.67%).

Another question was focused on recognizing the most problematic phases of implementing the BSC method (Tab. 4).

The most problematic phases of implementing the BSC method the respondents mentioned were the integration of the method into existing management system (25.00% of

Tab. 3: Benefits of implementing the BSC method from the viewpoint of Slovak businesses

Benefits of the method	% of answers
Improving performance measurement and evaluation of business processes	30.00
Supporting strategic objectives through operational and short-term objectives	20.00
Introducing an effective system of periodical evaluation of strategic objectives	17.70
Improving the knowledge of customer needs and overall knowledge of the market	16.15
Increasing employee's motivation towards achieving personal performance contributing to fulfilling strategic objectives	16.15

Source: processed according to the results of questionnaire research

Tab. 4: Problematic phases of implementing the BSC method from the viewpoint of Slovak businesses

Problematic phases of implementing the BSC	% of answers
Linking the strategic objectives to the objectives of departments, teams and individuals	8.33
Identification of critical success factors	8.33
Integration of the method into existing management system	25.00
Transformation of the departmental objectives into objectives of individuals	8.33
Linking the implementation of the method with the stimulation and motivation of employees	16.67
Selection of key performance indicators (measures)	16.67
Utilization of the results and information from the implemented method for corrective and preventive actions in the business	16.67

Source: processed according to the results of questionnaire research

answers), identification of key performance indicators (16.67% of answers) and linking the implementation of the method with the stimulation and motivation of employees (16.67% of answers).

The research confirmed that the lack of interest to implement the BSC arises from the missing knowledge of the method. The information gained from the questionnaire survey points to a paradigm in managing Slovak businesses: an ingrained strong resistance to change is noticeable and managers are more inclined to known and verified methods.

Conclusions

The proper understanding and implementation of the Balanced Scorecard method brings a number of benefits to businesses. The method serves as a support for implementing the business strategy, it strengthens cooperation

between business units, business departments, human resources of the business and serves as a communication tool in the business. Another important benefit is orientation of managers on key customers and partners and improvement of relations with the business stakeholders. The method makes business more transparent; it offers more relevant and complex information about the business that is helpful in early detection of possible bad direction of the business in future. If the method is properly implemented, it provides managers with feedback, offers them a space for self-reflection and leads to an improvement of internal processes by the means of communicating strategic objectives through all business levels.

The results of our research carried out on a sample of 284 businesses confirmed the presumption that the Balance Scorecard method is not only little used, but also the knowledge

about it is very low in Slovak businesses. The low interest of businesses to implement the method into practice can be viewed critically. The most common reasons for disinterest in implementing the BSC are lack of familiarity with the method, use of other strategic management tools, performing the BSC only as a performance management tool as well as not performing the strategic business management. The research results confirmed that the larger the business is, the higher the probability of implementing the BSC is. The benefits of the Balanced Scorecard method correspond to the most frequent reasons for its implementation in businesses in the Slovak Republic, which are the complexity of measuring business performance at present and in future, linking the strategy to operational decision-making in everyday practice, improving the effectiveness of internal business processes, attempting to eliminate barriers between the strategy formulation and its implementation and intensification of customer orientation. Conversely, one of the most frequently cited reasons for low interest in implementing the method is lack of familiarity with it.

On the basis of the presented benefits and the results of the questionnaire research, we consider the Balanced Scorecard method a strategic management tool that should be presented more to Slovak businesses. Better knowledge of the Balanced Scorecard method can lead to a wider use of the BSC in Slovak businesses and thus taking an advantage of the benefits that the BSC offers.

When formulating proposals to increase the level of knowledge of the Balanced Scorecard method in Slovak businesses we come out from the preferred methods of obtaining information in businesses. Managers acquire new knowledge mostly through school education (educational activities) or practical training. A number of businesses gain new knowledge also from the experience of other businesses (cooperating businesses, competition) and also from specialized journals and magazines. Innovation is nowadays a key factor for entrepreneurial activity (Šipikal, Pisár, & Uramová, 2010). With regard to these ways of obtaining information in Slovak businesses, the most suitable way of providing information about the BSC method appears to be educational activities as well as in-company training. Likewise, businesses have a possibility to use the services of special consulting agencies.

The Balanced Scorecard method can be implemented in different ways. The business can decide to implement the method by itself (in-house), with the help of consulting agencies or another expert who is a specialist in the BSC method. Synek et al. (2011) argue that in the process of designing (construction) and implementation of the BSC method into the business, the whole team of specialists should work together.

Based on the theoretical knowledge and practical experience of Slovak and foreign businesses, it is clear that for the proper implementation of the BSC method, the commitment of the top management is essential. We consider full support and active participation of the senior management an important precondition for successful implementation of the BSC. Full support and active participation of the senior management is required due to competencies and authority needed.

Similarly, managers at lower levels also have to be identified with the implementation of the BSC method. An essential point here is that managers have clearly defined competencies. Employees cannot be left out either – they should also have basic information about the method. Appropriate awareness reduces resistance to change as it minimizes the fear of the new and unknown.

In general, businesses have to meet certain prerequisites for successful implementation of the BSC method into their business practice. Several authors deal with this kind of research and define the assumptions that businesses should meet before the actual implementation of the BSC method. According to Karabašová (2010), the main prerequisites for successful implementation of the Balanced Scorecard are as follows: full support and active participation of the senior management, adaptation of all activities of the business to match the new governance, the business has to clearly define the responsibilities for achieving the measurements of the BSC and to connect them with the evaluation and remuneration of employees; a key factor here is the communication of the new system and involvement of all employees in its implementation.

It is evident that the Balanced Scorecard method could help our businesses not only measure the performance, but also manage the

strategies which have to be adopted so that the long-term goals are achieved. In other words, the application of this tool could help ensure the consistency of vision and action which is the first step towards the development of successful businesses.

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Abstract

THE KNOWLEDGE AND USE OF THE BALANCED SCORECARD METHOD IN BUSINESSES IN THE SLOVAK REPUBLIC**Lubica Lesáková, Katarína Dubcová, Petra Gundová**

The Balanced Scorecard method (BSC) has emerged since the late 1990s (as proposed by Kaplan and Norton) as one of the most successful concepts in the field of strategic performance management. It has evolved from its early use as a simple performance measurement framework to a full strategic planning and management system. Balanced Scorecard is used by many successful businesses all around the world. Main aim of the paper is to present the results of primary research focused on detecting the current state of the knowledge and use of the Balanced Scorecard method in businesses in the Slovak Republic. In the first part of the paper is presented the essence of the BSC method, formulated are the main benefits connected with the Balanced Scorecard implementation into the strategic management of the businesses. These benefits are defined according to the content analysis of domestic and foreign literature. Following the goal of the article next part presents the results of the empirical research based on the questionnaire survey. Results are connected with the evaluation of the six hypothesis defined in regard of the established goal of the paper. Formulated will be presumptions to improve the state of utilizing the BSC method by Slovak businesses. For the fulfilment of settled objectives we have used several scientific methods of examination, namely the method of analysis, synthesis, induction, deduction, abstraction, generalisation as well as statistical methods.

Key Words: *Balanced Scorecard, strategic management, knowledge and use of the Balanced Scorecard method, Slovak businesses.*

JEL Classification: M21, L25.

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ANALYSIS OF HIGH COST OUTLIERS IN A POLISH REFERENCE HOSPITAL

Malgorzata Cyganska

Introduction

A concern over the raising resources consumed by health care costs has become widespread in many countries in recent years (Popesko, Papadaki, & Novak, 2015). Health spending in Poland was 6.4% of GDP in 2013, well below the OECD average of 8.9%. In 2013, per capita health spending in Poland has increased by a strong 3.8% in real terms, far above the average growth (1.0%) across OECD countries (OECD Health Statistics 2015). Despite the fact, many hospitals still have negative financial results (Cyganska, 2015; Soltes & Gavurova, 2014). The growth of financial problems of the health care sector entities contributed to the intensive search for its causes (Mączyński, 2011; Ministerstwo Zdrowia, 2004; Szetela, Lichwa, & Korniejenko, 2011). One way is to improve the system of managing costs in the health care units. Many authors in their research analyzed the influence of different factors on the disease costs. (Hollenbeak, Murphy, Koenig, Woodward, Dunagan, & Fraser, 2000; Uematsu, Kunisawa, Yamashita, & Imanaka, 2015). Research conducted by Simrova, Bartak, Vojtisek and Rogalewicz (2014) has revealed that treatment costs significantly differ depending on the selected diagnostic and therapeutic procedures. Other researchers (Popesko, Papadaki, & Novak 2015) highlights differences between the costs of individual patients under the same diagnosis and their differing demands on hospitals activities. Moreover, they confirmed that the reimbursement rates not always reflect the costs of treatment. The health technology assessment agencies, that play a vital role in the decision –making process, whether or not to reimburse given health technology, claims that in almost half of the recommendations takes into account the cost effectiveness issues.

Because of different factors influencing the healthcare costs, hospitals try to develop

a systematic approach for identifying exceptional behaviors of certain patients' costs. Revealing them is important since it signifies that some extraordinary circumstances have occurred and shall deserve the attention of managers and doctors. Most of the studies identify the different causes of hospitalization as the factors that help in predicting the future costs (Dexter & Lubarsky, 2004; Mapela, Mcmillanb, Frostc, Hurleyc, Picchic, Lydicka, & Spencerd, 2005; Huang, Hu, Lee, Yang, Weng, Lin, & Lai, 2013; Rimar & Diers, 2006; Rottger, Scheller-Kreinsen, & Busse, 2012; Taheri, Butz, & Greenfield, 2000; Uematsu, Kunisawa, Yamashita, & Imanaka, 2015). Some of the studies highlight the cost outliers (CO) or the length of stay (LOS) outliers as a specific category of patients worthy of attention (Cots, Elvira, Castells, & Dalmau, 2000; Dahl, Wojtal, Breslow, Holl, Huguez, Stone, & Korpi, 2012; Sackman & Citrin, 2014). It was found that the probability of being the hospital CO is connected to LOS, acuity of illness, risk of mortality, social status, age, gender, type of admission, destination after discharge, Intensive Care Unit (ICU) stay and medical factors (Dahl et al., 2012; Pirson, Dramaix, Leclercq, & Jackson, 2006). However since there are differences in case-mix and cost structures between hospitals, the proportion of CO and factors influencing the patient being CO may vary (Cooney, Haluck, Ku, Bass, Macleod, Brunner, & Miller, 2003; Pirson, Dramaix et al., 2006). The aim of the study is to identify the factors facilitating identification of CO in one of the reference hospitals in northeast Poland.

1. Material and Methods

The analyzed hospital provides diagnostics, therapy, care, specialist advice, education, prevention, and health promotion. Between January and June 2013, there were 5,367 patients admitted to the Departments of Cardiology,

Laryngology, Ophthalmology, Nephrology, ICU, Gastroenterology, Orthopedics, Surgery, Neurosurgery, Gynecology, Endocrinology, Diabetology and Hematology. We reviewed all of the patients that were admitted to the hospital departments between January and June 2013, except newborns (N = 462). Some of the patients were excluded from the analysis

because of missing data (n = 335). Finally, we have included 4,570 patients for further assessment. The medical data for this analysis was obtained from the hospital's administrative database and accountancy and statistical data. The cost analysis was done retrospectively after the linkage the two databases.

Tab. 1: Characteristics of hospitalized patients (n = 4,570)

Patient characteristics	mean (sd)
Age [years]	56.54 (18.21)
LOS [days]	5.39 (6.65)
Age group in years	n (%)
18-30	470 (10.28)
31-50	1,011 (22.12)
51-70	1,775 (38.84)
71>	1,077 (23.56)
Gender	n (%)
Female	2,591 (56.69)
Male	1,979 (43.30)
LOS group in days	n (%)
1-2	1,663 (36.39)
3-4	1,033 (22.60)
5-7	916 (20.04)
8-10	462 (10.11)
11>	496 (10.85)
Admission	n (%)
Planned	2,382 (52.12)
Unplanned	2,188 (47.88)
Reason of discharge	n (%)
Completed therapeutic process	3,021 (66.11)
Directed to further treatment	1,443 (31.58)
Death	106 (2.32)
Department	n (%)
Surgical	3,445 (75.38)
Nonsurgical	1,125 (24.62)
Costs (€)	median [IQR]
Total Costs	895.20 [458.91-1,633.75]
Direct Costs	344.02 [130.30-883.20]
Indirect Costs	380.44 [193.40-774.30]

Source: own

SD – standard deviation; n (%) – number of samples and proportion; IQR - interquartile range

In studied hospital the allocation of hospital costs to patient-level costs involved 5 steps:

1. The allocation of costs to final, medical and non-medical cost support centers.
2. The allocation of non-medical (transportation, laundry) support costs centers costs to medical (laboratory, operating room) support and final (wards) cost centers.
3. Calculation of intermediate products costs (e.g. laboratory tests, diagnosis tests, surgical interventions).
4. Assigning intermediate products and administration costs to final cost centers.
5. Calculation of final products costs within direct costs (drugs, intermediate product costs) and overhead costs (based on the length of stay).

Cost in PLN were converted to euro on the basis of average exchange rate of NBP (Polish National Bank) from 30.09.2015 (1€ = 4.2386 PLN).

To select the outliers, we used the interquartile method using the median and the interquartile distance (Stanisz, 2007). To select high outliers, the 75th percentile + 1.5*interquartile range was used. To identify the low outliers, we used the 25th percentile – 1.5* interquartile range. Because the rule 25th percentile – 1.5* interquartile range detected a negative trim-point in further analysis, we considered only high cost outliers.

We considered age, LOS, gender, type of admission, reason of discharge, and type of department as the possible factors that may influence the patient being a cost outlier.

Tab. 2: Characteristics of cost outliers (CO) and inliers (CI)

Predictive factors	CO N = 433	CI N = 4,137	p-Value
Age [years] mean (s.d.)	59.47 (14.67)	56.23 (18.51)	<0.0016*
Age n (%)			
<56	158 (36)	1,873 (45)	<0.001**
>56	275 (64)	2,264 (55)	
Gender n (%)			
Female	175 (40)	2,416 (58)	<0.001**
Male	258 (60)	1,721 (42)	
LOS [days] mean (s.d.)	12.8 (14.5)	4.6 (4.5)	<0.001*
LOS n (%)			
<Mean	63 (15)	2,633 (64)	<0.001**
>Mean	370 (85)	1,504 (36)	
Type of admission n (%)			
Planned	178 (41)	2,204 (53)	<0.001**
Unplanned	255 (59)	1,933 (47)	
Reason of discharge n (%)			
Completed therapeutic process	158 (36)	2,863 (69)	<0.001**
Directed to further treatment	254 (59)	1,189 (29)	
Death	21 (5)	85 (2)	
Department n (%)			
Surgical	402 (93)	3,043 (74)	<0.001**
Nonsurgical	31 (7)	1,094 (26)	

Source: own

*Statistical significance calculated with Mann-Whitney test

** Statistical significance calculated with Pearson's χ^2 test

Statistical analysis was carried out using StatSoft, Inc. (2011) STATISTICA, version 10. The analysis of contingency tables was executed with the Pearson's χ^2 -test. Continuous variables without normal distribution (LOS, age) were analyzed with the Mann-Whitney test. Univariate and multivariable logistic regression analysis were used to determine the predictors of CO.

2. Results

On the studied population, the mean patient age was 56.5 years; men comprised 43.3% of the study sample. The mean and standard deviation of LOS were 5.39 and 6.65 days, respectively. Most of the patients were admitted to the hospital within planned admission (52.12%) and were discharged from the hospital within 4 days (58.99%). The main reason of the patients' discharge was completing the therapeutic process (66.11%). Most of the patients have been cured in the surgical departments (75.38%). The

median and standard deviation of the total hospitalization costs, direct costs, and indirect costs were €895.20 (458.91-1,633.75); €344.02 (130.30-883.20); and €380.44 (193.40-774.30), respectively (Tab. 1).

On the studied population, 433 patients were identified as cost outliers (CO). They comprised 9.47% of the study sample. The average age of CO was 59.5 (SD±14.7), the length of stay of CO was 12.8 (SD±14.5). Most of outliers were men (59%), directed to further treatment (59%) and surgical patients. The profile of CO in all analyzed variables was statistically significantly different from the inlier patients (Tab. 2).

The status of the cost outliers in contrast to inliers was associated with older age, unplanned admission, being directed to further treatment after discharge from hospital, and being a surgical patient. The median total cost, direct costs, and indirect costs for CO was €4,779.08, €2,758.49 and €1,755.28, respectively (Tab. 3).

Tab. 3: Median and range of total hospital costs, direct costs and indirect costs for cost outliers (CO) and inliers (CI)

Costs	CO median [range] (€)	CI median [range] (€)
Total costs	4,779.08 [3,944.89-6,040.47]	809.90 [423.36-1,346.16]
Direct costs	2,758.49 [2,046.40-3,753.44]	290.02 [115.70-687.84]
Indirect costs	1,755.28 [1,115.68-3,075.25]	345.21 [180.47-640.63]

Source: own

CO accounted for almost 37% of total hospital costs, 40% of direct costs, and 34% of indirect costs. In univariate analysis, we found all analyzed variables as the independent factors on being the CO (Tab. 4).

In multivariate analysis, we found that age and type of admission doesn't increase a patient's probability of being CO. We identified here gender, LOS, reason of discharge and type of department as the independent factors on being the CO (Tab. 5).

The probability of being the CO increased more than 13 times for patients that stayed in the hospital longer than 5 days (mean for all the patients). The probability of becoming a CO in surgical patients increased 6 times.

To determine the predictive value of the regression model we performed the receiver operating characteristic (ROC) analysis (Fig. 1). The area under the curve (AUC) for CO was

0.857, what represents a good accuracy of the regression model.

In Tab. 6 we presented the CO and CI by ICD 10 (International Classification of Diseases 10th Revision).

We have analyzed 4,570 patients, who suffered from 825 diseases classified by ICD 10. For further analysis we chose the diseases with the number of CO higher than 5 (n = 23). In the analysed group of diseases 93% (n = 402) of the CO were surgery patients and only 7% (n = 31) were non-surgery patients. In none of the analyzed diseases, the number of non-surgery outliers exceeded 1. The most frequent disease associated with surgery cost outliers was atherosclerotic cardiovascular disease (I25.0), which constitutes 9% of all surgery CO. In terms of five diseases the CO, occur more often than CI. It concerns coxarthrosis (M16), gonarthrosis (M17.0, M17.1), benign neoplasm

Tab. 4: Univariate logistic regression analysis for selected factors increasing a patient's probability of being cost outliers (CO)

Variables	Adjusted OR	(IC*95%)	p-Value*
Age			
<56	1		<0.001
>56	1.61	(1.25-2.06)	
Gender			
Female	1		<0.001
Male	2.09	(1.64-2.66)	
LOS			
<Mean	1		<0.001
>Mean	1.18	(1.16-1.20)	
Type of admission			
NS			
Reason of discharging (%)			
Completed therapeutic process	1		<0.001
Directed to further treatment	4.31	(3.38-5.53)	
Death	5.12	(2.80-9.35)	
Department			
Nonsurgical	1		<0.001
Surgical	6.03	(3.96-9.17)	

Source: own

OR – Odds Ratio; IC – Interval Confidence; NS – not significant
 *p-Value – statistical significance for univariate logistic regression analysis.

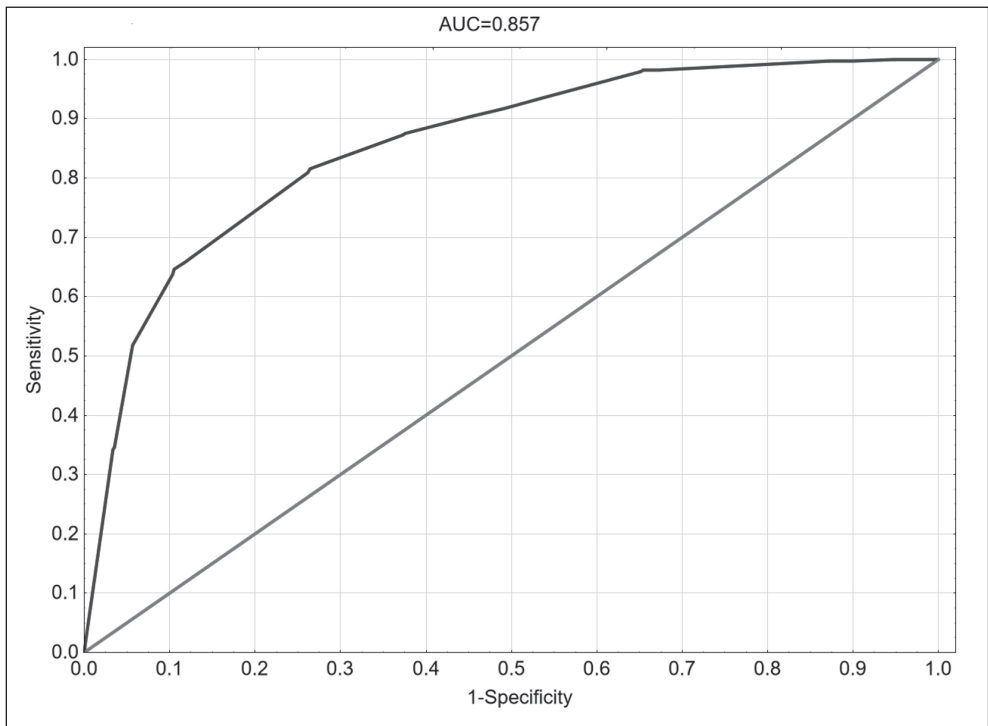
Tab. 5: Multivariate logistic regression analysis for selected factors increasing a patient's probability of being cost outliers (CO)

Variables	Adjusted OR	(IC*95%)	p-Value*
Gender			
Female	1		<0.001
Male	1.90	(1.51-2.40)	
LOS			
<Mean	1		<0.001
>Mean	13.79	(10.35-18.37)	
Reason of discharge (%)			
Completed therapeutic process	1		<0.001
Directed to further treatment	4.15	(3.27-5.27)	
Death	5.79	(3.21-10.45)	
Department			
Nonsurgical	1		<0.001
Surgical	6.51	(4.4-9.62)	

Source: own

OR – Odds Ratio; IC – Interval Confidence
 * p-Value – statistical significance for multivariate logistic regression analysis.

Fig. 1: ROC curve for the multivariate logistic regression model predicting CO



Source: own

of the brain and other parts of the central nervous system (D33.0), angina pectoris (I20.9) and abdominal aortic aneurysm (I71.4). In case of malignancy diseases of the larynx (C32.9), the ratio of cost outliers to cost inliers equaled 1. It confirms the previous findings that surgery patients are more likely to become cost outliers than non-surgery patients.

3. Discussion

In this study, we analyzed the factors facilitating the identification of patients being cost outliers. We have used factors available in the hospital database like age, gender, LOS, type of admission, reason of discharge.

In our research, the cost outliers comprised 9% of the study sample, which is similar to the previous analyses that reported 6% to 8% patients that can be identified as the high cost outliers (Huang et al., 2013), (Medicare Program, 2003), (Pirson, Dramaix et al., 2006;

Pirson, Martins, Jackson, Dramaix, & Leclercq, 2006). The differences in percentage of cost outliers can be associated with methods of selecting cost outliers. For example Pirson, Dramaix et al. (2006) selected cost outliers, by the 75th percentile $\pm 1,5$ *interquartile range, Cooney et al. (2003) defined cost outliers as patients with hospital costs >1 standard deviation above the mean and Calver, Brameld, Preen, Alexia, Boldy and Mccaull (2006) chose the top 5% of patients ranked from highest to lowest total inpatient costs. In our study, the CO accounted for 33% of total hospital costs. We analyzed the Polish public reference hospital, which admits the most severe patients from the region. That is why the percentage of the costs related to CO seems to be high. However, previous studies reported that cost outliers in public general hospitals in Wallonia accounted for 22-30% of total hospital costs (Pirson, Martins et al., 2006). In public and private hospitals located in Western Australia,

Tab. 6: Cost outliers (CO) by surgery (S) and non-surgery (NS) patients and inliers (CI) by ICD-10

	ICD 10	CI N = 4,137	CO		CO/CI [%]
			S N = 402	NS N = 31	
I25.0	Atherosclerotic cardiovascular disease, so described	212	36	0	16.98
M16.1	Other primary coxarthrosis	2	19	0	950
I70.2	Atherosclerosis of arteries of extremities	71	17	0	23.94
I20.9	Angina pectoris, unspecified	13	17	0	130.77
M51.1	Lumbar and other intervertebral disc disorders with radiculopathy	33	16	0	48.48
M16.0	Primary coxarthrosis, bilateral	0	14	0	–
I20.0	Unstable angina	40	11	0	27.5
D33.0	Brain, supratentorial	3	11	0	366.67
S06.5	Traumatic subdural haemorrhage	20	10	0	50
I21.1	Acute transmural myocardial infarction of inferior wall	39	9	0	23.08
M17.1	Other primary gonarthrosis	3	9	0	300
M51.2	Other specified intervertebral disc displacement	38	8	0	21.05
I50.1	Left ventricular failure	17	8	0	47.06
I21.0	Acute transmural myocardial infarction of anterior wall	32	8	0	25
I21.9	Acute myocardial infarction, unspecified	72	8	0	11
I71.4	Abdominal aortic aneurysm, without mention of rupture	6	7	0	117
M17.0	Primary gonarthrosis, bilateral	0	7	0	–
C32.9	Malignancy diseases of the larynx, unspecified	7	7	0	100
O99.1	Other diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism complicating pregnancy, childbirth and the puerperium	16	7	0	43.75
M50.1	Cervical disc disorder with radiculopathy	11	7	0	63.64
I25.1	Atherosclerotic heart disease	52	7	0	13.46
I70.9	Generalized and unspecified atherosclerosis	13	6	0	46.15
N18.0	Chronic kidney disease	49	5	1	12
-	Other	3,388	148	30	10.47

Source: own

CO accounted for more than 38% (Calver et al., 2006). The differences in percentage of costs assigned to CO can be related to differences in hospitals and (omit but?) also to diversified models of costs accounting systems (Raulinajtys-Grzybek, 2014).

We presumed that because older patients remain in hospitals significantly longer than younger patients, they would use more hospital resources (Rimar & Diers, 2006). However, we found that age is not associated with being the CO. The same finding was reported in previous studies (Calver et al., 2006; Pirson, Dramaix et al., 2006). Seshamani and Gray (2004) reveal that remaining time to death is much more important than age when discussing the influence on the hospital costs. According to others, higher hospital costs for older people can be explained mostly by differences in patient comorbidities and complications (Uematsu, 2015). Thus, changes in the average age of hospitalized patients cannot be a justification for changes in the level of costs in the hospital.

Some of the studies highlighted that admission type has an influence on patient's costs; some of them did not reveal it (Brimhall, Dean, Hunt, Siegrist, & Reiquam, 2003; Munoz, Zahtz, Lamantia, Chalfin, Lackner, & Wise, 1989). In our study of multivariate logistic regression analysis, in contrast to univariate, the admission type was not predictor of being the CO. That can be associated with the strong correlation between type of admission and length of stay, which was also reported by Perry and Alshurafa (2010). This means that acute admitted patients contribute to higher resource utilization because of longer stay rather than the use of more cost-intensive procedures. This is consistent with Huang et al., (2013) study, who reported that length of stay is an important measure of resource utilization.

In accordance with the Omachnonu, Suthummanon, Akcin and Asfour (2004) study, we discovered that in terms of gender, men are positively correlated with higher costs utilization. It could be related to the fact that women are more aware of health matters than men and take better care of themselves (Dean, 1989). In addition, they visit physicians more often than men, resulting in earlier detection of health problems (Cockerham, 1998). This indicates a strong need for patient education, with special emphasis on men in terms of disease prevention. As reported by Sultz and

Young (2001) patients who are hospitalized in an earlier stage of a disease tend to have a shorter stay in hospital, facilitating in lower resource consumptions. Therefore, educational activities can help to reduce the proportion of readmissions, and in consequence, to lower the hospital costs.

The study revealed that the probability of being the CO increased more than 6 times for the surgical patients. This is consistent with the analysis of CO by ICD 10. The analysis revealed that almost all patients suffered from diseases related to high proportion of CO, required surgery treatment.

The small number of analyzed factors leading to patient being CO is the main limitation of this study. We could not analyze medical factors such as complications due to the limitation of Polish hospital databases. However, similar analysis with additional explanatory factors derived from accessible hospital databases chosen by clinicians and managers working together could be used for CO identification. The study was carried out in only one hospital located in northeast Poland. According to our knowledge, this is the first study in the field within Poland, thus we chose to analyze primarily the patients' characteristics before concentrating on the diagnoses related groups (DRG).

Conclusions

Our study revealed that the small percentage of the patients is responsible for the significant level of costs. The median total cost for outliers is €4,779.08 and is almost 6 times higher than total cost for inliers – €809.90. The median direct costs for outliers is €2,758.48 and is even more than 9 times higher than for inliers – €290.02. This makes cost outliers worth special attention. The patient's characteristics can influence the costs in the direct or indirect way (by length of stay). There are several applications for the knowledge obtained from such analysis, namely identifying the patients who may require special funding on the basis of real cost; finding the explanatory factors for extreme total costs. Managers can be interested in extremely high costs and their association with medical procedures and LOS. Thus, this study can contribute to the knowledge of managers about the nature of cost outliers and identify ways to prevent future instances. Such information can also be used for health care financing policy

and for preparing hospital procedure guidelines. Detecting CO and the factors influencing it can be especially valuable in the financing systems where high costs outliers are separately paid or in systems where hospitals can incur financial penalties for cost outliers. Analyzing of cost outliers is important, as it helps to comprehend hospital costs.

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Abstract

ANALYSIS OF HIGH COST OUTLIERS IN A POLISH REFERENCE HOSPITAL**Malgorzata Cyganska**

The growing financial problems of healthcare institutions contribute to the search of methods in properly distributing and clearly justifying resources. One of these is detecting outliers accounting for an important share of hospital costs. The aim of the study is to identify the factors facilitating identification of cost outliers in one of the Polish reference hospitals in northeast Poland. We have analyzed 4,570 patients. Cost analysis was done retrospectively using accountancy and statistical data from the hospital. To select the outliers, we used the interquartile method using the median and the interquartile distance. To evaluate the factors that influence the patient being a cost outlier, we considered: age, length of stay, gender, type of admission, reason of discharge, and type of department. Univariate analysis and multivariable logistic regression were used in the study. Our study revealed that the small percentage of the patients is responsible for the significant level of costs. The total cost outliers comprised 9% of the study sample. They accounted for almost 37% of total hospital costs, 40% of direct costs, and 34% of indirect costs. We discovered that age, gender, length of stay, reason of discharge, and type of department has a significant influence on being the cost outlier. The study revealed that the probability of being the CO increased more than 6 times for the surgical patients. This is consistent with the analysis of CO by ICD 10. The analysis revealed that almost all patients suffered from diseases related to high proportion of CO, required surgery treatment. It is concluded that identifying the cost outliers can contribute to better knowledge by managers about the nature of the costs outliers and can be especially valuable in the financing systems where high costs outliers are separately paid.

Key Words: Direct costs, indirect costs, cost outliers, hospital management.

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HOW DOES CORPORATE SOCIAL RESPONSIBILITY IMPACT BANKING EFFICIENCY: A CASE IN CHINA

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Introduction

The concept of corporate social responsibility (CSR) drew much attention globally as economic growth was followed by such social problems as an increasing gap between the rich and the poor, cultural conflicts, and environmental degradation. Having acknowledged the importance of the latter challenges, the United Nations officially launched the “Global Compact” project in 2000, thereby calling the enterprises for commitments towards social responsibility in the areas of human rights, labor standards, and environmental protection, among other issues. As an important actor in the global economic development, the banking sector also became aware of huge social costs associated with unsustainable economic growth, and recognized its responsibilities in such areas as an active reduction of social inequality and environmental degradation. Thus it is important to analyze the impact of commitments towards CSR upon banking performance.

Indeed, most of the previous studies, discussing the impacts of CSR, were focused on the link between CSR and corporate financial performance (CFP), see, e.g., Paul & Siegel (2006). Furthermore, the parametric techniques were the most widely applied ones in the area (McWilliams & Siegel, 2000; Wu & Shen, 2013). One can find the four contradictory conclusions regarding the impact of CSR upon CFP in the literature, namely a positive impact (Ohene-Asare & Asmild, 2012), a negative impact (Winchester et al., 2008), an arbitrary impact (Lee & Park, 2009), and no impact (Soana, 2011). Based on the previous studies, we aim to verify the link between CSR and CFP by utilizing a nonparametric approach. Specifically, this paper attempts to re-examine the topic in Chinese banking sector.

Data envelopment analysis (DEA) is a celebrated nonparametric approach enabling

one to evaluate firm performance in relative terms. The latter technique features certain advantages over the parametric approach due to less restrictive assumptions regarding the functional form of a representation of the underlying technology. However, to the best of our knowledge, there have been only a handful of studies applying DEA to investigate the link between CSR and CFP in banking. Furthermore, contrary to the two-stage DEA framework, which involves a parametric regression (Vitaliano & Stella, 2006; Ohene-Asare & Asmild, 2012), we utilize a fully nonparametric approach, viz., conditional DEA framework. In our setting, CSR is treated as an environmental variable to investigate its impact on efficiency of Chinese banking sector.

1. Literature Review

1.1 The Origins of Corporate Social Responsibility

Sheldon (1923) was among the first to establish the concept of CSR, whereas Bowen (1953) defined the modern version of CSR by highlighting the social value and the social goal. In the earlier studies, CSR was widely discussed in fields of law and ethics with a controversy over the underlying rationale for contributing to CSR, cf., in particular, the famous *Berle-Dodd Dialogue* in the 1930s. Since the late 1960s, the argument has emerged among economists as well. Friedman (1970) argued that CSR would increase production cost and thus result in a reducing competitiveness of corporations. Therefore, the sole “social responsibility” of a manager should be achieving profit maximization for a corporation. However, Freeman (1984) developed the stakeholder theory, which treated CSR as a benefit not only for shareholders, but also for employees, customers, government, and even environment.

Furthermore, he argued that CSR would bring a positive effect for reducing transaction cost for corporations. Sheikh (1996) suggested considering profit optimization as the corporate objective in lieu of profit maximization.

As the debate continued, the topic of linkage between CSR and CFP was widely discussed. Yet, a rich body of literature did not yield a definite conclusion. As Carroll (2000) put it, CSR is a complex phenomenon and, thus, various instances of links between CSR and CFP are possible.

Roman et al. (1999) surveyed 52 studies, analyzing the link between CSR and CFP. It turned out that positive results had been reported in 33 papers, insignificant results – in 14 papers, and negative results – in 5 papers. Margolis & Walsh (2003) further increased the number of empirical studies covered up to 127, and the results suggested that there had been 54 papers reporting a positive relationship, 20 papers reporting an arbitrary relationship, 28 papers reporting an insignificant relationship, and 7 papers reporting a negative relationship. The aforementioned reviews suggest that most of the studies support a positive link.

Bragdon and Marlin (1972) were the first to study the link between CSR and CFP. Noteworthy, a positive result was obtained in the latter study. Moskowitz (1972) then applied a reputation index to explain the positive impact. Afterwards, the corporate reputation emerged as a popular point to support the positive link between CSR and CFP (Wu & Shen, 2013). Fombrun & Shanley (1990) asserted that higher contribution to CSR induces higher corporate reputation, which, in turn, can attract more customers, improve transactions, and increase loyalty. Furthermore, Bushman and Wittenberg-Moerman (2012) related high reputation to high profitability. The positive link was also explained in terms of a rapid cost reduction and eased regulation, which could eventually lead to an increase in equity value (Bird et al., 2007).

Noteworthy, Roman et al. (1999) reported 66% of the studies surveyed as having found a positive link between CSR and CFP, whereas the corresponding figure dropped to 42.5% in Margolis and Walsh (2003). These findings imply a possible divergence in terms of the impact of CSR upon CFP. Indeed, Margolis et al. (2009) affirmed this trend following a further research into the issue. A recent review by Wu and Shen (2013) defined the three different

motives to conduct CSR in banking along with their impacts: *altruism* is related to a negative effect of CSR on CFP, *strategic choice* is related to a positive effect, and *greenwashing* has no significant effect.

Weber (2008) showed that both qualitative (e.g., case studies) and quantitative (e.g., portfolio analysis, event studies, and multiple regression analysis) methods were applied for empirical research on CSR. Soana (2011) also applied content analysis, questionnaire survey, reputation measure, one-dimensional indicator and ethical rating to investigate the links between CSR and CFP.

As regards the applications of frontier techniques for analysis of CSR and CFP, the parametric approach has been the primal technique in the literature. However, thanks to less restrictive assumptions, a nonparametric approach, e.g., DEA, might be an appropriate tool for an empirical analysis. However, few studies have applied it to test the link between CSR and CFP either directly or indirectly. Vitaliano & Stella (2006) used an input-oriented DEA model to evaluate the cost efficiency of CSR and non-CSR saving banks in the U.S. and treated the inefficiency as a shadow price of CSR. Ohene-Asare and Asmild (2012) developed a conventional DEA-based intermediation model, incorporating contribution to CSR, to evaluate the efficiency of Ghanaian banks. They analyzed the differences between efficiency scores obtained by the virtue of models including CSR and those without CSR. It was found out that CSR had a significant impact on banking efficiency. Subsequently, a parametric regression was applied to check the link between CSR and CFP, which rendered a positive result. However, due to Ohene-Asare and Asmild (2012), several aspects need to be questioned. In the first stage, the aforementioned study interpreted CSR as an output variable and thus implicitly established a positive link between CSR and CFP. Although CSR was treated as an environmental variable later on, the analysis was based on a parametric approach. In this case, one needs to consider certain caveats pertinent to the second stage analysis, as per Daraio et al. (2010).

1.2 Conditional Efficiency

There are two main strands of approaches for analysis of the impact of the exogenous environmental variables upon efficiency, namely

single-stage and two-stage approaches. The single-stage approach treats the environmental variables as non-discretionary inputs or outputs when defining the technology. The two-stage approach treats the environmental variables as independent variables in a regression. However, there are some obvious drawbacks pertinent to the two conventional approaches. As regards the single-stage analysis, the primal problem is a classification of the environmental variables in terms of their role in the production process. The two-stage analysis draws certain critique as it involves parametric techniques (in its conventional form) and a crucial requirement of separability among environmental variables and controlled variables (inputs and outputs) arises. Even though Simar and Wilson (2007) developed the double bootstrap procedure to circumvent the problem of serial correlation in the regression, two-stage approach might not provide a meaningful inference in case the condition of separability is not fulfilled (Daraio et al., 2010).

Besides the two abovementioned conventional approaches, Cazals et al. (2002) extended their probabilistic order- m approach to so-called conditional efficiency measurement demonstrating how to take exogenous environmental variables into account. Daraio and Simar (2005) further systematically developed the standard conditional efficiency approach on the basis of Cazals et al. (2002), but it was confined to a non-convex technology and continuous environmental variables. Later on, Daraio and Simar (2007) extended the non-convex nonparametric approach to a convex version, while Bădin et al. (2010) and De Witte and Kortelainen (2013) considered discrete environmental variables based on Li and Racine's (2008) kernel function. Daraio and Simar (2014) generalized conventional conditional distance function to conditional directional distance function, and, additionally, considered the case of sub-vector directional efficiency analysis.

There are two intertwined questions, important to the conditional efficiency approach. The first one is bandwidth selection. Daraio and Simar (2005) applied a k -nearest neighbor method for bandwidth selection, yet it does not provide an optimal bandwidth to analyze the impact of environmental variables, and it does not fully satisfy the separability condition. The most widely applied approach for bandwidth selection is that applied by Bădin et al. (2010),

namely the least squares cross validation (LSCV) of Hall et al. (2004). Daraio and Simar (2014) suggested directly employing the optimal bandwidth selection by Hall et al. (2004), which is suitable for non-oriented measures. Another important aspect is the impact of environmental variables. Daraio and Simar (2005) described how to analyze the effect of environmental variables based on a nonparametric kernel regression, where the ratio of conditional to unconditional efficiency scores is a depended variable. In order to accommodate the conditional directional distance function, Daraio and Simar (2014) considered a difference rather than ratio.

Conditional efficiency studies covered such fields as mutual funds (Daraio & Simar, 2005), education (De Witte & Kortelainen, 2013), and environmental efficiency (Halkos et al., 2016), among others. Indeed, many previous papers were based on the order- m approach. As the conditional efficiency framework can be technically applied along with any appropriate estimator, recent empirical studies, based on conditional efficiency measures, involved some other efficiency models. For instance, Halkos et al. (2014) treated partiality, corruption, and effectiveness of government services as environmental variables identifying governance quality and thus analyzed their impact upon regional environmental performance. Furthermore, several types of pollution were treated as bad outputs by the means of the conditional directional distance function. Baležentis and De Witte (2015) extended multi-directional efficiency analysis (MEA) by Bogetoft and Hougard (1999) to conditional efficiency framework, and further empirically measured the efficiency of Lithuanian family farms with respect to their operational environment.

2. Methodology

2.1 Conditional Efficiency Measures

The conditional efficiency framework of Cazals et al. (2002) and Daraio and Simar (2005) is applied to analyze the impact of the environmental variables upon the relative performance. In other words, environmental variables may alter the production frontier and thus enable to obtain more reasonable efficiency scores for individual DMUs.

Besides inputs $X = x \in R_+^n$, good outputs $Y = y \in R_+^m$, and environmental variables $Z = z \in R_+^s$, we extended original conditional

efficiency model to additionally include bad outputs $B = b \in R_+^l$ into account. However, differently from Halkos et al. (2015), we define a modified joint probability function considering bad outputs as follows:

$$H_{XYB|Z}(x, y, b) = Prob(X \leq x, Y \geq y, B \leq b | Z = z) \quad (1)$$

Due to the characteristics of bad outputs, b , it is impossible to directly decompose Eq. (1) according to the Bayes rule (see Daraio & Simar, 2005, for more details), but it is still possible to obtain the conditional survivor function in the following manner (Daraio & Simar, 2014):

$$\hat{S}_{Y, B|X, Z}(y, b | x, z) = \frac{\sum_{k=1}^K I(X_k \leq x, Y_k \geq y, B_k \leq b) K_h\left(\frac{Z_k - z}{h}\right)}{\sum_{k=1}^K I(X_k \leq x) K_h\left(\frac{Z_k - z}{h}\right)} \quad (2)$$

where $K_h(\cdot)$ is the kernel function, and h is the bandwidth. Note that the bandwidth is critical to determine the smoothness of the estimated density. We select the appropriate bandwidth, h , according to Hall et al. (2004) in our framework. For orientations optimizing either good or bad output only, we modify the denominator of Eq. 2 accordingly. Specifically, for model, aimed at increasing the good output, we only look at observations, which consume x quantity of input at most and produce b quantity of bad output at most.

2.2 Multi-Directional Efficiency Analysis

Bogetoft and Hougaard (1999) first theoretically proposed the theoretical preliminaries for the new potential improvement approach and, subsequently, Asmild et al. (2003) developed a DEA-based efficiency measure, namely Multi-directional Efficiency Analysis (MEA). Unlike the conventional Farrell framework, MEA employs benchmarking against an ideal point, which is endogenously determined by operational environment, rather than a radial movement towards the origin. Given the output-oriented conditional efficiency framework, the ideal point for an individual observation, k' , is obtained as:

$$y_{k'm}^* (x, y, b) = \max \phi_{k'm}^* \quad (3)$$

$$s.t. \sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t x_{kn}^t \leq x_{k'n}, n = 1, \dots, N$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t y_{km}^t \geq \phi_{k'm}^*$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t y_{k(m-1)}^t \geq y_{k'(m-1)}^t, -m = 1, \dots, (m-1), (m+1), \dots, M$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t b_{kl}^t = b_{k'l}^t, l = 1, \dots, L$$

$$\lambda_k^t \geq 0, k, k' = 1, \dots, K$$

$$b_{k'l}^* (x, y, b) = \min \eta_{k'l}^t$$

$$s.t. \sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t x_{kn}^t \leq x_{k'n}, n = 1, \dots, N$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t y_{km}^t \geq y_{k'm}, m = 1, \dots, M$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t b_{kl}^t = \eta_{k'l}^t$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t b_{k(l-1)}^t = b_{k'(l-1)}^t, -l = 1, \dots, (l-1), (l+1), \dots, L$$

$$\lambda_k^t \geq 0, k, k' = 1, \dots, K$$

The two models given by Eqs. 3 and 4 can be solved jointly to arrive at optimization of both good and bad outputs. Following Asmild and Pastor (2010), the output-oriented slack-free MEA, based on the directional distance function, seeks to obtain the parameter β^t with $(s_{kn}^{xt}, s_{km}^{yt}, s_{kl}^{bt})$ being a nonnegative slack set:

$$\bar{D}(x, y, b) = \max \beta_k^t$$

$$s.t. \sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t x_{kn}^t + s_{kn}^{xt} = x_{k'n}, n = 1, \dots, N$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t y_{km}^t - s_{km}^{yt} = y_{k'm} + \beta_k^t (\phi_{k'm}^t - y_{k'm}^t), m = 1, \dots, M$$

$$\sum_{k|K_k(z^1, z^2) \geq z} \lambda_k^t b_{kl}^t + s_{kl}^{bt} = b_{k'l} - \beta_k^t (b_{k'l}^t - \eta_{k'l}^t), l = 1, \dots, L$$

$$\lambda_k^t \geq 0, s_{kn}^{xt} \geq 0, s_{km}^{yt} \geq 0, s_{kl}^{bt} \geq 0, k, k' = 1, \dots, K$$

Subsequently, one can obtain the output-specific MEA efficiency scores for individual observations as follows:

$$e_{yk'm}^t = \frac{y_{k'm}^t}{y_{k'm}^t + \beta_{k'}^t (\phi_{k'm}^t - y_{k'm}^t) + s_{k'm}^{yt}} \quad (6)$$

$$e_{bk'l}^t = \frac{b_{k'l}^t - \beta_{k'}^t (b_{k'l}^t - \eta_{k'l}^t) - s_{k'l}^{bt}}{b_{k'l}^t} \quad (7)$$

Furthermore, in order to ensure interpretability of the overall efficiency score, we employ the modified output-oriented slack-based measure (SBM), which ensures aggregation in the spirit of Tone (2001). The measure considers both desirable and undesirable outputs to calculate the overall efficiency score e_k^t :

$$e_{k'}^j = \frac{1}{1 + \frac{1}{M+L} \left(\frac{\beta_{k',m}^{jt} (\varphi_{k',m}^j - y_{k',m}^j) + s_{k',m}^{jt}}{y_{k',m}^j} + \frac{\beta_{k',l}^{jt} (b_{k',l}^j - n_{k',l}^j) + s_{k',l}^{jt}}{b_{k',l}^j} \right)} \tag{8}$$

Note that efficiency scores, defined in Eqs. 6-8, are bounded at unity from above and approach the latter value in case of full efficiency. Due to different directions of optimization, Eq. 2 is defined in different ways. Therefore, in the conditional framework, we estimate separate MEA models rather than decompose Eq. 8.

2.3 Impact of Environmental Variables to Efficiency

Due to the non-radial nature of measures in Eqs. 6-8, the estimation of the effects of environmental variables, z , based on the ratio form is not appropriate, and, thus, a difference form is applied in accordance with Daraio and Simar (2014):

$$Q^z = e(x, y, b | z) - e(x, y, b) \tag{9}$$

In a fully nonparametric framework, a smooth nonparametric regression is employed to estimate the impact of environmental variables, z , on the difference of conditional and unconditional efficiency scores, i.e.:

$$Q_k^z = f(z_k) + \varepsilon_k \tag{10}$$

where $f(z_k)$ is the mean regression function, and ε_k is the error term with $E(\varepsilon_k | z_k) = 0$. However, instead of the mostly used local constant kernel regression of Nadaraya (1964) and Watson (1964), we employ a local linear regression for $f(z_k)$, which is less sensitive to boundary effects and can also simultaneously uncover the marginal effects of the environmental variables (Jeong et al., 2010; De Witte & Kortelainen, 2013). The local linear model is based on the weighted minimization of errors:

$$\min_{(a,b)} \sum_{k=1}^K (Q_k^z - \alpha - (z_k - z)\beta)^2 K_h(z, z_k) \tag{11}$$

Following Bădin et al. (2012) and Daraio and Simar (2014), the difference in Eq. 9 will increase with z in case of the positive shift in

the production frontier. However, in the context of weak disposability and SBM, the direction of shift cannot be described explicitly. Anyway, a positive trend in Q^z against z indicates an increasing productivity of the resources used with respect to input transformation into good and bad outputs.

Given firms operate in different environments, the condition of separability (cf. Simar & Wilson, 2011) might not be fulfilled. In this case, regression on unconditional efficiency scores might not be meaningful. In order to measure the impact of z variables upon the average efficiency we follow Bădin et al. (2012) and define a flexible regression model:

$$e(X = x, Y = y, B = b | Z = z) = \mu(z) + \sigma(z)\varepsilon \tag{12}$$

where $E(\varepsilon | z) = 0$ and $V(\varepsilon | z) = 1$, $\mu(\cdot)$ measures the average effect of z upon efficiency and $\sigma(\cdot)$ provides a measure of variance and thus accounts for heteroskedasticity. Following this setting, one can recover “pure” efficiency scores, which indicate the managerial ability to ensure efficiency given the environment defined by the observed values of z variables. The “pure” efficiency can be estimated on the basis of the error term in Eq. 13:

$$\varepsilon = \frac{e(x, y, b | z) - \mu(z_s)}{\sigma(z)} \tag{13}$$

where $\sigma(\cdot)$ is estimated in lines with Bădin et al. (2012). In our setting, higher values of ε are associated with higher “pure” efficiency.

3. Data Used

Due to data availability, the dataset applied comprises 64 observations which cover 13 major Chinese commercial banks during the period of 2008-2013, and the total assets of sample banks occupy more than 70% of those in the Chinese banking sector. The whole sample can be classified into the two groups: large commercial banks (LCB), which commonly include four state-owned commercial banks, and small-medium commercial banks (SMCB), which include joint stock commercial banks and city commercial banks. Data come from Annual Reports of Corporate Social Responsibility of each individual bank. The variables are deflated with base year 2008.

3.1 The CSR Variable

CSR is treated as an environmental variable in this study. This sub-section, therefore, presents the main concepts for measurement of CSR along with approach taken in our analysis.

Carroll (1979) gave a comprehensive definition of CSR, involving economic, legal, ethical, and discretionary responsibilities, whereas lots of recent CSR studies referred to the latest definition by McWilliams and Siegel (2001), which highlights the voluntary activities. However, due to available data, previous studies typically employed various subjective indicators for the CSR (e.g., McWilliams & Siegel, 2001; Soana, 2011), whereas Ohene-Asare and Asmild (2012) further used an objective CSR variable, which can be measured in monetary terms. In this paper, we also employ a monetary objective variable as a CSR variable specific to the Chinese context.

The Shanghai Stock Exchange issued the *Notice on Strengthening Corporate Social Responsibility of Listed Companies* in 2008 and defined the concept of "social contribution value per share" (SCVPS). Following the definition, besides creating earning per share for shareholders, a listed company has a responsibility to increase tax revenue for government, offer reasonable pay for employees, pay regulatory loan interest to creditors, and raise charity donations. Meanwhile, the social cost, involving sewage charges and environmental violation fines, should also be considered when calculating the SCVPS. The SCVPS is, therefore, calculated as:

$$SCVPS = \text{Earnings per share} + \frac{\text{Taxes} + \text{Salaries} + \text{Interests} + \text{Donations} - \text{Social costs}}{\text{Equity}}$$

To put it otherwise, a listed company should raise awareness of performing responsibly not only in sense of improving its individual financial performance and protecting shareholders' interests, but also by taking into account non-commercial contributions to stakeholders, society, and environment. In general, the SCVPS can be decomposed into the two components, viz., economic responsibility, as represented by earnings per share, and purely social contribution, as represented by the rest of indicators. Given the former component corresponds to the very nature of commercial banks (i.e., pursuing for profit maximization), we

treat it as a desirable output in our production model. The remaining part of SCVPS is directly related to bank's responsibility towards society and thus we define the CSR variable for our model as follows:

$$CSR = \frac{\text{Taxes} + \text{Salaries} + \text{Interests} + \text{Donations} - \text{Social costs}}{\text{Equity}}$$

Indeed, we consider absolute input and output variables along with a relative z variable (i.e., monetary value per share) to avoid multicollinearity.

3.2 Input and Output Variables

The production model comprises one input, one good output, and one bad (undesirable) output:

- Input: fixed assets (FA),
- Good output: net profit (NP),
- Bad output: non-performing loans (NPL).

The FA is a conventional input variable, associated with increasing opportunity costs (Berger & Humphrey, 1997). Note that a contraction of fixed assets is often impossible for banks (Asmild & Matthews, 2012). Therefore, we do not look at the input orientation in this study. Moreover, we do not include labor costs into the model as it is associated with salaries, which, in turn, are included in the CSR variable. Indeed, we have computed the Pearson correlation coefficient for FA and the number of employees as a proxy for labor costs. The results show that there exists a high positive correlation (0.945) significant at 1% level, which implies that ignoring labor costs is not to impact the measures of banking efficiency to a considerable extent. Another common input, the deposit, is not employed as well, because it is associated with interests in the CSR variable, and the Pearson correlation coefficient for FA and deposit is 0.962 significant at 1% level.

The NP is an explicit desirable output variable, and it is related to "earning per share" in the SCVPS. The undesirable output, namely NPL, played a critical role during the Chinese banking reform. In order to reduce the non-performing loans, Chinese commercial banks have constantly been improving risk management capabilities thereby enhancing willingness and ability for performing responsibly.

Tab. 1 presents the descriptive statistics for both operational variables (input and outputs) and environmental variable, CSR. As one can

Tab. 1: Descriptive statistics

	Max	Min	Mean	SD	CV	Growth
CSR	6.65	0.77	2.52	1.61	0.64	0.268
FA	144,403	1,703	44,139	48,638	1.10	0.003
NP	231,054	2,260	61,139	61,662	1.01	0.057
NPL	104,482	743	30,478	32,026	1.05	-0.095

Source: own

Note: SD – standard deviation, CV – coefficient of variation, Growth – average rate of growth; the dimension of CSR is CNY per share, and those of FA, NP, and NPL are million CNY.

note, CSR exhibits the smallest CV value (0.64) among all the variables, yet CSR grew at the highest rate of 26.8%, which implies the CSR has become prevalent among banks in China. The values of the CV for operational variables are rather similar. FA features the lowest rate of growth (0.3%), whereas NP shows the largest one (5.7%), implying an increase in profitability; There is a negative rate of growth observed for NPL, -9.5%, due to banking reform in China, aimed at reducing NPLs.

4. Empirical Analysis

There are three conditional models utilized to analyze the impact of CSR (as measured per share) upon bank performance. Indeed, we focus on (i) output-oriented model with both good and bad outputs being optimized, (ii) output-oriented model with good output being optimized and bad output used to define the production frontier, and (iii) output-oriented model with bad output being optimized and good output used to define the production

Tab. 2: Overall and output-specific efficiency scores

Bank	Overall			NP			NPL		
	C	U	D	C	U	D	C	U	D
ICBC	0.89	0.61	0.28	0.94	0.40	0.54	0.80	0.60	0.20
CCB	0.86	0.60	0.26	0.93	0.40	0.53	0.78	0.59	0.19
BC	0.74	0.51	0.23	0.57	0.26	0.31	0.69	0.57	0.12
ABC	0.75	0.52	0.23	0.58	0.27	0.31	0.68	0.57	0.11
BCM	0.65	0.53	0.12	0.46	0.30	0.16	0.63	0.57	0.06
CMSB	0.73	0.66	0.07	0.63	0.52	0.11	0.69	0.62	0.07
SPDB	0.78	0.75	0.03	0.76	0.66	0.10	0.70	0.67	0.03
IB	1.00	0.97	0.03	1.00	0.98	0.02	1.00	0.93	0.07
CMB	0.78	0.69	0.09	0.58	0.50	0.08	0.69	0.65	0.04
CITIC	0.70	0.68	0.02	0.64	0.59	0.05	0.63	0.61	0.02
BBJ	0.84	0.84	0.00	0.82	0.82	0.00	0.75	0.75	0.00
BNJ	0.74	0.74	0.00	0.53	0.53	0.00	0.67	0.67	0.00
SHB	0.64	0.64	0.00	0.44	0.43	0.01	0.58	0.58	0.00
Mean	0.77	0.66	0.11	0.68	0.49	0.19	0.71	0.63	0.08
Spearman	0.614***			0.553***			0.682***		

Source: own

Notes: C – conditional efficiency; U – unconditional efficiency; D – difference between conditional and unconditional efficiencies; *** – significance at the 1% level; NP – NP efficiency; NPL – NPL efficiency.

frontier. Efficiency scores associated with these models are referred to as “Overall”, “NP”, and “NPL”, respectively.

4.1 Does CSR Impact Banking Performance?

Tab. 2 summarizes the mean efficiency scores for each bank under conditional and unconditional frameworks. It is evident that the conditional efficiency estimates are higher than the unconditional ones, as it should be expected due to sample restrictions under the conditional framework. We then employ the Spearman rank correlation to ascertain whether the differences between the two frameworks exist. As one can note, a significant positive correlation of 0.614 has been estimated for the overall efficiency scores, which implies that CSR has an impact on banking efficiency and, therefore, a substantive production frontier shift. As regards individual banks, the gaps in technical efficiency across conditional and unconditional frameworks are wider for large commercial banks (ICBI, CCB, BC, and ABC) if opposed to small and medium commercial banks (i.e., the rest of banks). Specifically, the mean gap is 0.11 for the overall efficiency scores.

We further measure the efficiency for NP-orientation and NPL-orientation to check the impact of CSR upon bank performance in regards to specific variables. The obtained rank correlation for NP (0.553) is smaller than

that for NPL (0.682), whereas the technical efficiency gap for NP (0.19) is larger than that for NPL (0.08). These findings imply that the CSR has a relatively stronger impact to NP than NPL.

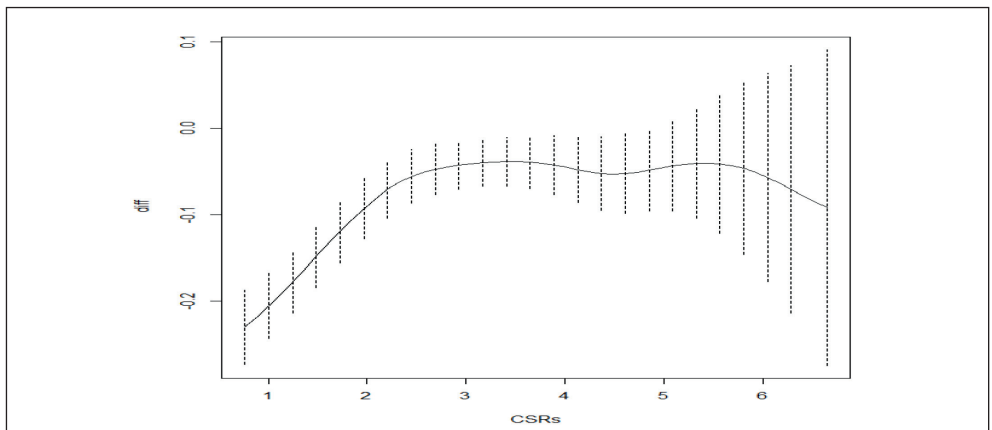
4.2 Disentangling the Impact

This sub-section aims to employ a nonparametric approach to analyze the link between CSR and CFP. All of the measures considered are bounded at unity from above and therefore an increasing (decreasing) slope of the nonparametric regression relating the differences of conditional to unconditional efficiencies to Z variables (cf. Eq. 10) implies a positive (negative) effect of a Z variable upon the attainable frontier.

Fig. 1 presents a nonparametric regression plot for the technology shifts based on the overall efficiency measure. As one can note, the impact of CSR is positive up to the value of 2. For higher values of CSR, however, we see no significant influence on the attainable technology. Indeed, the significance test (Racine, 1997; Racine et al., 2006) shows a significant relationship at the level of significance of 1%. This can be explained by the fact that the influence is observed only for a certain range of CSR. For higher values of CSR one can observe certain decreases in productivity. Furthermore, confidence bounds are expanded in that region due to few observations there.

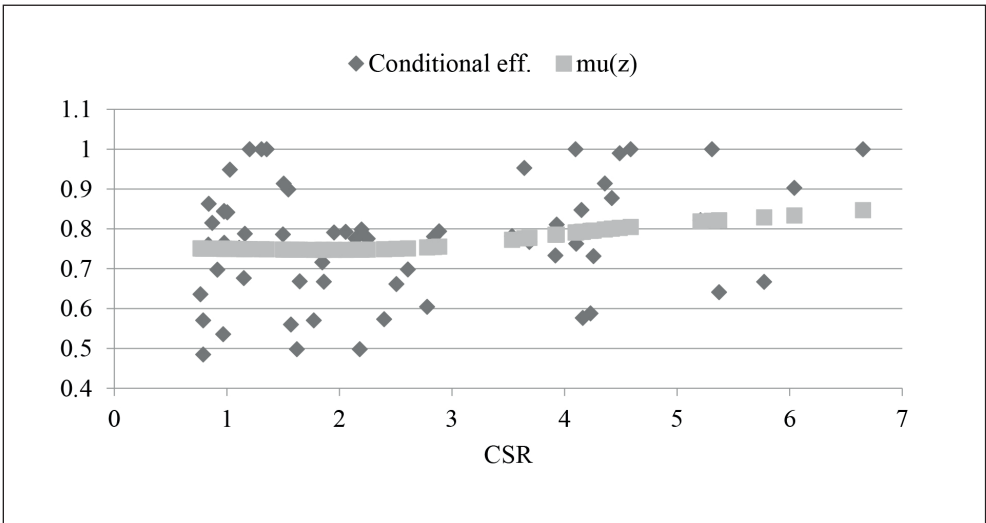
Fig. 1:

The impact of CSR upon the difference of conditional to unconditional overall efficiency



Source: own

Fig. 2: The impact of CSR upon average overall efficiency

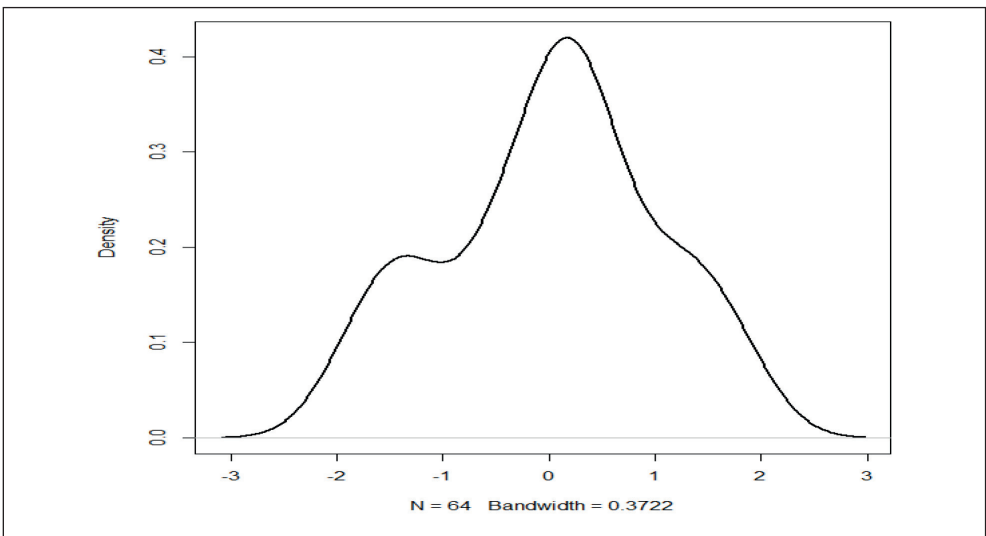


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Running a flexible regression enables to explore the relationships among the CSR and conditional efficiency thus ignoring the impact of environment a certain bank operates in.

In the context of CSR analysis, the environment can be perceived as commitments to the goals of CSR. The resulting estimates of the impact of CSR upon the conditional efficiencies,

Fig. 3: "Pure" overall efficiency



Source: own

$\mu(z)$, are presented in Fig. 2. Note that a positive impact of CSR is observed for values of CSR exceeding 4. The estimates of $\sigma(z)$ follow a decreasing linear trend as z increases, yet only a marginal variation in their values is observed. This implies that albeit the variance of the error term decreases along CSR, the presence of heteroskedasticity is not highly evident.

Therefore, small values of CSR stimulate productivity of the best performing banks and thus push the frontier away from the observations. However, the distribution of efficiency becomes more compact one only for larger values of CSR, viz. those exceeding 4. It can thus be concluded that increasing CSR is related to a higher homogeneity among the banks. Fig. 3 presents the kernel density of “pure” efficiency scores (note that higher values correspond to higher efficiency levels). As one can note, the distribution follows a normal distribution with a group of banks concentrated in low efficiency region. Therefore, most of the banks feature medium-level “pure” efficiency with few being extremely efficient ones.

Given the overall efficiency score (cf. Eq. 8) depends upon efficiencies associated with good and bad outputs (cf. Eqs. 6-7), we further look into relationships among CSR and NP

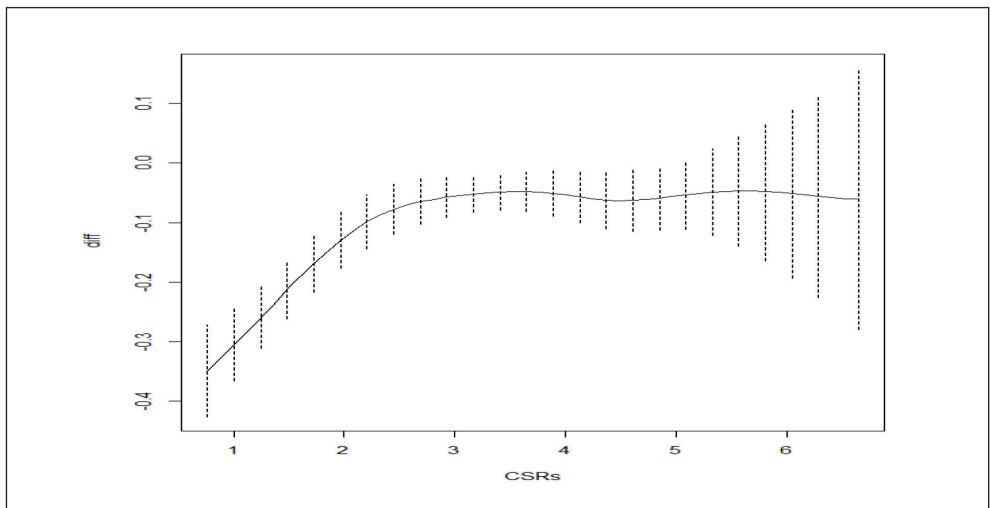
and NPL efficiencies. Considering the shifts of attainable frontier with increasing CSR, frontier movement as captured by the NP efficiency follows a similar trend as that observed for the overall efficiency (Fig. 4). In case of NP efficiency, a positive effect upon the frontier is evident for CSR below the value of 3. The trend is less noisy if opposed to that associated with the overall efficiency, and the relationship is significant at the level of 1%. Again, certain negative effects are observed for the highest values of CSR.

As regards the effect on average efficiency, CSR had a rather marginal impact (Fig. 5). Nevertheless, a positive trend is evident with a decreasing heterogeneity in the region of the highest values of CSR.

The distribution of “pure” NP efficiency scores is close to a half-normal distribution (Fig. 6). Indeed, most of the banks maintained the relatively high “pure” NP efficiency. This shows little improvement possible in good output given the current level of CSR.

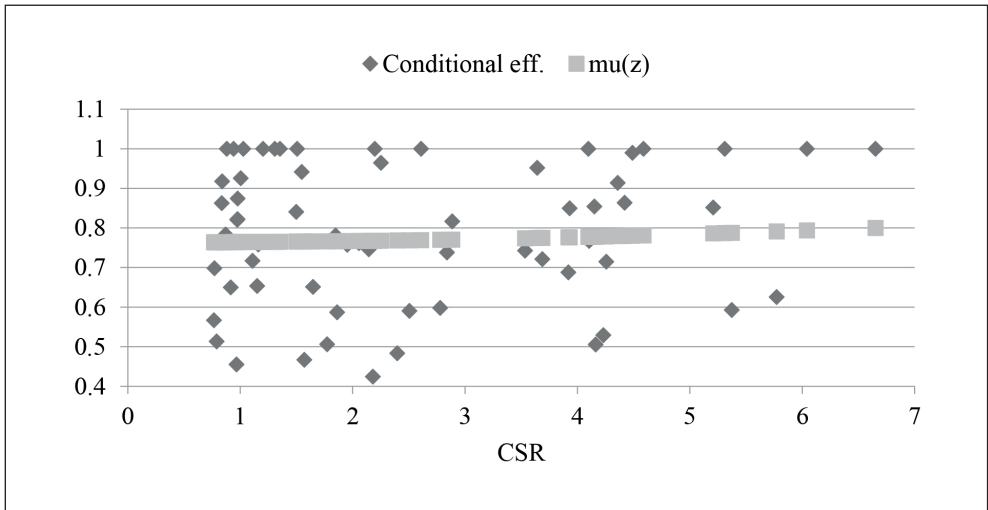
In case of the NPL efficiency, there is a U-shape relationship between CSR and the attainable frontier (Fig. 7). As this relationship is uncertain for most of the range of CSR, the p-value exceeds 10%. Anyway, it is evident that the potential NPL performance is affected more

Fig. 4: The impact of CSR upon the difference of conditional to unconditional NP efficiency



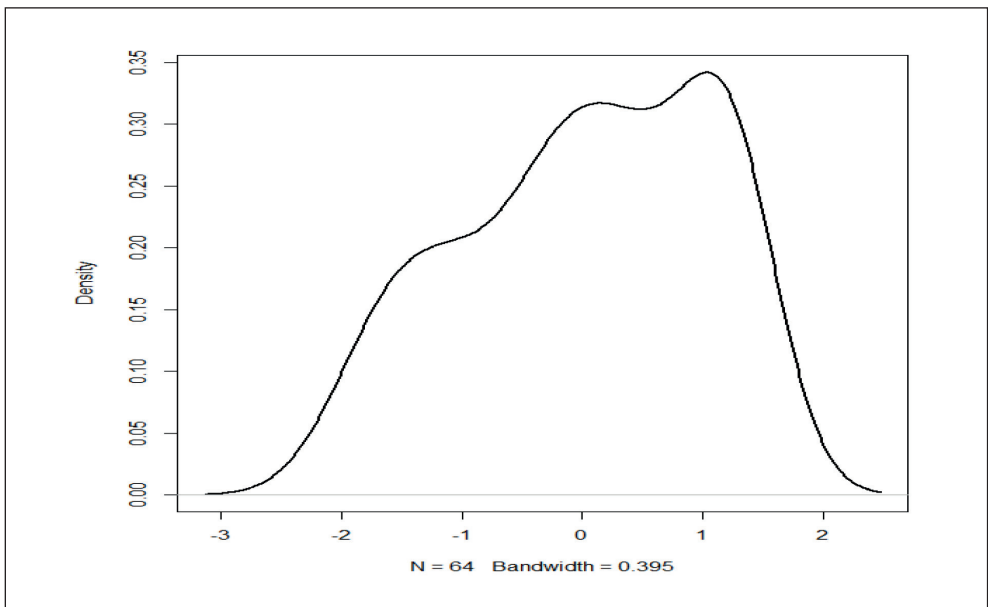
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Fig. 5: The impact of CSR upon average NP efficiency



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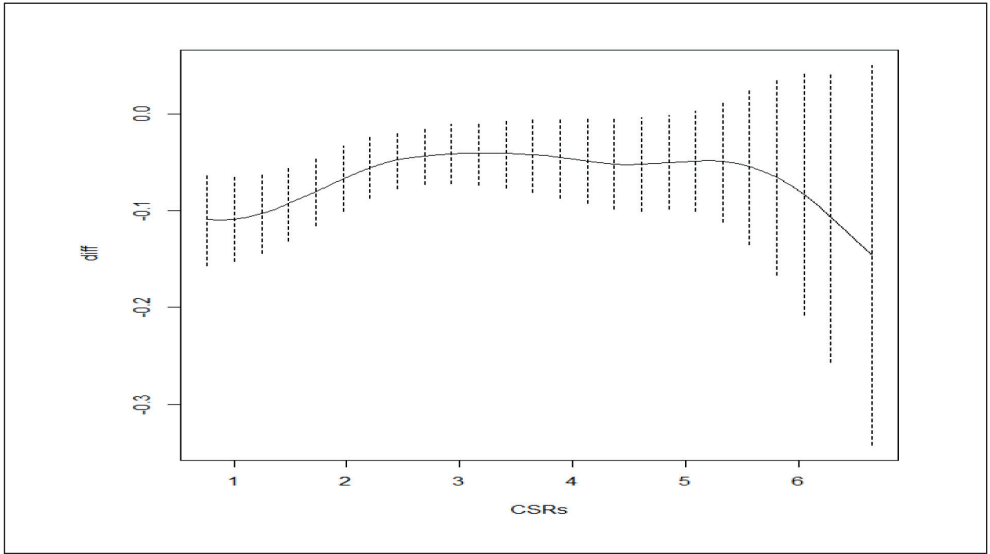
Fig. 6: "Pure" NP efficiency



Source: own

Fig. 7:

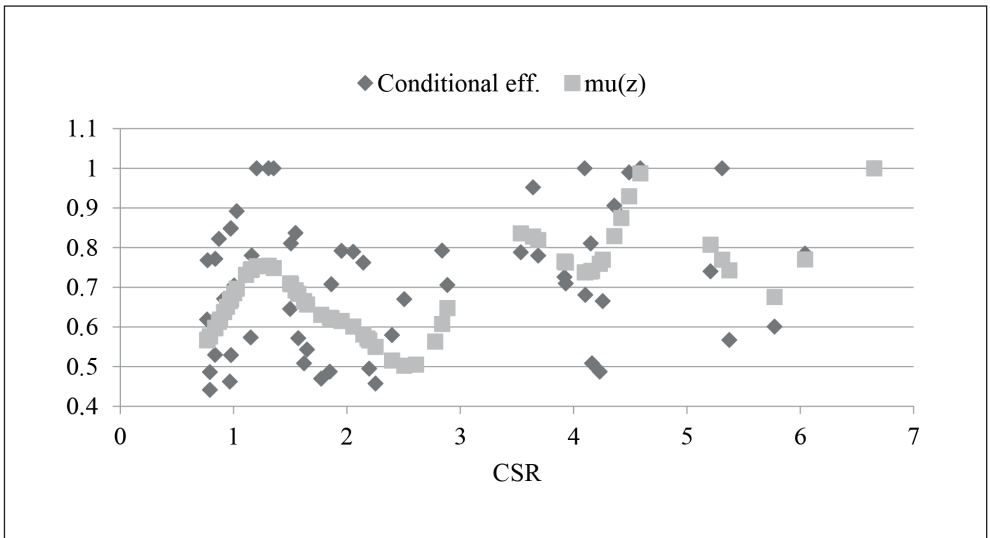
The impact of CSR upon the difference of conditional to unconditional NPL efficiency



Source: own

Fig. 8:

The impact of CSR upon average NPL efficiency



Source: own

severely (in a negative way) by the highest values of CSR with confidence intervals being extremely wide.

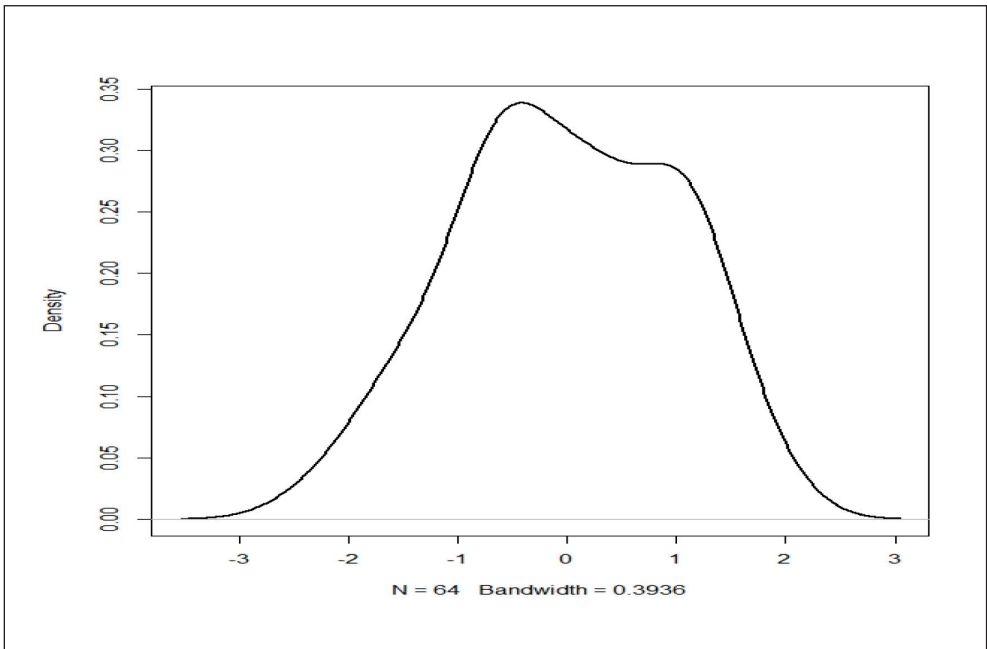
The impact of CSR upon average conditional efficiency is rather uncertain (Fig. 8). Anyway, a more or less positive trend is evident as the CSR increases. Therefore, banks with higher CSR are more efficient than those with low one, yet relatively low performance is also possible.

The kernel density plot of “pure” NPL efficiency is depicted in Fig. 9. The distribution

of “pure” NPL efficiency is close to uniform one with most of the values distributed around the average level. This suggests that banks are quite homogeneous in efficiency regarding NPL (after accounting for the effect of CSR level).

The carried out analysis, thus, implies some straightforward, yet meaningful findings. First, comparison of Figs. 1, 4, and 7 suggests that implies that a minimal increase in CSR is likely to contribute to stimulate the productivity (i.e., shift the conditional frontier). A possible

Fig. 9: “Pure” NPL efficiency



Source: own

explanation for that might be that successful activities of the bank, personnel motivation, and relatively higher remuneration are all intertwined. However, the effect of CSR becomes negative (in terms of the conditional frontier shift) when tax, remuneration etc. expenses become too burdensome. Therefore, there is a trade-off between CSR and bank performance when a certain limit is exceeded in Chinese banking. Current trade-off here is approximately value of 3 in all three conditional

models (Note that CSR is measured as a ratio of monetary flows over equity). When the CSR is lower than 3, there is a significant increase, but when CSR is greater than 3, the potential bank performance no longer increases and, actually, shows a decreasing trend, particularly at the highest values.

Indeed, an increasing CSR can bring both positive and negative effects simultaneously (Kang et al., 2010): at the initial phase, when the CSR is rather low (0-3), a robust growth

in revenue (positive effect) surpasses that in costs (negative effect); however, as CSR keeps increasing (>3), the growth in costs gradually offsets that in revenue. For example, the growth rate of NP in China Merchants Bank (CMB) is 37%, when the CSR is in 2.51, but the growth rate drops to 22% when the CSR rises to 4.49, with most of the banks following a similar pattern.

Furthermore, it is witnessed that the impact of CSR upon NP efficiency is much more evident than that upon NPL, as shown by regression plots and data in Tab. 2. Indeed, increasing NP would directly generate more revenue, albeit decreasing NPL might require for more resources. Therefore, higher CSR is closely linked to NP, whereas its links to NPL remain less certain. Taking the China Merchants Bank as an example, one can see that under CSR of 2.51, the growth rate of NP is 37%, while that of NPL is -3%. Comparatively, when the CSR increases to 4.49, the NP still maintains a relatively high growth rate (22%), but the NPL adversely increases to 23%, which illustrates a stronger link between CSR and NP if opposed to that between CSR and NPL.

Second, Figs. 2, 5, and 8 unanimously indicate that an increase in CSR leads to increase in the conditional efficiencies, although the latter link is not very significant in case of NPL. This basically implies an increasing homogeneity along with increasing CSR in terms of efficiency.

Third, the juxtaposition of Figs. 3, 6, and 9 reveals that banks are most efficient in turning input (fixed assets) into good output, i.e., they are able to better exploit their resources given their level of CSR. The performance in regards to contraction of NPL is less efficient. As a matter of fact, with exception for BC, BCM, and BNJ, the banks have higher “pure” NP efficiency than “pure” NPL efficiency, which is in line with previous findings of this study.

Conclusion

The results indicate that an increase in CSR generally leads towards an increase in conditional efficiency (i.e., efficiency relative to the banks with a similar level of CSR). However, the attainable frontier might be shifted to any direction for the highest values of CSR. This can

be explained by the fact that CSR depends on bank revenue and costs. Therefore, high values of CSR might be the outcome of interactions of these two factors and yield uncertainty in terms of banking productivity. All in all, an increase in CSR at its minimum values undoubtedly leads to increase in efficiency in Chinese banks, whereas further effects highly depend on banks' ability to mitigate the portfolio of non-performing loans.

The analysis of “pure” efficiency indicates that more reductions in bad output are possible, as opposed to expansion of the good one. Furthermore, it turns out that CSR is likely to affect the attainable frontier in the direction of good output (net profit) rather than bad output (non-performing loans). Indeed, the portfolio of non-performing loans is difficult to reduce and therefore the impact of CSR is not significant either on the frontier or on average efficiency. Furthermore, a continuous increase in CSR might require additional revenue, which, in turn, is related to higher risk and an increase in non-performing loan portfolio.

Unfortunately, due to data availability issues, we might have missed some relevant discussions. For example, the data for individual banks in Tab. 2 show that the technical efficiency gap between conditional and unconditional efficiencies are much larger for large commercial banks (ICBC, CCB, BC, and ABC) than for small and medium commercial banks. Accordingly, it seems meaningful to explore the impact of CSR to the two types of banks. However, due to small number of observations, we could not take that direction of research as the nonparametric regression for subgroups (21 observations for large commercial banks) was impossible. These issues, therefore, constitute an agenda for further research.

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Abstract

HOW DOES CORPORATE SOCIAL RESPONSIBILITY IMPACT BANKING EFFICIENCY: A CASE IN CHINA**Ning Zhu, Jelena Stjepcevic, Tomas Baležentis, Zhiqian Yu, Bing Wang**

Much of the earlier literature was focused on the link between corporate social responsibility and corporate financial performance, with contradictory conclusions regarding the impact of corporate social responsibility upon corporate financial performance in the literature. Departing from conventional parametric techniques, this paper employs a fully nonparametric approach to analyze the link between corporate social responsibility and corporate financial performance in Chinese banking sector. Specifically, the slack-free Multi-directional Efficiency Analysis is extended into the conditional efficiency framework. The results indicate that corporate social responsibility has a significant impact on banking performance, where an increase in CSR generally leads towards an increase in conditional efficiency, but the attainable frontier might be shifted to any direction for the highest values of corporate social responsibility. In details, the analysis of “pure” efficiency indicates that corporate social responsibility has a stronger impact on increasing net profit if compared to that on contracting the amount of non-performing loans. In other words, it turns out that corporate social responsibility is likely to affect the attainable frontier in the direction of expanding net profit rather than contracting non-performing loans, because the portfolio of non-performing loans is difficult to reduce and therefore the impact of corporate social responsibility is not significant either on the frontier or on average efficiency. However, there exists a trade-off between corporate social responsibility and bank performance when a certain limit is exceeded in Chinese banking. Thus, a minimal increase in corporate social responsibility is likely to contribute to improvements in banking performance (productivity), whereas a negative effect is observed at the highest levels of corporate social responsibility.

Key Words: Banking efficiency, corporate social responsibility, data envelopment analysis, conditional framework, multi-directional efficiency analysis.

JEL Classification: C61, D24, G21.

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ESTIMATING CONSUMERS' BEHAVIOUR IN MOTOR INSURANCE USING DISCRETE CHOICE MODELS

Cristian Mihai Dragos, Simona Laura Dragos

Introduction

As an effective tool for mitigating financial risk, insurance has nowadays become a key sector of a functioning modern society. Motor insurance constitutes the largest line of business of the non-life insurance sector in Europe, considering its fleet of around 334 million vehicles registered in 2013 (Insurance Europe, 2015). The total motor insurance premiums in Europe amounted to €123.5 billion in 2013, with a 28% share of the total Gross Written Premiums.

The motor insurance line of business has two components – the Motor Third Party Liability Insurance (MTPL) and the Motor Damage insurance. The motor damage policy covers the cost of repairing the owner's vehicle following an accident, while the MTPL insurance covers the cost of repairing the vehicle of the third party. The legal framework of those two components varies across Europe, the common point being the compulsory nature of the MTPL insurance. In some countries it is difficult to make an explicit distinction between those two components when it comes to the legal framework, because motor insurance is sold as comprehensive insurance (Insurance Europe, 2015). In other countries, motor damage insurance is a voluntary form of insurance, the premiums of this category amounting to around 40% of total gross written premiums in motor insurance policies.

Nowadays, when people tend to be more mobile in terms of car transport, an increase in the risk exposures affecting motor insurance can be perceived. The annual mileage covered by cars increases because of the road infrastructure and the migration of potential consumers' residence towards low traffic rural areas. This phenomenon, initially perceived only in developed countries, tends to generalise also towards emerging economies, mostly for those implied in an integration process to

a certain community (Busu & Gyorgy, 2016). This significant diversification of risks covered by the motor insurance market must alert the insurance providers to be extremely cautious when developing an offer or when assessing the risk profile of potential customers.

The aim of this article is to evaluate the key determinants of the decision to subscribe to voluntary motor damage insurance. Our study wishes to fill a need for academic applied studies in this area, especially considering the fact that motor damage insurance is legally compulsory in many countries. Still, for insurers from countries where these products are voluntary, including Romania, our study provides useful information for product design.

By using logit models (binary, multinomial and nested), this empirical study emphasizes some significant factors affecting consumer behaviour when purchasing such an insurance policy: the educational background, the distance travelled by car, the risk profile of the insurer, the ratio between the owner's income and the value of the car. As control variables, we have retained a number of socio-demographic factors. The main contribution of our article is to define two behavioural factors in order to explain more thoroughly the decision to purchase motor damage insurance. The first factor measures the risk profile of the individual in terms of savings and loans, and the second one is defined as the ratio between the estimated price of the car and the revenue of the owner.

This study could be relevant for other countries where motor damage insurance is placed under a voluntary legal framework, as long as there are no major behavioural differences in the reasoning mechanism of deciding whether to purchase such insurance or not.

The remainder of the paper has the following structure: Section 1 reviews previous studies on

insurance consumers' behaviour and formulates the research hypothesis. Section 2 explains the econometric models and the methodology used to identify and evaluate the main determinants of voluntary motor insurance consumption on the Romanian market. Section 3 provides the results and discussions of the empirical study, and Section 4 draws conclusions and provides recommendations and policy implications.

1. Literature Review and Hypothesis Development

Motor insurance and its components (compulsory insurance, damage or combined policies) are studied from various perspectives in the literature. Depending on continent or country, the factors considered when establishing premiums, as well as the insurance distribution channels vary considerably. In some North American states, the insurance premium is determined by taking into account the driver's history (number of accidents), the annual mileage and the driving licence holding period (Dwight & Russell, 1995). The insurance system based on the number of miles driven annually, PAYD (pay-as-you-drive), has also been adopted in Europe, in countries such as the UK and Italy. Insurers from Ireland, Sweden and UK incorporate a credit score of the individual into the premium in order to capture the individual's risk aversion (European Commission, 2009). Another insurance system frequently used in most European countries is the "bonus malus" system (European Commission, 2009) applied by insurance companies mainly to urge the policyholders to become more responsible.

In the academic literature, the theoretical research on motor insurance demand is rather scarce. For instance, Awunyo-Vitor (2012) has examined motor damage insurance drivers in Ghana by using a binary logit model. In his study, the considered factors were the income of the insured, the age, education level and gender of the car owner, the age and value of the vehicle, as well as the perception of the premium and of the claim procedure. He has found that the age of the vehicle has a significant negative influence over the demand of motor damage insurance, which means that new vehicles are more likely to be insured than old ones. The income of the car owners and the value of the vehicles were found to be positively related to motor damage insurance demand at 1% level of significance. Analysis of the persons

who perceived the premium as satisfactory revealed a 70% probability of their buying insurance policies, and the probability was 51% in the case of those who perceived the claim procedure as satisfactory.

By means of a mixed Logit model, Hsu et al. (2014) have studied the degree to which the automobile insurance claims are affected by the characteristics of policyholders and insurance policies. They show that replacement value and the age of the vehicle are important factors in deciding to purchase voluntary motor insurance in Taiwan. Peng et al. (2016) have shown that the liberalization of automobile insurance market in Taiwan in 2009 increased the rate competition among insurers and prompted them to lower their rates.

Motor insurance consumers reveal a multivalent behaviour. In order to explain it, some studies focus on identifying the stimuli influencing individuals to subscribe to such policies, while other studies deal with the processes taking place inside the consumer's mind. As a type of social behaviour, consumption is influenced by psychological factors as well. Consequently, the third categories of studies are those that analyse the consumer data in terms of revealed behaviours: repurchase, preference, recommendation etc. (Query et al., 2007; Parvatiyar & Sheth, 2000). To put it differently, the literature stipulates that, much like other services, motor insurance must also contribute to maximizing the value felt by customers so that they may build a lasting relationship with the company and reveal a loyal behaviour – recommendation, repurchase, preference (Kotler & Armstrong, 2001; Gencer & Akkucuk, 2017).

As far as consumers' perspective is concerned, Rundmo and Moen (2005) and Rundmo and Nordfjaern (2013) have found that the most significant predictor of risk perception involves evaluations of the probability of occurrence of an event, as well as assessments of the severity of the event, if it should happen. Rundmo and Nordfjaern (2013) have concluded that „risk awareness significantly predicts risk perception and that risk awareness is directly associated with a demand for risk mitigation in transport”.

Ionică et al. (2012) believe that the behaviour of insurance consumers is driven by different factors such as: marketing-related factors (e.g. advertising of insurance

products, distribution channels), cultural factors, economic, demographic and legislative factors and the individual characteristics of potential insurers. The authors establish that, of all these factors, education plays the essential role in the decision of purchasing insurance. Sapelli and Vial (2003) have found a positive relationship between the education level and the probability of purchasing voluntary insurance, which means that better educated persons are more likely to understand the benefits of insurance and to protect themselves by subscribing to a policy.

Dewar (1998) and Currie (1995) have found that gender is also significant for the insurance demand. Nevertheless, the result may be correlated with income since, given the same educational background, women earn on average less than men. Liu et al. (2011) prove that risk preferences, along with income and education, are important predictors of voluntary insurance demand. The differences between the socio-demographic characteristics are correlated with risk perception, thus influencing the insurance demand and the risk-taking behaviour (Ioncică et al., 2012; Kaščelan et al., 2016).

Depending on customers' socio-demographic characteristics (age, income, education, gender, driving licence holding period etc.) and behaviour (number of accidents or claims, number of indemnity payments, type of deductible chosen by the policyholder), insurance companies segment customers to avoid adverse selection (Barone & Bella, 2004). Adverse selection can be avoided by discriminating through prices, which means that the same insurance service will generate different costs for different consumers because they represent heterogeneous risks (Dragos, 2007). Companies generally avoid customers with a bad reputation or those who had a large number of accidents in the past. Instead, they pursue and win the loyalty of customers who demonstrate exemplary behaviour. Saito (2009) tests the Japanese auto insurance market for the presence of adverse selection in the case of bodily injury liability insurance. He finds little evidence that informational asymmetry leads to the inefficiency of the auto insurance market, even if this is a significant factor for the annuity market (Finkelstein & Poterba, 2004) and the health insurance market (Höfter, 2006).

An element of overwhelming importance to insurance companies is the proper assessment

of the drivers' risk profile. The literature abounds in theoretical and empirical approaches using econometric, statistical and mathematical models to explain the phenomenon of 'adverse selection in insurance' (Shi et al., 2012; Jindrová & Jakubínský, 2015). By asking their customers to answer various questions, fill out their profile or take part in role-playing, insurers attempt to determine as precisely as possible the extent to which their customers are either more or less inclined to take certain risks (in other words, the risk aversion degree of their clients). Based on such scenarios, the individuals who are willing to take increased risks will fall into the category of policyholders who pay a higher premium. At the same time, due to their increased risk preference, such individuals are likely to purchase extra insurance or buy higher-premium policies. Cohen (2005) found that, on the Israeli motor insurance market, new customers with more than three years of driving experience and choosing low deductibles for motor insurance are associated with more accidents and higher losses for the insurer.

Relying on quoted literature and logical reasoning, we are in a position to outline the following hypothesis:

H1: The risk profile of the individual influences the purchasing of voluntary motor insurance.

Generally, the economic literature accepts the influence of the risk profile of the individual on buying any type of voluntary insurance. Nevertheless, this mechanism is hard to distinguish in applications, because we do not have objective values of the risk profile at individual level. The empirical studies measure this profile by different proxy variables like age, gender, education, stability at work and type of job. In our study we are attempting a novel approach, relating the risk profile to the individual's behaviour regarding saving versus borrowing.

H2: The annual distance traveled by car influences the purchase of voluntary automobile insurance.

There is an inner risk profile of each individual, which comes from his human nature. Beyond this, there is a specific risk associated to intense car usage. This behaviour is easily noticed by the driver, influencing his decision to either buy a voluntary motor insurance or not. Basically, if the insured considers this risk, he or she can generate adverse selection in insurance.

Tab. 1: Variables description

Variable	Variable description
<i>Endogenous variables (for binary logit model)</i>	
Y = 1 (Motor Damage)	If the person has Motor Damage insurance
Y = 0 (No Motor Damage)	If the person does not have Motor Damage insurance
<i>Endogenous variables (for multinomial logit model and nested logit model)</i>	
Y = 1 (Motor Damage)	If the person has No Motor Damage insurance
Y = 2 (No Motor Damage)	If the person does not have Motor Damage insurance. Main motivation: owner's income allows him/her to cover easily the cost of potential damage
Y = 3 (No Motor Damage)	If the person does not have Motor Damage insurance. Main motivation: the likelihood of accident is assessed as being low and purchasing an insurance does not seem profitable
<i>Exogenous variables</i>	
<i>RISK_PROFILE</i>	1 if total savings exceed by far total value of loans 2 if savings are comparable in amount (max \pm 20%) with loans 3 if total loans do not exceed 40% of the current value of real estate ¹ 4 if total credits exceed 40% of the current value of real estate
<i>CAR_PRICE_RANGE</i>	1 if the estimated car price does not exceed 2,000 Euros 2 if the estimated car price is between 2,000 Euros and 4000 Euros ² 3 if the estimated car price exceeds 4,000 Euros
<i>KM/YEAR</i>	Mileage covered by the car over the last 12 months (thousands km)
<i>WAGE_RANGE</i>	1 if the net wage does not exceed 800 RON 2 if the net wage is between 800 and 1,700 RON ³ 3 if the net wage exceeds 1,700 RON
<i>WAGE/CARPRICE_RANGE</i>	from -2 to 2. Difference between the variables <i>WAGE_RANGE</i> and <i>CAR_PRICE_RANGE</i>
<i>BACHELOR</i>	1 if the owner holds a bachelor's or higher degree 0 if not
<i>URBAN</i>	1 if the owner's main residence is in urban area 0 if not
<i>AGE</i>	Owner's age
<i>GENDER</i>	1 if the owner is male 0 if the owner is female

Source: own

Notes:

- 1 The cutoff (40%) was taken from bank credit reports. This value allows roughly equal shares for *RISK_PROFILE*=3 and *RISK_PROFILE*=4.
- 2 The cutoffs (2,000 Euros and 4,000 Euros) ensure roughly equal shares for the three values of the variable *CAR_PRICE_RANGE*. The data on car value distribution in Romania are taken from statistics of insurance companies and from car sales websites.
- 3 The cutoffs 800 RON and 1,700 RON ensure a balanced distribution among the three groups, in accordance with income breakdown in Romania.

H3: The relationship between the individual's income and the value of the car influences the purchase of voluntary motor insurance.

We believe that treating the income of the individual and the value of the car separately cannot lead to conclusive results. Essentially, it is the connection between the two measurements that counts. An individual with a high income compared to the value of his car can easily support his own potential damages. On the contrary, an expensive car connected to an owner with a modest income generates a high risk against which it is better to be insured.

After briefly mentioning previous studies focusing on motor insurance demand, the following paragraphs describe and explain the econometric tools to estimate the consumers' behaviour when buying motor damage insurance, using a sample of Romanian car owners.

2. Data and Methodology

2.1 Data

The data was collected in Cluj County, Romania, over the period between September – and December 2015, and the tools used in the survey were the face-to-face and self-administered questionnaires. To avoid any systematic sampling bias, the respondents were chosen randomly. However, they had to meet two requirements simultaneously, namely, to possess a car and to have a driving licence. The questionnaire was run during the periodic roadworthiness tests carried out at accredited centres/garages. According to current Romanian legislation, the roadworthiness test is compulsory for all vehicles, regardless of the owner's socio-demographic characteristics (income, age, gender, workplace, domicile etc.), the value or age of the car, its annual mileage or technical condition etc. The sample comprised only persons who are car owners and their own driving time in the car exceeds 80% of the car's overall driving time. If the driver had not bought an insurance policy, the authors decided to limit the policy choice decision to two possible major motivations ($Y = 2$ and $Y = 3$, see Tab. 1). The drivers falling outside both of these defined motivations were excluded from the sample. As a result of the imposed prerequisites, the sample contains 311 fully-completed questionnaires providing values for all studied variables (see Tab. 1).

2.2 Methodology

Three models are used to model the individual choice: binary logit, multinomial logit and nested logit. The ROC curve is computed in order to compare the predictive performance of the models.

The Binary Logit Model

The individual's likelihood to choose ($Y = 1$) or not to choose ($Y = 0$) a Motor Damage insurance policy is modelled by the formula:

$$\Pr(Y_i = 1) = \frac{\exp(x_i b)}{1 + \exp(x_i b)} \quad (1)$$

where $i = \overline{1, N}$ Index of each individual; x_i the vector of the exogenous variables; b the the vector of the coefficients.

The Multinomial Logit Model

The individual's likelihood to choose one of the three alternatives ($Y = 1, Y = 2, Y = 3$, see Tab. 1) is modelled by the formula:

$$\Pr(Y_i = j) = \frac{\exp(x_i b_j)}{\sum_{j=1}^m \exp(x_i b_j)} \quad (2)$$

$i = \overline{1, N}$ index of each individual; $j = 1, 2, 3$ index of each alternative. x_i the vector of the exogenous variables. In the present application, all variables vary with respect to individual (i) but remain constant with respect to alternatives (j). b_j the vector of the coefficients. Coefficients vary with respect to alternatives (j). The values of b_j coefficients are interpreted with respect to a reference alternative.

The Nested Logit Model

The individual's likelihood to choose one of the three alternatives is modelled by grouping the alternatives. L represents the number of groups in which the alternatives are included. In each group l there are J_l possible choices, indexed by $j(l)$. The total number of possible alternatives is $J = J_1 + J_2 + \dots + J_L$. The decision process takes place at two levels: inside each group and between groups. The variables x_i describing qualities that are common to choices of the same group take values that may vary between groups, but not inside the group. The variables $x_{i(j)}$ vary across alternatives. McFadden (1973) has proved that a discrete choice model can be developed to the utility maximization, based on the hypothesis that error terms follow a Weibull

distribution. The probability $\Pr(j/x)$ of choosing the alternative j conditioned by the vector of explanatory variables x can be written as:

$$\Pr(j/x) = \Pr(l/x) \cdot \Pr(j(l)/x_{j(l)}) \quad (3)$$

$P(l/x)$ is the probability of choosing one of the L groups:

$$\Pr(l/x) = \frac{\exp(x_l b + \lambda_l I_l)}{\sum_{l=1}^L \exp(x_l b + \lambda_l I_l)} \quad (4)$$

$I_l = \ln \sum_{j=1}^{J_l} \exp(x_{j(l)} b_l)$ is the inclusion variable

$\Pr(j(l)/x_{j(l)})$ is the probability of choosing an alternative belonging to the group l :

$$\Pr(j(l)/x_{j(l)}) = \frac{\exp(x_{j(l)} b_l)}{\sum_{j=1}^{J_l} \exp(x_{j(l)} b_l)} \quad (5)$$

For each individual, the probability of choosing each alternative can be estimated for both the multinomial logit model and the nested logit model. In this study all econometric estimations are performed using LIMDEP 10 and its extension NLOGIT 5.

ROC (Receiver Operating Characteristics) Curve for Discrete Choice Models

Models are generally compared in the literature by means of purely econometric criteria such as pseudo R^2 , parameters significance etc. A highly appreciated practitioners' tool is the ROC curve, which assesses the predictive power of binary models. Recently the methodology has also been developed for Discrete Choice Models (Dragos, 2010). The following notation is used:

$N_{11(j)}$ the number of individuals choosing alternative j and that the model predicts will choose alternative j .

$N_{1T(j)}$ the number of individuals choosing alternative j .

$N_{00(j)}$ the number of individuals *not* choosing alternative j and that the model predicts will *not* choose alternative j .

$N_{0T(j)}$ the number of individuals *not* choosing alternative j .

Therefore, the following definitions are used:

- the proportion of correct predictions for

individuals choosing j

$$\frac{N_{11(j)}}{N_{1T(j)}} = sensitivity_{(j)} \quad (6)$$

- the proportion of correct predictions for individuals not choosing j :

$$\frac{N_{00(j)}}{N_{0T(j)}} = specificity_{(j)} \quad (7)$$

This allows the ROC curve to be plotted for each alternative j . To plot the global ROC curve (for all alternatives), *global sensitivity* and *global specificity* are defined (Dragos, 2010) as follows:

$$\begin{aligned} sensitivity_{(G)} &= \frac{\sum_{j=1}^J N_{11(j)}}{\sum_{j=1}^J N_{1T(j)}} = \frac{\sum_{j=1}^J N_{11(j)}}{N} \\ &= \sum_{j=1}^J \frac{N_{11(j)}}{N} = \sum_{j=1}^J \left(\frac{N_{11(j)}}{N_{1T(j)}} \times \frac{N_{1T(j)}}{N} \right) \\ &= \sum_{j=1}^J \left(sensitivity_{(j)} \times \frac{N_{1T(j)}}{N} \right) \end{aligned} \quad (8)$$

$$\begin{aligned} specificity_{(G)} &= \frac{\sum_{j=1}^J N_{00(j)}}{\sum_{j=1}^J N_{0T(j)}} = \frac{\sum_{j=1}^J N_{00(j)}}{\sum_{j=1}^J (N - N_{1T(j)})} \\ &= \sum_{j=1}^J \frac{N_{00(j)}}{(J-1)N} = \sum_{j=1}^J \left(\frac{N_{00(j)}}{N_{0T(j)}} \times \frac{N_{0T(j)}}{(J-1)N} \right) \\ &= \sum_{j=1}^J \left(\frac{N_{00(j)}}{N_{0T(j)}} \times \frac{N_{0T(j)}}{(J-1)N} \right) = \sum_{j=1}^J \left(specificity_{(j)} \times \frac{N_{0T(j)}}{(J-1)N} \right) \end{aligned} \quad (9)$$

By comparing the ROC curves of two competing models, arguments may be advanced with respect to their comparative performance. Because the ROC curve for Discrete Choice Models has only recently been developed, it is not yet implemented in the econometric software. All the computations and figures concerning the ROC curve are performed using Microsoft Excel.

3. Results and Discussions

The use of the binary logit model (the results reported in Tab. 2) points to several preliminary results concerning the behaviour of car owners. The alternatives where the individual does not

Tab. 2: Results of binary logit model (Y = 0 No Motor Damage is the base outcome)

Exogenous variable	Coefficient	t-value
<i>RISK_PROFILE</i>	** -0.899	5.88
<i>WAGE/CARPRICE_RANGE</i>	0.080	0.60
<i>KM/YEAR</i>	0.014	0.48
<i>BACHELOR</i>	* 0.656	2.25
<i>URBAN</i>	0.146	0.53
<i>AGE</i>	-0.008	0.77
<i>GENDER</i>	-0.150	-0.52
<i>Constant</i>	*1.450	1.97
N = 311; Pseudo R ² = 0.129		

Source: own

Note: **, * : significant at 1% and 5%

have a Motor Damage insurance are grouped into a single alternative where Y = 0 (without Motor Damage).

The individual's risk profile and the level of education are the only statistically significant variables. The coefficient of the variable *RISK_*

PROFILE has the negative sign, meaning that car owners with low risk aversion are less incited to subscribe to insurance policies. The positive value of the variable *BACHELOR* indicates that university-educated drivers reveal an increased level of preference for insurance, this fact

Tab. 3: Results of multinomial logit model (Y = 3 is the base outcome)

Exogenous variable	Coefficient	t-value
<i>RISK_PROFILE</i> (Y = 1)	** -0.781	-5.41
<i>RISK_PROFILE</i> (Y = 2)	-0.213	-1.68
<i>WAGE/CARPRICE_RANGE</i> (Y = 1)	0.263	1.76
<i>WAGE/CARPRICE_RANGE</i> (Y = 2)	** 0.394	2.88
<i>KM/YEAR</i> (Y = 1)	** 0.086	2.84
<i>KM/YEAR</i> (Y = 2)	** 0.075	2.64
<i>BACHELOR</i> (Y = 1)	* 0.773	2.39
<i>BACHELOR</i> (Y = 2)	0.101	0.31
<i>URBAN</i> (Y = 1)	0.242	0.80
<i>URBAN</i> (Y = 2)	-0.115	-0.42
<i>AGE</i> (Y = 1)	0.010	1.18
<i>AGE</i> (Y = 2)	-0.005	-0.56
<i>GENDER</i> (Y = 1)	0.047	0.15
<i>GENDER</i> (Y = 2)	-0.146	-0.50
N = 311; Pseudo R ² = 0.090		

Source: own

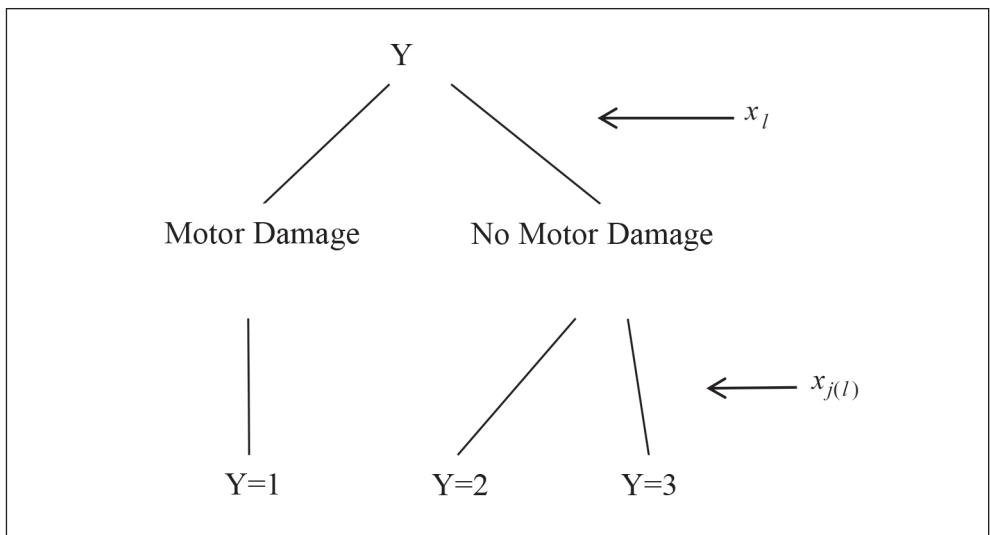
Note: **, * : significant at 1% and 5%

accounting at least partially for their decision to subscribe or not to a Motor Damage insurance policy. However, if the decision is not to buy an insurance policy, the structure of the binary model doesn't reveal anything about the motivations behind this option. To better understand the mechanism, the range of alternatives is extended ($Y = 1, 2, \text{ or } 3$, see Tab. 1). Because there isn't any ordered connection between the three alternatives, the econometric estimation is performed using discrete choice models (such as multinomial and nested logit).

Unlike in the case of the binary model, for the multinomial logit model (the results reported

in Tab. 3, the variables *WAGE/CARPRICE_RANGE* and *KM/YEAR* significantly influence the individual's decision concerning an insurance policy. However, the multinomial logit model cannot determine which of the variables better explains the two options: a) the decision to subscribe or not to an insurance policy, or b) in case of non-subscription, what the appropriate motivation is? ($Y = 2$ or $Y = 3$). To solve this problem, the decision must take the form of a tree-like pattern (Fig. 1). The coefficients of different possible specifications of the nested logit model are estimated.

Fig. 1: The tree structure of the nested logit model



Source: own

According to the estimates of the binary and multinomial logit models, the variables *RISK_PROFILE* and *BACHELOR* belong to the attributes x_l and account for the decision between groups (nests). The variables *URBAN*, *AGE* and *GENDER* belong to the attributes $x_{j(l)}$ and account for the choice of the alternative in the group "without Motor Damage". By contrast, previous models cannot establish a definite conclusion for the variables *WAGE/CARPRICE_RANGE* and *KM/YEAR*. Consequently, each variable must be considered in two ways: a) as belonging to x_l attributes to explain the decision

to subscribe or not an insurance policy (Nested Logit 1) and b) as belonging to $x_{j(l)}$ attributes to explain, in case of non-subscription, what the appropriate motivation may be (Nested Logit 2). The estimations are presented in Tab. 4.

Among all models used for estimations, Nested Logit 2 is the most adequate in terms of classical econometric criteria: the Pseudo R^2 and the significance of coefficients. A recently developed tool (Dragos, 2010), the Receiver Operating Characteristic Curve for Discrete Choice Models, allows us to estimate comparatively the predictive power of this

Tab. 4: Results of nested logit model (Y = 3 is the base outcome)

Exogenous variable	Nested Logit 1		Nested Logit 2	
	Coeff.	t-value	Coeff.	t-value
<i>Attributes of the utility function</i>				
WAGE/CARPRICE_RANGE (Y = 1)	...	...	-0.2980	-1.21
WAGE/CARPRICE_RANGE (Y = 2)	...	...	** 0.3930	2.99
KM/YEAR (Y = 1)	...	...	-0.0350	-0.71
KM/YEAR (Y = 2)	...	...	* -0.0530	2.28
URBAN (Y = 1)	0.2910	0.77	0.3020	0.80
URBAN (Y = 2)	-0.1130	-0.42	-0.1310	-0.48
AGE (Y = 1)	-0.0060	-0.53	0.0003	0.03
AGE (Y = 2)	-0.0026	0.44	-0.0010	-1.49
GENDER (Y = 1)	-0.0440	-0.12	0.2100	0.51
GENDER (Y = 2)	-0.1050	-0.40	-0.3610	-1.28
<i>Attributes of Branch Choice Equations (G1 = reference)</i>				
RISK_PROFILE (G2)	** 0.9330	6.02	** 0.9300	6.01
BACHELOR (G2)	* -0.6230	-2.19	* -0.6270	-2.20
WAGE/CARPRICE_RANGE (G2)	-0.0650	-0.48	...	...
KM/YEAR (G2)	-0.0140	-0.49	...	...
<i>Inclusive Value Parameters</i>				
G1	1.0000	fix. param.	1.0000	fix. param.
G2	* -2.1990	-2.04	* -2.0770	-2.00
	N = 311 Pseudo R ² = 0.151		N = 311 Pseudo R ² = 0.169	

Source: own

Note: **, * : significant at 1% and 5%

group of models for a single alternative (Fig. 2), as well as for all alternatives (Fig. 3).

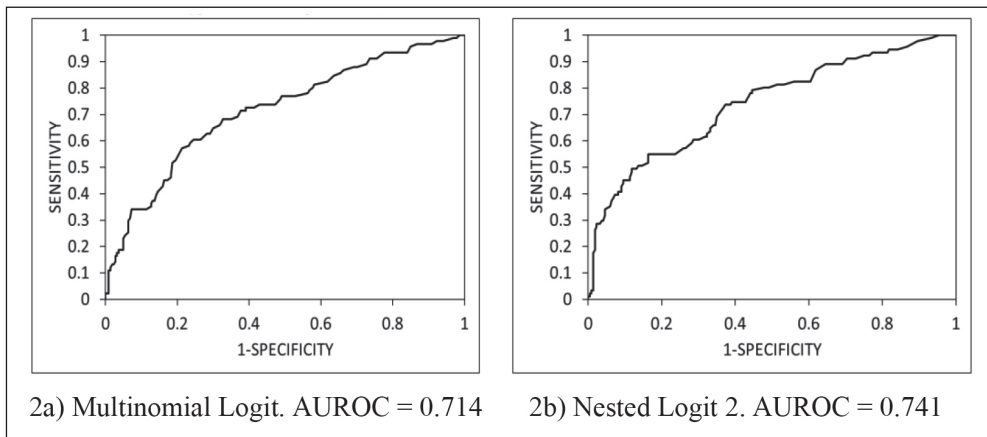
According to the results of the econometric estimations, the ROC curve confirms that the best specification of a model is provided by Nested Logit 2. The tree structure of the model allows the separate identification of factors explaining: a) the decision to subscribe or not to an insurance policy (attributes of branch choice equations) and b) in case of non-subscription, what the appropriate motivation may be (attributes of the utility function).

The variables kept preserved in the model to explain the decision to subscribe or not are both significant. An individual's willingness to incur financial risks and a lower level of

education increase the probability of his not purchasing a Motor Damage insurance policy. On the other hand, nor the risk profile, nor the education level can explain the motivation to subscribe to such insurance or not.

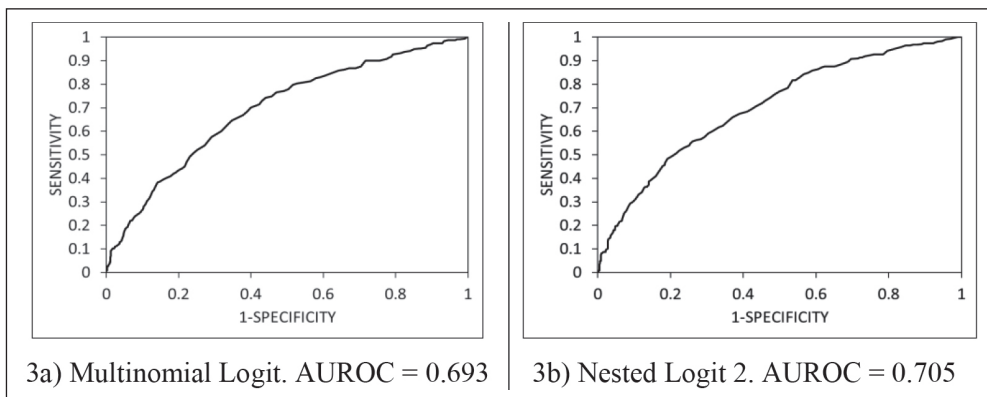
From the variables preserved in the model to explain the motivation for not subscribing to insurance, the annual mileage and the ratio between the estimated price of the car and the revenue of the owner are significant. There are two main motives behind the behaviour of the uninsured. The first motivation (Y = 2) consist in the possibility of easily providing coverage from the owner's available income in case of a car accident. The variable WAGE/CARPRICE_RANGE is statistically significant,

Fig. 2: Comparing ROC curves for the alternative Y = 1



Source: own

Fig. 3: Comparing ROC curves for all three alternatives



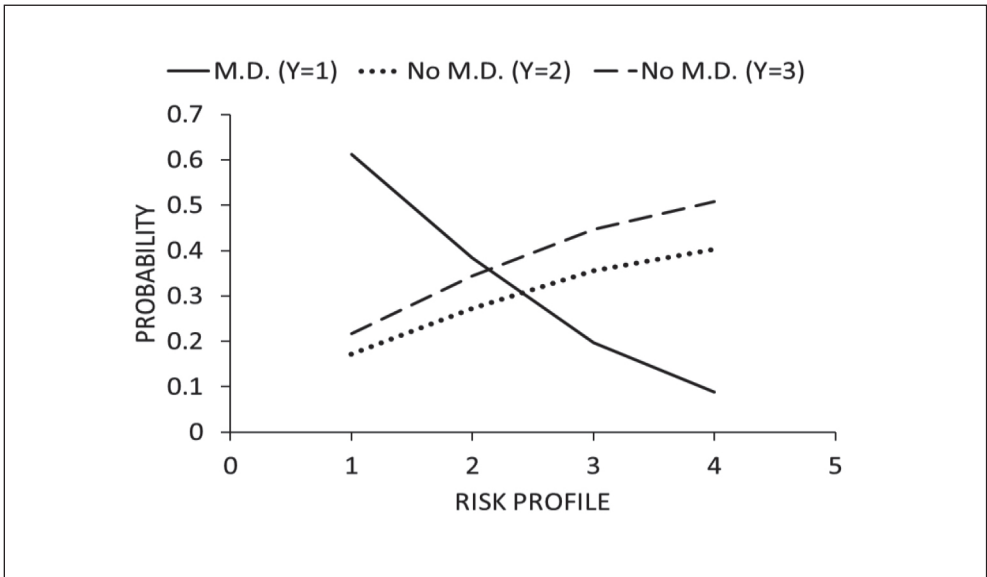
Source: own

accurately capturing the car owners' rationale. The second motivation ($Y = 3$) refers to the way in which drivers perceive the low likelihood of a car accident. Their perception is closely correlated with the car mileage (variable *KM/YEAR*). The sample includes people who drive between four and five thousand kilometres annually, sometimes only in rural areas where the volume of traffic is low. The fact that age, gender and the urban/rural environment are not statistically significant can be surprising, but is mainly due to the correlation, to some extent, with other regressors. For instance, women

are less willing than men to incur risks of any kind, including car and traffic-related risks. This effect was expressed by the *RISK_PROFILE* variable. A similar effect was detected for the variable *AGE*. While the rural residence of the respondents does not have any significance, the values of variables like annual mileage, net income, and car price are significant. Consequently, the *H1*, *H2*, and *H3* hypotheses are accepted.

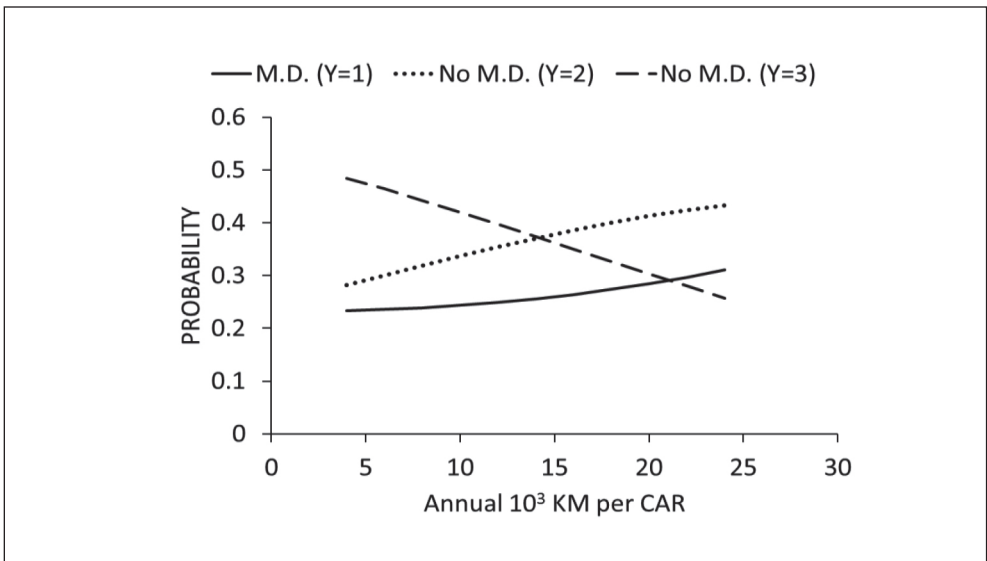
The most performant econometric model of our study, Nested Logit 2, may well lie behind the simulation of commercial policies

Fig. 4: Probability of choosing alternatives with respect to RISK_PROFILE



Source: own

Fig. 5: Probability of choosing alternatives with respect to annual mileage



Source: own

on insurance. We simulated the effect exerted by the variation of each explanatory variable on the probability of choosing one out of the three alternatives. The remaining regressors are supposed to be constant, taking the average value in the sample (Fig. 4 and Fig. 5).

The variation of the driver's risk profile has the strongest effect on the probability of subscribing an insurance policy (Fig. 4). By contrast, the perception of the probability of being involved in an accident and therefore of choosing the third alternative is most affected by the annual mileage (Fig. 5).

Conclusions

Meeting and satisfying customers' changing preferences, expectations and needs represent a major challenge for insurance companies. Therefore, all insurance providers must innovate on a regular basis and come up with new ways of approaching the target segments and of promoting their offers. Companies should also attempt to increase customers' awareness of risk exposure when driving irresponsibly, as well as their understanding of the negative impact of this on themselves and on the society at large.

The international literature on the individual's behaviour when purchasing motor insurance appears rather scarce, not least because in many countries the two insurance components – the compulsory (MTPL) and the optional (Motor Damage) – are sold together as one package. The relevance of this analysis only for voluntary insurance – where the customer decides to subscribe or not to a motor insurance policy – points to this state of affairs. While previous studies estimated the risk profile only through proxy variables such as income, age or gender, without accounting for any behavioural aspects, our study has successfully integrated the risk profile of the policyholders as a self-standing explanatory variable.

In emerging economies, the upward trend of the workforce mobility entails more frequent and longer commutes between home and workplace. The awareness of risk exposures (the perception of the probability of being involved in a car accident) will increase given the heavy road traffic. Even if, from a legal point of view, motor damage insurance remains voluntary, its share of the non-life segment is expected to increase significantly. The percentage of university-educated people is

also an upward trend, with the educational aspect instrumental in rendering these individuals more aware of the advantages of an insurance system compared to self-insurance. The other variables in the study (income, age, gender) are either statistically insignificant or relatively constant in time. Therefore, they are not expected to exert any impact on motor insurance consumption in the near future.

To improve the profitability of this insurance category and because of the high number of road casualties, we consider the introduction of a common database for all motor damage insurers imperative. This database should provide, for the benefit of all potential insureds, the individuals' characteristics such as their risk perception, the properties of their car and the history of their road casualties. The database would help reduce the phenomenon of migration in the case of "high risk" policyholders. It refers to individuals with a bad history of past claims who try to avoid penalties charged for repeated damage by changing the insurer.

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ESTIMATING CONSUMERS' BEHAVIOUR IN MOTOR INSURANCE USING DISCRETE CHOICE MODELS

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Insurance is a financial service in which consumption is highly affected by the characteristics of the potential buyer and his perceptions about the offered product. Motor insurance with its two components – the Motor Third Party Liability Insurance (MTPL) and the Motor Damage insurance – constitutes the largest line of business of the non-life insurance sector in Europe. The present study models the voluntary motor damage insurance consumer behaviour using discrete choice models, hypothesizing a hierarchical and a non-hierarchical decision. The sample consists of 311 car owners from Cluj County, Romania. The econometric estimations use binary logit, multinomial logit and nested logit models. The predictive power of these models is compared by means of the Receiver Operating Characteristic curve for discrete choice models. The results reveal that the main factors affecting the purchase of a voluntary motor insurance policy are risk preference/aversion, the distance travelled by car, the driver's education level and the ratio between the driver's income and the car price. In contrast to previous studies who estimated the risk profile only through proxy variables without accounting for any behavioural aspects, our study has successfully integrated the risk profile of the policyholders as a self-standing explanatory variable. Since the explanatory variables are representative not only for a particular geographical area, the highlighted behaviour may be applied to all cases where motor damage insurance is voluntary.

Key Words: Motor insurance, risk profile, consumer behaviour, discrete choice models, ROC curve.

JEL Classification: C25, G22, M31.

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BOOTSTRAP TESTING OF TRADING STRATEGIES IN EMERGING BALKAN STOCK MARKETS

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Introduction

Technical analysis is an approach to predicting future prices based on detecting regularity patterns in prices, volume and other market indicators. It ordinarily proceeds by noting market activity in some graphical form and then deducing possible future trends from the observed historical data. This paper stands on the postulate that stock prices manifest various regularities; once these regularities are identified, technical analysts and/or market participants should be consulted about what is likely to happen next. This scenario allows the participants to run a profitable trading strategy and to reject the weak-form market efficiency hypothesis. They identify trends at the early stage and maintain their positions until they notice indications of price movement reversal. The absence of weak-form efficiency, in which information set involve only historical market data, does not necessarily translate into profitable information due to trading costs. Park and Irwin (2007) review international evidence on the profitability of technical analysis and indicate that previous studies are not capable to provide convincing arguments supporting the benefits of technical trading strategies. In addition, most of implemented studies, similar to Fifield et al. (2005), have demonstrated that better trading performances are more possibly to appear in emerging stock markets. This fact is the basic motive to handle such a research. Hence, a technical analysis in stock markets of the Balkan States analogously to other conducted in emerging markets has to be performed.

Most lately, the attention of technical trading analysis has shifted to emerging stock markets which collectively bring a significant alternative source of opportunities to international investors (McKenzie, 2007). On the other hand, investment attractiveness and predictive power

seem to disappear in the course of time. Thus, it is of constant interest to examine whether the allurements of technical trading strategies keeps on hold for the most recent sample periods.

According to Brock et al. (1992), stock prices are probably the most studied financial series and most susceptible to data snooping. Therefore, the possibility of various spurious patterns uncovered by technical analysis cannot be dismissed. Although a complete revealed remedy for data snooping biases does not exist, we try to reduce this issue by presenting results from all technical trading rule variants and underline the robustness of results among used bootstrap data generating processes. The introduction of the bootstrap, as a main part of resampling processes, enables testing of diverse null hypothesis for which analytical approaches would be impracticable. The use of resampling methods also offers a possible solution to adjust for the biases caused by data snooping.

The basic hypothesis of this paper is that there is no weak-form efficiency in observed stock markets of neighboring countries, such as proven in the Croatian stock market (Festić et al., 2012). As a matter of fact, earlier research processes in stock markets of neighboring countries have been directed to the stock price movement effects and the risk of such investments, as an example Žiković (2008) or Žiković and Aktan (2009), while so far the researchers ignored the significance of trading rule predictive power. Consequently, the aim of this paper is to examine the profitability and predictive ability of technical trading rules in six stock markets of the states of the Balkan States. Furthermore, the paper is providing resume evidence on the predictive power of four general classes of technical trading rules: moving average, filter, trading range breakout and channel breakout rule. These rules have

proven to be most popular in the literature and their application will enable immediate comparisons to previous research. In addition, the study provides an analysis about relationships among selected stock markets considering the hypothesis that financial crisis may result in stronger international linkages of stock markets due to more or less simultaneous “contagion” effects (Kizys & Pierdzioch, 2011).

The paper encompasses six related sections. After the introduction, the first section of research provides the literature review of technical trading rules applied in financial time series. The second section explains theoretical background of technical analysis and indicates the basic types of technical trading rules. The third section outlines the methodology applied in this paper to test predictive ability of technical trading rules. The fourth section describes the observed stock market indices data and analyses the empirical results of trading rules tests. Finally, this paper ends by some recommendations, as well as concluding remarks.

1. Literature Review

Brock et al. (1992) tested two of the simplest and most popular technical trading rules by utilizing the Dow Jones index over the period 1897-1985. Their results provide strong encouragement for further development of trading strategies. In the following, the focus of the paper is on the methodology similar to that of Brock et al. (1992), although Sullivan et al. (1999) demonstrated that their forecasting performance has disappeared over recent years due to data snooping problem. On the other side, Bessembinder and Chan (1995) conclude that two simple technical trading rules are successful in predicting stock price movements in Japan, Hong Kong, South Korea, Malaysia, Thailand and Taiwan. Gencay (1998), Ratner and Leal (1999) also support the predictive power of technical trading rules. Kwon and Kish (2002), employing three popular technical trading rules to NYSE index over the period 1962-1996, deduce that the trading rules have the potential to capture profit opportunities over various trading strategies comparing to buy-and-hold policy. However, Ready (2002) emphasize that evident success of applied technical trading rules is spurious result of data snooping and not essentially persist in the future, while Parisi and Vasquez

(2000) and Gunasakarage and Power (2001) found support for the profitability of technical trading rules in several South American and emerging South Asian markets, respectively. Using Singapore Exchange market data, Wong et al. (2003) found that market members tend to achieve sustainable profits by applying technical analysis.

Ben-Zion et al. (2003) compared Tel-Aviv Stock Exchange Index to S&P 500 Index with implication that market efficiency is higher in developed financial markets than in emerging financial markets. Chang et al. (2004) also found that technical trading rules are profitable on some emerging stock markets. Similarly, McKenzie (2007) tested three technical trading rules for seventeen emerging markets and indicated that some of the trading rules appear to earn significant returns but the forecast accuracy decreases for more recent sample periods.

Most recent evidence on testing technical trading rules in European stock markets presents following results. Metghalchi et al. (2007) showed that moving average rules for the Austrian Stock market have predictive power and can notice price patterns for profitable trading. Metghalchi et al. (2008) applied various trading rules in the Swedish stock market and referred that several moving average strategies outperform buy-and-hold strategy even considering transaction costs and data snooping. Lonnbark and Soultanaeva (2009) presented the results of applying technical trading rules in three stock markets of the Baltic region. They discerned importance of the choice of a methodology for testing the profitability of technical trading rules. Also, Papathanasiou and Samitas (2010), applying Brock et al. (1992) methodology, confirmed in general that used technical strategies win the market, concerning buy-and-hold strategy.

Other recent studies continue to provide a confirmation of the technical trading rule predictive ability but also a few critiques and potential drawbacks. McKenzie (2007) claims that market inefficiency could be a constant feature of emerging financial markets. Similarly, Marshall et al. (2009) consider technical trading rules more profitable for smaller, less liquid stocks. Lento (2010) employed some combined technical trading rules and found that certain combination are profitable even when individual trading rules alone are not. Garza-Gomez and

Metghalchi (2011) found the Mexican stock market inefficient in years before modernization and futures market introduction, and gradually disappearing of market inefficiency in years after. Moreover, Mitra (2011) investigated moving average trading rules for the Indian stock market and observed that profitable opportunities from technical analysis holds as a puzzle in the stock market. Pauwels et al. (2012) made a comprehensive investigation on 34 emerging stock markets and noticed the inefficiency only in four after an adjustment for transaction costs and data snooping bias. Also, the same group of authors provided evidence that during the recent economic crisis number of inefficient markets are increasing comparing to other observed periods.

Majority of the previously mentioned studies point at the strong possibility to reject the weak-form efficiency hypothesis in case of emerging financial markets. Even after all these facts and with the lack of possible application of the analogous results, the potential profit opportunities are not fully exploited by the stock market analysts in the Balkan States. Often confronting results in previous work pinpoint the importance of separate studying of technical trading rules applicability in the stock markets in the defined region.

2. Technical Trading Rules

Technical trading rules or their variants, technical trading strategies, are algorithms that take inputs regarding to stock market, and outputs an investment decision, whether to buy or sell a stock for a given time interval. They have been widespread used tools by traders in financial markets for many decades and their performance has been a topic of extensive research. According to Charoenwong (2012), using daily data permits for more variation in the stock price. Hence, if there is more volatility in the data, there are more potential opportunities to buy and sell stocks. Though the stock market may have indicated a stabile long term price movement pattern, in the short term the price behavior is very noisy. Thus, active trading strategies should be more profitable in the short term with more variation then the long term.

2.1 Types of Technical Trading Rules

According to Coe and Laosethakul (2010), every trading strategy is different regarding possible application and predictive power.

Therefore, technical trading rules have to be tested separately and then compared. Similarly to Sullivan et al. (1999) and Qi and Wu (2006), this paper provides a comprehensive coverage of applied technical trading rules in order to obtain significant estimate of data snooping biases. Four popular types of trading rules are considered in this study: moving average, filter, trading range breakout and channel breakout rules. In each case, we assume that the technical analyst and/or market participant initially does not hold any stock position, but he does have starting wealth to be used in the stock trading with a high probability of expected returns growth.

1) The first rule is based on moving averages which are series of simple partial averages of prices P over the previous n trading days, including the current day. They represent a measure of stock price momentum. Therefore, the moving average at time t for n trading days is computed as follows:

$$MA_t^n = \frac{1}{n} \sum_{i=1}^n P_t \quad (1)$$

Thus, the original time series of stock prices conducts two new series of partial moving averages, one for short term and another for long term. Considering the moving average rule, when the short moving average of stock prices is above the long moving average, the traders initiate buy or hold decision relying on believe that the short term price growth surpass the long term price growth in expected time period. Oppositely, when the short moving average is below the long moving average or when they are equal, the traders make a sell or stayout decision.

A typical number of trading days in short and long term moving averages depends on research assumptions. Hence, Brock et al. (1992) are used 1 and 5 days interval for the short moving average, and from 50 to 200 trading days for the long moving averages, while Charoenwong (2012) considered that the short moving averages can range from 5 to 15 days and the long moving average from 50 to 90 days. This paper implements 1 and 5 days interval for the short, and 100, 150 and 200 trading days for the long moving average.

2) According to Pauwels et al. (2012), filter rules try to avoid spurious trading signals based on short term prices changes. Therefore,

these trading strategies filter out small price movements and only generate trading signals in the case of larger price changes. However, filter strategies are a set of straightforward rules initiated by the price movements that decide whether to sell or buy stock after a certain percentage of price growth or downfall. To reduce a number of trading signals, we apply the range from 1% to 10%.

3) Trading range breakout rule generates buying signals when the stock prices exceed the resistance level or the maximum price over the previous n trading days by defined percent. Moreover, when the stock price goes below minimum price over the previous n days by certain percent, the traders decide to sell the stocks. A great number of trading analysts believe that investors are willing to sell at the peak. However, these selling signals will cause resistance to a price rise above the previous peak. Such a breakout is considered to be a buy signal.

In order to implement trading range breakout strategies, we follow the rules consistent with the moving average strategy and set by Brock et al. (1992). The resistance level is determined based on the past 50, 100, 150 and 200 trading days.

4) Under the channel breakout rule, the traders buy stock when the closing price goes above the channel and sell it when the closing price goes below the channel. A channel is defined as a price span within x percent of stock price movements over the previous n trading days. Similar to the trading range breakout rule, this paper use a price span between 1% and 10%.

3. Methodology

3.1 Bootstrap

The bootstrap, originally introduced by Efron (1979), appeared as a procedure to measure the accuracy of an estimator. Many researchers have decided to use the bootstrap methodology in case of complex statistical problems. Bootstrap methods are more flexible than classical statistical methods which could be analytically intractable or unusable because of a lack of the appropriate assumptions being satisfied. Those methods are related to Monte Carlo simulation, but with one fundamental difference. Data generating process in Monte Carlo simulation is completely artificial, while bootstrap process obtains a description of

the properties of estimators by applying the sample data themselves and involves sampling repeatedly with replacement from the actual data. Thereby, two distinctive advantages of bootstrap procedure over analytical results of traditional statistical methods appear. First, bootstrap method enables the researcher to conduct the inference without considering strong distributional assumptions. The bootstrap includes empirically estimated sampling distribution by looking only at the variations of the statistics within sample. Consequently, bootstrap procedure treats the original sample as a population from which bootstrap samples can be drawn. Second advantage emphasizes bootstrap process as more robust than classical statistical methods. The robustness enables an effective usage of bootstrap methods with relatively small samples and preserves the estimator stability during the periods of unexpected volatility shifts.

Initial bootstrap procedure begins with a set of n independent and identically distributed observations with distribution function F and an unknown parameter as a function of F . The bootstrap just described is the simplest version and it is only valid in the case of i.i.d. observations. Therefore, if one applied the i.i.d. bootstrap procedure immediately to dependent observations, the resampled data will not preserve the properties of the original data set. That experience provides inconsistent statistical inferences. With inclusion of dynamic correlation and conditional heteroscedasticity, Ruiz and Pascual (2002) offered a classification of two bootstrap groups (parametric and nonparametric bootstrap) developed for time series data. The parametric methods are based on assuming a specific regression model for the data. If the serial dependence of the data is misspecified by the selected model, the parametric bootstrap could be inconsistent. Consequently, alternative approaches that do not require fitting a parametric model have been developed to deal with time series data. We choose one bootstrap procedure from each mentioned group. However, this paper subsumes two widely used bootstrap methods in financial time series, the residual based bootstrap and the moving block bootstrap method.

Residual Bootstrap

The parametric bootstrap method is based on assumption that there is always a specific

regression model suitable enough for time series data. There are two open questions due to the residual based resampled efficiency. First, considering the distribution approximation of population made by the parametric model, it is inevitable to pay attention to model specification. Second, the residual series made by bootstrap procedure could be various thanks to the model estimation method or choice of residual scheme. Ruiz and Pascual (2002) indicated a few types of residual from the same parametric model and noticed different predictive power of residuals in respect to purpose of application. In order to compare the results with mentioned study, this paper uses the AR(1)-GARCH(1,1) model to estimate stock price returns and generate series of residuals as foundation for bootstrap procedure.

$$Y_t = \mu + \phi_1 \cdot Y_{t-1} + \varepsilon_t \quad (2)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2 \quad (3)$$

where Y_t is stock price or stock price return in time t , ε_t is residual in time t , and σ_t^2 conditional variance in time t . Other indices represent the estimation parameters.

The formulation (2) represents conditional mean equation in the GARCH(1,1) model, while expression (3) shows conditional variance equation of the same model. The parametric bootstrap procedure rely on assumption that the basic time series process follows the final stationary autoregressive model form, as presented in (2). Hence, after defining the form of the estimation model, the residual bootstrap method contains following six iterations:

1. Estimate mentioned autoregressive model on the actual data series.
2. Obtain the fitted values of dependent variable and calculate the series of residuals $\hat{\varepsilon}_t = Y_t - (\hat{\mu} + \hat{\phi}_1 \cdot Y_{t-1}) = Y_t - \hat{Y}_t$.
3. Take the sample of size n with replacement from original series of residuals and generate the series of bootstrapped residuals ε_t^* .
4. Generate a bootstrap dependent variable by adding the fitted values to the series of bootstrapped residuals $Y_t^* = (\hat{\mu} + \hat{\phi}_1 \cdot Y_{t-1}) + \varepsilon_t^*$.
5. Estimate the bootstrap parameters of AR(1) model $Y_t^* = \mu^* + \phi_1^* \cdot Y_{t-1}^* + \varepsilon_t^*$.
6. Go back to the step 3 and repeat a total of B times.

Nevertheless, the parametric model has to present an appropriate approximation of true model. Thus the utility value of the residual bootstrap method predominantly depends on adequate model selection procedure.

Moving Block Bootstrap

Kunsch (1989) and Liu and Singh (1992) proposed separately the moving block bootstrap method that divides the original data set into the overlapping blocks series of fixed length and resample with replacement from these blocks. The moving block bootstrap retains the original structure of financial time series by performing the resample process within defined blocks.

Despite noticed regularities in time series data structure, the accuracy of the moving block bootstrap method primarily relies on optimal block length selection. Therefore, an optimal block length selection depends on sample size, implemented data generating process and chosen statistics of interest. When sample size increases, the block length must pursue the changes in order to secure bootstrap consistency and empirical distribution function. By choosing the optimal block length it is conceivable to minimize the mean squared or absolute error. According to Berkowitz and Killian (2000), a question of block length selection is a matter of compromise. They concluded that as the block length becomes too small, the moving blocks bootstrap desolates the time dependency in the data series and its average accuracy will decrease. Oppositely, as the block length becomes too large, there are few blocks and bootstrap data will gravitate to look alike. Also, bootstrap data generated by moving block with large block size will look similar to independent and identically distributed bootstrap data.

The moving block bootstrap procedure encompasses four indispensable steps in order to assemble an efficient resampling algorithm:

1. Divide time series into overlapping blocks with identical length l , where the first block contains a set of X_1, \dots, X_l elements, the second one X_2, \dots, X_{l+1} etc.
2. Perform the resampling procedure within defined overlapping blocks and align resampled blocks in one bootstrap sample X_1^*, \dots, X_n^* .
3. Estimate the statistics of interest by using the constructed bootstrap sample $T_n^* = T_n(X_1^*, \dots, X_n^*)$.

4. Reproduce steps 2 and 3 B times to achieve a bootstrap probability distribution of forming the test statistic using indicator function

$$\hat{G}_n(t, F_n) = P^*(T_n^* \leq t) = \frac{1}{B} \sum_{b=1}^B I(T_{N,b}^* \leq t).$$

3.2 Testing Procedure

Technical trading rules represent undisputed evidence of the stock price predictive power if expected stock prices depend on available buy/sell information. To estimate such a relationship it is important to test the difference between expected returns of buy and sell signals or returns of buy/sell signals generated from the technical trading rules and returns of buy-and-hold strategy. Obvious choice for this purpose is the t-test of differences between the arithmetic means of two subsamples, presented by the following expressions:

$$t^* = \frac{\bar{R}_b - \bar{R}_s}{\sqrt{\frac{\sigma_b^2}{N_b} + \frac{\sigma_s^2}{N_s}}} \quad (4)$$

$$t^* = \frac{\bar{R}_{b/s} - \bar{R}}{\sqrt{\frac{\sigma_{b/s}^2}{N_{b/s}} + \frac{\sigma^2}{N}}} \quad (5)$$

where the \bar{R}_b and \bar{R}_s are mean returns following the buy and sell signals, \bar{R} is the unconditional mean, σ_b^2 and σ_s^2 are the variances of returns generated from buy and sell signals, σ^2 is the unconditional variance, N_b and N_s are the numbers of buy and sell signals, N is the overall number of observed data. The index b/s identifies combined buy and sell signals. The results of the t-test will help either accept the null hypothesis (there is no actual difference between mean returns) or reject it (there is an actual difference between mean returns).

The t-test results assume independent, stationary and asymptotically normal distribution. Many times these assumptions do not characterize the financial time series. Therefore, to solve this problem, Brock et al. (1992) and many authors after them used bootstrap methods. Bootstrap experiments help the investigation of estimation biases caused by data snooping. For this reason, White (2000) proposes Reality Check (RC test) procedure for testing the null hypothesis that the model

selected in a specification search has no predictive power over the given benchmark model.

At the beginning, the Reality Check extracts the performances of the technical trading rules relative to the benchmark by interpreting the mean return. Actually, the returns of trading rule k at time t are presented as following:

$$R_{k,t} = R_t \cdot I_{k,t-1} \quad (6)$$

where R_t is continuously compound returns $R_t = \ln(Y_t / Y_{t-1})$, and $I_{k,t-1}$ is a dummy variable based on trading signals generated by trading rule k using available information at time t .

The relative performance of trading rule k at time t , compared to the buy-and-hold benchmark model or always-long position can be formulated as follows:

$$f_{k,t} = R_{k,t} - R_t \quad (7)$$

Alternatively, when the benchmark is always neutral position, the relative performance is equal to the returns generated from trading rule k , i.e.

$$f_{k,t} = R_{k,t} \quad (8)$$

With searching for existence of superior trading rule, the null hypothesis should be tested that the performances of the best trading rule is no better than the benchmark performances, in other words:

$$H_0 : \max_{1 < k < m} (E(f_k)) \leq 0 \quad (9)$$

where the expectation is evaluated with a simple arithmetic mean:

$$\bar{f}_k = N^{-1} \sum_{t=1}^N f_{k,t} \quad (10)$$

Rejecting the hypothesis shall guide to the conclusion that the best trading rule achieves performance superior to the benchmark.

White (2000) indicates that the null hypothesis can be tested by applying the bootstrap methodology to the observed values of $f_{k,t}$. The procedure is implemented in the following steps:

1. Resample the realized return series $f_{k,t}$, express the resulting series by $f_{k,t}^*$ and repeat this step at least 500 times.

2. For each replication i , compute the simple mean of the bootstrapped returns by

$$\bar{f}_{k,i}^* = N^{-1} \sum_{t=1}^N f_{k,t}^* \quad (11)$$

3. Formulate the following statistics:

$$T_N^{RC} = \max_{1 < k < m} (N^{1/2} \cdot \bar{f}_k) \quad (12)$$

$$T_N^{RC,*} = \max_{1 < k < m} (N^{1/2} \cdot (\bar{f}_{k,i}^* - \bar{f}_k)) \quad (13)$$

4. Obtain p-value by comparing T_N^{RC} to the quintiles of $T_N^{RC,*}$. In other words, the p-values are derived by the next indicator function:

$$p = \begin{cases} 0 & \text{if } T_N^{RC} < T_N^{RC,*} \\ 1 & \text{if } T_N^{RC} > T_N^{RC,*} \end{cases} \quad (14)$$

By utilizing the maximum value over all technical trading rules, the Reality Check procedure covers the effect of data snooping. Nevertheless, Hansen and Lunde (2005) find that this p-value can be manipulated when irrelevant models are included. Hence, they propose the Superior Predictive Ability (SPA) test which changes previous procedure on two levels. They use a studentized test statistics and utilize a sample dependent distribution. The SPA test is composed as following:

$$T_N^{SPA} = \max_{1 < k < m} \left(\frac{N^{1/2} \cdot \bar{f}_k}{\hat{\sigma}_k} \right) \quad (15)$$

$$T_N^{SPA,*} = \max_{1 < k < m} \left(\frac{N^{1/2} \cdot (\bar{f}_{k,i}^* - \bar{f}_k)}{\hat{\sigma}_k} \right) \quad (16)$$

With an estimator for variance in return:

$$\hat{\sigma}_k^2 = \text{var}(N^{1/2} \cdot \bar{f}_k) \quad (17)$$

Analogously to formulation (14), the p-values can be derived by comparing T_N^{SPA} and $T_N^{SPA,*}$.

4. Empirical Results

This paper contains evidence on the profitability of a predefined set of technical trading rules in stock market indices of the Balkan States. Also, there is reliable evidence that technical

trading rules have some predictive value over the future movements of stock market prices and outperform the always long and the always neutral benchmarks. Additionally, applying of well-known technical trading rules provides an initial test of the weak-form market efficiency hypothesis. If stock markets are efficient, one cannot achieve superior results by using technical trading rules. In other words, all assets in the market will be appropriately priced offering adequate level of expected return to risk (Stavarek & Heryan, 2012). However, if market inefficiencies are present, profitability opportunities may arise.

4.1 Data and Summary Statistics

To be certain in required results and to avoid potential distortions and disagreements caused by different price movement patterns before and after the financial crisis, the paper employs only last five years of price movements when all the observed stock markets denoted some signs of potential recovery. Due to the examination of technical trading rules in the course of time, the paper uses the time period from April 2009 to April 2014 presented by 1,261 daily stock market indices values. Because of the complex supply and demand dynamics of various industries, this study narrows down to stock market indices. The used stock market indices are: The Belgrade Stock Exchange Index (BELEX15), The Zagreb Stock Exchange Index (CROBEX), The Ljubljana Stock Exchange Index (SBITOP), The Sarajevo Stock Exchange Index (SASX-10), The Macedonian Stock Exchange Index (MBI10) and The Montenegro Stock Exchange Index (MONEX20). All mentioned indices are considered as indicators of average stock price movements in six small emerging financial markets which possess very short trading history.

According to Žiković (2008), developing stock market indices form Croatia and stock markets of other states of the former Yugoslavia significantly differ in statistical characteristics from the developed markets. Tab. 1 contains descriptive statistics of daily returns for the entire series of stock market index values of six Balkan States. The results show strongly leptokurtic feature of data series with some signs of skewness, especially in the MONEX20. The volatility is almost at the same level for all six stock market indices. Serial correlations $\rho(i)$, estimated at lag i for each data series,

Tab. 1: Descriptive statistics

Index	BELEX15	CROBEX	SBITOP	SASX-10	MBI10	MONEX20
Mean	0.00002	0.00002	-0.00014	-0.00035	-0.00031	0.00011
Max	0.08250	0.08563	0.03721	0.05938	0.07115	0.11286
Min	-0.07471	-0.07020	-0.06059	-0.06940	-0.06647	-0.07497
Std	0.01293	0.01172	0.01028	0.01016	0.01234	0.01319
Skewness	0.41146	0.25187	-0.17799	0.22389	0.22814	1.38286
Kurtosis	8.97597	11.20972	5.33171	8.58919	8.10252	16.02261
$\rho(1)$	0.26062	0.11022	0.07203	0.14631	0.18202	0.19221
$\rho(2)$	0.11310	-0.01619	-0.00721	0.02203	-0.03104	0.07706
$\rho(3)$	0.04103	0.07003	-0.00920	0.01717	-0.02236	0.02218
$\rho(4)$	0.10424	0.02529	-0.02537	-0.00423	0.02314	0.01354
$\rho(5)$	0.04600	-0.00331	0.05009	0.01784	0.08533	-0.02101

Source: own

Notes: The skewness of the normal distribution is zero. If this statistic is negative, then the data are spread out more to the left of the mean. If the skewness is positive, the data are spread out more to the right. The kurtosis of the normal distribution is 3. A distribution with fat tails has kurtosis greater than 3, while a distribution with lower peak has this statistic less than 3. $\rho(i)$ is the estimated autocorrelation at lag i for each series.

are generally small with the exception of a few relatively large values at the first lag. The data provides large enough samples to generate robust trading strategies that accomplish long term surplus profits as opposed to short term profits that do not automatically perform any possible trends in the stock prices.

4.2 Results of Applying Technical Trading Rules

Resume of research process considers the implementation of technical trading rule strategies to the series of historical return data. This paper includes 18 different trading strategies from 4 explained technical trading rules. The strategies differ by the length of averages or percentage spans denoted in the parentheses. Tab. 2 presents the results of applying different technical trading rules and enable further comparison of trading rules in the light of comprehending buy and sell signal origins.

Tab. 2 includes 18 technical trading strategies with adhered statistics in previously mentioned data sample. First column of these tables brings short description of applied trading strategy. In such a way, the moving average rule is expressed in parentheses with short and long moving averages respectively.

The range breakout rule is briefly explained by the length of previous time intervals for deriving local minimum and maximum. Finally, the filter and channel breakout rules contain percentage deviation for daily observed returns defined in advance. Next two columns $N(\text{buy})$ and $N(\text{sell})$ record the number of buy and sell signals reported during the sample interval. $R_t(\text{buy})$ and $R_t(\text{sell})$ columns indicate the average returns of buy and sell signals respectively. Then, $R_t > 0(\text{buy})$ and $R_t > 0(\text{sell})$ are the fraction of buy and sell returns greater than zero. And finally the last column shows the t-statistics of differences between the arithmetic means of buy and sell returns.

First impression about mentioned table is the presence of a significant difference in the number of generated buy and sell signals among all trading strategies. The moving average and filter rule, with no extra percentage needed to generate a trading signal, divide approximately all trading signals into the buy and sell signals. However, the appearance of a trading signal does not represent immediate buy or sell action. A sell signal should be a precaution for investors to stay out of the potential stock investment until another trading signal appears. Otherwise, a buy signal without making any investment activity could be an unquestionable evidence of retaining given

Tab. 2: Results for various trading strategies using BELEX15

Strategy	N(buy)	N(sell)	Rt(buy)	Rt(sell)	Rt>0(buy)	Rt<0(sell)	t-test	p-value
ma(1,100)	461	642	0.00101	-0.00002	0.50108	0.49221	1.99532	0.04624
ma(1,150)	434	573	0.00167	-0.00133	0.54608	0.44503	6.25279	0.00000
ma(1,200)	407	553	0.00049	-0.00105	0.50614	0.46112	3.41630	0.00066
ma(5,100)	545	510	0.00121	-0.00128	0.54312	0.43333	5.14846	0.00000
ma(5,150)	428	579	0.00089	-0.00072	0.51636	0.46805	3.33994	0.00086
ma(5,200)	408	552	-0.00001	-0.00068	0.48775	0.47464	1.47872	0.13949
filter0.001	556	591	0.00628	-0.00587	0.75180	0.23350	24.70290	0.00000
filter0.002	502	645	0.00691	-0.00535	0.76892	0.26357	24.70110	0.00000
filter0.005	360	787	0.00880	-0.00400	0.81944	0.33164	24.36530	0.00000
filter0.01	209	938	0.01173	-0.00259	0.84211	0.40512	24.05710	0.00000
trb(50)	132	123	0.01308	-0.01003	1.00000	0.00000	36.70280	0.00000
trb(100)	96	69	0.01199	-0.01209	1.00000	0.00000	36.35500	0.00000
trb(150)	64	83	0.01324	-0.00737	1.00000	0.00000	32.57360	0.00000
trb(200)	26	132	0.00904	-0.00417	1.00000	0.00000	30.01350	0.00000
channel0.001	494	449	0.00308	-0.00239	0.61336	0.36971	10.24830	0.00000
channel0.002	420	403	0.00369	-0.00250	0.62619	0.37221	11.02500	0.00000
channel0.005	229	264	0.00511	-0.00308	0.64192	0.34848	12.35130	0.00000
channel0.01	110	106	0.00784	-0.00467	0.68182	0.30189	15.00220	0.00000

Source: own

Notes: The moving average rule is identified as ma(short, long average return). The Filter rule is presented as filter(percentage of price movements). The trade range breakout rule enters in parentheses the number of previous days for measuring resistance level. The Channel breakout rule is defined as channel(price span within determined percentage). Also, because of the lack of space, the paper show only the trading results in case of BELEX15.

stocks in the investment portfolio. Usually, the first trading signal in a series of buy or sell signals is assumed to be of most interest due to the fact of existing stock price autocorrelation. According to basic mechanism of generating trading signals, the trade range breakout rule compared to other two mentioned trading rules infrequently induces buy/sell signals. Such a mechanism gathers more credibility of the investor, but does not encourage enough the growth of activity at the stock market. Similar to previous, the channel breakout rule generates a number of trading signals directly opposite to defined upper and lower band of the channel.

Presented strategies achieved significantly different results observing a whole sample of 5 years of daily stock price returns. The majority of 18 trading strategies obtains a positive average one-day return on buy-signals and a negative average one-day return on sell-signals and

compared with unconditional one-day average in Tab. 1 it rejects the null hypothesis that the returns equal the unconditional returns at the 5 percentage significance level using a two-tailed test. These t-test results are presented in Tab. 3.

Back to the description of Tab. 2, $R_t(\text{buy})$ column mainly exceeds 50 percent, while $R_t(\text{sell})$ column stays below 50 percent. The results of these two indicators give a confirmation that applied technical trading rules produce useful trading signals. As mentioned by Brock et al. (1992), the negative returns for sell signals are particularly meaningful. These returns cannot be explained by different seasonalities since they are based on about 30 percent of all trading days in 18 trading strategies. Hence, the returns made from trading rules are likely to be predictable. The return predictability can reflect the rejection of market efficiency

Tab. 3: Testing of differences between trading strategy mean and unconditional mean

Strategy	BELEX15	CROBEX	SBITOP	SASX-10	MBI10	MONEX20
ma(1,100)	1.54478	0.03063	4.40231	3.01900	0.26389	3.39481
ma(1,150)	4.50517	2.51854	4.07085	3.10771	2.60893	2.51326
ma(1,200)	2.31750	1.94371	2.84205	2.89108	2.15028	1.93926
ma(5,100)	3.73080	1.30446	1.87367	1.58724	1.12994	1.33393
ma(5,150)	2.42005	1.43947	0.97222	1.29688	1.32101	1.29103
ma(5,200)	1.00631	0.17368	1.27085	0.48426	0.04667	-0.13064
filter 0.001	18.22250	15.01000	15.63640	13.56160	15.43200	16.26290
filter 0.002	18.38590	15.16530	15.77940	13.93950	15.66910	16.31640
filter 0.005	19.19080	17.13090	16.42890	15.11150	17.17270	17.49820
filter 0.01	21.47350	20.69080	17.57320	17.31980	20.78490	20.69280
trb (50)	34.65520	32.14650	31.90460	27.39590	33.12530	34.20760
trb (100)	36.11160	33.16110	30.79640	26.40350	33.84010	30.39890
trb (150)	30.90420	22.70350	27.25230	22.62150	22.84200	27.07870
trb (200)	19.81940	15.55560	24.68230	18.28380	15.43140	21.16760
channel 0.001	8.19866	5.97173	6.86922	6.74923	6.05186	7.50347
channel 0.002	9.28053	7.56726	8.32808	7.90224	7.73319	9.17137
channel 0.005	12.28170	11.16950	13.22220	10.81360	11.68700	14.00490
channel 0.01	18.76670	6.53685	28.59270	16.61790	6.77650	20.43590

Source: own

Notes: The results are standard t-ratios testing the difference between buy and sell one-day returns and unconditional one-day mean return.

hypothesis. Although it is difficult to distinguish such an explanation from the equilibrium model expected returns. Also, t-test of difference between returns in buy and sell trading days are performed in Tab. 2. There are only a few trading strategies in all six observed stock market indices which accept the null hypothesis of statistical equivalence between returns on buy and sell signals. Leaving those inefficient trading strategies, for example ma(1,100) for CROBEX and MBI10, ma(5,150) for SBITOP or ma(5,200) for BELEX15, CROBEX, SASX-10, MBI10 and MONEX20, the paper proposes a set of trading tools with significant predictive power and a high possibility of making profitable investment. This fact once more points out the awareness of applying technical trading rules in emerging stock markets such as the stock markets of the Balkan States. Besides, all six stock markets show similar stock price movement patterns and separate several dominant trading strategies.

Generally, there are more sell signals in observed sample. In overall, SBITOP, SASX-10 and MONEX20 generate sell signals in more than 63% of all trading signals. In a similar situation are other studied indices which produce about 57% of sell signals in total sample. This epilogue indicates the signs of moderately to entirely reduced stock market activity and draws attention to the lack of market capitalization. Otherwise, Pauwels et al. (2012) consider it as a support of the efficient market hypothesis. Even though, these rules are still capable to produce positive returns over the entire sample period due to the fact that the profits achieved by winning trades exceed the losses generated by the losing trades.

4.3 Bootstrap Testing Technical Trading Rules

Combining the concept of bootstrap and application of technical trading rules in order to evaluate a model specification creates a wide

spectrum of possible practical usefulness. First noticed by Brock et al. (1992), the mentioned combination provides information about necessary model modification in order to achieve better description of observed stock return time series. Using bootstrap procedure, these authors draw residual series from estimated regression model and then measure profits of technical trading rule for each bootstrapped sample and compare them with profits derived from the original data series. Mills (1997) applies previous methodology on the FT30 index and shows that even though the used technical trading rules surpass profits of defined benchmark in the time interval, their predictive ability significantly decline after the observed period. However, many other authors try to implement this combining procedure, for an example, LeBaron (1999) tests the predictive power of the exchange rate using technical trading rules during the period with and without interfering of the Federal Reserve. Anyway, in all previous studies data snooping has been prevalent due to the lack of practical methods that are suitable of assessing its potential obstacles in variety of situations. Therefore, White (2000) proposes the Reality Check procedure for testing the null hypothesis that the selected model has no predictive

power over a given benchmark model. The procedure allows aggressive model searching to be initiated with confidence that one will not confuse results that could have been generated by chance for genuinely good results. Thus, the RC procedure tests the superiority of selected model over the benchmark after involving data snooping effects. Also, this paper has no attention to disregard the Superior Predictive Ability test created by Hansen and Lunde (2005) established on the disadvantages of previous methodology.

Bootstrap procedure provides a better approximation of a given statistics derived from technical trading rules and makes a decision about how a certain statistical model can explain the results of these rules in appropriate way. Through the bootstrap simulation processes in the investment period of time the mentioned tests will show the level of profit in applying defined technical trading rules and will isolate the superior rule. In order to achieve that, two benchmarks are used to assess the excess return from each studied trading rule: always long and always neutral position. In the always long position, the investors buy and hold certain stocks during the entire forecasting period. In the always neutral position, the investors are not taking any action (buy or sell) and simply

Tab. 4: Relative performance of the best trading rule without transaction costs

Index	Bootstrap method	Best trading rule	Benchmark: always long			Benchmark: always neutral		
			Nominal p-value	RC p-value	SPA p-value	Nominal p-value	RC p-value	SPA p-value
BELEX15	MBB	filter0.001	0.000	0.006	0.004	0.000	0.003	0.002
	Residual	ma(1,150)	0.001	0.012	0.015	0.001	0.009	0.005
CROBEX	MBB	filter0.002	0.000	0.009	0.006	0.000	0.008	0.004
	Residual	filter0.002	0.002	0.015	0.011	0.001	0.013	0.009
SBITOP	MBB	trb(50)	0.000	0.005	0.003	0.000	0.005	0.004
	Residual	filter0.002	0.000	0.022	0.015	0.000	0.018	0.013
SASX-10	MBB	filter0.001	0.000	0.011	0.010	0.000	0.010	0.009
	Residual	trb(100)	0.002	0.026	0.023	0.000	0.021	0.022
MBI10	MBB	filter0.001	0.003	0.019	0.016	0.002	0.018	0.015
	Residual	filter0.002	0.006	0.055	0.043	0.004	0.052	0.041
MONEX20	MBB	trb(100)	0.000	0.002	0.001	0.000	0.000	0.000
	Residual	ma(1,100)	0.000	0.014	0.009	0.000	0.012	0.008

Source: own

Notes: The best trading rule means the rule with higher relative performance estimated by the Reality Check procedure.

holds previously bought stocks throughout the investment horizon. Tab. 4 presents the relative performance of the best technical trading rule considering two recognized benchmarks.

Tab. 4 presents the performance statistics of the trading models before including transaction costs. The bootstrap tests of mentioned statistics are performed by 1,000 repetitions or bootstrap samples ($B = 1,000$) on three different performance levels. According to Qi and Wu (2006), the nominal p-value is computed by applying the Reality Check procedure to the best technical trading rule only, thereby ignoring the effects of data snooping biases. By interpreting the nominal p-values from Tab. 4, this study confirms that before extracting data snooping biases, the relative performance of technical trading rules is strongly significantly in all observed stock markets. It means that technical trading rules significantly outperform two benchmarks. These results are not disappointing, as they correspond with previous studies on technical trading rules in emerging markets, such as surveys of Parisi and Vasquez (2000), Gunasakarage and Power (2001), Chen et al. (2009) and Pauwels et al. (2012) etc. The Reality Check p-value, on the other hand, is measured by applying the Reality Check procedure to the whole set of technical trading rules and therefore corrects for the biases due to data snooping. This correction for data snooping in RC methodology alters given results. Nevertheless, the null hypothesis that technical trading rule does not possess certain utility comparing to the benchmark can be rejected at the 5 percent level of significance for the case of the MBI10 index. The performance results of other stock market indices at the 5 percent level of significance remain within the previous decision made by the nominal p-value. Additionally, the SPA procedure is performed to check once more the performance results after data snooping corrections. Comparing nominal with RC and SPA p-values in Tab. 4, the differences are obvious, but with no statistical significance in the case of the MBI10 index at the 5 percent level. Also, as expected, the performance results indicate some differences between the RC and the SPA procedure. These outcomes are supporting research study of Hansen and Lunde (2006), who conclude that the involvement of one or more poor performing technical trading rules can have significant influence on the Reality Check p-value. When

interpreting the performance results of the MBI10 index, the RC p-values are 0.055 and 0.052 for always long and always neutral position, respectively. The conclusion from those results would be that the best technical trading rule is not able to outperform both benchmarks. Nonetheless, when examining the SPA p-values, which show 0.043 and 0.041, this study confirms that the benchmark is not a best possible trading solution at the 5 percent level of significance. This fact emphasize that the Reality Check procedure sometimes unjustifiable punishes the best performing technical trading rule when a large number of poor performing rules are present. There are also visible differences between two applied bootstrap methods. The moving block bootstrap shows relatively stable results comparing to the residual based bootstrap.

However, maybe it is premature to infer that the best performing technical trading rules presented in Tab. 4 are actually profitable because of the absence of consideration for the transaction cost effects on the technical trading rule performance. These effects can certainly be important when the trading frequencies are high. Even though the percentage of transaction costs per trade can be low, frequent trading can accumulate the small costs per trade into a substantial number. Therefore, Tab. 5 presents the relative performance of technical trading rules after involving a certain percentage of transaction costs per trade. In practice, it is not rational to trade if expected return implied by the trading signal is not higher than the transaction costs per trade. Hence, a larger transaction cost enforce greater penalty on the trading rules that generated more trading signals. After all, the assumption made from this fact is that a rule with less frequent trading has more probability to be selected as the optimal rule. This study considers the transaction cost of 1% per trade and a market transaction will be assessing only if expected return exceed presumed costs.

Compared to the baseline results in Tab. 4, the results in Tab. 5 indicate that the costs have relatively small effect on the overall performance of the technical trading rules. In many cases, the best performing rule for stock index is identifying to be the same type with or without transaction costs, but with different parameterization, such as the case of BELEX15, SASX-10, MBI10 and MONEX20

Tab. 5: Relative performance of the best trading rule with transaction costs

Index	Bootstrap method	Best trading rule	Benchmark: always long			Benchmark: always neutral		
			Nominal p-value	RC p-value	SPA p-value	Nominal p-value	RC p-value	SPA p-value
BELEX15	MBB	filter0.002	0.000	0.011	0.009	0.000	0.008	0.006
	Residual	ma(1,150)	0.003	0.031	0.024	0.002	0.026	0.020
CROBEX	MBB	filter0.005	0.002	0.016	0.011	0.000	0.011	0.009
	Residual	trb(150)	0.004	0.027	0.023	0.002	0.024	0.018
SBITOP	MBB	channel0.01	0.000	0.013	0.008	0.000	0.010	0.005
	Residual	filter0.005	0.005	0.041	0.038	0.004	0.036	0.033
SASX-10	MBB	filter0.002	0.000	0.024	0.019	0.000	0.022	0.014
	Residual	trb(100)	0.006	0.052	0.050	0.005	0.048	0.041
MBI10	MBB	filter0.002	0.006	0.035	0.033	0.004	0.031	0.025
	Residual	filter0.005	0.007	0.084	0.077	0.004	0.079	0.072
MONEX20	MBB	trb(100)	0.000	0.015	0.014	0.000	0.010	0.015
	Residual	ma(1,150)	0.002	0.032	0.030	0.000	0.031	0.024

Source: own

Notes: See notes from Tab. 4.

indices. Also, some trading rules do not persist with involving the transaction costs, for example the case of CROBEX and SBITOP indices. An explanation for such changes in outcomes can be found in the number of produced trading signals per rule. According to Pauwels et al. (2012), this implies that holding periods are very short and transaction costs high. Consequently, the differences in parameterization of trading rules or even change of a trading rule in each case are explained by the need for less trading periods.

At the same time, comparing the results in Tab. 4 and Tab. 5 shows some signs of sensitivity analysis to examine the robustness of results. Data snooping biases from transaction costs are relatively small and cause no harm in the case of BELEX15, CROBEX, SBITOP and MONEX20 indices. Hence, a given performance results are highly robust.

The degree of data snooping biases is found to be more serious in the Reality Check p-values than in the nominal p-values. When the always long benchmark is applied, the Reality Check p-values are significant at the one percent level for all observed stock indices and at the five percent level for two of six indices. In other words, the Reality Check p-values can be rejected at the ten percent

level for the SASX-10 and the MBI10 and at the five percent level for the other involved indices. Slightly smaller results of p-value are shown by SPA p-values which reject the hypothesis of better benchmark in the case of the BELEX15 and the SBITOP when using the moving block bootstrap procedure. Using the always neutral position as a benchmark, the study finds in the RC and the SPA procedures that the hypothesis can be rejected at the ten percent level for the MBI10 and at the five percent level for the others. These results show better performances using active investment strategy compared to passive one applied in case of six emerging financial markets, confirming the main findings made by Fifield et al. (2005), Metghalchi et al. (2008), Papathanasiou and Samitas (2010) etc. Also, similar to the study of Pauwels et al. (2012), this paper justifies the existence of inefficient markets during and few years after the financial crisis.

Conclusions

This paper considers the ability of an extensive range of technical trading rules to forecast future stock market movements for a sample of emerging stock markets in the Balkan States. Overall, results of this study contain strong

support for the technical trading rules we have explored. If technical analysis does not have any predictive power, then the average buy day return is not differ substantially from the average sell day return. Our results indicate that almost all buy-sell differences are positive and t-statistics rejecting the null hypothesis of equality of average buy and sell returns. In other words, presented results generated by the implementation of technical trading rules on the stock market indices reject the weak-form market efficiency hypothesis. Further, it is distinctive that applied technical trading rule algorithms in all six stock market indices generate more losing trades than winning trades.

While numerous studies report significant profitability of certain technical trading rules, it is unsure whether their superior performance is due to actual financial information, or is due to a combination of accidental circumstances. The main problem is simultaneous application of numerous technical trading rules to a data set and there is high possibility that some rules may work well by pure chance regardless of their information set. This is the genuine data snooping problem in finance which is treated through this study by the popular Reality Check and Superior Predictive Ability algorithm. However, the evidence from six stock markets of the Balkan States indicates that the data snooping problem is in general rarely serious. Namely, even after including data snooping biases, this study finds that the null hypothesis that trading rules do not outperform the benchmark can be rejected at the 5% significance level for five separate stock indices. Although the discovery of profitable technical trading rules should be helpful in understanding stock market dynamics, investors must consider transaction costs. Imposing reasonable percent of transaction costs in all six observed stock market indices does not notably affect the basic bootstrap test results.

All stated technical trading rules represent just a fragment of a comprehensive investment portfolio management analysis. For example, Pauwels et al. (2012) described that their analysis of similar type did not show any evidence about that investors are able to detect the best technical rule ex ante. Notice that even if these technical trading rules obtain higher returns, this will not naturally lead to more significant results. Therefore, complete

understanding of the stock price movements in observed period requires tools of the fundamental investment analysis, which mainly rely on personal opinion and experience of financial engineering experts.

Finally, the trading strategy offers insight in the behavior of the stock market; it does not appear suitable for small investors to implement. Individual case of stock investment requires similar procedure of measuring relative performance of technical trading rules referred directly to potential investment opportunities.

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Abstract

BOOTSTRAP TESTING OF TRADING STRATEGIES IN EMERGING BALKAN STOCK MARKETS**Boris Radovanov, Aleksandra Marcikić**

Most lately, the attention of technical trading analysis has shifted to emerging stock markets which collectively bring a significant alternative source of opportunities to international investors. Accordingly, the aim of this paper is to investigate the effectiveness of four technical trading rules (moving average, filter, trading range breakout and channel breakout rule) in six stock market indices of the Balkan States. Also, the paper is providing resume evidence on the predictive power of four mentioned trading rules. We apply the Reality Check and the Superior Predictive Ability test using bootstrap methodology to evaluate the relative performance of those rules. Furthermore, presented tests provide an answer to data snooping problems, which is essential to obtain unbiased outcomes. The original time series is resampled with random draw in two ways: a parametric residual-based method from the AR(1)-GARCH(1,1) model, and a nonparametric, the moving block bootstrap. After including data snooping biases, this study finds that the null hypothesis that trading rules do not outperform the benchmark can be rejected at the 5 percent significance level for five separate stock indices, excluding the MBI10 index. Similarly, such results show the rejection of the weak-form market efficiency hypothesis in case of mentioned stock markets. Applied technical trading rule algorithms in all six stock market indices mainly generate more losing trades than winning trades. Finally, transaction costs have relatively small effect on the overall performance of selected technical trading rules in case of indices BELEX15, CROBEX, SBITOP and MONEX20, but with some changes in choice of the best technical trading rule considering the effects of trading frequencies.

Key Words: Technical trading rules, stock market indices, market efficiency, bootstrap, data snooping.

JEL Classification: C15, C22, G14, G15.

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PROPERTY TAX IN THE REGIONS OF THE CZECH REPUBLIC

Jana Janoušková, Šárka Sobotovičová

Introduction

The issue of fiscal decentralization in the context of the fiscal autonomy of local self-governments is still current. The Czech Republic is among the countries with lower tax autonomy (Blöchliger & Pinero Campos, 2011; OECD, 2016; Sedmíhradská, 2015). The revenue from assigned taxes and from subsidy programs makes up decisive share in municipal budgets. The state specifies the percentage of revenue for this type of tax that belongs to a specific part of the budget system (in the case of the Czech Republic i.e. regions and municipalities). In terms of a flexible response, this method of funding does not give municipalities much possibility, as they may influence the amount of such revenues only through their interventions to a very small extent. In addition, non-guaranteed access to subsidies brings a certain uncertainty and hinders the possibility of revenue prediction for the nearest period (Janoušková & Sobotovičová, 2016a).

One of the stable revenues of municipalities is a tax on immovable property (formerly real estate tax) flowing into municipal budgets in most EU countries. Thus, the principle of benefit (Keith & McCluskey, 2004; Mrkývka, 2003) and the principle of subsidiarity are fulfilled, where decision-making and responsibility in public affairs takes place at the lowest level of public administration being closest to the citizens. Municipalities have the option to adjust the structural elements of the tax, and they can then manage their revenues. These taxes are revenue stable (Birch & Sunderman, 2013; Bečica, 2014), and they do not have a distortion effect on work, as well as they do not hamper the economic activity to such an extent as the income taxes, which directly cut back the yield from a work activity. They should lead the owners of immovable property to a more rational and more effective property

management. However, political representation often shies away from these tax increases in the context of the potential number of votes (Bird, 2010).

The tax on immovable property is one of the basic tools of fiscal decentralization. Fiscal decentralization in theory is associated in particular with the efficiency of allocation of funds to secure public goods within the public sector. It is related to the discussion of the strengthening of the role of local self-governments, especially, the powers of decision-making and responsibilities of municipalities in the economic field. Decentralization allows for a greater public involvement in decision-making and brings even greater transparency and efficiency in the use of financial resources (Tiebout, 1956; Bish & Kirk, 1974). Local self-governments can use the tax on immovable property to influence the revenues of their own budgets in favour of improving the quality of life in the place of tax collection (Haider-Markel, 2014; Marková, 2007; Bird, 2011; Roubínek et al., 2015).

In the context of the economic transformation in Central and Eastern Europe in the 1990s, the extreme centralization has been overcome, moreover the ways of the gradual decentralization and strengthening of the autonomy of municipalities are searched for, which should lead to the efficiency of public services (Tanzi, 1991). Authors, such as Smith et al. (2011) are investigating the local perception of progress towards fiscal decentralization in the context of the transformation of the Czech economy in the 1990s. Transitive economies (Bryson, 2010) confronted the problem of the reconstructing of the self-government, the definition of competencies in selecting the sources of their financing or by providing for their self-sufficiency in acquiring revenues. In the context of the taxation of immovable

property, it is possible to keep track of more different approaches and empirical studies. Property valuation for purposes of determining the tax base of the real estate is often a hot topic (Horne & Felsenstein, 2010; Presbitero, Sacchi, & Zazzaro, 2014). Moreover, the Czech Republic is criticized for its unit approach in the determination of the tax base and a lack of coherence on the fair value of the real estate (OECD, 2010; OECD, 2011; European Commission, 2015). The Czech Republic is also recommended an increase in this tax revenue, as it accounts for a small proportion of the total tax revenues in comparison with other EU countries. Coombs, Sarafoglou and Crosby (2012) dealt with the possibility of using the taxation of immovable property in connection with a potential increase in the revenue for municipal budgets.

1. Taxation of Immovable Property in the Czech Republic

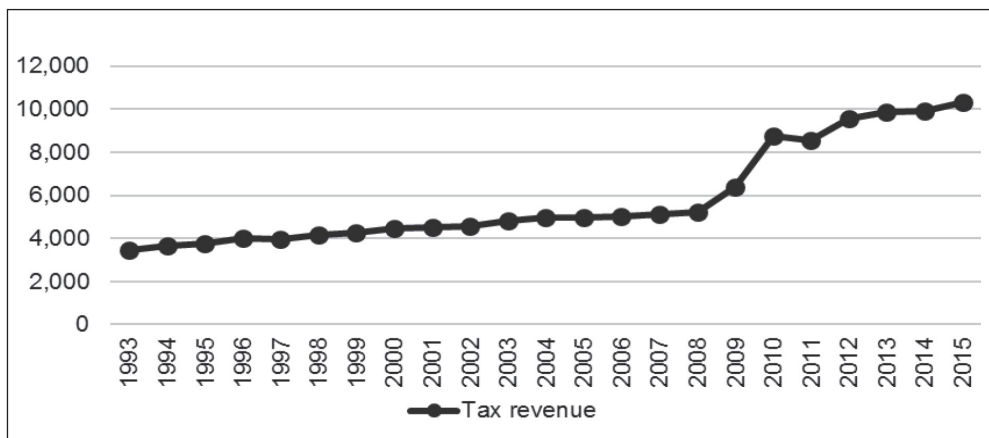
In the Czech Republic, the tax revenue on immovable property flows into the budget of the municipality on whose territory the immovable property is located. Tax rates, are set by law and their amount is the same for all municipalities. A municipality may affect the amount of the revenue, in particular by means of the coefficients, which it determines generally by a binding public notice. This is a corrective

coefficient based on the number of inhabitants, the municipal and local coefficient (Janoušková & Sobotovičová, 2016b).

The corrective coefficient depends on the number of inhabitants in the municipality. The municipality has the possibility to affect the amount of the coefficient by reducing it for individual parts of the municipality by one to three categories or increase it by one category. The coefficient is applied to residential buildings and their appurtenances and units. The corrective coefficient is also applied to construction sites and due to modifications, the amount of corrective coefficients for buildings and land may vary. The municipality may set the municipal coefficient at 1.5 and burden essentially only non-residents of the municipality. Indeed, it applies to buildings used for family recreation, garages and buildings for business. The advantage of this coefficient is that it does not burden buildings for permanent housing, and vice versa, the disadvantage is that a municipality cannot influence its amount. The municipality can set the local coefficient at two, three, four and five. The entire calculated tax obligation is multiplied by this coefficient, except for some land (arable land, grassland).

Tax revenues on immovable property have had a growing trend since 1993. This trend is influenced by many factors, for example, since 2001, by the improvement of the state of registration in the Land Registry and

Fig. 1: The development of the tax revenue from immovable property in the Czech Republic



Source: Tax administration (2015), own processing

transparency of ownership relations and by streamlining control and search operations of local financial authorities. The most significant factor, however, are legislative changes. In 2009, the exemption from completed constructions of residential houses and buildings, where insulation was carried out, was abolished, along with introducing the possibility of setting the local coefficient. Another major change that affected the tax yield on immovable property was the increase in tax rates from 2010 onwards. The reduction of the tax revenues in 2011 occurred partly as a consequence of the increase in the volume of arrears, but also due to additional reductions and subsequent tax refunds for the previous tax year as a result of court decisions. The gradual precision of legal norms had also a positive impact on increasing tax yields on immovable property.

2. Position of the Regions of the Czech Republic in the Context of Tax Yields on Immovable Property

In the Czech Republic there are fourteen local self-governing units, these are 13 regions and the capital Prague, not an independent region, however, has the same powers as a region. There are many geographic, demographic and socio-economic disparities among individual regions.

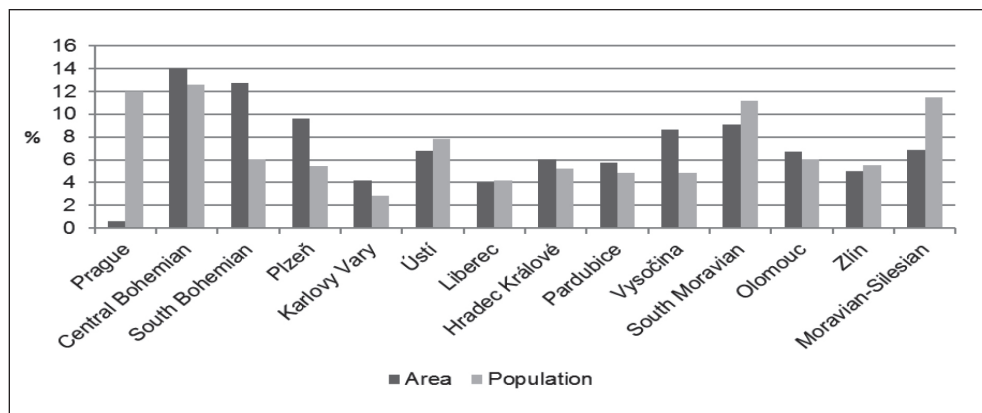
As seen from the graph (Fig. 2), in terms of the area and population the Central Bohemian

Region is the largest. The lowest population is in the Karlovy Vary Region, which is also the second smallest by area. Large differences between regions are also in population density, which is the highest in the Moravian-Silesian Region (224 inhabitants per m²). On the contrary, the lowest density of population is in the South Bohemian Region, which is the second largest by area. The Capital City of Prague shows a specific position among the regions, which has a small area but a large number of inhabitants (12% of the total population in the Czech Republic) and thanks to it, it is a place with the highest population density, which is 2,555 people per m².

A tax imposed in individual regions (Fig. 3) shows a similar trend as tax revenues on immovable property in Fig. 1. The tax imposed is growing with a significant increase between 2009 and 2010, in connection with legislative changes in those years. The highest amounts of the tax imposed are in the Central Bohemian Region, the South Moravian Region and Moravian-Silesian Region, while the lowest are in the Karlovy Vary Region.

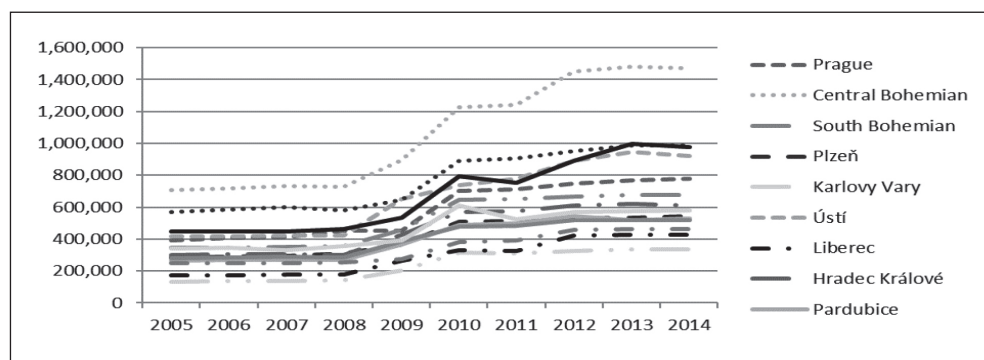
As it can be seen from Tab. 1 the comparison of the regions in terms of taxes on immovable property is significantly different when compared by area and population. The highest amount of taxes per 1 ha is in Prague and in the Moravian-Silesian Region and in the Usti Region. These are the industrial

Fig. 2: The size of local self-governing units in terms of the area and population (in %)



Source: Czech Statistical Office (2016), own calculation

Fig. 3: The development of the tax imposed of immovable property 2005-2014
(in thousands CZK)



Source: Tax administration (2015), own processing

Tab. 1: The comparison of regions in terms of the tax imposed in 2014
(in thousands CZK)

	Tax imposed	Tax imposed per 1 ha	Tax imposed per 1 inhabitant
Prague	779,024	15,701	623
Central Bohemian	1,473,171	1,337	1,125
South Bohemian	678,594	675	1,065
Plzeň	542,278	717	945
Karlovy Vary	338,402	1,021	1,128
Ústí	923,401	1,731	1,120
Liberec	428,501	1,355	977
Hradec Králové	610,450	1,283	1,106
Pardubice	527,293	1,167	1,022
Vysočina	520,384	766	1,020
South Moravian	986,112	1,371	842
Olomouc	579,394	1,100	911
Moravian-Silesian	977,706	1,802	802
Zlín	463,443	1,169	791

Source: Czech Statistical Office (2016), Tax administration (2015), own calculation

regions. According to the amount of taxes per 1 inhabitant the highest amount of taxes is in the Central Bohemian Region, the Karlovy Vary Region and the Usti Region. In contrast, absolutely the lowest property tax per capita is in Prague. It is the largest city in the Czech Republic, which has namely the highest

corrective coefficient according to population; on the other hand, Prague has not introduced the local coefficient.

3. Goal and Methods

The primary objective of the research is to determine the use of legislative instruments,

leading to an increase in tax revenues from immovable property in the regions of the Czech Republic. Access of municipalities to the increase in the tax revenues on immovable property is then studied through coefficients within the Moravian-Silesian Region. Using a questionnaire survey the use of individual coefficients and reasons, leading municipalities to their implementation, modification or cancellation are examined. This research closely follows up on the research of the use of local coefficients, which was carried out in 2014 and 2015.

In the article, there is also a description of the immovable property tax development in the Czech Republic based on time series of the tax imposed in response to legislative changes. The dynamics of the time series was investigated using a growth rate that was in the year t calculated according to formula (1):

$$k_t = \frac{y_t}{y_{t-1}}, t = 2, 3, \dots, n \quad (1)$$

where y_t is the value of the immovable property of the tax imposed in the year t , y_{t-1} is the value of the immovable property tax imposed in the year $t-1$.

The tax imposed represents the amount of tax as reported in tax returns and yield (Y) is calculated according to formula (2):

$$Y = \frac{TR}{TI} * 100 \quad (2)$$

where TR is tax revenue, TI is tax imposed.

By using the chi-square test it was verified whether the municipality location in the district influenced its decision on assessing or modifying coefficients.

A contingency table was created, based on observed and expected frequencies, which were calculated according to the following formula (3):

$$E_{ij} = \frac{n_i}{n} \cdot \frac{n_j}{n} \cdot n = \frac{n_i n_j}{n} \quad (3)$$

where n_i is the sum of individual lines, n_j is the sum of individual columns in the contingency table, n is the sum of all observed frequencies.

The test criterion was calculated using the formula (4):

$$T = \sum_{i=1}^2 \sum_{j=1}^s \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad (4)$$

where s means the number of categories of a monitored variable.

Critical value $K = \chi_{\alpha}^2(s-1)$ of chi-squared distribution with a degree of freedom $df = s-1$ was calculated using Excel and the function CHINV (α ; df) for the given level of significance $\alpha = 0.05$ (Ramík & Perzina, 2014). To verify the accuracy, significance (p -value) was calculated and was compared with the chosen significance level ($\alpha = 0.05$). The function CHIDIST (T ; df) was used for the p -value calculation.

Methodically, the research relies on the evaluation of secondary statistical data of the Czech Statistical Office and the General Financial Directorate of the Czech Republic. The paper used the results of primary research focused on the application of the coefficients by municipalities of the Moravian-Silesian Region, which was implemented in 2016, by a questionnaire through personal interviews, email or telephone.

4. Results and Discussion

As it is evident from the data in Tab. 2, the growth rate in 2009 in all local self-governing units is greater than one, as a result of the possibility of introducing a local coefficient, which could be just used for the first time in this year. 389 municipalities introduced the local coefficient, which accounts for 6.22% of the total number of municipalities in the Czech Republic. In 2010, the growth rate is again high and it is even higher than 1.5 in some regions and in Prague. This fact is influenced by doubling the basic rate of tax on all land, buildings and units (excluding agricultural land and buildings for other business activities). Increasing tax rates led some municipalities to cancel the local coefficient (it was the case of about 189 municipalities), other municipalities introduced it newly in 2010 (83 municipalities). Given that the various local self-governing units have different areas, types of land and buildings, the impact of the increase in tax rates is different, too.

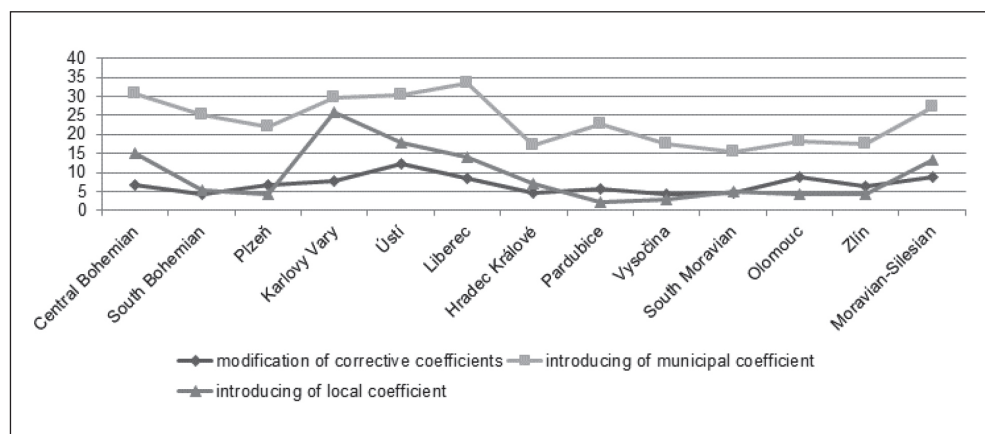
As already mentioned in the beginning, the structure of financial resources of municipalities is diverse and consists of tax and non-tax revenues. Tax revenues are critical for municipal budgets and taxes are made up of shared and

Tab. 2: The development of the coefficient growth of the tax imposed

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Prague	1.04	1.01	1.09	1.01	1.54	1.02	1.05	1.02	1.02
Central Bohemian	1.01	1.03	0.99	1.23	1.37	1.01	1.17	1.02	0.99
South Bohemian	1.00	1.03	1.01	1.27	1.42	1.00	1.02	1.01	1.01
Plzeň	1.01	1.02	1.05	1.18	1.38	1.01	1.03	1.01	1.01
Karlovy Vary	1.03	0.99	1.03	1.44	1.54	0.99	1.05	1.02	1.02
Ústí	1.00	1.01	1.01	1.53	1.13	1.05	1.15	1.06	0.98
Liberec	0.99	1.02	1.00	1.49	1.26	0.99	1.29	1.01	1.00
Hradec Králové	1.02	1.00	0.98	1.42	1.33	1.01	1.06	1.02	0.98
Pardubice	1.02	1.00	1.00	1.36	1.33	1.03	1.08	0.96	1.01
Vysočina	1.01	1.01	0.99	1.35	1.24	1.01	1.07	1.00	1.00
South Moravian	1.02	1.02	0.97	1.11	1.37	1.02	1.05	1.04	1.00
Olomouc	1.01	0.96	1.08	1.09	1.56	0.86	1.08	1.01	1.00
Moravian-Silesian	1.00	1.00	1.04	1.16	1.48	0.95	1.18	1.12	0.98
Zlín	1.00	1.01	1.02	1.07	1.39	1.04	1.16	1.01	1.00

Source: own calculation

Fig. 4: The development of the use and modifications of coefficients by municipalities in individual regions (in %) in 2015



Source: own calculation

assigned taxes. Revenues on shared taxes are transferred to municipal budgets under the Act on budgetary allocation of taxes and the municipality has no possibility to influence their amount.

The assigned tax, i.e. a tax on immovable property in the Czech Republic can respond to the actual costs of the municipality. The amount of tax revenues on immovable property within the local self-governing units is significantly

influenced by the decision of individual municipalities on introducing or modifying coefficients. The following graph (Fig. 4) specifies the percentage use of coefficients in individual regions. Due to differences in the number of municipalities in the regions, the percentage use was compared.

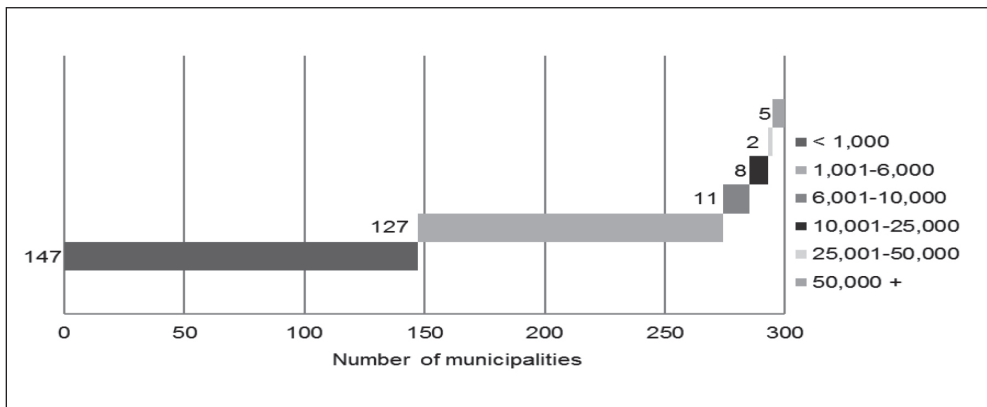
From Fig. 4, it is clear that the municipal coefficient is most used. This coefficient applies to buildings for family recreation and for buildings used for business. Therefore, a coefficient does not burden the residents of the municipality. In the Central Bohemian Region, the Liberec Region and the Usti Region this possibility is used by more than 30% of the municipalities. The use of the modification of corrective coefficients is low (in the Czech Republic the average use is 6.4%). There are not enormous differences among regions and rather modifications are used to differentiate various parts of the municipality. The modification is most used by municipalities in the Usti Region. The local coefficient can be

considered the most effective tool, by which the municipality as a recipient of tax can significantly increase the tax revenue on property on its territory, and it is used by an average of 8.3%, and municipalities in the Karlovy Vary Region use it most. In that region, more than a quarter of municipalities have adopted a similar strategy and some of them have introduced a local coefficient since 2009 and have used it up to the present.

4.1 The Form of Fiscal Autonomy in the Moravian-Silesian Region

Subsequent research aims to identify and evaluate the regional context of the activities of municipalities in the Moravian-Silesian Region in connection with influencing tax revenues on immovable property. In the following graph (Fig. 5) the distribution of municipalities in the Moravian-Silesian Region by population is shown. Size groups are determined by population for applying the corrective coefficient for calculating the tax on immovable property.

Fig. 5: The distribution of municipalities in the Moravian-Silesian Region by size groups

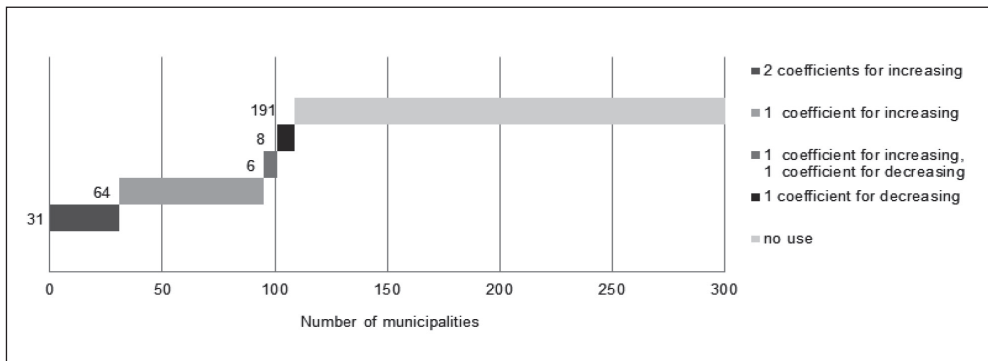


Source: Czech Statistical Office (2016), own calculation

In the Moravian-Silesian Region, there are 300 municipalities. Of these only 109 municipalities (Fig. 6) use the determination or the modification of coefficients for influencing the tax revenues on immovable property. Municipalities may introduce or modify the amount of the three coefficients. Most municipalities use only the modification of just one coefficient. The decrease in the

corrective coefficient is used least, and only by 8 municipalities. A combination of introducing the municipal coefficient is inspirational, while reducing corrective coefficients. This fact has been detected only in 5 cases, though. This approach can be observed especially in municipalities that want to provide the required tax yields especially from other entities other than its own citizens.

Fig. 6: The use of coefficients by municipalities in the Moravian Silesian Region



Source: own calculation

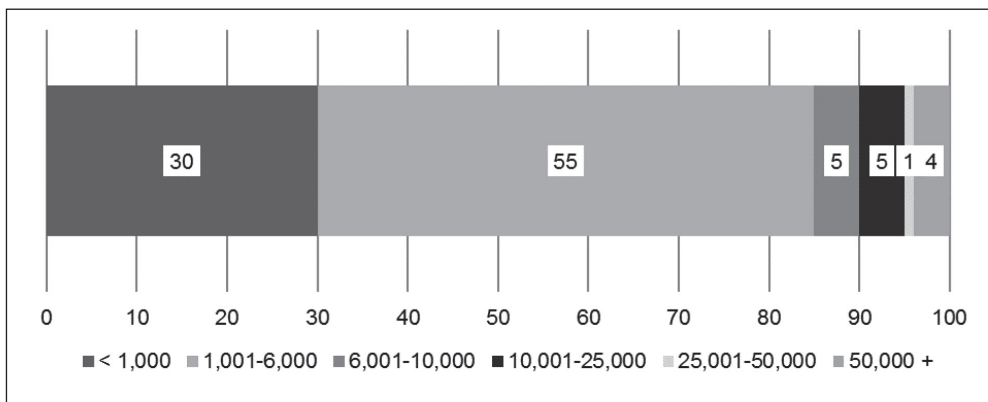
4.2 The Results of Empirical Research and Discussion

The research is focused on exploring the use of coefficients of the tax on immovable property by individual municipalities and was conducted by questioning. The research instrument involved a questionnaire, which included both closed-ended and open-ended questions, in which the respondent was not submitted response options, and the respondent answered in his/her words. The responses were then grouped according to semantic categories.

This is a local research, which focuses on the Moravian-Silesian Region. The region has a total of 300 municipalities, and 250 of them were addressed. 100 questionnaires were placed into processing and the response rate was 40%.

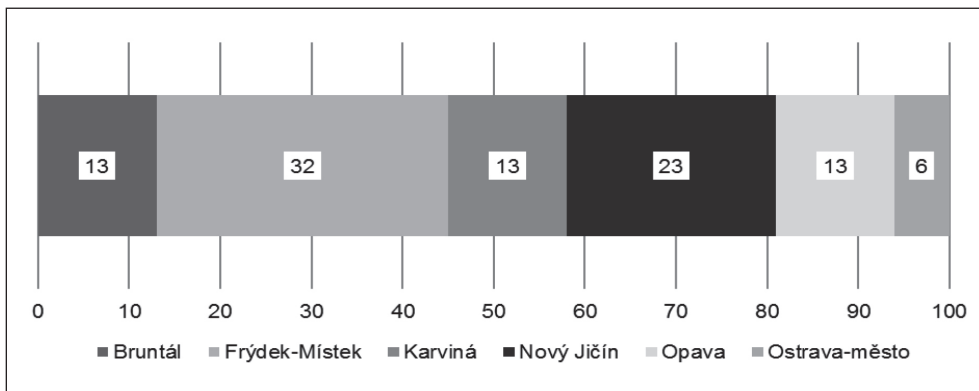
The structure of respondents (municipalities) by size is shown in the following Fig. 7. The graph shows that most respondents are formed by municipalities with a population of 1,001 to 6,000. The structure of the respondents is influenced by a low response rate of questionnaires in the smallest municipalities with a population of up to 1,000.

Fig. 7: The structure of respondents by size of the municipality



Source: own calculation

Fig. 8: The structure of respondents by districts



Source: own calculation

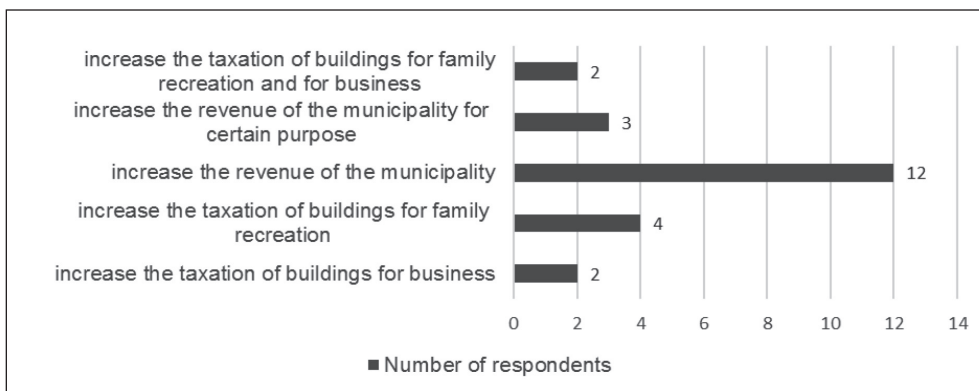
The structure of the respondents in terms of districts in the Moravian-Silesian Region is shown in Fig. 8. A small number of respondents in districts with a large number of municipalities is, among others, influenced by a varying size structure of municipalities, where for example in the Bruntál district there are 78% of municipalities with a population up to 1,000 and, for instance, in the Karvina district there is not any such a small municipality.

4.3 Motivation for Introducing the Coefficients by the Municipalities of the Moravian-Silesian Region

The reasons which led the municipalities to the introduction of coefficients were determined by using open-ended questions and then were grouped into semantic categories.

As it is evident from Fig. 9 above the most common reason that motivated municipalities to introduce municipal coefficients was to increase

Fig. 9: Motivation for introducing municipal coefficients



Source: own calculation

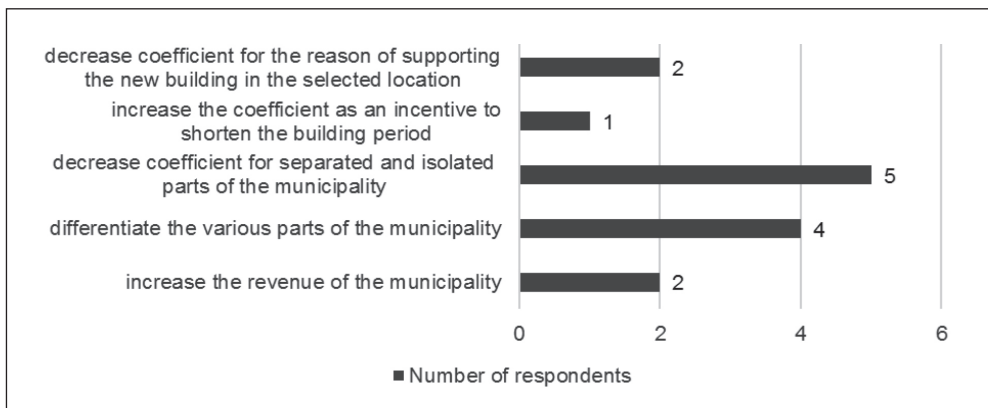
the revenue of the municipality. By determining municipal coefficients some municipalities wanted to increase the taxation of buildings for family recreation or for business. The increase in this tax liability thus does affect the population of the given municipality. In determining this coefficient, municipalities cannot choose its amount, but they can specify to which types of buildings (except buildings for permanent housing) the coefficient will apply. There were also reasons from which an insufficient orientation in the field of the tax on immovable property could be inferred, for instance, the coefficient was set by another mayor then they do not know the reasons or the coefficient was set at the request of tax authorities. If the municipalities stated that the reason for setting the coefficient was

to increase the revenue of the municipality for a specified purpose, the most often mentioned were: the beautification of municipal areas, covering the costs of the cleanliness of the municipality, covering the costs of sewerage, flood protection measurements, health, sport and culture. The municipal coefficient was introduced in 28 municipalities surveyed.

Corrective coefficients are determined by law, and as mentioned above, they can be modified differently for land and buildings through their increase or decrease. The corrective coefficient for land was modified by 18 municipalities and by 17 municipalities for buildings.

When modifying corrective coefficients for land a different objective is usually pursued than

Fig. 10: Motivation for modifying corrective coefficients for land



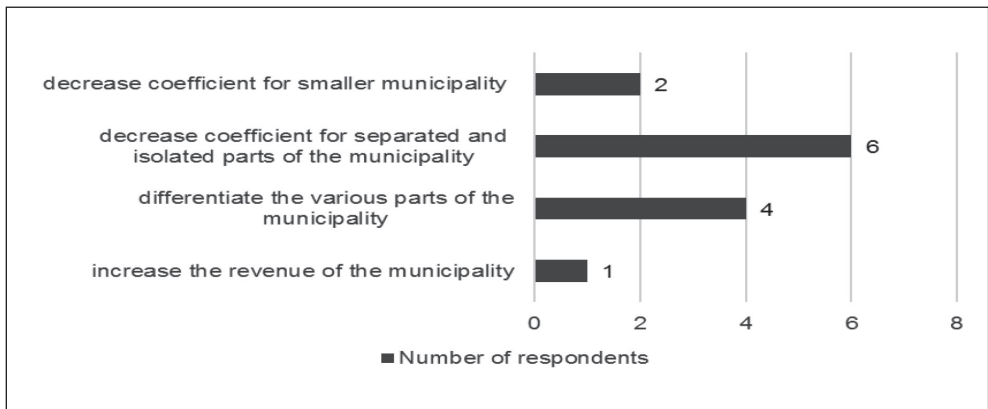
Source: own calculation

to increase the revenue of the municipality. Most often, this coefficient is used to differentiate the various parts of the municipality according to infrastructure and attractiveness as it does not have to be set for the whole territory of the municipality at the same level (Fig. 10). An interesting reason is to increase the coefficient as an incentive to shorten the building period, because then the building will be taxed by using the corrective coefficient for buildings, which is lower. On the other hand, municipalities can benefit from a reduction in corrective coefficients for the reason of supporting the new building in the selected location.

Similarly, a different objective is pursued than to increase the revenue of the municipality while reasoning for the modification of corrective coefficients for buildings. This coefficient is used to differentiate the various parts of the municipality according to infrastructure, attractiveness, amenities and access to employment. The reduction of corrective coefficients is also used in parts of the municipalities that are affected by the negative impact of transport or mining activities (see Fig. 11).

The local coefficient was set by 18 respondents and half of them had it already

Fig. 11: Motivation for modifying corrective coefficients for buildings



Source: own calculation

introduced in 2009. The prevailing local coefficient rate is above 2 (a total of 12 municipalities), the amount of the coefficient is generally most frequently used also in the Czech Republic. Unlike other coefficients, the most common reason for introducing the local coefficient is generally to increase the revenue in the municipal budget. Or the revenue is used for specific investment needs of municipalities such as sewer construction. The increase in tax yields occurs in municipalities that are industrial and on whose territory large entrepreneurial businesses have their property. As found most municipalities have higher costs associated with the maintenance of the cadastral area, which is mortgaged property owned by business entities. Municipalities also want to motivate firms through coefficients for the better use of property on the territory of the municipality with the aim of securing new jobs, especially for the citizens of the municipality. These are often the buildings of companies that have their headquarters outside the municipality (especially in large cities such as Prague and Brno) and therefore assigned taxes flow into the budgets of other towns.

In the context of municipalities with a high population growth and increased construction, there is also an increase in the costs of installation of utilities, public lighting, radio, and maintenance of local roads, which also encourages municipalities to introduce local coefficients. Municipalities that are recreational

areas with sports and recreational facilities also introduce local coefficients for increasing the revenue, and the increased tax is compensated to the citizens of the municipality, for example, by reducing or abolishing certain fees (e.g. waste disposal) and thus the municipality also reduces the administrative burden in connection with the collection of these fees.

Based on questionnaires reasons were also identified why municipalities do not use the possibility of introducing coefficients. One of the reasons, is, for instance, a low number of inhabitants in the municipality, or a small increase in the revenue of the municipality at the expense of the high financial burden on citizens.

4.4 The Effect of the Municipality Location on Researched Phenomena

By using the chi-square test it was verified whether the municipality location in the district influenced its decision on assessing or modifying coefficients. A zero hypothesis H_0 was set: **Determining or modifying coefficients do not depend on the municipality location.**

Based on the results in the above table (Tab. 3) we can say that we shall reject the null hypothesis. The decision on introducing or modifying coefficients depends on the municipality localization. There are significant differences between the municipalities, which

Tab. 3: Verification of the hypothesis H_0

CHI-SQUARE	12.6643
alfa	0.05
df	5
CHINV	11.0705
CHIDIST	0.0267

Source: own calculation

Tab. 4: The use of coefficients according to districts in the Moravian-Silesian Region (in %)

Municipality	Use of coefficients	Municipalities of lower 1,000 inhabitants
Bruntál	28	78
Frydek-Místek	50	40
Karviná	47	0
Nový Jičín	30	48
Opava	30	47
Ostrava-město	54	31
Moravian-Silesian Region	36	49

Source: own calculation

are located in different districts of the Moravian-Silesian Region, such as municipalities in Opava, which do not use the option of determining the local coefficient.

As shown in Tab. 4 the percentage of municipalities that use the coefficients in the individual districts is very different. Municipalities on average at 36% in the Moravian-Silesian Region use the coefficients; municipalities in the districts of Bruntál, Nový Jičín and Opava are below average. Conversely, a higher percentage is the districts of Frýdek-Místek, Karviná and Ostrava-město. There can also be monitored the link between the size of municipalities, as in all three districts using coefficients to a greater extent, larger municipalities of over 1,000 inhabitants predominate.

Conclusion

Fiscal decentralization in the context of the reallocation of public resources is a complex and multi-faceted process, which fosters social priorities and strategies. Local taxes and especially the tax on immovable property is considered the most apposite municipal

tax. However, a number of contentious issues are associated with this tax in the context of valuation, assessment of the tax rate or controversy if the property should be taxed at all, in spite of it, the taxation revenue of the of immovable property fills municipal budgets more or less in all European Union countries.

Municipalities in the Czech Republic have the ability to affect tax revenues on immovable property through coefficients thus being the only assigned tax. As found in the carried out analyses, the possibility of modifying coefficients for increasing the revenue is still underused by municipalities. E.g., the introduction of the local coefficient is still postponed by almost 92% of the municipalities in the Czech Republic, either due to concerns of inhabitants about raising taxes or as a result of insufficient orientation of the municipal council in the given field.

It was found that the municipal coefficient is most used, whose determination is the simplest and does not burden the residents of the given municipality. The use of modifications of corrective coefficients is low and it is used only by 6.4% of the municipalities in the Czech Republic, although there are large differences

between regions. The local coefficient that can be considered the most effective tool by which the municipality as a recipient of tax can significantly increase the tax revenue on immovable property on its territory is used by an average of 8.3% of municipalities, and municipalities in the Karlovy Vary Region use it most.

The Moravian-Silesian region is among the regions with higher tax revenues on immovable property. It is largely due to its industrial character. Analyses made suggests that even here there is certainly the possibility for increasing municipal budgets through the tax revenue on immovable property by increasing or modifying coefficients.

As the primary research revealed (conducted in the years 2014-2016) motivation to use coefficients to increase tax yields on immovable property is different. They differ mainly in relation to the specific application of the individual coefficients. Differences also result from the structure of buildings and land on the territory of the municipality and the way they are used. Some municipalities introduce coefficients to increase the taxation of buildings for family recreation, while others want to burden buildings for business by a higher tax.

It was found that taxpayers when providing transparency of the use of the revenues do not negatively perceive the higher tax burden, particularly in smaller municipalities. Thus, the principle of subsidiarity is fulfilled, where decision-making and accountability in public affairs, takes place at the lowest level of public administration being closest to citizens. It is therefore in the interest of the municipality to explain to taxpayers what consideration is granted, not only by public lighting infrastructure facilities, protection of property or an increase in property values, but municipalities finance e.g. schools, kindergartens, subsidize public transport (Janoušková & Sobotovičová, 2016b). This leads to increased political accountability, thanks to the proximity of voters.

Even though tax revenues on immovable property have had a growing trend since 1993, the Czech Republic is still among the countries with the lowest share of taxes in total tax revenues in EU countries. It is mainly due to the structure of the tax base and the assessment of the tax base is subject to criticism, which is not based on property value reflecting inflation. Problems concerning income and expenditure

balancing arise in municipalities, as public expenditure is subject to inflation.

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PROPERTY TAX IN THE REGIONS OF THE CZECH REPUBLIC**Jana Janoušková, Šárka Sobotovičová**

Fiscal decentralization in the context of the reallocation of public resources is a complex and multi-faceted process, which fosters social priorities and strategies. The main objective is to increase the self-reliance and self-sufficiency of municipalities related to allocation efficiency and possible adjustment to the local conditions. The municipalities in the Czech Republic have the possibility to affect the tax revenue on immovable property by means of the coefficients being thus the only assigned tax. The aim of the paper is to determine the use of legislative tools to increase the tax revenue on immovable property in the regions of the Czech Republic. Access of municipalities to the increase in the tax revenues on immovable property is then studied through three coefficients within the Moravian-Silesian Region. Examples of good practice in motivating municipalities to implement or modify selected coefficients leading to an increase in municipal budgets are examined. The article also performs a description of the development of the tax on immovable property in the Czech Republic, on the basis of the time series of tax imposed as a follow-up to the legislative changes. Methodically the research relies on the evaluation of secondary statistical data of the Czech Statistical Office and Financial Administration of the Czech Republic, and the primary research that was implemented in 2016 focuses on the application of the coefficients by municipalities of the Moravian-Silesian Region. This research closely follows up on the research of the use of local coefficients, which was carried out in 2014 and 2015.

Key Words: *Fiscal decentralization, tax autonomy, immovable property tax, regions, Moravian-Silesian Region.*

JEL Classification: *H70, H71.*

DOI: *10.15240/tul/001/2017-4-009*

INFLUENCE OF SECURITY AND TRUST ON ELECTRONIC BANKING ADOPTION IN SLOVAKIA

Martin Vejačka, Tomáš Štofa

Introduction

The rapid development of information and communication technologies (ICT) in recent years has brought major changes in many areas of the economy and even created its new sectors. Rising complexity of technological and heterogeneity of technological infrastructure and their applications contributed to changes in every business area (Voříšek et al., 2015). New opportunities to sell products and provide services arose in the electronic environment. Customers routinely buy in e-shops and electronic banking became a very important form of banking services usage in last two decades. Improvements in information and communication technologies have positively influenced also areas like retail commerce, banking, public administration, healthcare administration (Šoltés & Gavurová, 2014) and many others. Significant changes occurred in the provision of banking services. Some of the forms of electronic banking quickly became old and out-dated (e.g. Wireless Application Protocol – WAP banking). Faster data transmissions within mobile networks and the Internet allowed multiple innovations and improvements of electronic banking forms. The form of electronic banking growing fast in numbers of users is mobile banking in smartphones and tablets (and other devices). This form of mobile banking uses dedicated application installed in mobile device allowing active usage of banking services, although for communication with the bank it uses mostly the Internet (mobile network, Wi-Fi etc.).

Claessens et al. (2002) adduced that electronic provision of banking services brings many benefits to its users and also to providers, e.g. cost savings for both sides of banking services, higher speed of service, almost unlimited availability and higher conformability. When clients want to benefit from electronic banking, they must trust in electronic banking.

In general, trust in information and communication technology affects the adoption of ICT. Additionally, information and communication technologies may promote trust while they allow faster and more reliable acquisition of information and support transparency. Delina and Dráb (2010) stated that trust within the electronic environment is often connected with reputation mechanisms, which allows reputation assigning to the both sides of the commercial relationship to assess their trustworthiness. In the case of e-commerce trustworthy seller (the one that sends his goods on time and in demanded quality and quantity) should have high reputation generated by previous sales.

Multiple publicized cases of major security failures have increased public concerns about electronic commerce and reduced their trust in it. This is especially true for the area of electronic banking as one of the areas of e-commerce while customers are more concerned about security when the process includes sensitive personal information. In electronic banking, sensitive personal financial information is manipulated and its customers are concerned about the security issues of e-banking form what may inhibit their use of electronic banking.

In the case of electronic banking, the provider of electronic banking service is banking institution, which is liable to various banking committees and supervising authorities. So clients of electronic banking services have a high level of certainty that the other side of this commercial relationship (the bank) is a serious and trustworthy partner under the supervision of higher authority. On the other hand, electronic banking uses various electronic environments where abuse might be unseen until the very last moment. Attacks by third parties on electronic banking of its users (e.g. phishing, pharming etc.) might be a source of risk that dissuades

potential users from e-banking usage. Therefore banks are trying to prevent such a threat by increasing level of electronic banking security and safety of its use.

Lev-On (2009) explored the importance of trust in an online environment and pointed out the difference between security and trust. Hawkins and Sato (2004) investigated the trust in electronic finance and banking with finding that both non-technical and technical aspects of trust building must be covered to provide confidence and trust for users in this area by financial and banking institutions. Trust in electronic banking providers is generated mainly by bank supervision and dispensing of banking license by higher authorities.

Competition among banks in retail area pushes them to improve also comfort and security of their electronic banking services, although occasional cases of e-banking abuses noted in media might disrupt the confidence of electronic banking users as stated Dandapani (2004). Furthermore establishing, adopting and strict application of security procedures and policy in electronic banking is an issue according to Simpson (2002).

Potential bank clients might sense both multiple advantages and risks of electronic banking when deciding whether to adopt it or not. Faster service, great availability and higher comfort of use are benefits attracting potential users to the electronic banking. On the other hand, doubts about safety and security of electronic banking might impede its adoption by potential clients. Further banks are seeking costs reduction, higher efficiency, customer satisfaction and possibility to serve to more customers at once when introducing electronic banking (Mittal & Kumra, 2004; Berger et al., 2007).

Electronic banking acceptance in Slovakia was investigated in Vejačka (2014), however, trust in electronic banking was not considered specifically. Investigation of the influence of trust and security on electronic banking adoption in the conditions of retail banking in Slovakia will be the main goal of this paper. The extent of the influence of further identified factors on electronic banking adoption by its potential users in Slovakia will be investigated.

1. Literature Review

Many research studies investigate customer acceptance of internet banking or electronic banking in general (including other forms of

e-banking besides internet banking). The most of these studies are based on the Technology Acceptance Model established by Davis (1989). Technology Acceptance Model (TAM) detects factors of perceived usefulness, perceived ease of use, and awareness of particular technology investigated. In studies dedicated to electronic banking, the TAM is often further extended or adapted by some specific aspects of electronic banking technology to investigate their influence on electronic banking acceptance (e.g. Venkatesh & Davis, 2000). TAM serves for development of the research model, which is further verified by factor analysis, which can test how well the measured variables represent the number of factors, firstly developed by Jöreskog (1969).

Pikkarainen et al. (2004) detected web information about electronic banking service as one of the main factors predicting acceptance of given service. Teo et al. (1999) included in their version of TAM also perceived enjoyment. It was detected as a significant inherent motivator to information system usage.

Cheng et al. (2006) investigated the acceptance of internet banking in Hong Kong using Technology Acceptance Model. Their research results indicated the suitability of using TAM for investigating customer's acceptance of internet banking. Qureshi et al. (2008) also confirmed TAM as suitable for online banking acceptance prediction using data from developing countries.

Agarwal and Karahanna (2000) extended TAM with perceived playfulness and ascertained that perceived playfulness is prior to the perceived ease of use and perceived usefulness. Furthermore, Moon and Kim (2001) detected its significant influence of customer technology adoption in the world-wide-web context. Werber et al. (2015) indicated that computer literacy is a key factor in adopting new information and communication technology.

Multiple authors aimed their research to the effects of trust on acceptance of various technologies, like e-commerce and electronic banking. Jarvenpaa et al. (2000) investigated purchase behavior at online stores. According to their findings trust influences perception of risk and attitude toward purchase at given online store and trust itself was influenced by the perceived reputation and size of the store.

Gefen (2002) examined the influence of trust on purchase intentions in an online

environment and detected the significant influence of trust, which is further affected by benevolence and integrity. Influences on the intent to make Internet purchases were also investigated by George (2002), who detected privacy and the Internet trustworthiness as main significant factors affecting the decision about purchases on the Internet. Gefen et al. (2003) later investigated purchase intentions of experienced and inexperienced customers in online stores and ascertained the significant effect of disposition to trust and familiarity on trust, which significantly influences customers' intentions to purchase.

Bhattacharjee (2002) examined if the consumers are complaisant to make online transactions. His results suggested that compliance to transact online is affected by familiarity and trust. Trust has a significant effect on willingness to transact according to Pavlou (2003) and is a determinant of perceived usefulness in an online environment.

In general, the low trust in an electronic environment is often considered as an important barrier to wider proliferation of electronic banking (Yousafzai et al., 2009). The results of Aladwani (2001) and Lee and Turban (2001) showed that privacy and security concerns hinder the adoption of Internet banking and lower trust. Suh and Han (2002) detected trust's significant influence on attitude towards using Internet banking and its overall acceptance by potential users. Sohail and Shanmugham (2003) found out that trust in customer's bank has a significant effect also on Internet banking adoption by given customer among other factors like security concerns, attitude towards change and availability of the Internet.

Many researchers examined also the influence of security on trust in electronic banking and consequently on its adoption by potential users. Pikkarainen et al. (2004) did not detect the influence of security on electronic banking acceptance. The research of Widjana and Rachmat (2011) also showed similar results. On the other hand, many studies detected importance of security and safety when introducing electronic banking to their potential users. Roboff and Charles (1998) detected importance of privacy of financial information in cyberspace and suggested banks to address consumers' concerns in this area. Chellappa and Pavlou (2002) adduced that security concerns very often accompany an introduction of new

information technologies. Then, the acceptance of these novel technologies depends on preventing of security threats, improving the perception of security by consumers and building their trust in given technology. Hamlet and Strube (2000) indicated that safety of online banking perceived by bank clients will affect its adoption. Dzemydienė et al. (2010) explored security disturbance risks in electronic banking systems. According to their results, multiple risk factors and the implementation of modern ICT technologies increase the security of electronic payment security and significant efforts must be made to build the trust by prevention of security risks.

Alsajjan and Dennis (2006) investigated the influence of trust on sensitive information use in online banking and on user's acceptance of electronic payments. The results of Grabner-Kräuter and Faullant (2008) showed a significant influence of privacy on customer attitudes towards internet banking on risk perception while using it. Qureshi et al. (2008) ascertained that high perceived security of online banking together with perceived usefulness led to a significant shift from traditional banking to electronic banking. Good security and privacy levels according to findings of Geetha and Malarvizhi (2011) increased the adoption of electronic banking services by banking customers in India. Acceptance of electronic banking by customers, in this case, was also affected by safety guidance from bank's side.

Alsajjan and Dennis (2010) examined the managerial side of consumer acceptance of internet banking. Internet banking customer must perceive electronic transactions as safe and easy to promote internet banking adoption. It builds a trust in internet banking in a significant way according to their findings. Furthermore, banks should create their reputation as innovative institutions and promote positive perception and trustworthiness in eyes of potential customers. For these promotional purposes, banks should use digital media like blogs, social networks and emails.

Kumar et al. (2012) highlighted the importance of the reducing the risk of the internet banking customer by bank's structures, including security, assurances, service quality and benevolent policies. They also detected the effects of the individual's customers' attitude towards the internet and internet banking on the disposition to trust. The banks

should communicate to users all its benevolent policies to enhance the level of the internet banking usage in order to positively influence their disposition to trust with the aim to increase the level of the internet banking usage.

Researchers often explore the acceptance of online banking, aiming their research only on internet banking. However, customers might use more forms of electronic banking at present. Mobile banking using internet connection (in the case of Slovakia called Smart banking) or mobile network is a most common alternative to internet banking. In many countries around the world, investigations on electronic banking adoption by customers were realized during recent years, e.g. in Australia (Sathye, 1999), Turkey (Polatoglu & Ekin, 2001), United Kingdom (Howcroft et al., 2002), Finland (Karjaluoto et al., 2002), Hong Kong (Cheng et al., 2006), Pakistan (Qureshi, 2008), India (Geetha & Malarvizhi, 2011), Romania (Moga et al., 2012), Nigeria (Popoola, 2013) or in Vietnam (Nguyen et al., 2014).

A similar investigation of electronic banking adoption in Slovakia was conducted (Vejačka, 2014). However, this research was not aimed at security and trust influence on electronic banking acceptance. Therefore the issue of trust and security influencing electronic banking adoption by potential users in Slovakia will be the focus of this study.

2. Research Model

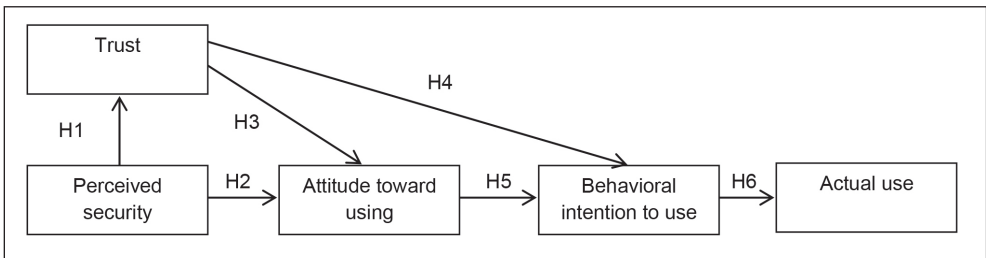
Multiple models of trust within the environment of electronic banking or services were used during investigations. McKnight et al. (2002) suggested the trust model on the web. In this model, the adoption of the e-commerce

system depends on the customers' trust in the web, which is related to trusting beliefs and disposition to the trust of the customer. Kumar et al. (2012) adopted this model for use in case of internet banking (that can be considered as an extension of e-commerce) to reflect various technology-related trust dimensions influencing the institution-based trust.

According to Tan and Thoen (2001), trust is determined by four basic beliefs: competence belief, dependence belief, disposition belief and fulfillment belief, while competence belief reflects the usefulness of supplier of product or service perceived by the customer. The same assumption can be applied to electronic banking or basically to any information technology. Perceived usefulness is one of acceptance factors according to TAM developed by Davis et al. (1989). Suh and Han (2002) extended TAM with the concept of trust influencing attitude toward using and behavioral intention to use, while trust itself is influenced by perceived usefulness and in turn by perceived ease of use.

In this research, foundations of technology acceptance model are used with modifications similar to those made in the study of Suh and Han (2002). However, factors of perceived usefulness and perceived ease of use are not considered because their influence is well investigated in many studies using TAM. In our study perceived security is examined instead, while it is one of the basic aims of our research. Influence of both, perceived usefulness and perceived ease of use on electronic banking acceptance, was already investigated in Slovak conditions (Vejačka, 2014). However, in this research, the influence of security and trust on electronic banking acceptance will

Fig. 1: Research model



Source: own

be investigated together with the effect of perceived security on trust in electronic banking. The constructed research model is graphically presented in Fig. 1.

According to model following research hypotheses are formulated:

H1: Perceived security has a positive impact on customer's trust in electronic banking.

Kumar et al. (2012) found that security of internet banking perceived by users has significant positive influence on institution-based trust in internet banking. It can be generalized also for other forms of electronic banking. Sanayei and Noroozi (2009) stated that trust is increased and positively associated with the perceived level of security.

H2: Perceived security has a positive impact on customer's attitude toward using electronic banking.

The security mechanisms support customers' confidence to interact with electronic banking according to Suh and Han (2002). Liao and Cheung (2002) suggested that the visibility of these security mechanisms to the users is important and influences customer's attitude toward using internet banking or electronic banking in general.

H3: Customer's trust has a positive impact on customer's attitude toward using electronic banking.

Customer's trust in store positively influences attitude toward using given store according to Macintosh and Lockshin (1997) and attitude is one of the components of store loyalty. Also, Jarvenpaa et al. (2000) suggested that customer trust in an online store strongly influences attitude toward using particular online store.

H4: Customer's trust has a positive impact on customer's intention to use electronic banking.

Influence of trust on behavioral intention to use any service was investigated mainly in the marketing area. Gefen et al. (2003) suggested that trust positively influences buyer's intention to use the online store of the seller.

This hypothesis was adopted for the case of electronic banking usage.

H5: Customer's attitude toward using electronic banking has a positive impact on customer's intention to use electronic banking.

Suh and Han (2002) verified in their study that customer's attitude toward using internet banking has a positive impact on his/her actual use of it. This hypothesis has been modified to the form for all electronic banking forms and is part of our research model.

H6: Customer's intention to use electronic banking has a positive impact on customer's actual use of electronic banking.

Again, Suh and Han (2002) investigated and confirmed positive impact of customer's intention to use internet banking on actual use of it. Also, this hypothesis is incorporated in form of influence of electronic banking in our research model.

3. Methodology

Our research model mentioned in previous chapter was developed on the basis of the Technology Acceptance Modelling (TAM) approach with factors of perceived security, trust, attitude towards using and behavioral intention to use electronic banking. With an aim to verify our research model, data was gathered using an online survey. The questionnaire survey was aimed to investigate factors influencing electronic banking adoption showed in our research model.

Potential factors of were further investigated by confirmatory factor analysis, which is contemporary technique for assessing the construct validity of multiple attempts to measure the same concept being in agreement. Confirmatory factor analysis is a multivariate statistical procedure that is used to test how well the measured variables represent the number of constructs (factors). It is a tool that is used to confirm or reject the measurement theory. It was developed by Jöreskog (1969). Confirmatory factor analysis serves to detect factors accounting for the covariance in the measures, while these factors are being unrelated to each another. The theoretical measurement model is compared with the reality model to detect how well the data fits. Chi-square test

and other goodness of fit statistics like root mean square residual, goodness-of-fit index, normed fit index, comparative fit index are key indicators that might indicate measuring the model validity, i.e. how well the proposed model captured the covariance between all the items or measures in the model (Hair & Black, 2010). If the constraints the researcher has imposed on the model are inconsistent with the sample data, then the results of statistical tests of model fit will indicate a poor fit, and the model will be rejected. If the fit is poor, it may suggest that some items measuring multiple factors, or some items within a factor are more related to each other than others. Confirmatory factor analysis is often used in technology acceptance studies, like Suh and Han (2002), Cheng et al. (2006), Kumar et al. (2012), Nguyen et al. (2014) etc.

Principal axis factoring is a confirmatory factor analysis method used in technology acceptance studies (Cheng et al., 2006) and its suitability is detected by Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. Bartlett's test of sphericity can confirm factorability, while it compares the observed correlation matrix to the identity matrix. It detects if there is a certain redundancy between the variables that can be summarized by a few number of factors. If the variables are perfectly correlated, only one factor is sufficient. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy compares the values of correlations between variables and those of the partial correlations. If the KMO is close to one, the principal axis factoring can act efficiently; if it is KMO is close to zero, the principal axis factoring is not relevant (Kumar et al., 2012). As internal consistency reliability measure, the Cronbach's alpha was used, similarly as in Hair and Black (2010). Cronbach's alpha is the expected correlation of two tests that measure the same construct.

Factor analysis is frequently used as a first step to assess the proposed measurement model in a structural equation model (SEM). Many of the rules of interpretation regarding assessment of model fit and model modification in structural equation modeling apply equally to confirmatory factor analysis. While in confirmatory factor analysis factors are not presumed to directly cause one another, SEM often specifies particular factors and variables to be causal in nature (Hox & Bechger, 1998). Therefore, the Structural Equation Modelling

(SEM) approach was further used to show relations between variables in our research model. Fundamentally, SEM is a term for a large set of techniques based on the general linear model and it has the ability to test relationships between constructs comprised from multiple items (Weinberg & Abramovitz, 2002) and the capability of testing the measurement characteristics of constructs (Hair & Black, 2010).

Hox and Bechger (1998) stated that a structural equation model implies a structure of the covariance matrix of the measures. Once the model's parameters have been estimated, the resulting model-implied covariance matrix can then be compared to an empirical or data-based covariance matrix. If the two matrices are consistent with one another, then the structural equation model can be considered a plausible explanation for relations between the measures. The SEM approach offers greater ability to handle multicollinearity, inherent errors in measuring independent variables and estimation of parameters (Hair & Black, 2010).

4. Results

The questionnaire survey was aimed to gather data to investigate factors influencing electronic banking adoption showed in our research model. The Likert seven-point scale was used for the answer options. Only individuals were addressed within our survey. Over 600 potential individual clients from Slovakia were asked to fill in the questionnaire. In total, 211 filled out surveys were gathered, what represents approximately 35 percent return rate of questionnaires. There were 104 questionnaires returned (49.29%) from male respondents and 107 questionnaires (50.71%) from female respondents in our conducted survey. This ratio corresponds well to the demographic composition of the population in Slovakia. Two-thirds of respondents were younger than 40 years old. The biggest group of respondents (37.44%) was younger than 25 years old. Above 29% was between 25 and 40 years old and 24% between 41 and 55 years old. Over 55 years were only 19 respondents what represents 9% of respondents.

Following Tab. 1 contains all demographic characteristics of our survey respondents gathered.

Besides the demographic characteristics, Tab. 1 contains also electronic banking usage

Tab. 1: Demographic characteristics of survey respondents

Characteristic	Value	Frequency	Percentage
Sex	Male	104	49.29
	Female	107	50.71
Age	Less than 25 years	79	37.44
	Between 25 and 40 years	62	29.38
	Between 41 and 55 years	51	24.17
	Over 55 years	19	9.00
Electronic banking usage	Does not use	17	8.06
	Less than 1 year	20	9.48
	Between 1 and 3 years	80	37.91
	Over 3 years	94	44.55
Forms of e-banking used	None	17	8.06
	Internet banking	124	58.77
	Smart banking	1	0.47
	Both Smart banking and Internet banking	69	32.70
Frequency of usage per month	None	17	8.06
	1-2 payments	67	31.75
	3-4 payments	58	27.49
	5-6 payments	37	17.54
	More than 6 payments	32	15.17

Source: own

of respondents detected in our survey. Since the survey was aimed at general population in Slovakia, there was a possibility for the respondent to indicate that he or she does not use any form of electronic banking. We recorded 17 responses of respondents not using any form of electronic banking what represents approximately 8 percent.

The remaining 194 survey respondents using electronic banking will be used for verification of our research model. Twenty of our respondents (9.48%) have used electronic banking shorter than one year. Eighty respondents (37.91%) stated between one and three years of electronic banking usage and ninety-four respondents (44.55%) indicated over three years of usage.

Most of the respondents (124) were using internet banking what is over 58% of respondents. Only one user indicated using smart banking without using internet banking at the same time, while 69 users (32.70%) stated

that they use both smart banking and internet banking.

Further, the frequency of using electronic banking for payments was investigated. Over 31 percent of respondents (67) make 1 or 2 payments through electronic banking per month. Around 3 or 4 payments per month indicated 58 respondents what is 27.49 percent and 5 or 6 payments were stated by 37 respondents (17.54%). Approximately 15 percent of respondents use electronic banking intensively, i.e. more than 6 payments during the month.

Each of our proposed factors is represented by group of multiple questions or statements, presented in Tab. 2.

Cumulative percentage of variance explained represents increasing portion of variance explained by an inclusion of all previous factors stated in table. For further analysis of data, IBM SPSS Statistics software was used. Potential factors of perceived security, trust,

Tab. 2: Factor loadings

Item	Perceived security	Trust	Attitude toward using	Behavioral intention to use e-banking	Actual use of e-banking
I have enough information about secure use of electronic banking	.844				
I use electronic banking securely	.782				
Transferring sensitive information via electronic banking is secure	.903				
Overall, using electronic banking is secure	.851				
Electronic banking of my bank is trustworthy		.887			
I trust in electronic banking of my bank		.897			
Electronic banking keeps my best interests in mind		.845			
Using electronic banking is a good idea			.863		
Using electronic banking is convenient and pleasant			.900		
I consider electronic banking as suitable solution of covering my needs of banking services			.834		
I intend to continue using electronic banking in the future				.867	
I will recommend others to use electronic banking				.795	
I would always prefer e-banking				.767	
I am satisfied with advantages that electronic banking usage brings				.826	
I use electronic banking often					.849
I use electronic banking more frequently than classic banking					.822
I use electronic banking as main way of using banking services					.860
Percentage of variance explained	31.838	17.704	17.441	12.979	6.630
Cumulative percentage of variance explained	31.838	49.542	66.983	79.962	86.592

Source: own

attitude toward using and behavioral intention to use were investigated by confirmatory factor analysis. Specifically, principal axis factoring method with varimax rotation was used. This method is widely used in technology acceptance studies (e.g. Cheng et al. (2006), Yousafzai et al. (2009), Kumar et al. (2012) etc.). Foremost, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were expressed. Bartlett's test of sphericity confirmed factorability since it was significant at a value of 0.000. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy with value at 0.958 confirmed that factor

analysis was appropriate because it surpassed required a minimum level of 0.60 for reliability (Kumar et al., 2012).

Cronbach's alpha serves as internal consistency reliability measure (Hair & Black, 2010). Cronbach's alpha test was performed to test the reliability of constructs as standard test of reliability of constructs (Kumar et al., 2012). Tab. 3 contains Cronbach's alphas of all constructs considered in our model. Minimum level for reliability is Cronbach's alpha at the value of 0.70 (Suh & Han, 2002; Hair & Black, 2010). Our first factor identified was perceived security with four variables and Cronbach's

Tab. 3: Reliability of constructs

Construct	Cronbach's Alpha
Perceived security	0.896
Trust	0.921
Attitude toward using	0.933
Behavioral intention to use	0.914
Actual use	0.859

Source: own

alpha at 0.896. The factor of trust had three variables with Cronbach's alpha at 0.921. The third factor of attitude towards using electronic banking contained three variables and had Cronbach's alpha value at 0.933. The fourth factor – behavioral intention to use electronic banking consisted of four variables with Cronbach's alpha of 0.914. The last factor is actual use of electronic banking and Cronbach's alpha at the level of 0.859.

The identified factors in Tab. 2 had eigenvalue above 1 and explained 86.59 percent of variable's variance in total.

We further used a Structural Equation Modelling (SEM) approach to validate the research model. This method was chosen for its ability to test relationships between constructs comprised from multiple items (research questions) (Weinberg & Abramovitz, 2002) and the capability of testing the measurement

characteristics of constructs (Hair & Black, 2010). The SEM approach offers several advantages over the conventional regression approach by providing greater facility in handling multicollinearity, inherent errors in measuring independent variables and estimation of parameters (Hair & Black, 2010). Also this method is widely used in studies on similar topic (e.g. Suh & Han (2002), Yousafzai et al. (2009), Nguyen et al. (2014)). AMOS extension of IBM SPSS Statistics software was used to perform further analysis. We used correlation matrix as input matrix to simplify interpretation of results. In the SEM approach, the validity of factors can be assessed by multiple fit indices. Tab. 4 shows overall fit indices of our research model.

All overall model fit indices surpassed the recommended values, therefore our research model has good representation of relationships between factors.

Tab. 4: Overall model fit indices of our model

	Score	Recommended value
Chi-square	43.015	
Degree of freedom	17	
Chi-square/degree of freedom	2.532	<3.00
Goodness-of-fit index (GFI)	0.827	>0.80
Adjusted goodness-of-fit index (AGFI)	0.894	>0.80
Root mean square residual (RMSR)	0.071	<0.08
Normed fit index (NFI)	0.924	>0.90
Non-normed fit index (NNFI)	0.922	>0.90
Comparative fit index (CFI)	0.951	>0.90

Source: own

Note: recommended values from Hair and Black (2010).

Tab. 5: Overall model fit indices of our model

Construct	Composite reliability	Variance extracted
Recommended value	>0.8	>0.5
Perceived security	0.864	0.680
Trust	0.937	0.861
Attitude toward using	0.901	0.769
Behavioral intention to use	0.879	0.793
Actual use	0.826	0.597

Source: own

Note: recommended values from Suh and Han (2002).

The validity of measurement can be assessed by composite reliability and the variance extracted measure. Composite reliability depicts the degree to which the items indicate the common construct. The variance extracted measure reflects the amount of variance in the items captured by the construct. Composite reliability and variance extracted by our research model constructs are presented at Tab. 5.

All composite reliabilities were above recommended value of 0.8 and all variance extracted measures were above recommended level of 0.5. This results demonstrate overall validity of constructs or factors used. Further we examined the estimated coefficients of the relationships between constructs, which would validate the hypotheses from our research model.

Firstly, hypothesis H1 examined the impact of perceived security on trust was investigated. It was observed that perceived security had a significant impact on trust in electronic banking ($\beta = 0.793$, $t = 11.224$, $P < 0.01$). The model explained 72.4% of the variance in trust ($R^2 = 0.724$). Our results support hypothesis H1, so perceived security has a significant positive impact on customer's trust in electronic banking.

Further, the relationship between perceived security and customer's attitude toward using electronic banking was expressed. Statistically significant ($\beta = 0.453$, $t = 8.957$, $P < 0.01$) influence of security perceived by the customer on attitude toward using was detected. The results support hypothesis H2 stating that perceived security has a significant positive impact on customer's attitude toward using

electronic banking. Also, the influence of trust on attitude toward using was examined and found to be statistically significant ($\beta = 0.357$, $t = 5.742$, $P < 0.01$). This result supported hypothesis H3 and thus customer's trust has significant positive impact on customer's attitude toward using electronic banking. These two factors explained 59.2% of the variance ($R^2 = 0.592$) in attitude toward using electronic banking.

Further, the investigation of the impact of trust and attitude toward using electronic banking on customer's behavioral intention was conducted. The influence of trust on behavioral intention to use electronic banking was detected as significant ($\beta = 0.471$, $t = 7.867$, $P < 0.01$). The impact of attitude toward using on behavioral intention to use electronic banking was also significant ($\beta = 0.385$, $t = 6.027$, $P < 0.01$). These results support our hypotheses H4 and H5 and hence trust and attitude toward using electronic banking have significant positive influence on customer's behavioral intention to use electronic banking. These factors explained 63.7% of variance ($R^2 = 0.637$) in customer's behavioral intention. Finally, the influence of customer's behavioral intention to use banking on its actual use was examined and it was found significant ($\beta = 0.359$, $t = 4.911$, $P < 0.01$). The results support hypothesis H6 and customer's behavioral intention to use electronic banking has a significant positive impact on customer's actual use of electronic banking explaining 21% of variance ($R^2 = 0.209$). Overview of impacts detected by model are summarized in following Tab. 6.

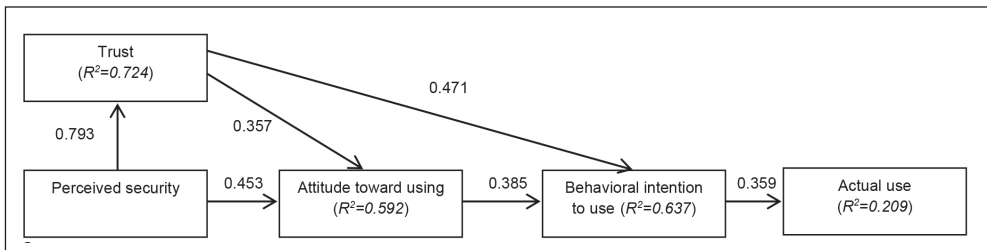
Our research model with relationships and values of coefficients displayed is presented

Tab. 6: Influence between constructs detected by model

Dependent construct	Independent construct	β	t	P
Trust	Perceived security	0.793*	11.224	0.000
Attitude toward using	Perceived security	0.453*	8.957	0.001
Attitude toward using	Trust	0.357*	5.742	0.002
Behavioral intention to use	Trust	0.471*	7.867	0.001
Behavioral intention to use	Attitude toward using	0.385*	6.027	0.001
Actual use	Behavioral intention to use	0.359*	4.911	0.003

Source: own

Note: *Significant at $\alpha = 0.01$; β – measures the prediction of the dependent construct from independent i.e. represents relation between constructs, t -value measures the size of the difference relative to the variation in sample data i.e. shows whether a coefficient is significantly different from zero., P -value tests the null hypothesis that the coefficient is equal to zero i.e. probability that construct has no effect.

Fig. 2: Structural model fit

Source: own

Tab. 7: Indirect and total effects on attitude, behavioral intention and actual use of e-banking

Independent construct	Attitude toward using e-banking		Behavioral intention to use e-banking		Actual use of e-banking	
	Indirect	Total	Indirect	Total	Indirect	Total
Perceived security	0.184* (5.412)	0.453* (8.957)	0.201* (6.015)	0.201* (6.015)	0.091* (4.701)	0.091* (4.701)
Trust		0.357* (5.742)	0.179* (4.431)	0.471* (7.867)	0.134* (3.954)	0.134* (3.954)
Attitude toward using				0.385* (6.027)	0.095* (4.162)	0.095* (4.162)
Behavioral intention to use e-banking						0.359* (4.911)

Source: own

Note: *significant at $\alpha = 0.05$. t -values are in parentheses

in the Fig. 2. The coefficients represent measure of detected influences between suggested factors from confirmatory factor analysis. The coefficients of determination (R^2) for each endogenous construct are also shown in the figure.

Suh and Han (2002) in their study expressed indirect effect of trust on attitude toward using, behavioral intention to use and actual use of electronic banking. In our research, besides trust also perceived security and its effects on attitude toward using, behavioral intention to use and actual use were investigated. Our results show that both perceived security and trust have a significant effect on attitude toward using and behavioral intention to use which has direct effect on actual use and hence trust and perceived security have an indirect effect also on adoption of electronic banking. So additional step of SEM approach analysis was performed to identify indirect effects and total effects on attitude, behavioral intention and actual use of e-banking. Its results are illustrated in Tab. 7.

All factors had significant effects on attitude toward using, behavioral intention to use and actual use of electronic banking at $\alpha = 0.05$.

Conclusions

In this study, we proposed research model based on adjusted TAM indicating a relationship between perceived security, trust, attitude toward using electronic banking and behavioral intention to use electronic banking. Perceived security was found a very important factor of trust building in the area of electronic banking and significant factor influencing attitude toward using it.

Trust was detected to have a significant influence on attitude toward using and behavioral intention to use electronic banking by customers. Further attitude toward using e-banking had a significant effect on behavioral intention to use electronic banking and subsequently the actual use of electronic banking by bank customers was significantly influenced by behavioral intention to use electronic banking by bank customers. These results correspond with results of multiple studies, e.g. Polatoglu and Ekin (2001), Black et al. (2002), Grabner-Kräuter and Faullant (2008) or Nguyen et al. (2014).

Security and trust have a significant effect on attitude toward using and behavioral intention to use according to our results and

therefore influence the process of adoption of electronic banking by customers. Suh and Han (2002) already showed that trust indirectly influences acceptance of electronic banking. Our research confirmed the influence of trust on electronic banking adoption. In addition, our study also included perceived security into research model and confirmed its influence on electronic banking adoption by potential users.

Our results suggest to the bank managers at Slovak retail banking market to build trust in electronic banking by increasing its security perceived by potential users. Banks should communicate every positive change in security standards of their electronic banking forms to improve confidence of clients when using it. This will promote adoption of electronic banking according to our results. Increased actual use of electronic banking might help to decrease labor consumption at brick-and-mortar branches of banks, while multiple time-consuming services (e.g. typing of bank transfers, creating account statements etc.) are advanced to clients themselves in electronic banking.

Furthermore, the novelty of our research is also in applying research of security and trust influencing electronic banking adoption in Slovakia, contributing to knowledge of conditions at Slovak retail banking market and customers. Our model might be used also in other fields of e-services (like e-commerce) adoption in both, Slovak and international conditions.

Our results are significant, but still have limitations of validity. The ideal representativeness of our sample was not achieved, affecting the generalization of results. A number of respondents in our sample (194) was also relatively lower than in multiple other studies (e.g. Nguyen et al. (2014), Suh and Han (2002) etc.) restricting the validity of our results.

Many studies using Technology Acceptance Model modified original TAM to investigate various factors affecting acceptance of given technology creating new versions of TAM. Also, our model can be further modified and extended by new factors to investigate their effects. Furthermore, our future research might be conducted in the sector of small and medium-sized enterprises.

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INFLUENCE OF SECURITY AND TRUST ON ELECTRONIC BANKING ADOPTION IN SLOVAKIA

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Dynamical development of information and communication technologies has been one of the major factors of economic growth in recent decades. Electronic commerce allowed selling and buying of products or services to many times larger number of customers than ever before. Electronic banking as a part of electronic commerce is nowadays very important distribution channel for banking services. With the intense development of information and communication technologies also several forms of electronic banking arose and also vanished. Especially mobile banking recorded turbulent development in recent decades. Mobile banking in smart devices together with internet banking are now the main forms asserting in the electronic banking market. Competition among banks in the field of electronic banking pushes them to improve their electronic banking services to sustain or increase their market share. The important issue is trust of bank customers in the form of electronic banking used. Banks' customers also sensitively perceive security of electronic banking forms used by them.

In this article, we mainly investigated the influence of security and trust on electronic banking adoption. Research model based on technology acceptance model was developed and research hypotheses based on this research model were constructed. Data for hypotheses verification was gathered by online survey with 211 answering respondents. The influence of perceived security, trust, attitude toward using and behavioral intention to use electronic banking in Slovakia was examined using factor analysis. The results reveal that all factors investigated have statistically significant direct and indirect effects on electronic banking adoption by users on the Slovak retail banking market.

Key Words: Trust, security, technology acceptance model, electronic banking, internet banking, mobile banking.

JEL Classification: G29, L86.

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EVALUATION AND COMPARISON OF B2C E-COMMERCE INTENSITY IN EU MEMBER STATES

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Introduction

Electronic commerce (e-commerce), as part of e-business, is still undergoing dynamic development and significantly affects the economic reality in EU member states. E-commerce relates to the development of information and communications technologies (ICT). It has gone through development stages (detailed below), and since 2010 (Schneider, 2015) has been in its current maturity stage in developed countries and the European Union (EU) (Qin et al., 2014, according to whom the maturity stage of e-commerce dates back to 2004). This paper aims to propose a tool for assessing and comparing the intensity of B2C e-commerce in EU member states. Regarding this goal, the authors deal with the following research questions: What is the position of individual EU member states in terms of the intensity of B2C e-commerce? Is there a strong correlation between B2C e-commerce intensity and the level of economic development of EU member states? Is there a correlation between B2C e-commerce intensity and the length of the countries' EU membership?

In the first section of this paper, the terms e-commerce and B2C e-commerce, as well as the developmental stages of B2C e-commerce are defined. These definitions are followed by an overview of the indicators used in measuring B2C e-commerce intensity in an economy and the so-called B2C e-commerce indices, which in recent years, have been created to capture an aggregate view of various aspects of B2C e-commerce. The empirical section of our study introduces criteria for assessing the intensity of B2C e-commerce in EU member states and the procedure for creating the B2C e-commerce intensity index, which will allow a comprehensive comparison of B2C e-commerce in EU member states based on the selected criteria. Method TOPSIS was used in

designing the proposed index. The assessment criteria reflect the relevant publicly available data on the B2C e-commerce intensity in EU member states, which are quantified in the form of specific indicators. The output of the empirical section consists list of EU member states in terms of B2C e-commerce intensity, which consider all the selected assessment criteria. The application of the results of this study contributes to the development of the theory of e-commerce, as well as represents a practical contribution. Determining and comparing the positions of EU member states in terms of B2C e-commerce intensity allows us to identify countries that do not sufficiently utilize the potential of B2C e-commerce to increase their prosperity and achieve consumer utility. In the conclusion of this paper, the current research limitations are discussed along with a suggestion for further research.

1. Theoretical Background of e-Commerce

Over the course of its existence, e-commerce has become a phenomenon that has been defined in many ways (e.g. Ho et al., 2007; Qin et al., 2014; Reynolds, 2010; Schneider, 2015; Yadav et al., 2013). The development of ICT and its implementation in the sphere of e-commerce has led to more specific definitions. The fast growth of e-commerce has created the need to adopt a uniform and internationally accepted definition for statistical monitoring and measuring this new phenomenon in commerce. The analyses of scientific research into e-commerce (Ngai & Wat, 2001; Wang & Chen, 2010) suggest that the first studies (e.g. Treese & Stewart, 1998) were published in specialized journals in the early 1990s. The rapid growth of electronic transactions in the second half of the 1990s and the need for statistical measuring required a precise, and for reasons

of international comparison, an internationally acceptable definition of the term “electronic commerce” and its distinction from “electronic business” (e-business).

1.1 Defining e-Commerce

In 2009, the Organisation for Economic Co-operation and Development (OECD) published a revised definition, which is still used in OECD documents today: “E-commerce transactions are the sale or purchase of goods or services conducted over computer networks by methods specifically designed for the purpose of receiving or placing of orders; payment and delivery are not considered. Transactions can occur between enterprises, households, individuals, governments and other organisations. The definition includes orders made through web pages, extranet or EDI and excludes orders by telephone calls, fax or manually typed e-mail.” (OECD, 2013b, p. 226). A similar definition of electronic commerce is that by Eurostat (2015). However, scientific sources indicate other definitions of e-commerce and define e-commerce in a narrower and broader sense.

Defining electronic commerce in the narrow and broad sense relates to activities that are included in e-commerce. For example, Lee (2012) states that, in the narrow sense of the phrase, e-commerce is the process of buying, selling, or exchanging products, services and information via telecommunications networks. In the broader sense, e-commerce also includes, apart from buying and selling products and services, servicing customers, collaborating with business partners, and conducting electronic transactions within an organization.

The narrow definition of e-commerce, per Turban et al. (2015, p. 7), means “using the Internet and intranets to purchase, sell, transport, or trade data, goods, or services.” A broader concept is presented by Stallmann and Wegner (2015, p. 6), according to whom e-commerce is “the sum of all digital commercial transactions between economic entities, conducted through the Internet, most of it being the sale of goods and services.”

Issues with defining electronic commerce do not include only the varying scope of definitions used, but also the understanding of the relationship between e-commerce and e-business. In 2003, the OECD defined

electronic business as “(automated) business processes (both intra- and inter-company) over computer mediated networks” (OECD, 2003, p. 4). This definition was also adopted by the EU (European Commission, 2010, p. 174). Using this definition, electronic business includes a range of activities, including electronic commerce. However, according to some professional sources, the definition of e-commerce is virtually identical to that of e-business (e.g., Xu & Quaddus, 2010; Schneider, 2015).

The non-uniform approach to understanding electronic commerce also manifests itself in Czech professional literature. Machková (2009) uses the terms e-commerce and e-business synonymously, saying: “Typical of the second half of the 1990s was the growth in electronic commerce (e-commerce, e-business).” Suchánek (2012) and Machková, Černošlávková, Sato, Malý and Sedláček (2014), on the other hand, consistently distinguish between the terms e-commerce and e-business. In our study, we use the term e-commerce per the 2009 OECD definition (see above).

1.2 Classification of e-Commerce

E-commerce is classified based on various criteria. The basic categories of classification of the entities involved include business-to-business (B2B) and B2C. Interactions between consumers mediated by a third party fall under the consumer-to-consumer (C2C) category; however, direct interaction between consumers, e.g., on social media networks, without the use of a third party, are referred to as peer-to-peer (P2P). A category that grew in significance later was consumer-to-business (C2B), in which the impetus comes from consumers who place their demand, for example, on the Internet. The number of e-commerce categories has increased with the inclusion of government institutions that provide their services to other entities online, which has given rise to the categories G2B, G2C, G2G, B2G, and C2G (Waghmare, 2012). The inclusion of employees has led to the creation of other categories, e.g., B2E (Turban et al., 2015) or E2E, formed by employees using a company network – intranet (Chaffey, 2015). According to OECD data, approximately 90% of the value of e-commerce comprises B2B transactions and 10% of those transactions are of the B2C, B2G, and

C2C variety (OECD, 2013a, p. 4). Further classification is, for example, based on the openness of the medium used (OECD, 1999b) or the degree of use of ICT (e.g., Suchánek, 2012; Tassabehji, 2003; Turban et al., 2015). From the geographical point of view, there is a distinction between local, national, cross-border (Gomez Herrera et al., 2014) and global e-commerce.

1.3 Development of B2C e-Commerce

Since the mid-1990s, B2C e-commerce has seen rapid development. The significant milestones in e-commerce include the launch of the first e-shops in 1995 (Amazon, eBay), the so-called dotcom crash in 2000, and the huge increase in the sale of smartphones in 2013.

For example, Schneider (2015) defines B2C e-commerce in context with the development of online business in the USA and views it as a long-term process divided into three stages. The first stage was the period between 1995 and 2003; the second stage lasted between 2004 and 2009, and the third stage has been in progress since 2010. The milestones between the individual stages are represented by the beginning of the rapid development of e-shops in the USA in 1995, termination of the second wave of investments in e-commerce and e-business in the USA in 2003 following the dotcom crash, and the parallel appearance of new factors in 2010, which had a significant impact on further development of B2C e-commerce.

Similarly, Qin et al. (2014) characterize the development of e-commerce during the period from 1995 to 2000 as a Phase of e-commerce based on the Internet. During this phase, B2C e-commerce went through the germination stage (1995-1997) and the innovation stage (1997-2000).

The period after 2000 is referred to by the authors as the stage of e-concept-based e-commerce, during which e-commerce experienced a crisis following the dotcom crash. In 2004, e-commerce entered its maturity stage, which has lasted to this day. Further, they claim that after 2004 e-commerce ceased to be a phenomenon confined to the USA and became a business model that has spread to an increasing number of countries.

In the most recent period, since 2010 (Schneider, 2015), several new e-commerce models have rapidly become widespread:

mobile commerce (m-commerce), social commerce (s-commerce), and the electronic sale of mobile apps, following the "App Store" model. The massive increase in the number of users of the social network Facebook and its use for B2C e-commerce has given rise to the term f-commerce (Turban et al., 2015, p. 13). Social networks also represent a new phenomenon in e-commerce (Khan & Sagar, 2015).

2. Measuring B2C e-Commerce

Starting in 1999, an OECD task force dealt intensively with questions of how to measure e-commerce. Their task was to suggest an internationally accepted definition of electronic commerce and a set of indicators for measuring and comparing internationally electronic commerce and its economic and social impacts (OECD, 1999a). The basis for identifying e-commerce indicators was the S-curve, representing three stages in the life cycle of e-commerce (e-commerce readiness, e-commerce intensity, and e-commerce impact) and its measurement priorities. A different type of information is given priority in each stage of the life cycle of e-commerce. Some research studies (e.g., Chaffey, 2015; Gomez Herrera et al., 2014; Ho et al., 2007; Kartiwi & MacGregor, 2007; Kshetri, 2007; Savrul et al., 2014; Sing et al., 2001; Spremic & Hlupic, 2007; Zhu et al., 2003) search for factors supporting the development of B2C e-commerce or, on the other hand, representing obstacles in its development, and thus contribute to the development of the methodology of measuring e-commerce.

In this study, we focus on the second stage of B2C e-commerce, e-commerce intensity, which comes after e-commerce readiness, and is followed by the third stage, focused on the future, e-commerce impact. In the second stage, that is, e-commerce maturity, the intensity of the use of e-commerce is tracked, and the current question is: What effect does e-commerce have on the economy and society? (OECD, 1999a; OECD, 2011)

2.1 Measuring B2C e-Commerce Intensity

The use of B2C e-commerce includes the intensity and growth of B2C e-commerce, the nature of transactions, the sellers' activities, the consumers' behaviour, and other aspects (see Tab. 1). Statistical tracking of the aspects listed

Tab. 1: Indicators of B2C e-commerce intensity and selected data sources

Indicators of B2C e-commerce intensity	Selected data sources (data published with varying periodicity)
Companies selling online. Individuals shopping online. Turnover of B2C e-commerce. Average value of an online order. Frequency of online shopping. Structure of goods and services sold online. Payment methods used. Ways of delivering products.	The Czech Statistical Office The Eurostat database Ecommerce Europe. Worldpay. Global payments report. Commercial and research organizations
Domestic and cross-border online purchases, sales.	The Czech Statistical Office Eurostat database

Source: own

above makes it possible to identify sectors, industries, and whole economies that do or do not use the possibilities of B2C e-commerce.

Individual indicators measure only selected aspects of B2C e-commerce. For a comprehensive assessment of B2C e-commerce, the not only the choice of individual indicators, but also their aggregation into an overall indicator, which can express a global view of B2C e-commerce based on the evaluation criteria, is important. The aggregate indicators of B2C e-commerce (referred to as indices in foreign sources) are relatively new. There are currently several B2C e-commerce indicators, each of which focuses on tracking B2C e-commerce from a different point of view, however, none of them indicates the intensity of B2C e-commerce and its use.

Since 2012, the ATKearney consulting company has been publishing "The Global Retail E-commerce Index" (ATKearney, 2013), which expresses the attractiveness of economies for investments in B2C e-commerce on a 100-point scale. In 2014, The Economist Intelligence Unit published "The G20 e-Trade Readiness Index" (The Economist Intelligence Unit, 2014), which expresses the conditions for engagement in cross-border B2C e-commerce in G20 countries. It is evident that it does not comprehensively compare the use of e-commerce in the area that we are concerned. Since 2015, the "The UNCTAD B2C E-commerce Index" (UNCTAD, 2016) has been published, which compares economies based on four criteria: the share of individuals using the Internet, the number of secure Internet servers per 1 million people, the share of individuals with a credit card, and the postal reliability score. This index allows us to compare

economies in terms of their readiness for B2C e-commerce and to identify their strengths and weaknesses in this area. Apart from the indices listed, there is also "The Readiness Index Forrester," put forth by the Forrester Company (2016). This index assesses the conditions for the development of B2C e-commerce based on 25 indicators. It is available only for clients of Forrester, and information regarding its structure or values is not publicly accessible.

2.2 Issues with Measuring B2C e-Commerce

Although B2C e-commerce has been around for more than 20 years, measuring and statistically tracking it is still problematic. In the early stage of its existence, B2C e-commerce was difficult to measure and the statistical data obtained wasn't comparable, as there was neither a uniform definition of B2C e-commerce nor any methodology of how to measure it (cf. Hawk, 2004). Introducing an internationally acceptable definition of B2C e-commerce and development of a methodology to measure it have contributed to resolving the initial problems. However, the problem with the objectivity and accessibility of data on B2C e-commerce transactions provided by business entities continues to this day (mainly regarding revenues from online sales, the average value of an online purchase, the number of orders, the average value of an order, and others). However, the fewest problems concern the availability of data regarding the readiness of the economy for B2C e-commerce.

Problems with measuring B2C e-commerce transactions are due to several factors, which include: a large number of companies engaged

in B2C e-commerce; the fact that a number of companies engage in both electronic and traditional (brick-and-mortar) sales, yet their records do not make a distinction between the two sales methods; the tight competition in the field of B2C e-commerce, which leads to the concealment or distortion of data; the dynamic development of ICT and the resulting new trends in B2C e-commerce; and lastly, the ongoing methodological issues with measuring B2C e-commerce.

A large obstacle in measuring B2C e-commerce objectively is competition, which was mentioned by the OECD in the 1990s (OECD, 1997) as an obstacle in gaining business data for measuring B2C e-commerce, but it is mentioned by other professional sources as well. Gomez Herrera et al. (2014) point out that data on B2C e-commerce are generated mainly by private companies involved in online e-commerce; however, commercial interests stop them from publishing this data. Cardona et al. (2015) and similarly Duch-Brown and Martens (2015) point to the problem with statistical data on e-commerce in the EU. The problem with data availability also applies to the Czech economy (e.g., Hlavenka, 2011).

Measuring B2C e-commerce is also affected by methodological problems, e.g., different procedures in data collection, in measuring cross-border B2C e-commerce, or in measuring B2C e-commerce in multinational corporations (OECD, 2015). Some of these problems can be eliminated by international standards for tracking and measuring B2C e-commerce. An example of such a standard is the Global Online Measurement Standard for E-commerce (GOMSEC), adhered to by the international association for B2C e-commerce, Ecommerce Europe, including its national associations, and other cooperating organizations (Ecommerce Europe, 2016). Among other things, GOMSEC has defined the categories of products and services included in B2C e-commerce (e.g., Media and entertainment, Fashion, Toys, Electronics, and others), and determined which items will be excluded from reports on B2C e-commerce (e.g., the sale of motor vehicles, real estate, stocks and bonds, and others).

Since January 1, 2008, the Czech Statistical Office has been using the NACE international classification, which has considered technological development and structural changes in the economy, and made it possible

to compare the statistical data from the Czech Republic with those of the EU as well as globally (Czech Statistical Office, 2008). In recent years, data on the development of B2C e-commerce has also been published by Eurostat in connection with the goals of the Europe 2020 strategy. The OECD publishes statistical data for all e-commerce categories without the distinction of B2C e-commerce. Information on selected B2C e-commerce indicators, without an extensive time series, is published on a limited scale by various organizations (e.g., Ecommerce Foundation, Statista.com, Forrester, Boston Consulting Group), which provide the full versions of documents only to their members. In the Czech Republic, apart from the Czech Statistical Office, e-commerce is monitored mainly by e-commerce consulting companies APEK and ACOMWARE.

3. Comparison of EU Member States in Terms of B2C e-Commerce Intensity

The goal of this study is to propose a tool for assessing and comparing the intensity of B2C e-commerce in EU member states and, in relation to this, answer the following research questions: What is the position of individual EU member states in terms of B2C e-commerce intensity? Is there a strong correlation between B2C e-commerce intensity and the level of economic development of EU member states? Is there a correlation between B2C e-commerce intensity and the length of the countries' EU membership?

3.1 Method

To assess and compare B2C e-commerce intensity in EU member states, method of multi-criteria evaluation of alternatives, that fall into the category of multi-criteria decision analysis methods, was chosen. Methods of multi-criteria evaluation of alternatives allow the aggregation of partial evaluation based on selected criteria into an aggregate assessment, which considers all the assessment criteria. The multi-criteria evaluation of the alternatives used results in the compilation of an order of alternatives (EU member states) from "the best" to "the worst" alternative (Kunešová, 2016).

Multi-criteria decision analysis is both an approach and a set of techniques, with the aim of providing an overall ordering of options,

from the most preferred to the least preferred option (Dinçer, 2011). Multi-criteria decision problems are characterized by a set of decision alternatives, a set of evaluation criteria, and a number of links between the criteria and the alternatives. The decision-maker inputs information on the alternatives and evaluation criteria, which helps to formulate the multi-criteria model. Multi-criteria evaluation of alternatives makes it possible to assess a finite number of alternatives based on the finite number of criteria. The number of alternatives can range from several to thousands of alternatives. The alternatives are “screened, prioritized, selected and/or ranked” (Yoon & Hwang, 1995, p. 2).

Crucial to the evaluation of alternatives is the choice of evaluation criteria, specifically, attributes according to which the alternatives are assessed. Yoon and Hwang (1995, p. 2) state that the number of evaluation criteria depends on the nature of the problem. The criteria must be independent, should cover all the evaluation attributes, should not be too many in number to avoid making the problem chaotic (Šubrt et al., 2015), and must be quantifiable. To resolve problems of multi-criteria evaluation of alternatives, it is important whether and how certain criteria are given preference.

In the study, the preference of criteria is expressed by criteria weights. Generally, criteria weights are values in the interval $(0, 1)$, which express the relative importance of individual criteria in comparison with others. The sum of all criteria weights is equal to 1. The greater the importance of a criterion, the bigger its weight. The relative importance of an individual criterion is expressed by the criteria weight vector (Fiala, 2013).

This study uses the point method, which is based on the supposition that the decision-maker is able, not only to determine the order of criteria based on their importance, but also quantify the importance of each criterion by a number of points on a pre-selected scale. This method is suitable even for evaluation by multiple experts (Šubrt et al., 2015). The assigning of points to criteria by a larger number of experts (e.g., through questionnaires) increases the level of objectivity in determining criteria weights. The calculation of criteria weights (the normalization of weight vector values) from the point evaluation was done using the following formula:

$$v_i = \frac{b_j}{\sum_{j=1}^n b_j} \tag{1}$$

where b_j is the sum of all points assigned by the individual experts to criterion j , and $j = 1, 2, \dots, n$.

In our study we used the TOPSIS method (the Technique for Order of Preference by Similarity to Ideal Solution – TOPSIS), which was developed by Hwang and Yoon (1981) and represents methods based on the principle of minimization of the distance from the ideal solution and maximization of the distance from the negative-ideal solution. The TOPSIS method allows us to determine the order of all the alternative solutions. The required input data include cardinal information (the actual values of the alternatives based on individual criteria in different units) and individual criteria weights. The TOPSIS method evaluates the decision matrix which refers to p alternatives which are evaluated in terms of k criteria. The TOPSIS method consists of the following six steps (for example Dinçer, 2011; Fiala, 2013; Šubrt et al., 2015; Triantaphyllou et al., 1998).

Step 1: Construct the normalized decision matrix

This process tries to convert the various attribute dimensions into non-dimensional attributes. For the normalization of input values, the TOPSIS method uses an approach based on the Euclidean distance (formula 2). The element r_{ij} of the normalized decision matrix R can be calculated as follows:

$$r_{ij} = \frac{y_{ij}}{[\sum_{i=1}^p (y_{ij})^2]^{1/2}} \tag{2}$$

where y_{ij} is the input value of the i alternative assessed by the j criterion; p is the number of alternatives, $i = 1, 2, \dots, p$, $j = 1, 2, \dots, k$.

Step 2: Construct the weighted normalized decision matrix

The weighted normalized criteria matrix $W = (w_{ij})$ is based on the normalized criteria matrix $R = (r_{ij})$ in such a way that each element r_{ij} of the R matrix is multiplied by the appropriate weight v_j (formula 3):

$$w_{ij} = v_j r_{ij} \tag{3}$$

where v_j is the weight of criterion j , and r_{ij} are the matrix elements of the normalized criteria matrix R .

Step 3: Determine the ideal and the negative-ideal solutions

The elements of the matrix W determine the ideal solution H_j with criteria values (H_1, H_2, \dots, H_k) and the negative-ideal solution D_j with criteria values (D_1, D_2, \dots, D_k) , given the values in the weighted criteria matrix W . The ideal solution delivers the best values based on each criterion; the negative-ideal solution delivers the worst values based on each criterion.

Step 4: Calculate the separation distances of each alternative to the ideal solution and the negative-ideal solution

$$d_i^+ = \sqrt{\sum_{j=1}^k (w_{ij} - H_j)^2}, i = 1, 2, \dots, p \quad (4)$$

where d_i^+ is the separation (in the Euclidean sense) of each alternative from the ideal solution.

$$d_i^- = \sqrt{\sum_{j=1}^k (w_{ij} - D_j)^2}, i = 1, 2, \dots, p \quad (5)$$

where d_i^- is the separation (in the Euclidean sense) of each alternative from the non-ideal solution.

Step 5: Calculate the relative distances of each alternative from the negative-ideal solution

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-}, i = 1, 2, \dots, p \quad (6)$$

where c_i is the indicator of the relative distance of an alternative from the negative-ideal solution.

Step 6: Rank the preference order

Rank the alternatives, sorting them by the value of the indicator c_i , in decreasing order. The best alternative is the one that has the longest distance from the negative-ideal solution.

3.2 Criteria for Evaluating B2C e-Commerce Intensity

For the purpose of comparing EU member states in terms of B2C e-commerce intensity, two criteria were selected that relate to the engagement of consumers and sellers in B2C e-commerce, and one criterion that relate to commercial transactions within B2C e-commerce (relative size of the turnover of B2C e-commerce). Following research into the potential sources of data on the use of B2C e-commerce, the Eurostat database (2017) was chosen to provide statistical data for these criteria. Tab. 2 details the selected criteria, their quantification in the form of a specific indicator, and the data source. The study uses the latest data from the sources listed.

All the criteria in Tab. 2 are maximization criteria, i.e., the higher the value of the particular criterion, the better the result of the country in the area that is being evaluated. In connection with the above-mentioned criteria and selected method of multi-criteria evaluation of alternatives, the authors have suggested the following hypotheses:

H1: There is a strong correlation between the order of EU member states in terms of B2C e-commerce intensity and their order in terms of their economic development.

Tab. 2: Criteria for evaluating B2C e-commerce intensity

Criterion No.	Criterion	Quantification of the criterion	Data source
1	Internet purchases by individuals	The percentage of individuals (aged 16-74) who made last online purchase in the past 12 months, data obtained in 2016	Eurostat (2017)
2	Enterprises selling via a website - B2C	The share of enterprises that sold online on the B2C market in 2016 (% of enterprises excluding those in the financial sector)	Eurostat (2017)
3	Relative size of the enterprises' turnover from web sales - B2C	The share of the turnover from web sales – B2C in the total turnover of enterprises in 2016 (in %)	Eurostat (2017)

Source: own

Tab. 3: The decision matrix for evaluating B2C e-commerce intensity

Criterion No.	1	2	3
Type of criterion	max.	max.	max.
Period	2016	2016	2016
Alternative / unit	%	%	%
Austria	58	12	1
Belgium	57	17	3
Bulgaria	17	6	0 ⁽ⁿ⁾
Croatia	33	11	1
Cyprus	29	12	1
Czech Republic	47	17	2
Denmark	82	15	2
Estonia	56	12	2
Finland*	67	13	2
France	66	12	2
Germany	74	18	1
Greece	31	10	3
Hungary	39	11	1
Ireland	59	22	12
Italy*	29	7	0 ⁽ⁿ⁾
Latvia	44	7	1
Lithuania	33	15	2
Luxembourg**	78	8	3
Malta	48	18	1
Netherlands	74	14	3
Poland	42	8	1
Portugal	31	10	2
Romania	12	4	1
Slovakia	56	9	1
Slovenia	40	12	1
Spain	44	11	2
Sweden	76	15	3
United Kingdom	83	15	4

Source: Eurostat (2017) and authors' own elaboration

Note: (n) not significant

* For countries marked with an asterisk, data for criterion 3 for the year 2016 were not available and the last known data were used instead (Finland: 2015, Italy: 2014).

** In the case of Luxembourg, there were no data for criterion 3 available for any year (according to Eurostat, data for Luxembourg are confidential). The missing value of criterion 3 for Luxembourg was set as the average of the values for criterion 3 of Belgium and the Netherlands (countries of the Benelux).

H2: The highest B2C e-commerce intensity can be found in countries that have been members of the EU the longest.

H3: The lowest B2C e-commerce intensity can be found in new EU member states with low economic development.

The input data contained in Tab. 3 shows that none of the alternatives assessed are the best or worst in all criteria. Using the point method, a weight was assigned to each criterion, based on a questionnaire survey conducted among experts on B2C e-commerce. The criteria weights are calculated according to formula (1). The points assigned by the experts and the calculation of criteria weights are shown in Tab. 4. The experts include representatives of three Czech universities, who have been engaging with the topic of online marketing and e-commerce for a long term (five years experience minimum), representatives of major companies, such as Google Czech Republic, ACOMWARE, MarketUP, and representatives of regional professional agencies that administer a number of e-shops, such as ANT Studio and ProSEO Media, and finally representatives of e-shop owners. These experts make up a representative sample for the purpose of determining the weights of selected B2C e-commerce criteria.

The following text presents the output of the selected method of multi-criteria evaluation of alternatives that was applied to the selected evaluation criteria and their preference given by the criteria weights. All the calculations were performed in MS Excel.

4. The Order of EU Member States Determined by the TOPSIS Method

The decision matrix for evaluating B2C e-commerce intensity (Tab. 3) was converted according to the formula (2) to a normalized criteria matrix (Tab. 5).

Based on the normalized criteria matrix in Tab. 5 and the criteria weights (Tab. 4), the weighted criteria matrix was constructed according to the formula (3). Using its elements, the hypothetical negative-ideal solution D_j was determined with the criteria values (D_1, D_2, \dots, D_k) and the hypothetical ideal solution H_j with the criteria values (H_1, H_2, \dots, H_k) with respect to the values in the weighted criteria matrix. Using the formulas (4) and (5) for calculating the distance of individual alternatives from the ideal and negative-ideal solutions, the coefficient d_i^+ was determined, which expresses the distance of the alternative i from the ideal solution, and the coefficient d_i^- , which expresses the distance of the alternative i from the negative-ideal

Tab. 4: Determining criteria weights for evaluating B2C e-commerce intensity by the point method

Experts	Criteria		
	1	2	3
Expert 1	9	8	8
Expert 2	5	8	5
Expert 3	7	8	6
Expert 4	10	7	10
Expert 5	7	6	9
Expert 6	10	9	8
Expert 7	10	10	8
Expert 8	9	5	10
Expert 9	4	3	3
Subtotal	71	64	67
Total No. of points assigned: 202			
Criterion weight	0.351	0.317	0.332

Source: own

Tab. 5: Normalized criteria matrix according to the TOPSIS method

Criterion No.	1	2	3
Austria	0.2036	0.1766	0.0635
Belgium	0.2001	0.2502	0.1905
Bulgaria	0.0597	0.0883	0.0000
Croatia	0.1159	0.1619	0.0635
Cyprus	0.1018	0.1766	0.0635
Czech Republic	0.1650	0.2502	0.1270
Denmark	0.2879	0.2208	0.1270
Estonia	0.1966	0.1766	0.1270
Finland	0.2352	0.1913	0.1270
France	0.2317	0.1766	0.1270
Germany	0.2598	0.2649	0.0635
Greece	0.1088	0.1472	0.1905
Hungary	0.1369	0.1619	0.0635
Ireland	0.2072	0.3238	0.7620
Italy	0.1018	0.1030	0.0000
Latvia	0.1545	0.1030	0.0635
Lithuania	0.1159	0.2208	0.1270
Luxembourg	0.2739	0.1177	0.1905
Malta	0.1685	0.2649	0.0635
Netherlands	0.2598	0.2060	0.1905
Poland	0.1475	0.1177	0.0635
Portugal	0.1088	0.1472	0.1270
Romania	0.0421	0.0589	0.0635
Slovakia	0.1966	0.1325	0.0635
Slovenia	0.1404	0.1766	0.0635
Spain	0.1545	0.1619	0.1270
Sweden	0.2668	0.2208	0.1905
United Kingdom	0.2914	0.2208	0.2540

Source: own

solution. Using the formula (6) the indicator c_i was calculated. The alternatives are arranged in a descending order, from the highest to the lowest values of the indicator c_i . This way, all the alternatives are ordered according to their relative distance from the hypothetical negative-ideal solution (Tab. 6).

Next Tab. 7 shows the order of EU member states in terms of B2C e-commerce intensity determined by the TOPSIS method of multi-criteria evaluation. The ordered list considers

three selected evaluation criteria. Based on the similarity of the relative indicator of the distance of the alternatives from the negative-ideal solution, the EU member states were divided into clusters (see Tab. 7). The division of countries into clusters was carried out using the centroid clustering method (Klímek, 2008) and the appropriate software. Countries assigned to the same group are more similar to one another in terms of overall use of B2C e-commerce than countries assigned to other clusters. The

Tab. 6: Determining the order of alternatives according to the TOPSIS method

Alternatives	d_i^+	d_i^-	c_i	Order of alternatives
Austria	0.2385	0.0711	0.2295	17
Belgium	0.1938	0.1037	0.3485	5
Bulgaria	0.2760	0.0112	0.0389	28
Croatia	0.2454	0.0467	0.1599	23
Cyprus	0.2457	0.0477	0.1626	22
Czech Republic	0.2167	0.0855	0.2830	11
Denmark	0.2133	0.1089	0.3379	7
Estonia	0.2185	0.0782	0.2635	12
Finland	0.2159	0.0902	0.2947	9
France	0.2169	0.0872	0.2867	10
Germany	0.2329	0.1027	0.3060	8
Greece	0.2079	0.0730	0.2599	13
Hungary	0.2436	0.0512	0.1736	21
Ireland	0.0296	0.2728	0.9022	1
Italy	0.2708	0.0252	0.0851	26
Latvia	0.2470	0.0469	0.1595	24
Lithuania	0.2221	0.0713	0.2430	15
Luxembourg	0.2008	0.1047	0.3428	6
Malta	0.2366	0.0817	0.2567	14
Netherlands	0.1937	0.1096	0.3614	4
Poland	0.2462	0.0465	0.1588	25
Portugal	0.2273	0.0558	0.1970	19
Romania	0.2617	0.0211	0.0746	27
Slovakia	0.2420	0.0627	0.2057	18
Slovenia	0.2424	0.0550	0.1850	20
Spain	0.2222	0.0663	0.2299	16
Sweden	0.1927	0.1134	0.3704	3
United Kingdom	0.1718	0.1319	0.4343	2

Source: own

last two columns of Tab. 7 indicate the year of the country's accession to the European Union (or the European Community, or the European Economic Community) and the economic development of the country in the year 2016 expressed by GDP per capita in Purchasing Power Standards (PPS). This indicator is expressed in relation to the European Union (EU28) average set to equal 100.

5. The Results of the TOPSIS Method: Comparison of B2C e-Commerce Intensity

The results of the multi-criteria evaluation and the positions of individual countries in the overall order indicate that in terms of B2C e-commerce intensity, EU member states are a rather heterogeneous group. Among other things, this leads to the fact that only certain economies can use B2C e-commerce for their

Tab. 7: The order of alternatives in terms of B2C e-commerce intensity and their division into clusters

Order	Alternative	Indicator c_i	Clusters and centroids	Accession to the EU	GDP per capita in PPS 2016 (EU28 = 100)
1	Ireland	0.9022	Cluster 1 Centroid: 0.9022	1973	177
2	United Kingdom	0.4343	Cluster 2 Centroid: 0.3659	1973	108
3	Sweden	0.3704		1995	124
4	Netherlands	0.3614		1958	128
5	Belgium	0.3485		1958	118
6	Luxembourg	0.3428		1958	267
7	Denmark	0.3379		1973	125
8	Germany	0.3060		Cluster 3 Centroid: 0.2653	1958	123
9	Finland	0.2947	1995		109
10	France	0.2867	1958		105
11	Czech Republic	0.2830	2004		88
12	Estonia	0.2635	2004		74
13	Greece	0.2599	1981		67
14	Malta	0.2567	2004		95
15	Lithuania	0.2430	2004		75
16	Spain	0.2299	1986		92
17	Austria	0.2295	1995		126
18	Slovakia	0.2057	Cluster 4 Centroid: 0.1753		2004	77
19	Portugal	0.1970		1986	77
20	Slovenia	0.1850		2004	83
21	Hungary	0.1736		2004	67
22	Cyprus	0.1626		2004	81
23	Croatia	0.1599		2013	59
24	Latvia	0.1595		2004	65
25	Poland	0.1588		2004	69
26	Italy	0.0851	Cluster 5 Centroid: 0.0662	1958	96
27	Romania	0.0746		2007	59
28	Bulgaria	0.0389		2007	48

Source: own and Eurostat (2017), European Union (2017)

own growth and take advantage of the benefits that e-commerce offers to both vendors and consumers.

Intensive use of B2C e-commerce is found in Ireland, which significantly outperform all other EU member states. Ireland exhibits the highest share of turnover of B2C e-commerce in the overall turnover of businesses and the

highest share of businesses with online sales in the B2C market (see Tab. 3). Ireland is followed, after a large gap, by highly developed economies of Northern and Western Europe, which form a relatively homogenous group concentrated in cluster 2. The high engagement of the population of Great Britain in online shopping, together with the large turnover of

Amazon and other online retailers (e.g., Tesco and Sainsbury's) puts Great Britain in a leading position in this group.

The third group includes EU member states with an average and slightly below-average B2C e-commerce intensity. This group also includes the Czech Republic, which took the eleventh place on the list. This cluster includes highly developed economies (Austria, Germany, Finland, France), as well as countries with significantly lower economic level (e.g. Estonia and Greece).

The EU member states in clusters 4 and 5 are engaged very little in B2C e-commerce. A problematic situation is especially in Bulgaria, Romania and Italy.

The correlation between the order of countries in terms of B2C e-commerce intensity and in terms of their economic development is calculated using the Spearman Rank Correlation Coefficient according to the formula (7) with correction for tied ranks (Neubauer et al., 2016, p. 240):

$$r_S = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1) - n_x - n_y} \quad (7)$$

where r_S is the value of the Spearman Coefficient, d_i is the difference in paired ranks, n is the number of cases, n_x and n_y are the correction factors for the variables x and y , respectively, when tied ranks occur (i.e., two or more cases receive the same rank on the same variable):

$$n_x = \frac{1}{2} \sum_{j=1}^r (n_{x,j}^3 - n_{x,j}) \quad (8)$$

$$n_y = \frac{1}{2} \sum_{k=1}^s (n_{y,k}^3 - n_{y,k}) \quad (9)$$

where r is the number of groupings of different tied ranks and $n_{x,j}$ is the number of tied ranks in the j -th grouping, s is the number of grouping of different tied ranks and $n_{y,k}$ is the number of tied ranks in the k -th grouping.

The Spearman Coefficient, r_S , can take values from +1 to -1. A r_S of +1 indicates a perfect association of ranks, a r_S of zero indicates no association between ranks and a r_S of -1 indicates a perfect negative association of ranks.

The calculated value of the Spearman Coefficient is 0.7844. This demonstrates a strong and statistically significant correlation

between the two rankings (the critical value of Spearman's coefficient for a two-tailed test, $n = 28$ and significance level $\alpha = 0.05$ is 0.3749). The H1 hypothesis was thus confirmed. The level of economic development appears to be a significant factor in B2C e-commerce intensity; however, it does not sufficiently explain the differences in B2C e-commerce intensity in the various EU states (see Tab. 7).

The data in Tab. 7 suggest not a strong correlation between the order of countries in terms of B2C e-commerce intensity and the length of their EU membership. Tab. 7 shows that B2C e-commerce intensity is not highest in countries with the longest duration of EU membership, therefore Hypothesis 2 is not confirmed. The Spearman Coefficient was also used to determine the correlation between the order of the countries in terms of B2C e-commerce intensity and their order in terms of the length of their EU membership. In this case, its value, calculated using the formula (7) and the data in Tab. 7, is 0.6596, which indicates a moderate and statistically significant correlation of the said rankings.

Conclusions and Research Limitations

An overall view of the evaluation criteria provides clear information on the B2C e-commerce intensity in EU member states. The order of countries based on the value of the aggregate indicator and the differences between countries suggest that currently there is a large unused potential of B2C e-commerce in the EU, not only in countries with weaker economies, but also in highly developed countries. The differences in the level of economic development of the countries do not sufficiently explain the differences in the intensity of B2C e-commerce. The order of countries also suggests a likely link between the B2C e-commerce intensity and other factors. The low B2C e-commerce intensity in the southern part of the EU indicates a possible influence of other factors: for example, the countries' geographical location and the low B2C e-commerce intensity in neighbouring countries (see Ho et al., 2007). On the contrary, linguistic proximity with another country (e.g., in English- or German-speaking EU member states) presents an advantage of cross-border e-commerce and results in higher B2C e-commerce intensity.

With respect to factors influencing B2C e-commerce, it is obvious that B2C e-commerce

relates to ICT development itself (Qin et al., 2014; Schneider, 2015; Shih, 2010) and the implementation of new ICT in the economies of EU member states (see the position of countries according to the ICT Development Index 2015 (ITU, 2016)). The development of B2C e-commerce is also narrowly connected with innovation activities in the commercial sector, which for a number of years have been co-financed from the EU structural funds, and also with creating an integrated EU market, harmonizing the relevant legislation, including consumer protection, etc. Still, the correlation between the order of countries in terms of B2C e-commerce intensity and in terms of the length of their EU membership is not very strong. It would be beneficial for further research to focus on the question of which factors have boosted the relatively high use of B2C e-commerce in some new EU member states with lower level of economic development (Estonia and Lithuania) and what obstacles prevent more intensive use of B2C e-commerce in Italy and Austria, whose level of economic development significantly exceeds that of the aforementioned countries.

Research limitations are driven mainly by the limited availability of relevant data regarding the use of B2C e-commerce and missing or insufficient methodology of data supplied by private companies.

Our study of B2C e-commerce significantly enhances an understanding of this area and complements the above-mentioned and otherwise focused indices of AT Kearney (2013) and UNCTAD (2016) with a B2C e-commerce intensity index created from three selected evaluation criteria using method of multi-criteria evaluation of alternatives (TOPSIS). Further research may focus on refining this index, if, for example, the methodology for defining e-commerce is elaborated in more detail, and more internationally comparable data in this segment become available. It is also apparent that further ICT development, as well as the development of new forms of e-commerce and online marketing will have an impact on the subsequent analysis and comparison of B2C e-commerce.

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Abstract

EVALUATION AND COMPARISON OF B2C E-COMMERCE INTENSITY IN EU MEMBER STATES**Hana Kunešová, Ludvík Eger**

Electronic commerce in the business-to-consumer sphere (B2C e-commerce) represents a significant factor in the competitiveness of companies and entire economies. The purpose of this paper is to propose a tool to evaluate and compare B2C e-commerce intensity in economies. The authors address the following research questions: What is the position of individual EU member states in terms of B2C e-commerce intensity? Is there a strong correlation between B2C e-commerce intensity and the level of economic development of EU member states? Is there a correlation between B2C e-commerce intensity and the length of the countries' EU membership?

From a theoretical background, key indicators of B2C e-commerce intensity are selected, which are aggregated into the B2C e-commerce intensity index using the TOPSIS method. The results of the multi-criteria evaluation and the positions of individual countries in the overall order indicate that in terms of B2C e-commerce intensity, EU member states are a rather heterogeneous group. The order of countries based on the value of the B2C e-commerce intensity index exhibits a strong and statistically significant correlation with the order of the countries in terms of the level of their economic development. However, the differences in the countries' economic development do not sufficiently explain the differences in the use of B2C e-commerce. The results indicate that there is a large unused potential of B2C e-commerce in the EU, not only in countries with weaker economies, but also in highly developed countries. The correlation between B2C e-commerce intensity and the duration of EU membership is moderate. It would be beneficial for further research to focus on the question of which factors have boosted the relatively high use of B2C e-commerce in some new EU member states with lower level of economic development (Estonia and Lithuania) and what obstacles prevent more intensive use of B2C e-commerce in Italy and Austria, whose level of economic development significantly exceeds that of the aforementioned countries.

Key Words: B2C e-commerce, e-commerce intensity index, European Union, multi-criteria decision analysis, TOPSIS.

JEL Classification: L81, M21, C44.

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ACCESSIBLE TOURISM FOR ALL – CURRENT STATE IN THE CZECH BUSINESS AND NON-BUSINESS ENVIRONMENT

Ivica Linderová, Petr Janeček

Introduction

Tourism is a sector of remarkable economic importance. It is currently one of the most dynamically developing sectors of the economy. It provides huge opportunities for socio-economic development (Maráková, Dyr, & Wolak-Tuzimek, 2016). According to the World Tourism Organisation (UNWTO), the European tourism economy contributes about 5% (depending on its definition up to 11%) to the GDP of the European Union and provides between 8 and 24 million jobs (depending on the definition of the sector). Tourism development has numerous economic and socio-cultural impacts on the regional economy, entrepreneurship and local businesses.

Nowadays, new ways to develop tourism are being discovered. One of them is accessibility and social policy aspects.

The aim of the paper is to map the possibilities for people with physical disabilities to participate in tourism in the Czech Republic. The paper is organized into two parts. The first part focuses on a review of the literature in the field of accessible tourism and disability. The second part deals with conditions of accessible tourism services in the Czech business and non-business environment. We focused on accommodation facilities, catering facilities, tourist routes and cycle routes and UNESCO heritage. The situation in all 14 administrative regions was evaluated. The research was conducted from 2013 to 2016.

Accessible tourism facilities are an impulse for accessible tourism development. Accessible tourism is a part of social tourism. In the context of the ageing of the world population, a focus on social tourism is even more important. The term "tourism for all" is used by the European Union for social tourism. This term often refers to very different aspects. Sometimes, in particular in a social policy context, it is used to underline

the need to facilitate holidays for lower income groups, sometimes to take into account the needs of disabled visitors (Leidner, 2006).

Minnaert (2014) says that social tourism is tourism that specifically encourages the participation in tourism activities of people who are economically weak or otherwise disadvantaged. Cazes (2000) sees social tourism as a complex phenomenon, which allows tourism participation for disadvantaged persons. It respects human rights as the right to holiday and the right to tourism, it is based on a non-profit concept and it accepts the social and financial situation of participants. According to Cazes (2000), the aim of social tourism is the active use of leisure time, the physical and cultural development of participants. McCabe (2009; 2010), Darcy (2010), Shi et al. (2012), Eichorn et al. (2013), Garcés Ferre et al. (2015), Michopoulou (2015) also deal with social tourism.

In practice, social tourism addresses four main target groups – senior citizens, young people, low-income families and people with disabilities. The majority of these target groups have special requirements during their travels and holidays. Disabled visitors and seniors are groups with the biggest needs. They have limited mobility and need a special environment.

In the context of accessibility for people with physical disabilities it is preferable to speak about accessible tourism for all. It is a form of tourism that involves a collaborative process among stakeholders that enables people with access requirements, including mobility, vision, hearing and cognitive dimensions of access, to function independently and with equity and dignity through the delivery of universally designed tourism products, services and environments (Linderová, 2015).

Accessible tourism for all is not about creating separate services for disabled people, it aims at

full integration, or rather the inclusion of people with special needs, in particular, disabled and aged people, in the tourism sector. Viewed from the perspective of accessible tourism for all, the tourism policy in the European Union can be said to unite accessibility targets that are part of the otherwise commerce-related aspects of the tourism policy and a disability policy that, based on the UN's Standard Rules, support goals and specific measures at various levels that are designed to enhance accessibility in connection with tourism policy (Leidner, 2008).

The long-term goal of the tourism accessible for all movement is the creation of a tourist environment in which all tourists, irrespective of their individual needs (age, size, (dis)ability) can participate actively (Leidner, 2008).

The definition of Tourism for All adopted by the Nordic Council on Disability Policy underlines this approach: Everyone – regardless of whether they have any disabilities – should be able to travel to the country, within the country and to whatever place, attraction or event they should wish to visit (Leidner, 2006).

1. Accessibility as a Factor of Tourism Development

We could imagine a lot of possibilities under the term accessibility. Accessibility can be understood as barrier-free access to hotels, restaurants, museums, castles, etc. It also means financial accessibility for low-income families, seniors and socially disadvantaged people.

According to international law, e.g., the Convention of the UN, the Global Code of Ethics for tourism and national legislation in European countries, the right to tourism is held by everybody. Nationality, sex, age and religion are not important.

The Global Code of Ethics for tourism says that tourism activities should respect the equality of men and women; they should promote human rights and, more particularly, the individual rights of the most vulnerable groups, notably children, the elderly, the handicapped, ethnic minorities and indigenous peoples. The prospect of direct and personal access to the discovery and enjoyment of the planet's resources constitutes a right equally open to all the world's inhabitants.

By looking at tourism, transport and disability, Cavinato and Cuckovich (1992, in Darcy & Buhalis, 2011) refer to access in terms

of dealing with and addressing a wide range of constraints. Darcy (1998, in Darcy & Buhalis, 2011) divides the term access into three dimensions: physical access, sensory access and communication access. Darcy (1998) views these three dimensions as an inclusive marketing process, which allows tourism players to realise the potential of accessibility for the marketing of tourism products and services to the widest possible client base.

Usability and universal design are also related to the term access and accessibility. The universal design addresses the inclusion of the entire population, incorporates aspects of accessibility and usability at the beginning and represents a less stigmatising concept (Iwarsson & Ståhl, 2003, in Darcy & Buhalis, 2011).

1.1 Disability with an Emphasis on Physical Disadvantages

According to the World Health Organization (2011), there are approximately 1 billion persons with disabilities in the world. This equates to approximately 15% of the world population having a physical, mental or sensory disability. In Canada 3.6 million people live with disability, in the United Kingdom 8.5 million people, in the USA 54 million people, and around Europe 60 million people (European Commission, 2008).

Due to the ageing population in industrialized countries, the rate of disability among people with the capacity to travel is also increasing, adding to the demand for an accessible environment, transport and services – thereby adding to the market value of the accessible tourism segment (Rahman, 2005).

Disability can be defined as limitations on possibilities to participate in the life of society at the same level as other people that is due to architectural or social barriers (Shaw & Coles, 2004).

According to the World Health Organization (WHO), different terms are used. WHO differentiates impairment, disability and handicap.

In the context of health experience, an impairment is any loss or abnormality of a psychological, physiological, or anatomical structure of the function. A disability is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being. A handicap is a disadvantage for a given individual resulting from an impairment or

a disability that limits or prevents the fulfilment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual (WHO, 1980).

Persons with disabilities includes all persons who, owing to the environment being encountered, suffer a limitation in their relational ability and have special needs during travel, in accommodation, and other tourism services, particularly individuals with physical, sensory and intellectual disabilities or other medical conditions requiring special care, such as elderly persons and others in need of temporary assistance (UNWTO, 2005).

While access, involving a range of barriers, is shown to be an issue for the disabled, physical access is but one issue, with other constraints often being more significant to this group. There is an important segment of disabled people for whom removing the barriers of physical access is only part of the problem. For this group, holidays are not possible because of financial restrictions. These are clearly associated with disabilities as these restrict access to the world of work (Shaw & Coles, 2004, in Lovelock & Lovelock, 2013).

When speaking about accessible tourism for all, it is important to define physical disability. Physical disability represents an impairment or defect in the motoric and musculo-skeletal systems, i.e., bones, joints, tendons, muscles, vascular and nervous systems if it is manifested by an impaired ability to move (mobility).

Mobility impairment can be a result of heredity, disease or injury, and inner and outer factors can be considered among the reasons (Renotíerová, 2006). Vítková (1998) classifies movement disabilities as central and peripheral paralyses (e.g., cerebral palsy), deformations, malformations, and amputations.

The shared feature of disabled people is a reduction in usual activities and in some cases also partial to complete immobility (Novosad, 2005).

Buřvalová and Reitmayerová (2007) understand physical disability as a mobility defect in terms of functional limitations, i.e., something does not work in comparison with the standard, or as physical deformation in terms of aesthetic impairment, i.e., something that is not accepted very positively by others. Filipiová (1998) divides types of physical disabilities into four categories in Tab. 1.

According to the findings of the Czech Statistical Office, in the Czech Republic live 54,831 people with physical disabilities (data from 2013). These people represent 36% of all health impaired persons in the country. Compared with 2007, when the share of physical impairments in all health disabilities was 29%, it means an increase.

1.2 Barrier-Free Solutions in Tourism

A variety of authors have endeavoured to group barriers and constraints in tourism opportunities into categories, e.g., Smith (1987), Darcy and

Tab. 1: Categories of physical disabilities according to used aids

1st category lighter physical disability	a) people using crutches b) result of injury, worn-out joint
2nd category medium physical disability	a) crutches, orthopedic prosthetics (splints, braces) b) difficulties when walking, standing up or walking up stairs
3rd category severe physical disability (people in wheelchairs)	a) people who cannot stand for a longer period of time, who have undergone amputation of lower limbs, elderly people b) people permanently confined to a wheelchair; only in sporadic need of assistance c) people confined to a wheelchair; in some situations, in need of assistance d) people confined to a wheelchair; assistance necessary 24 hours a day e) people confined to a powered wheelchair
4th category very severe physical disability	a) disease manifests itself slowly and goes gradually through all the above-mentioned categories

Source: Filipiová (1998)

Darruwalla (1999), Israeli (2002), Shaw and Coles (2004), Daniels et al. (2005), Goodall (2006), Arab-Moghaddam et al. (2007), Packer et al. (2007), Yates (2007). According to Darcy & Buhalis (2011) three categories are employed that can be addressed by the tourism industry: physical access constraints, attitudinal barriers and lack of information.

The tourist product is complex and consists of goods and services gathered and offered to the client (Buiga et al., 2017). Persons with disabilities have special needs. So, it is usable for them to adapt different elements in tourism destination.

Adapted parking areas are fundamental. Special parking spaces with proper identification for vehicles of persons with reduced mobility are needful.

For people with reduced mobility modified communication tools are suitable, e.g., adapted telephone, fax, internet, and for persons with sensory impairments such as sign language or Braille are of course important communication tools.

Inside the buildings of accommodation facilities, monuments, etc., horizontal (elevators) and vertical movements (ramps, stairs) should be adapted and public hygiene facilities should be available (accessible toilet stalls and washbasins).

Tourism is not just about staying in a destination, but it is also about travel. So, passenger vehicles, including private vehicles for hire, buses and coaches, taxis, trams,

funiculars (cable cars), trains, commuter ferries and cruise ships should be designed to allow safe, comfortable and equitable transport. Accessible stations and passenger terminals are a matter of course. That means access ramps, elevators, platform lifts, information in visual and acoustic formats.

Disabled visitors have to find accommodation facilities with adapted rooms at a destination, adapted catering facilities, cultural activities such as museums, theatres, cinemas, sports facilities (access to stadiums, race tracks, etc.).

Some tourists are also interested in green spaces and natural environments. A barrier-free natural environment means accessible routes, adapted place for rest, fountains and benches.

Architectural barriers (Tab. 2) are considered most important for the possibility of the physically disabled to participate in tourism. They may be divided into several categories.

It is necessary to keep in mind the fact that areal, volume, and dimensional parameters of premises for disabled people are given by the manoeuvring and dimensional limits of the wheelchair. It is so because these demands are the biggest in terms of space, thus they are spatially suitable even for other groups of disabilities (Samová, Puškár, & Mikulová, 1999). The dimensions of the wheelchair and the physical abilities of its user are always crucial.

Reach distances of a person in a wheelchair are important typological data in Tab 3. They are

Tab. 2: Overview of architectural barriers according to space requirements

Barriers	Characteristics
Vertical	<ul style="list-style-type: none"> ▪ stairs ▪ height differences
Horizontal	<ul style="list-style-type: none"> ▪ ramp inclination ▪ surface of walking areas
Spatial	<ul style="list-style-type: none"> ▪ small handling parameters ▪ inappropriate position of furniture
Anthropometric	<ul style="list-style-type: none"> ▪ reach distances ▪ WC height mounting
Ergonomic	<ul style="list-style-type: none"> ▪ the shape of doorknobs, handles, etc. ▪ inappropriate furnishings and furniture
Wayfinding and Directional	<ul style="list-style-type: none"> ▪ missing tactile information ▪ wayfinding and directional systems and pictograms

Source: NIS (2013)

Tab. 3: Crucial dimensions for layout of an interior for a physically disabled person

Parameter	Dimension in mm	Influence on .../importance for ...
height of seat	520	height of surface onto which seats are changed
length of wheelchair	1,250	layout of the minimum space, e.g., elevator cabin, WC dimensions
height of feet from ground	220	equipment protection from scuffing, furniture alteration to make it accessible
width of wheelchair	900	width of corridors and doorways
height of knees	670	height of handling work areas
height of armrest	720	height of handling work areas

Source: Samová, Puškár, & Mikulová (1999)

used for interior layout and for the positioning of control elements (Samová, Puškár, & Mikulová, 1999). Reach distances of a wheelchair user are individual and depend on the ability of a given person to move the upper part of their body and their degree of disability. However, the layout of the interior in public buildings is based on maximum, not minimum, reaching abilities of a wheelchair user.

2. Readiness of Tourism Facilities in the Czech Republic for Visitors with Physical Disabilities

Accessibility is not only about disabled people but also about older people, families with small children, people with short-term or chronic ailments, etc. In Europe alone, this amounts to an estimated 130 million customers for the tourism industry. In contrast to the huge number of tourists demanding accessible tourism facilities, the share of tourism facilities reported by Member States as being accessible – at least for wheelchair users – amounts to only 1.5% of restaurants & catering facilities, 6.5% of accommodation establishments and 11.3% of attractions (Neumann, 2008).

2.1 Aim and Methodology

The aim of this contribution was to map the possibilities for people with physical disabilities to participate in tourism in the Czech Republic.

Partial aims were also defined:

- To map accessible accommodation facilities which follow legal regulations,
- To map restaurant & catering facilities accessible for wheelchair users,
- To map culture and historic UNESCO

heritage sites and their accessibility for disabled visitors,

- To map barrier-free tourist routes and cycle routes.

Following the partial aims, we hypothesized the existence of an interdependence between the number of visitors and the number of accessible accommodation establishments. At the same time, a hypothesis forms that in regions with a higher share of accommodation establishments of classes **** and ***** there will be a higher number of barrier-free accommodation establishments available.

To verify the hypothesis, we used correlation analysis, which deals with the dependency ratios of random data. Its standard output is a coefficient describing the dependency rate – typically the correlation coefficient. Correlation coefficients serve as a measure expression of “linear constraints tightness”. Given the significant differences in the examined data from a normal distribution, we chose the Spearman correlation coefficient.

The Spearman coefficient is based on a comparison of the sequence of values. This coefficient is robust. Its relationship to the classical correlation coefficient is an analogous relationship to the arithmetic median diameter. Coefficient can be written as follow:

$$\rho_{Sp} = 1 - \frac{6}{n(n^2 - 1)} \sum_{i=1}^n (P_{1i} - P_{2i})^2 \quad (1)$$

where P1, P2 are numbers indicating the order.

We assessed the situation in all administrative regions, while focusing on coverage of the territory with capacity of

accommodation establishments and restaurant & catering facilities, on the existence of accessible educational trails, tourist routes, and cycle routes. We were also interested in possibilities to visit UNESCO world heritage sites.

Accommodation establishments were evaluated from the point of view of a barrier-free entrance (designed without levelling stairs, with

a ramp, skid or otherwise), and accommodation options for physically disabled people. A barrier-free room is considered a room enabling the handling of a wheelchair, having a barrier-free entrance, and the use of seating furniture, bed, storage space, and featuring an adapted bathroom and toilet (more information in Tab. 4).

Important features of hospitality establishments were also barrier-free entrances

Tab. 4: Evaluation criteria – accommodation establishments

Parameter	Characteristics	
entrance to building	✓ ✗	direct with no threshold, with ramp, skid, slightly elevated threshold step or stairs
room	✓ ✓ ✓ ✗ ✗	entrance to room (no threshold, slightly elevated threshold) space for turning the wheelchair furniture adapted for visitors in a wheelchair (seating furniture, bed, wardrobes, writing desk) – respecting reaching abilities of a wheelchair user problematic movement in space non-fulfilment of any of the above points
bathroom	✓ ✓ ✓ ✓ ✓ ✓ ✗ ✗	entrance to bathroom space for turning the wheelchair entrance to shower cubicle or possibility for a person in a wheelchair to enter bathtub adapted washbasin adapted toilet handles in appropriate places possibility to use bathroom furniture, hairdryer, waste bin problematic movement in space non-fulfilment of the condition of barrier-free possibility to perform hygiene

Source: own

Note: ✓ barrier free, ✗ inaccessible.

Tab. 5: Evaluation criteria – hospitality establishments

Parameter	Characteristics	
entrance to building	✓ ✗	direct without threshold, ramp, skid, slightly elevated threshold step or stairs
sales area	✓ ✓ ✓ ✗ ✗	space for turning the wheelchair and transfer of the wheelchair furniture adjusted for visitors in a wheelchair (tables, bar counter) – respecting spatial and reaching abilities of a wheelchair user problematic movement in space non-fulfilment of any of the above-listed points
toilet	✓ ✓ ✓ ✓ ✗	entrance to the room space for turning the wheelchair adapted washbasin adapted toilet handles in appropriate places problematic movement in space

Source: own

Note: ✓ barrier free, ✗ inaccessible.

Tab. 6: Evaluation criteria – tourist routes, cycle routes, educational trails

Parameter	Characteristics	
surface	✓ ×	asphalt, sand, gravel, boardwalks, nature trail hardening step or stairs, stones, historic pavement, tree roots, etc.
parking*		designated parking spaces for health disabled
refreshments*		wheelchair accessible (sales window, restaurant, bistro, etc., with barrier-free access)
toilet*		entry with a wheelchair handles in appropriate places

Source: own

Note: ✓ barrier free, × inaccessible, * criteria not evaluated.

to building, the possibility of transferring between tables, comfortable dining, and an adapted toilet (Tab. 5).

As for tourist routes, cycle routes, and educational trails, from the point of view of barrier-free access, we assessed mainly surface finishes suitable for wheelchairs. Parking possibilities, refreshments or barrier-free toilets were welcomed but not necessary for the evaluation of route accessibility for physically disabled people. The reason was that the mentioned infrastructure is often missing even for regular visitors (Tab. 6).

Cultural and historic UNESCO heritage sites are major tourist attractions in several regions of the Czech Republic. Monuments enabling accessibility to at least a part of an exposition (a tour route, church, gardens) for the physically disabled are considered accessible. We were also interested in facilities, such as parking and barrier-free toilet stalls (see in Tab. 7).

The contribution is based on primary and secondary data sources. Among the secondary

sources we used mainly professional book and journal literature, recommendations from UNWTO, international documents regarding social tourism and the relevant legislative regulations of the Czech Republic. Furthermore, we used specialised web portals providing information to people with disabilities, databases of tourist information centres, web portals of particular regions, various hotel portals, websites of accommodation and restaurant&catering establishments, information materials of national parks, etc.

Primary data were obtained from field research within the framework of which we verified barrier-free access found out with the help of secondary research. We personally visited a large number of tourism establishments and attractions. Information about some of the establishments was verified by telephone.

Collecting of primary data took place in 2013 through 2016. The methods of analysis and generalization were used.

Tab. 7: Evaluation criteria – cultural and historic UNESCO heritage sites

Parameter	Characteristics	
entry	✓ ×	at least into a part of a building step or stairs, stones, historic pavement, tree roots, etc.
services	✓ ×	min. 1 accessible tour route, exposition only garden accessible
parking*		designated parking spaces for health disabled
toilet*		entry with a wheelchair handrails in appropriate places

Source: own

Note: ✓ barrier free, × inaccessible, * criteria not evaluated.

2.2 Accommodation Facilities

As for visitors with physical disabilities, the possibility of their being able to enter accommodation or restaurant&catering facilities is essential.

The entrance door to the accommodation or restaurant&catering premises should be minimum 900mm wide and 2,000mm high. The entrance door, if not operated by electric eye, has to allow opening outwards to a width of minimum 900mm. Glass windows must be marked with contrasting elements. Guiding and signal lines for blind people are a matter of course.

Tourist enterprises provided with their own car parks should also have parking spaces for disabled people. Adjusted parking places are important especially for accommodation establishments or cultural and social establishments, such as theatres, museums,

etc. The total number of designated spaces is rounded up to integers. A minimum of 1% of total parking spaces must be reserved for health disabled people within establishments providing services (Šestáková, 2011). The minimum dimensions of a parking space should be 5,000 x 2,200mm (some regulations specify a width of 3,500 mm). When parked, the wheelchair user should have a space of 1,500 mm next to the vehicle to get out.

In accommodation establishments, but also in some additional services, such as wellness centres, swimming pools, etc., it is necessary to consider a reception adapted to people in a wheelchair. The reception desk should be low at a minimum of one place in such a way that a person in a wheelchair or a parent with a baby carriage can communicate comfortably with an employee of the reception.

Tab. 8: Share of barrier-free accommodation facilities in regions of the Czech Republic

Prague	Central Bohemia	South Bohemia	Hradec Králové	Pardubice	Liberec	Pilsen
18.40	10.30	9.91	1.36	2.28	11.30	8.55
Carlsbad	Ústí nad Labem	Moravian-Silesian	South Moravia	Vysočina	Olomouc	Zlín
20.10	10.70	7.57	8.70	11.30	11.70	16.30

Source: Linderová & Scholz (2016)

We hypothesized the existence of an interdependence between the number of visitors (Tab. 9) and the number of accessible accommodation establishments. At the same time, a hypothesis forms that in regions with a higher share of accommodation establishments of classes **** and ***** there will be a higher number of barrier-free accommodation establishments available (Tab. 8).

The term interior communication in tourism establishments can include corridors, lifts, and staircases, but also doors inside the building. Internal communications should be barrier-free and should connect the entrance to the building, e.g., a hotel, with the entrance hall, or the reception, and consequently the reception and barrier-free rooms. The rooms should be provided with access to the restaurant, hotel café, lounges, congress halls, terrace, etc. A matter of course is a barrier-free emergency exit and escape routes. The elevator cabin

should have minimum dimensions of 1,100 mm x 1,400 mm and a height of 2,200 mm, the minimum recommended load bearing capacity is 250 kg. The minimum width of the corridor for guests, alternatively visitors, is 1,500 mm, the minimum passable width of a staircase is 1,100 mm.

According to the valid Czech legislation, at least 5% of rooms in accommodation establishments should be barrier free. The resulting number of rooms is rounded up to integers (Šestáková, 2011). Rooms should be furnished in such a way as to ensure the comfortable movement of people in a wheelchair, with the possibility of grasping and moving. The same conditions also apply to bathrooms, terraces, and balconies. The entrance to the room is provided with a door of minimum width of 900 mm with a properly designed door handle. In the room, there must be a space of 1,500 mm diameter to turn the wheelchair. Between individual pieces of

Tab. 9: Number of visitors in accommodation establishments in the Czech Republic in 2015

Region	Number of visitors	Share of foreign visitors	Number of AF	Share of hotels ****, *****	Share of accessible AF
Prague	6,605,776	87	797	32.10	18.40
Central Bohemia	907,567	23	669	5.50	10.30
South Bohemia	1,341,912	31	1,205	2.90	9.91
Hradec Králové	1,124,032	23	1,055	3.30	1.36
Pardubice	413,443	14	341	2.50	2.28
Moravian-Silesian	775,047	23	576	4.86	7.57
Pilsen	650,250	36	521	4.41	8.55
Carlsbad	850,891	63	471	20.80	20.10
Ústí nad Labem	487,259	35	468	5.76	10.70
Liberec	820,802	20	892	2.20	11.30
South Moravia	1,536,172	32	813	4.67	8.70
Vysočina	473,712	13	445	4.40	11.30
Olomouc	547,538	21	465	2.58	11.70
Zlín	661,149	16	455	6.74	16.30

Source: Czech Statistical Office and own research

Note: AF – accommodation facilities.

furniture is a clearance with a width of 900 mm, at the foot of the bed 1,100 mm. Wheelchair armrests must fit under the writing desk, or dressing table, which must be adapted. The layout of the room should be adapted so that a person in a wheelchair can transfer themselves into the bed, armchair or sofa. The bed should have a height of 450 mm, the bedside table from 500 to 570 mm. The recommended height of the writing desk and dressing table should be 700 mm, the height of tables 800 mm. Opening wardrobes, bedside tables, minibars must be easily manageable and allow easy handling. Visual contrast should be maintained in bathrooms and toilets. This also applies to fixtures and fittings (wash-basin, toilet bowl), handrails and handles. According to the regulations, shower cubicles and stalls have minimum floor-plan dimensions of 1,400 x 1,400 mm. A non-slip finish and handrails next to the bathtub, shower cubicle, and toilet are a matter of course.

Based on our research between the years 2013 and 2016 we can state that Ústí nad Labem, Liberec, Carlsbad and Prague are the

regions with the highest share of barrier-free accommodation facilities. We assumed the highest share in Prague, but there are other regions with a higher share of accessible accommodation facilities, e.g., Carlsbad. On the basis of an evaluation of the Spearman correlation coefficient (see in Tab. 10), we can conclude that the set-out hypotheses cannot be confirmed. The null hypothesis test assumes independence, and with respect to p-values greater than 0.05 it was not possible to reject the hypothesis of independence.

It is necessary to state that an interdependency between the number of visitors and the possibility of accommodation for health disabled people in particular regions was not validated. Also, the correlation between a higher number of accommodation establishments and a subsequent higher share of barrier-free accommodation establishments in regions is not valid.

Some relationship can be seen between the number of foreign visitors and a higher share of accessible accommodation establishments (Praha, Carlsbad).

Tab. 10: Spearman Rank Order Correlations

Variable	Spearman Rank Order Correlations (List 1 in hotels) MD pairwise deleted Marked correlations are significant at p <.05000				
	Number of visitors	Share of foreign visitors	Number of AF	Share of hotels ****, *****	Share of accessible AF
Number of visitors	1.000000	0.558504	0.841758	0.305495	0.072607
Share of foreign visitors	0.558504	1.000000	0.426053	0.580580	0.159117
Number of AF	0.841758	0.426053	1.000000	-0.090110	-0.226623
Share of hotels ****, *****	0.305495	0.580580	-0.090110	1.000000	0.466447
Share of accessible AF	0.072607	0.159117	-0.226623	0.466447	1.000000

Source: own

We also did more detailed research in selected cities in the Czech Republic. In Telč (Vysočina) we found 15% of accommodation was accessible, e.g., Hotel U hraběny, Hotel Antoň. In Jeseník (Olomouc region) 13% of accommodation facilities are accessible, in Olomouc 19%, in Brno (South Moravia) 19.11%, in Jihlava (Vysočina) 21.2%.

2.3 Catering Facilities

In restaurant&catering facilities as well as in hotel restaurants, cafes, etc., it is important to ensure comfortable passage between tables. A passing space width of 800 to 900mm is recommended. It is necessary to take into account space to manoeuvre and turn the wheelchair around in a circle with a minimum diameter of 1,500mm. Dining furniture must be adjusted to the wheelchair so that it is big enough to let the wheelchair fit under. It shall be possible to fit the wheelchair armrests under the dining table. The optimum height of a dining table is 720 to 750 mm. The minimum space at the table is 900mm per person. The areas connecting the interior of a restaurant with a terrace or garden should not have a gradient of more than 10%.

Regarding parking spaces, the same guidelines apply as for accommodation establishments.

According to Tab. 11, the highest share of barrier-free or accessible catering facilities can be found in Prague and Carlsbad. What is surprising is the huge number of accessible catering facilities in the Olomouc Region. This may be due to presentations of enterprises promoting themselves as barrier-free via specialized portals. On the grounds of such a presentation the establishment was listed in the barrier-free category of restaurants in the region.

Some of the regions were investigated in more detail. In Jeseník 10% of catering facilities are barrier-free, in Olomouc around 21%, in Brno 20%, and in Jihlava 13.4%.

2.4 UNESCO Heritage

As for the accessibility of cultural and historic monuments, not only the entrance to the building is important but also access communications. Obstructions, such as bins, bicycle stands, etc., shall be removed from the path of travel. The entrance to the building should be provided with at least one entry at the road/communication level without levelling steps. If it is not possible

Tab. 11: Share of barrier-free catering facilities in regions of the Czech Republic

Prague	Central Bohemia	South Bohemia	Hradec Králové	Pardubice	Liberec	Pilsen
32.70	12.7	6.80	1.75	5.31	20.00	6.24
Carlsbad	Ústí nad Labem	Moravian-Silesian	South Moravia	Vysočina	Olomouc	Zlín
16.50	17.00	20.31	3.10	3.00	28.60	29.20

Source: own

Tab. 12: Accessibility of cultural and historic UNESCO heritage sites for people with physical disabilities – Part 1

Locality	Site	Description of accessibility
Prague		
Prague – Old Town	Prague Castle, St. Vitus Cathedral, St. Wenceslas, Adalbert, St. Mary's Church, All Saints Church, St. George's Basilica, Old Royal Palace, Imperial Stables, The Ball Game Hall, Golden Lane, Lobkowitz Palace, Royal Garden of Prague Castle and Summer Palace of Queen Anne, Schwarzenberg Palace, Lapidarium, Strahov Monastery, Charles Bridge, Wallenstein Palace, Ledebur Garden, Convent of St. Agnes of Bohemia, Bethlehem Chapel, St. Nicholas Church/Cathedral	BWC (Prague Castle, Bethlehem Chapel), barrier-free restaurant (Ledebur Garden), historic buildings accessible for immobile visitors always at least partly (e.g., main and side aisle), interiors of houses in Golden Lane are not accessible
Prague – Vyšehrad	Tábor Gate, Gothic vaults, parks with sculptures, cemetery and Slavín (Pantheon), Casemates	BWC at Basilica of St. Peter and St. Paul
Praha – Josefov	House of Black Madonna, Church of Our Lady before Týn, Old Town Hall, Old Jewish Cemetery, Pinkas Synagogue, Maisel Synagogue, Spanish Synagogue	historic buildings accessible for immobile visitors always at least partly
Central Bohemian Region		
Kutná Hora	St. Barbara's Church, Sázava Monastery	with a companion, accessible monastery gardens, exhibitions, Church of St. Procopius
Kutná Hora - Sedlec	All Saints Church with Ossuary	
South Bohemian Region		
Český Krumlov	Castle and stately home, gardens, Minorit Monastery, St. Vitus Church	pavement in the castle courtyards, BWC, parking
Holašovice	Village monument reserve	movement alongside the road may be problematic for immobile visitors, missing pavements
Pardubice Region		
Litomyšl	castle, riding hall, birth house of Bedřich Smetana	for immobile visitors accessible castle theatre, riding hall through side entry, BWC, parking
Moravian-Silesian Region		
Olomouc	Holy Trinity Column	BWC nearby
South Moravian Region		
Brno	Villa Tugendhat	barrier-free entry, exposition
Lednice Valtice	Lednice Castle	barrier-free only one tour, former castle riding hall, French garden and park, palm conservatory (it is necessary to get over 4 steps), BWC, parking

Tab. 12: Accessibility of cultural and historic UNESCO heritage sites for people with physical disabilities – Part 2

Vysočina Region		
Telč	castle	for the immobile accessible only tour C/gallery, garden and park, parking on the square, BWC
Třebíč	Jewish Quarter, St. Procopius Basilica, Front Synagogue, Jewish Cemetery	historic pavement, accessible main cathedral aisle, for the immobile inaccessible crypt, accessible gardens, accessible ground floor of Front Synagogue, 3x BWC (Eurokey, skid, part of tourist information centre), parking
Žďár nad Sázavou	Pilgrimage Church of St. John of Nepomuk at Zelená hora/Green Hill	entry with the help of ramps, parking, educational trail cannot be used
Zlín Region		
Kroměříž	Archbishop's Castle, Castle Garden and Baroque Flower Garden	BWC

Source: own

to ensure entry this way, the levelling shall be resolved by a ramp, staircase landing, or outside lift. If barrier-free entry for wheelchair-bound people to the building is not possible due to heritage conservation, it is appropriate to ensure at least access for people with reduced mobility and the ability to orientate themselves.

Based on the results of the conducted survey in Tab. 12, it can be stated that each monument is partially prepared for visits by people with disabilities. However, due to the historical value

of the buildings being preserved, frequently only parts of them are made accessible. Nevertheless, the greatest attention is paid to persons with physical disabilities. Often, a barrier-free toilet or refreshments are not available.

2.5 Greenways

There is a need to modify the surface to ensure access to natural monuments, parks, or the use of cycle routes. Suitable is an asphalt finish, gravel, alternatively sand or boardwalks.

Tab. 13: Barrier-free routes in the Czech Republic by region – Part 1

Attraction	Number of routes	Comment
South Bohemian Region		
educational trails	10	NP Šumava
tourist routes	10	CHKO Třeboňsko, Český Krumlov, Lipno
cycle routes	1	Frymburk – Lipno nad Vltavou
skiing trails	1	Ski resort Lipno
Plzeň Region		
educational trails	37	2 accessible only with a companion
cycle routes	-	No information on barrier-free access
Karlovy Vary Region		
educational trails	6	CHKO Slavkovský les (2)
Ústí nad Labem Region		
tourist routes	11	NP České Švýcarsko (6), CHKO České Středohoří (5)
cycle routes	6	NP České Švýcarsko (4), CHKO Labské pískovce (2)

Tab. 13: Barrier-free routes in the Czech Republic by region – Part 2

Attraction	Number of routes	Comment
Liberec Region		
tourist routes	43	CHKO Lužické hory (8), CHKO Jizerské hory (15), CHKO Český ráj (20)
ski trails	3	Ski resort Bedřichov, Ski resort Tanvaldský Špičák, Ski resort Javorník
Hradec Králové Region		
tourist routes	28	NP Krkonoše (10), CHKO Český ráj (2), CHKO Orlické hory (2), CHKO Broumovsko (6)
educational trails	5	CHKO Orlické hory
cycle routes	13	total length: 52.2 km
Pardubice Region		
tourist routes	1	CHKO Orlické hory, CHKO Železné hory
educational trails	8	2 accessible only with a companion
cycle routes	31	total length: 99.4 km
Central Bohemian Region		
tourist routes	3	CHKO Český kras, CHKO Blaník, CHKO Kokořínsko,
cycle routes	6	CHKO Křivoklátsko*
Prague		
tours of the town	10	e.g. Vyšehrad, through Staré Město to Josefov
cycle routes	3	Praha-Klecany (1.7 km), Podolí-Zbraslav (10.9 km), Vltavská magistrála (10 km)
Vysočina Region		
educational trails	13	CHKO Žďárské vrchy
cycle routes	5	
South Moravian Region		
educational trails	12	CHKO Pálava, Lednicko-Valtický area
cycle routes	6	NP Podyjí, CHKO Pálava
Zlín Region		
educational trails	4	CHKO Beskydy, CHKO Bílé Karpaty
skiing trails	2	Ski resort Razula, Ski resort Troják
Olomouc Region		
educational trails	8	CHKO Jeseníky, CHKO Litovelské Pomoraví
skiing trails	5	Ski resorts Kareš, Ramzová, Petřikov, Kraličák, Kladky
Moravian-Silesian Region		
tourist routes	31	CHKO Beskydy (16), CHKO Jeseníky (5)
educational trails	16	CHKO Poodří (5), CHKO Beskydy (9)
cycle routes	17	CHKO Poodří (1), CHKO Beskydy (8), CHKO Jeseníky (2)

Source: Scholz & Linderová (2016)

Steeper sections should be fitted with railings or ramps.

In the case of leisure activities and sports in a natural environment, the Czech Republic offers barrier-free routes, educational trails, and cycle routes (see in Tab. 13). However, people with physical disabilities face many problems. Markings on barrier-free routes and trails are not unified. Some areas, e.g., Krkonoše, mark wheelchair-accessible pathways with pictograms. Barrier-free routes are marked out mainly in areas where "barrier-free" projects were carried out, i.e., Šumava, Krkonoše, Beskydy. The Czech Tourist Club also participates in marking routes suitable for the wheelchair bound. However, this initiative proceeds slowly due to financial demands. Information on accessibility of tourist routes, educational trails, and cycle routes is difficult to obtain. In some places, the information is provided by tourist information centres or the national park service or protected area service. However, many routes are not provided with this information. For the wheelchair bound, information on the surface (asphalt, forest tracks, gravel) of the given route is also essential. This information enables them to make a decision about a particular route.

Conclusion and Discussion

Major worldwide events, such as the Paralympics, have shown globally how people with disabilities can lead independent, successful lives and play a full role in society (Darcy & Buhalis, 2011).

Disabled people's interest in travel, getting to know new things, recreation or culture is on the rise, regardless of their type of disability. Integration of people with disabilities into regular life is being resolved at a constantly growing rate. In many cities or holiday destinations, the public transport, public service buildings (post offices, banks, hospitals), stores, etc., are becoming completely or partly barrier free. Projects aimed at creating barrier-free access have been carried out, e.g., in Bordeaux, Barcelona, and in the Czech Republic, e.g., Olomouc. Areas with attractive primary offer for tourism are joining these initiatives. Among examples of good experience are, e.g., Valencia with its accessible beaches, Girona with the making of accessible tourist routes, Vienna with its special information portal for the hearing impaired, United Kingdom and Paris with their

specialized web guides, etc. We ought to name, e.g., Krkonoše and Beskydy among others in the Czech Republic.

Disabled visitors are undoubtedly an interesting segment for tourism enterprises. In addition to the fact that they often travel with an assistant, which automatically increases the number of visitors, some of them look to travel outside the main tourist season. They therefore belong in the segments of visitors which can help enterprises to bridge seasonal fluctuations and make the tourist season longer. They look for services modified to their disadvantages and this is another reason for their coming back with pleasure to places where they have been satisfied.

The aim of this contribution was to map the possibilities of people with disabilities to participate in all tourism in the Czech Republic. We evaluated the situation in all administrative regions, while focusing on coverage of the territory with capacity of accommodation and restaurant&catering establishments, on the existence of accessible educational/nature trails, tourist routes, and cycle routes. We were also interested in the possibility of visiting UNESCO heritage sites.

On the basis of the conducted analysis, we can conclude that the situation in the Czech Republic in the area of accessible tourism is not particularly positive. The average share of barrier-free accommodation establishments in the country is 11% and 12% in restaurant&catering establishments. The presumption is that regions with a higher number of accommodation establishments of a higher standard (First Class****, Luxury*****) have a higher share of accessible ones. However, we can say that a higher share of barrier-free accommodation establishments is available in regions with a greater primary offer of tourism (Prague, Carlsbad).

We presumed that restaurant&catering establishments would be better adjusted to physically disabled clients. A frequent drawback is too narrow spaces to get wheelchairs between tables, a missing or poorly designed toilet stall for the disabled. In such a case, even an establishment with a barrier-free entrance shall not be considered barrier free for the disabled.

Leisure-time activities and sports also belong to tourism. Therefore, in our research we focused on the accessibility of educational/

nature trails, tourist routes, and cycle routes. According to Tab. 13 we can say that regions with national parks or attractive natural sites, such as Český ráj, Krkonoše, Šumava, České Švýcarsko, are best prepared.

When we compare situation in the Czech Republic with traditional social tourism countries as France or Spain, we state some differences. France has redesigned rating system of accessible accommodation facilities. Accommodation facilities and other tourism activities can be part of Tourisme et Handicaps Brand. It is a response to the demand of people with disabilities who want to choose their holidays and leisure freely. The brand provides a guarantee of an efficient welcome to the essential needs of the disabled. At the end of the year 2016 already more than 5.5 thousand facilities were assigned to the brand. Majority of them are accommodation facilities (57%), restaurants (8%), monuments and sightseeings (12%), other attractions as aquaparks, casinos, beaches (12%) (Tourisme et Handicaps, 2016). Spain is oriented on seniors and disabled visitors as well. The national organization

Imsero provides benefits in social tourism visitors. The hotel chain Paradores also works here. All Paradores hotels have to be fully accessible for wheelchair users. Some regions as Valencia or Catalonia have prepared accessible plans for tourism activities. State and municipalities in both of these countries are focused on accessible environment for all. Both countries have programmes of senior travellers and disabled travellers support. Evaluating and labelling of accessible tourism facilities is in both countries in the competence of a specialized organization and supported by government. Best practices we can find also in Great Britain, where governmental support for families with disabled children works.

In the Czech Republic there is evaluating of accessible activities still private initiative and no united system of evaluating works. Therefore, some incorrect information is presented e.g. accessible accommodation without access to restaurant, accessible access to castle without possibility to visit first or second floor or accessibility without accessible restrooms etc.

Tab. 14: Accessible tourism facilities and attraction in the Czech Republic

Region	Share of accessible accommodation facilities (%)	Share of catering facilities (%)	Greenways (hiking trails, cycle routes)	UNESCO heritage
Prague	18.40	32.70	13	Prague
Central Bohemia	10.30	12.70	9	Kutná Hora
South Bohemia	9.91	6.80	21	
Hradec Králové	1.36	1.75	46	
Pardubice	2.28	5.31	40	Litomyšl
Moravian-Silesian	7.57	20.31	64	
Pilsen	8.55	6.24	37	
Carlsbad	20.10	16.50	6	
Ústí nad Labem	11.60	3.70	17	
Liberec	11.20	3.40	43	
South Moravia	8.70	3.10	18	Brno, Lednice
Vysočina	11.30	3.00	18	Telč, Třebíč, Žďár nad Sázavou
Olomouc	11.70	28.60	8	Olomouc
Zlín	16.30	29.20	6	

Source: own

The situation in the Czech Republic in the area of providing disabled people with tourism services is improving in comparison with the past. Trips, package tours or stays for such clientele are still neglected. We can state that the Czech Republic has accommodation, restaurant&catering establishments, possibilities to visit natural attractions, and cultural and historic monuments accessible for the disabled. The offer is distributed unevenly in the country and it is difficult to draw up a particular product for several days so that comforts for the visitor are ensured.

The aforesaid analysis provides a summary of the situation in providing tourism services for the physically disabled in Tab. 14. In regard to the results, the limitations of the conducted analysis ought to be mentioned. Even though the field research took place over the course of three years and was considerably extensive across the board, the stated results cannot be considered exhaustive. Account must be taken of the fact that there is an ongoing process of dismantling barriers and adapting the environment to people with physical disabilities. For more detailed and exhaustive knowledge of the situation, it is desirable to undertake partial research focused on particular cities/towns or tourist areas.

The carried-out research represents the input data for extensive mapping of the situation within the framework of smaller areas. Orientation towards social tourism, and discussions on possibilities of adapting tourist attractions for people with disabilities are a topical issue in the actual demographic trend of an aging population not only in Europe but also in the Czech Republic. It is necessary to emphasize the importance of barrier-free solutions not only for the disabled but also for seniors, parents with strollers or people with temporary restrictions in movement.

The data obtained by the carried-out survey are shared with mapybezbarier.cz portal, which is an initiative of the Charter 77 Foundation – Barriers Account. An interactive informative map portal is being created following demands by wheelchair-bound people. The portal maps several hundred buildings in the Czech Republic, but far from all of them. The data obtained from research are shared, reviewed and gradually put into the information database which provides information to the disabled.

Mapping barrier-free objects of tourism is not that regular.

In some cities or destinations there is brief information with an offer of barrier-free accommodation which is dealt with mostly by a destination management organization, sometimes this information is provided by an organization of persons with disabilities. Most often, however, they are aware only of tourist facilities which present themselves as barrier-free on their websites. Around the world there are several initiatives, for example, wheelchairtraveling.com or wheelmap.org. But this means mapping objects that guide groups of enthusiasts, mostly in wheelchairs, and therefore portals provide brief information only on sites that have been visited by the initiators personally.

For the future of social tourism and tourism by people with health disabilities, it is important not only to map the accessibility of individual buildings but also to raise awareness of the needs of disabled passengers, making the environment barrier-free, etc. This can be helped by practical workshops and mapping the situation in cities, towns, and neighbouring countries, e.g., in the Slovak Republic and Poland, where this issue is gradually getting more attention.

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Abstract

ACCESSIBLE TOURISM FOR ALL – CURRENT STATE IN THE CZECH BUSINESS AND NON-BUSINESS ENVIRONMENT

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Tourism is a sector of remarkable economic importance. Nowadays, new ways to develop tourism are being discovered. One of them is accessibility and social policy aspects.

The aim of the paper is to map the possibilities for people with physical disabilities to participate in tourism in the Czech Republic.

*Following the aim, the article hypothesizes the existence of an interdependence between the number of visitors and the number of accessible accommodation establishments. At the same time, a hypothesis forms that in regions with a higher share of accommodation establishments of classes **** (First Class) and ***** (Luxury) there will be a higher number of barrier-free accommodation establishments available.*

It assesses the situation in all administrative regions while focusing on coverage of the territory with the capacity of accommodation establishments and restaurant & catering facilities, on the existence of accessible educational trails, tourist routes, and cycle routes. The article is also interested in possibilities to visit UNESCO world heritage sites.

On the basis of the conducted analysis, it is possible to conclude that the situation in the Czech Republic in the area of accessible tourism is not particularly positive. The average share of barrier-free accommodation establishments in the country is 11% and 12% in restaurant&catering establishments.

The most accessible routes, cycle routes, etc., are found in regions with national parks or attractive natural sites, such as Český ráj, Krkonoše, Šumava, and České Švýcarsko.

The situation in the Czech Republic in the area of providing disabled people with tourism services is improving in comparison with the past.

Key Words: Accessibility, accommodation facilities, disability, greenways, social tourism.

JEL Classification: L83, Z32.

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THE MODERATING INFLUENCE OF CONSUMER DEMOGRAPHICS ON THE RELATIONSHIP BETWEEN PERCEIVED CSR AND BRAND LOYALTY IN THE ROMANIAN RETAIL BANKING SECTOR

Ovidiu-Ioan Moisescu, Oana-Adriana Gică

Introduction

The relationship between brand loyalty and the extent to which companies are perceived by their customers as being socially responsible represents a relevant research topic, especially in the service industry, and particularly in the banking sector. Currently, even though the banking sector can be generally considered an oligopoly in most countries, competition among banks is intense, due to the decreasing level of their customers' inertia, as well as to the ease and velocity of switching banking services providers.

In this context, retaining customers and developing long-term customer relationships in the banking sector should take into consideration the link between corporate social responsibility (CSR) and brand loyalty, as well as specific demographic-based market segments, if demographic variables can be acknowledged as moderators of the relationship between CSR and brand loyalty. The relevance of this research topic is even more prominent due to the fact that, especially during the last decades, studies have linked both CSR and brand loyalty to several relevant business benefits.

Thus, by retaining existing customers strong competitive advantages can be gained (McMullan, 2005), brand loyalty being proved to be significantly and positively associated to business performance and long-term profitability (Salegna & Goodwin, 2005).

Moreover, based on several scientific endeavors, researchers have suggested that if companies adopt, implement, and communicate CSR policies, and, consequently, are perceived as good corporate citizens, they

can leverage or enhance employee attraction and retention (Kim & Park, 2011), purchase decisions (Brown & Dacin, 1997; Sen & Bhattacharya, 2001; Becker-Olsen, Cudmore, & Hill, 2006), and customer relationship (Sen & Bhattacharya, 2001; Pelozo & Shang, 2011). Researchers have also argued that by being perceived as socially responsible, business organizations can turn customers into brand ambassadors and make them more resilient to negative brand news, while all these generate positive reactions from other stakeholders such as seeking employment with the company or invest in it (Du, Bhattacharya, & Sen, 2010).

Given the above-outlined arguments and considering the level of competitiveness in the banking industry, it is extremely important that the relationship between brand loyalty and perceived CSR be deeply and thoroughly investigated in the specified context, as well as the influence of consumer demographics on the nature and extent of this relationship. Such a research endeavor can contribute to the literature on CSR and brand loyalty, and could also outline practical implications for efficient CSR implementation and communication in the banking industry, with direct and indirect effects on customer loyalty.

Moreover, considering the particular socio-cultural and economic context of Central and Eastern European countries, very little is known about the relationship between perceived CSR and brand loyalty, both in general, and in the particular sector of banking services, and even less regarding the demographics-based dissimilarities of this relationship.

Under these considerations, the purpose of the current paper is to analyze the

demographic discrepancies regarding the relationship between customers' perceptions of CSR and their loyalty towards retail banks within the particular context of Romania – one of the largest national markets of Central and Eastern Europe. Our investigation is based on data collected within a survey conducted among a large non-probabilistic sample of Romanian retail banking customers, taking into consideration several variables regarding the extent to which Romanians perceive their banking services providers as being socially responsible, and their loyalty towards these providers. Our results indicate several significant dissimilarities between gender, age, education, and residence type based consumer segments, concerning the impact of various CSR dimensions, as perceived by customers, on brand loyalty towards corporate brands in the Romanian retail banking sector.

The paper is further structured into four main sections. The first section includes a theoretical background and develops several research hypotheses, the second one describes the methodology of the research, the third one includes a detailed presentation of the results along with discussions, while the fourth and last section outlines the conclusions and implications of the research.

1. Theoretical Background and Research Hypotheses

In this section, after briefly describing the concepts on which the research is based (CSR and brand loyalty), we depict the theoretical background regarding the relationship between brand loyalty and perceived CSR in the banking sector, as well as concerning the correlations between consumers' demographics and their perceived relevance of CSR-related aspects, and, based on the depicted theoretical background, we develop several specific research hypotheses.

1.1 The Concept of CSR

CSR represents a complex, wide and, therefore, difficult to define concept. After analyzing no less than 37 definitions of CSR, Dahlsrud (2008) came to the conclusion that despite certain similarities among various definitions of CSR, a widely accepted definition in this case still remains an important issue in the literature.

From a general perspective, CSR can be regarded as a company's engagement

in improving the social well-being through discretionary or philanthropic business practices and through contributing from its own resources (Kotler & Lee, 2005). More specifically, CSR includes those voluntary activities that integrate economic, social and environmental concerns in business operations (Van Marrewijk, 2003).

Despite its complex nature, most of the approaches regarding CSR systematization and quantification can be reduced to three main categories: those based on stakeholders, those based on sustainability principles, and, respectively, those circumscribed to Carroll's (1979) view. From a stakeholder-based perspective (Freeman, Harrison, Wicks, Parmar, & De Colle, 2010), CSR can be systematized into several dimensions, each being related to corporate responsibilities towards a certain stakeholder category: shareholders, customers, employees, the environment, the society etc. From a sustainability stand point (Kolk & Van Tulder, 2010) CSR integrates economic, environmental and social responsibilities. Finally, Carroll's (1979) perspective on CSR regards it as a four-dimensional concept including economic, legal, ethical, and discretionary/philanthropic responsibilities of organizations.

1.2 The Concept of Brand Loyalty

Brand loyalty represents one of the most investigated concepts, especially in the marketing literature. However, during the last decades the concept has been subject to several divergent approaches, its definition and meaning being still a matter of debate in the literature, most of these issues originating from its dual nature: attitudinal and behavioral (Oliver, 1999).

Therefore, despite the apparent simplicity of some popular definitions such as the one provided by brand "guru" David A. Aaker (1991) who regards brand loyalty as a reflection of how likely a consumer is to switch to another brand, especially when that brand makes a change in marketing programs, we consider the original and classic definition of brand loyalty given by Jacoby and Chesnut (1978) as being more relevant and suited from a measurement perspective, the authors regarding it as a function of psychological processes consisting in the biased behavioral response expressed over time by consumers with respect to one or more alternative brands out of a set of brands.

From this standpoint, many scholars have emphasized the fact that behavioral loyalty cannot distinguish between true loyalty and spurious loyalty (Dick & Basu, 1994), psychological commitment and positive brand attitude being essential elements of the authenticity of brand loyalty.

1.3 The Relationship between Brand Loyalty and Perceived CSR in the Banking Sector

Investigating the relationship between brand loyalty and perceived CSR in the financial services industry represents a relevant and difficult research topic, brand loyalty in the service sector being more elusive and unpredictable as compared to other sectors (Vlachos & Vrechopoulos, 2012).

After scrutinizing the main scientific literature sources one can be surprised by the fact that relevant research on this particular topic and, respectively, specific industry is rather scarce and mostly focused on Western and developed regions such as the USA (e.g. Walsh & Beatty, 2007; Choi & La, 2013), Spain (e.g. Marin, Ruiz, & Rubio, 2009; Salmones, Pérez, & Bosque, 2009; Matute-Vallejo, Bravo, & Pina, 2011; Pérez, Salmones, & Bosque, 2013), Australia (e.g. Chomvilailuk & Butcher, 2014), or Austria (e.g. Öberseder, Schlegelmilch, Murphy, & Gruber, 2014).

Thus, Walsh and Beatty (2007), after conducting a survey among American customers of banks, retailers and restaurants, concluded that perceptions regarding a company being customer orientated, a good employer, a reliable and financially strong company, or socially and environmentally responsible, all positively influence customer satisfaction, trust, and loyalty. American consumers were also investigated by Choi and La (2013) whose results suggest that perceived CSR has a significant impact on customer trust and loyalty in the context of service recovery (their sample including American students who had a recent service failure and recovery experience).

Spanish consumers have also been extensively investigated with regard to the impact of perceived CSR on brand loyalty in the financial services sector. Thus, Marin et al. (2009), after surveying customers of a regional bank from Spain, found that CSR has an indirect effect on brand loyalty, mediated by customer-company identification. Salmones

et al. (2009) also conducted a survey among customers of financial services companies from Spain, their results showing that customer satisfaction, trust, and identification with the company are the main determinants of loyalty, ethical and social dimensions of CSR having an indirect effect, mediated by trust and customer-company identification. Matute-Vallejo et al. (2011) also surveyed customers of banks from Spain, showing that both CSR and price fairness indirectly contribute to achieving customer loyalty, with satisfaction and commitment as mediating variables. More recently, Pérez et al. (2013) investigated a sample of financial services companies' customers from Spain, suggesting that perceived CSR contributes to building consumer-company identification, which is positively correlated to satisfaction, while satisfaction along with consumer-company identification determine attitudinal customer loyalty.

Two other significant studies conducted on the topic regard the Austrian and the Australian markets. Öberseder et al. (2014), after conducting a survey among Austrian customers of a manufacturer, a FMCG company, and a bank, found a direct and positive relationship between customers' perceptions of CSR (towards customers, employees, the environment, community, society, shareholders, and suppliers) and their purchase intention, as well as an indirect one, mediated by customer-company identification. Similarly, Chomvilailuk and Butcher (2014), after surveying Australian bank customers, found that CSR perceptions have significant effects on purchase intentions and word of mouth.

Given the above-outlined theoretical background, and considering the purpose and context of the current research, the following research hypothesis was issued:

H0: There is a positive relationship between perceived CSR and brand loyalty in the retail banking sector.

1.4 Consumers' Demographics and Perceived Relevance of CSR-Related Aspects

As already stated, the literature is rather scarce with regard to research on the relationship between brand loyalty and perceived CSR in the financial services industry, being mostly focused on developed countries and regions. This scarcity is even more acute when it

comes to considering demographic variables as potential moderators of the relationship between perceived CSR and brand loyalty. However, past research has tried to investigate the relationship between various demographic variables and consumers' knowledge, attitude and/or behavior related to socially responsible or sustainable products, demographics being widely used to profile the so-called 'green' consumers (Park, Choi, & Kim, 2012).

Thus, Shrum, McCarty, and Lowrey (1995), after conducting a survey among U.S. citizens, noted significant gender based differences in consumers' interest in purchasing environmentally safe products.

Berger (1997), after analyzing data concerning Canadian households, came to the conclusion that education, income, size of residential area, and type of dwelling represent significant determinants of consumers' environmentally responsible behaviors.

Wiidegren (1998) investigated a nationwide sample of Swedish consumers and indicated that while education and income do not have any influence on pro-environmental behavior and willingness to pay higher prices for environmentally friendly products, gender and age could be considered important factors of these CSR related behaviors and attitudes. Partially similar results were obtained by Laroche, Bergeron, and Barbaro-Forleo (2001) who, after analyzing the profiles of Canadian consumers, concluded that gender and marital status significantly influence consumers' willingness to pay more for environmentally friendly products, while consumers' age, level of education, household income, as well as work status, do not play significant roles in developing such green attitudes.

Diamantopoulos, Schlegelmilch, Sinkovics, and Bohlen (2003) developed and tested, on a large nationwide sample of British citizens, several hypotheses concerning the relationship between consumers' environmental consciousness and their demographic characteristics. Their results showed that consumers' gender, age and educational level have a significant impact on their environmental knowledge, attitudes and behavior (including green purchasing behavior). These findings among UK consumers were partially confirmed by Smallbone (2005) who indicated that consumers' behavior and concern about sustainability issues correlate positively with their age and income.

However, after analyzing a sample of UK consumers, Gilg, Barr, and Ford (2005) came to the conclusion that even though age and income positively influence green consumption, gender does not have an influence in this direction.

More recently, Jansson, Marell, and Nordlund (2010) concluded, based on a survey conducted among consumers from Sweden, that age and education level have a significant negative influence on green curtailment behaviors, education and income have a significant positive influence on consumer adoption of innovations marketed as green, while there are no significant differences regarding the investigated issues between gender-based consumer categories.

Paço and Raposo (2010), after investigating a sample of Portuguese consumers, found that age, education, occupation and income (but not gender) are significant for differentiating between the 'greener' consumer group and the other segments. However, Abeliotis, Koniari, and Sardianou (2010), after examining the profile of the Greek green consumer, found age and income (but not gender and educational level) to be influential factors in determining engagement in reuse and recycle activities, while age, income and gender (but not educational level) were found to be significant in influencing sustainable consumption. Moreover, Pinto, Nique, Añaña, and Herter (2011), after conducting a survey among a sample of Brazilians, indicated that consumers' ecologically responsible consumption is positively influenced by age, negatively impacted by education, and not at all differentiated among gender based groups.

Park et al. (2012) also examined the influence of demographic variables on consumers' behavior and choices with regard to environmentally friendly products. Thus, after analyzing a sample of Canadian consumers, the authors concluded that females are more likely than males to be ecologically conscious, that the relative importance of products' green certification differs cross income levels, in a non-linear way, while age and education are not significant in this direction. However, a different result was emphasized by Ansar (2013) who, after conducting a research among Pakistani residents, stated that no demographic variable (gender, age, income and education level being included in the analysis) is significantly related to consumers' green purchase intention.

A more complex research approach was recently embraced by Kim, Lee, and Park (2010) who conducted a study among U.S. and Korean consumers in order to examine how much variance associated with brand loyalty was explained by fair trade product beliefs and corporate evaluation, including several demographic factors in their analysis as potential relationship moderators. Their results suggest that, at least in the case of American consumers, the relationship between brand loyalty and the variables related to fair trade, as part of corporate social responsibility, is significantly moderated by gender and age, and insignificantly determined by consumers' country of residence or occupation.

As it can be seen, past research regarding the correlations between consumers' demographics and their perceived relevance of CSR-related aspects has shown inconsistent findings. Nevertheless, the overall findings suggest that consumers' knowledge, attitudes and behavior with regard to socially responsible or sustainable products and companies can significantly differ among various demographic-based market segments. Therefore, given the above-outlined theoretical background, and taking into consideration the purpose and context of the current research, the following research hypotheses were issued:

H1: The relationship between perceived CSR and brand loyalty in the retail banking sector differs among gender-based market segments.

H2: The relationship between perceived CSR and brand loyalty in the retail banking sector differs among age-based market segments.

H3: The relationship between perceived CSR and brand loyalty in the retail banking sector differs among education-based market segments.

H4: The relationship between perceived CSR and brand loyalty in the retail banking sector differs among residence-based market segments.

2. Methodology

In this section, we describe the research objectives, the research design, and the primary data collection method, providing details regarding the variables used in order to measure perceived CSR and brand loyalty, as well as relevant information concerning the

investigated sample. This section also includes a preliminary analysis of the data, based on an exploratory factor analysis, as well the proposed multiple linear regression model, in which demographic variables such as gender, age, education and residence type were included as potential moderators.

2.1 Research Objectives, Research Design, and Primary Data Collection Method

Given the business benefits of CSR and brand loyalty, and considering the level of competitiveness in the banking sector, it is important to examine the relationship between brand loyalty and perceived CSR in this industry, as well as the influence of consumer demographics on the nature and extent of this relationship. Such a research endeavor can contribute to the literature on CSR and brand loyalty, and could also outline practical implications for efficient CSR implementation and communication in the banking industry, with direct and indirect effects on customer loyalty.

The current research investigates the moderating influence of consumer demographics on the relationship between customers' perceptions of CSR and their corporate brand loyalty towards retail banks in Romania, one of the largest countries of Central and Eastern Europe.

The primary data were collected using a self-administered paper and pencil questionnaire which included 34 items (Tab. 1) for measuring CSR perceptions (28 items) and brand loyalty (6 items). All items were measured using Likert scales ranging from 1="strongly disagree" to 7="strongly agree", with a middle/neutral point.

The initial list of items was drawn up from relevant literature sources concerning the assessment of brand loyalty (Zeithaml, Berry, & Parasuraman, 1996; Cronin, Brady, & Hult, 2000; Sloot, Verhoef, & Franses, 2005; Rosenbaum, 2006; Martínez & Bosque, 2013), and the quantification of consumers' perception of CSR (Maignan, 2001; Salmons, Crespo, & Bosque, 2005; Wagner, Bicen, & Hall, 2008; Turker, 2009; Öberseder et al., 2014; Pérez & Bosque, 2013). The initial list was afterwards purified by identifying and removing those items which were considered ambiguous, redundant or imperceptible to potential respondents.

The CSR measurement item-pool was set so as to reflect all dimensions of the concept,

both from sustainable development perspective (comprising items regarding economic, environmental, and social responsibilities), and a stakeholder-based standpoint (including items to reflect responsibilities towards shareholders, customers, employees, society, public authorities).

The questionnaires were distributed, thoroughly explained, self-administrated, recovered and systematized between January and March 2015. The sampling technique was non-probabilistic, based on potential respondents' willingness to participate in the study, and consisted of quota sampling by gender and age, the final sample comprising 1,449 retail banking customers, most of them (85.5%) being users of the financial services provided by the four main banks activating in Romania: 554 customers (38.23%) of Banca Transilvania (owned by the BT Financial Group from Romania), 295 customers (20.36%) of BCR (owned by the Erste Group from Austria), 245 customers (16.91%) of BRD (owned by the Société Générale Group from France), and 145 customers (10%) of Raiffeisen Bank (owned by Raiffeisen Banking Group from Austria).

Respondents' gender and education level were measured as nominal data: "male" or "female" in the case of gender, and, respectively, "primary school, middle school or high-school", "BA university degree", "MA university degree" or "PhD degree or higher" in the case of education level. However, for the purpose of this research and considering the sample's educational level distribution, the

variable referring to respondents' education was recoded in order to generate two comparable similar-sized groups ("no university degree" or "university degree – BA, MA, or higher"). Age was measured as ordinal data (respondents stating their actual age, in years) and further on recoded so that it would also generate two comparable similar-sized groups ("up to 35 years" or "more than 35 years"). Finally, in what concerns the size of each respondent's city of residence, this variable was initially measured as nominal data (respondents stating their current city of residence); afterwards it was recoded so that the sample be divided into two comparable similar-sized groups, considering the current size of each specified city ("cities with up to 100,000 inhabitants" and "cities with more than 100,000 inhabitants").

Considering its demographic structure, the sample comprised 712 (49.14%) men and 737 (50.86%) women, 756 (52.17%) respondents aged up to 35 years and 693 (47.83%) older, 717 (49.48%) subjects with a university degree (BA, MA, or higher) and 732 (50.52%) without higher education, and, respectively, 759 (52.38%) respondents from cities with up to 100,000 inhabitants and 690 (47.62%) from larger cities.

2.2 Preliminary Analysis and Proposed Model

In order to operationalize the research, the large number of observed variables (34 items) was firstly reduced to a limited number of reflective latent variables after an exploratory

Tab. 1: Observable and latent variables – Part 1

Latent variables	Observable variables (items)	Based on*	Load**
Responsibility towards shareholders	Strives to maximize profits and improve economic performance	[1,2,3,4]	.861
	Pursues its success in the long term, not only in the short term	[1,2,3,4]	.810
Responsibility towards customers	Strives to offer its customers services of reasonable quality	[2]	.697
	Is concerned with its customers' satisfaction	[3,5]	.727
	Provides honest & complete information about its services	[2,3,5,6]	.762
	Charges fair and reasonable prices for its services	[2,6]	.742
	Provides safe services, not-threatening to physical/mental health	[2,6]	.671
	Works diligently to handle and solve its customers' complaints	[2,3]	.686

Tab. 1: Observable and latent variables – Part 2

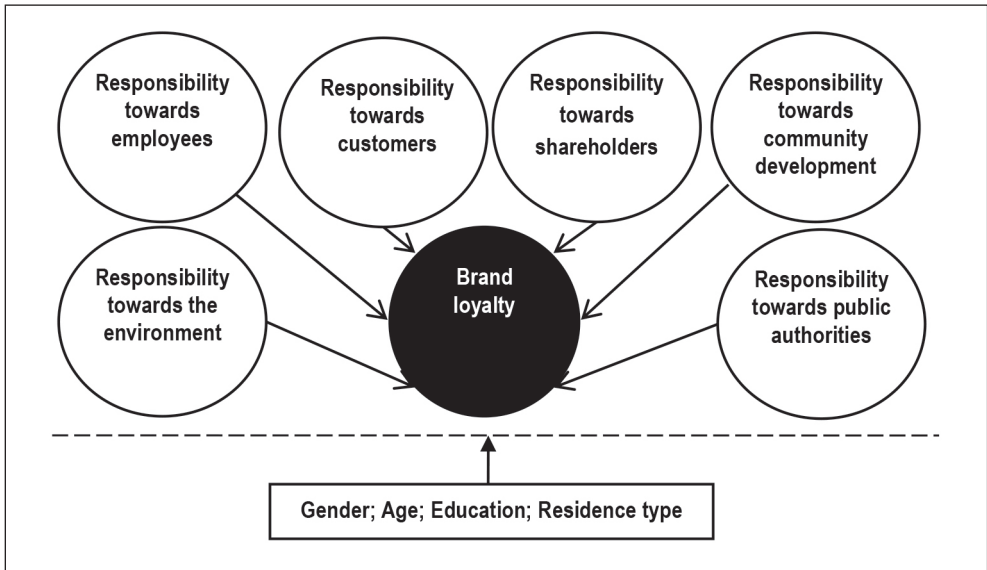
Latent variables	Observable variables (items)	Based on*	Load**
Responsibility towards employees	Pays its employees fairly and in a reasonable manner	[2,3,6]	.702
	Offers its employees decent working conditions	[2,3,6]	.749
	Does everything possible to prevent employees discrimination	[2,3,6]	.778
	Respects the rights of its employees	[1,2,5]	.839
	Treats its employees with respect	[6]	.822
	Provides development & promotion opportunities to employees	[2,3,5]	.700
Responsibility towards the environment	Does everything possible to reduce effects on the environment	[2,3,5,6]	.702
	Minimizes resources consumption that affect the environment	[2]	.821
	Works diligently to use environmentally friendly materials	[2,3,5,6]	.839
	Is concerned with waste management and recycling activities	[2,6]	.754
Responsibility towards community development	Contributes to the regional economic growth & development	[2]	.694
	Contributes to the welfare and life quality in the region	[1,3,4,5]	.687
	Creates and sustains jobs in the region	[2]	.771
	Contributes to the development of other companies in the region	[2]	.724
	Respects the values, customs and culture of the region	[2]	.595
	Supports charitable/social projects aimed at the disadvantaged	[1,2,3,4,5]	.648
	Supports cultural and social events (music, sports, etc.)	[3,4]	.640
Responsibility towards public authorities	Fully complies with the legislation in conducting its activities	[1,4,5,6]	.730
	Always pays state taxes in a fairly and honestly manner	[5,6]	.805
	Tries to prevent & avoid corruption in its relation with the state	[6]	.758
Brand loyalty	I consider myself a loyal customer of this bank	[9,10]	.695
	This bank is my first choice, compared to others in the sector	[8,11]	.775
	I will continue to be a customer of this bank	[7,8]	.745
	In the future I plan to purchase more services from this bank	[11]	.724
	I would recommend this bank to my friends & acquaintances	[7,8,11]	.738
	I wouldn't give up being a customer even if a competitor came up with a better offer	[11]	.598

Source: own

Note: * [1] Maignan, 2001; [2] Öberseder et al., 2014; [3] Pérez & Bosque, 2013; [4] Salmones et al., 2005; [5] Turker, 2009; [6] Wagner et al., 2008; [7] Cronin et al., 2000; [8] Martínez & Bosque, 2013; [9] Rosenbaum, 2006; [10] Sloot et al., 2005; [11] Zeithaml et al., 1996.

**Component loadings according to exploratory factor analysis using Varimax rotation (IBM SPSS Statistics 20).

Fig. 1: Proposed multiple regression model



Source: own

factor analysis with Varimax rotation. As it can be seen in Tab. 1, the six loyalty indicators were adequately grouped into a single latent variable, while the 28 perceived CSR items were clustered into six components: responsibilities towards shareholders, customers, employees, the environment, community development, and, respectively, public authorities.

From a statistical standpoint, the conducted factor analysis' reliability is appropriate: the Kaiser-Meyer-Olkin value $KMO = .937$ indicates excellent sampling adequacy, the Bartlett's test of sphericity ($\chi^2 = 31,609.326$; $df = 561$; $p < .001$) suggests appropriate correlations in the data set, and the resulted latent variables explain a total of almost 70% (68.565%) of their common variance.

After assigning each latent variable a score equal to the mean value of its reflecting items, a multiple regression model was proposed (Fig. 1) in which the latent variables regarding CSR perceptions were considered predictors, while the latent variable corresponding to brand loyalty was treated as dependent variable.

Furthermore, the proposed model was successively tested using multiple linear regression analyses within various demographics-based

consumer segments, in order to test the issued hypotheses.

3. Results and Discussion

Results in Tab. 2 convey the general conclusion that customers' loyalty towards their banks is positively and significantly impacted by how they perceive their financial services providers' overall CSR, confirming hypothesis H0. More specifically, in both gender categories, the variance in brand loyalty accounted for by customers' perceptions of CSR is very close to 50%: 47.7% in the case of men, and, respectively, 49.2% in the case of women. As it can be seen, in both cases the most influential dimension of perceived CSR consists of banks' responsibility towards customers ($\beta = .546/.593$; $p < .001$), while customers' perceptions regarding their banks' responsibilities towards shareholders or employees do not significantly impact brand loyalty.

However, even though both men and women are loyalty-sensitive with regard to how they perceive their banks' responsibilities towards community development, brand loyalty among male customers is slightly more influenced by this CSR perception as compared

to female customers (Beta = .114 and $p = .003$ versus Beta = .076 and $p = .022$). Two other important gender-based dissimilarities in the relationship between perceived CSR and brand loyalty can also be outlined: on one hand, brand loyalty is influenced by perceived responsibility towards the environment only in the case of female customers (Beta = .079; $p = .017$), while, on the other hand, perceived responsibility towards public authorities is only relevant for brand loyalty in the case of male customers (Beta = .080; $p = .021$). Considering the above described findings, hypothesis H1 is accepted.

The similar overall impact of perceived CSR on brand loyalty in both cases (men and women) is consistent with the findings of Gilg et al. (2005), Jansson et al. (2010), Pinto et al. (2011), Paço and Raposo (2010), and Ansar (2013), none of these researchers finding any significant influence of gender on consumers' attitudes towards sustainable products.

The fact that brand loyalty is influenced by perceived responsibility towards the environment only in the case of female customers is in accordance with the findings of Diamantopoulos et al. (2003) who showed that gender has a significant impact on environmental knowledge, attitudes and behavior, as well as with the results obtained by Park et al. (2012) who emphasize that women are more likely than men to be ecologically conscious. Similar findings were actually outlined by Shrum et al. (1995), Wiidegren (1998), Laroche et al. (2001), and Abeliotis et al. (2010), all these researchers stating that

gender plays a significant role in consumers' green consumption and willingness to pay more for environmentally friendly products.

Moreover, the dissimilarities between men and women in what concerns the impact of perceived responsibilities towards community development and public authorities on brand loyalty are consistent with the findings of Kim et al. (2010) who indicated that the relationship between brand loyalty and the variables related to fair trade is significantly moderated by gender.

Results in Tab. 3 are partially consistent with those previously outlined in Tab. 2. Thus, it can be restated that in all analyzed segments customers' loyalty towards their banks is positively and significantly impacted by how they perceive their banks' overall CSR (hypothesis H0 being thus confirmed), the most influential dimension of perceived CSR consisting of banks' responsibility towards customers (Beta = .537/.608; $p < .001$). The impact of perceived responsibility towards community development is also significant (Beta = .078 and $p = .021$; Beta = .108 and $p = .003$), while customers' perceptions regarding their banks' responsibility towards employees do not significantly impact brand loyalty.

Nevertheless, the variance in brand loyalty accounted for by customers' perceptions of CSR is slightly different among the two age categories: 46% in the case of those aged up to 35 years, and, respectively, 51.5% in the case of older customers.

However, only younger bank customers are loyalty-sensitive with regard to their

Tab. 2: Multiple regression standardized coefficients: men versus women

	Men			Women		
	Beta	t	p	Beta	t	p
Shareholders	-.058	-1.901	.058	-.047	-1.616	.106
Customers	.546	15.030	.000	.593	18.352	.000
Employees	.070	1.955	.051	.053	1.572	.116
Environment	.028	.817	.414	.079	2.393	.017
Community development	.114	3.023	.003	.076	2.299	.022
Public authorities	.080	2.312	.021	.044	1.306	.192
	R ² = .477; F(6,705)=107.33; p<.001			R ² = .492; F(6,730)=117.99; p<.001		

Source: own data processing (IBM SPSS Statistics 20)

Tab. 3: Multiple regression standardized coefficients: younger versus older

	<=35 years			>35 years		
	Beta	t	p	Beta	t	p
Shareholders	-.026	-.854	.393	-.079	-2.706	.007
Customers	.537	15.652	.000	.608	17.850	.000
Employees	.066	1.936	.053	.063	1.795	.073
Environment	.087	2.665	.008	-.001	-.019	.985
Community development	.078	2.306	.021	.108	2.980	.003
Public authorities	.057	1.700	.090	.076	2.176	.030
	R ² =.460; F(6,749)=106.17; p<.001			R ² =.515; F(6,686)=121.63; p<.001		

Source: own data processing (IBM SPSS Statistics 20)

banks' responsibility towards the environment (Beta = .087; p = .008), while brand loyalty is impacted by perceived CSR towards public authorities (Beta = .076; p = .030) and shareholders (Beta = -.079; p = .007) only in the case of older customers. It is also important to emphasize the fact that in this latter case the impact on brand loyalty is negative, older bank customers being less loyal to their banks if they perceive them as being too focused on profitability and business performance. Considering these findings, hypothesis H2 is accepted.

The finding that the overall impact of perceived CSR on brand loyalty is larger in the case of older customers is consistent with the results of Smallbone (2005) who state that consumers' behavior and concern about sustainability issues correlates positively with their age, and with those of Kim et al. (2010), who indicate that the relationship between brand

loyalty and the variables related to fair trade (as a component of corporate social responsibility) is significantly moderated by age.

The fact that only younger bank customers could be emphasized as loyalty-sensitive with regard to their banks' responsibility towards the environment is both consistent and inconsistent with past research. Thus, the findings of Gilg et al. (2005), who state that age positively influence green consumption, and those of Pinto et al. (2011), who indicate that consumers' ecologically responsible consumption is positively influenced by age, strongly contradict this paper's results. Our results are also inconsistent with other previous findings such as those of Laroche et al. (2001), Park et al. (2012) and Ansar (2013) who could not identify any significant influence of age on consumers' behavior and choices with regard to environmentally friendly products. However, our

Tab. 4: Multiple regression standardized coefficients: lower versus higher educated

	No university degree			University degree		
	Beta	t	p	Beta	t	p
Shareholders	-.030	-.988	.323	-.076	-2.619	.009
Customers	.563	16.606	.000	.583	16.748	.000
Employees	.071	2.054	.040	.045	1.268	.205
Environment	.018	.549	.583	.083	2.473	.014
Community development	.103	2.952	.003	.080	2.250	.025
Public authorities	.077	2.299	.022	.056	1.603	.109
	R ² =.474; F(6,725)=108.97; p<.001			R ² =.495; F(6,710)=115.98; p<.001		

Source: own data processing (IBM SPSS Statistics 20)

results are in accordance with Diamantopoulos et al. (2003) who identify several past studies which emphasize that younger members of the population exhibit higher levels of environmental consciousness.

Results in Tab. 4 are less consistent with those previously outlined in Tab. 2 and Tab. 3. Consistencies refer to the fact that hypothesis H0 is confirmed in all analyzed segments, customers' loyalty towards their banks being positively and significantly impacted by how they perceive their banks' overall CSR (the variance in brand loyalty accounted for by customers' perceptions of CSR being relatively similar for the two education-based consumer segments: 47.4% and 49.5%). Moreover, in both education categories banks' responsibility towards customers is the most influential dimension of perceived CSR (Beta = .563/.583; $p < .001$).

However, only less educated bank customers' loyalty is significantly impacted by how they perceive their banks' responsibilities towards employees (Beta = .071; $p = .040$) and public authorities (Beta = .077; $p = .022$), while only higher educated customers are loyalty-sensitive with regard to their banks' responsibilities towards the environment (Beta = .083; $p = .014$) and shareholders (Beta = -.076; $p = .009$). It is again important to emphasize the fact that in this latter case the impact on brand loyalty is negative, higher educated bank customers being less loyal to their banks if they perceive them as being too focused on profitability and business performance. Considering the above described dissimilarities, hypothesis H3 is accepted.

Our findings indicating that the variance in brand loyalty accounted for by customers' overall perceptions of CSR is relatively similar for the two education-based consumer segments is consistent with previous studies' results such as those of Wiidegren (1998), Laroche et al. (2001), Abeliotis et al. (2010), Park et al. (2012), and Ansar (2013), none of these researchers identifying any significant influence of consumers' education on their attitudes towards sustainable products.

If the particular responsibility towards the environment is taken into consideration, our findings are in accordance with previous research conducted by Berger (1997), Diamantopoulos et al. (2003), Jansson et al. (2010), and, respectively, Paço and Raposo

(2010), all of these authors emphasizing that there is a significant positive influence of consumers' educational level on their attitude and behavior towards environmentally friendly products/companies. However, our results do not support the findings of Pinto et al. (2011) who outlined that consumers' ecologically responsible consumption is negatively impacted by education.

Results in Tab. 5 present several common findings as compared to those previously emphasized. Thus, no matter the size of the city consumers reside in, their corporate brand loyalty is positively and significantly influenced by how they perceive their banks' overall CSR, hypothesis H0 being confirmed (customers' perceptions of CSR accounting for almost 50% of the variance in brand loyalty in both segments). Moreover, perceptions regarding companies' responsibilities towards customers (Beta = .575/.567; $p < .001$) and community development (Beta = .084 with $p = .020$, and Beta = .122 with $p = .001$) are significant predictors of brand loyalty in both cases.

Nevertheless, brand loyalty is significantly impacted by how customers perceive their banks' responsibility towards employees only in the case of bank customers residing in smaller cities (Beta = .073; $p = .036$), while only those residing in larger cities are loyalty-sensitive with regard to how they perceive their banks' responsibilities towards public authorities (Beta = .089; $p = .009$) and shareholders (Beta = -.063; $p = .041$). As within previous results, in this latter case the impact on brand loyalty is negative, bank customers from larger cities being less loyal to their banks if they perceive them as being too focused on profitability and business performance. Finally, considering the findings above, hypothesis H4 is accepted.

Even though past research has tried to investigate the relationship between demographic variables and consumers' attitudes towards sustainable products, variables related to the size of consumers' residential areas have generally been ignored. One of the very few studies which take this demographic variable into consideration is that of Berger (1997) who concludes that the size of consumers' residential area represents a significant determinant of their environmentally responsible behavior. Berger's (1997) results do not contradict our findings which emphasize the fact that banks' perceived responsibility

Tab. 5: Multiple regression standardized coefficients: smaller versus larger cities

	Cities with <=100,000 inhabitants			Cities with >100,000 inhabitants		
	Beta	t	p	Beta	t	p
Shareholders	-.047	-1.648	.100	-.063	-2.043	.041
Customers	.575	16.588	.000	.567	16.816	.000
Employees	.073	2.099	.036	.041	1.166	.244
Environment	.065	1.901	.058	.032	.977	.329
Community development	.084	2.338	.020	.122	3.455	.001
Public authorities	.037	1.068	.286	.089	2.608	.009
	R ² =.499; F(6,752)=124.69; p<.001			R ² =.468; F(6,683)=100.05; p<.001		

Source: own data processing (IBM SPSS Statistics 20)

towards the environment doesn't significantly impact their customers' loyalty neither in the case of those residing in smaller cities, nor in the case of those living in larger ones.

Conclusions and Implications

This paper manages to fill a regional knowledge gap regarding the moderating influence of consumer demographics on the relationship between perceived CSR and brand loyalty in the retail banking sector of Romania, one of the largest Central-Eastern European countries.

The results indicate that, regardless of consumer demographics, brand loyalty is positively and significantly influenced by how customers' perceive their banks' overall CSR, perceptions regarding companies' responsibilities towards customers and community development being significant predictors of brand loyalty in all demographics-based categories.

However, there are certain demographics-based dissimilarities in what concerns the relationship between perceived CSR and brand loyalty in the Romanian retail banking sector. Thus, brand loyalty is influenced by perceived responsibility towards the environment only in the case of female customers, while, on the other hand, perceived responsibility towards public authorities is only relevant for brand loyalty in the case of male customers. Moreover, only younger bank customers are loyalty-sensitive with regard to their banks' responsibility towards the environment, while brand loyalty is impacted by perceived CSR towards public authorities and shareholders only in the case of older customers. Also, only less educated bank

customers' loyalty is significantly impacted by how they perceive their banks' responsibilities towards employees and public authorities, while only higher educated customers are loyalty-sensitive with regard to their banks' responsibilities towards the environment and shareholders. Last but not least, brand loyalty is significantly impacted by how customers perceive their banks' responsibility towards employees only in the case of bank customers residing in smaller cities, while only those residing in larger cities are loyalty-sensitive with regard to how they perceive their banks' responsibilities towards public authorities and shareholders.

It is also important to emphasize that, even though for most of the analyzed CSR dimensions customers' perceptions are positively associated with brand loyalty, in the case of banks' responsibilities towards shareholders the impact on brand loyalty is negative. Thus, bank customers who are older, higher educated or residing in larger cities are less loyal to their banks if they perceive them as being too focused on profitability and business performance.

The findings have practical implications related to the adequate CSR implementation and communication in the Central-Eastern European retail banking industry. Starting from the premises that banks regard the enforcement of their customers' loyalty as a strategic direction, and that the benefits and business returns of CSR are contingent on stakeholders' (in this case customers) awareness of CSR activities (Du et al., 2010), the paper conveys the idea that those banks which activate in

in the specific context of Central-Eastern European countries should be focused on communicating their responsibility towards customers in all demographics-based market segments, and, depending on the market segment they are targeting, should selectively convey their responsibility towards employees, the environment, community development and/or public authorities. Moreover, in certain demographics-based market segments, banks' focus on business performance, profitability and shareholders' satisfaction should be carefully conveyed within the public, as this could negatively impact their customers' loyalty.

The main limitations of our current paper consist of the fact that potential mediating factors of the relationship between customers' perceptions of CSR and brand loyalty were not included in our model. However, this represents a future research opportunity, our analysis being extendable by taking into consideration several mediating variables such as customer satisfaction, customer trust, company-consumer identification etc. and integrating them into a structural equation model along with perceptions of CSR as exogenous variables and brand loyalty as endogenous.

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Abstract

THE MODERATING INFLUENCE OF CONSUMER DEMOGRAPHICS ON THE RELATIONSHIP BETWEEN PERCEIVED CSR AND BRAND LOYALTY IN THE ROMANIAN RETAIL BANKING SECTOR**Ovidiu-Ioan Moisescu, Oana-Adriana Gică**

The current research investigates the moderating influence of consumer demographics on the relationship between customers' perceptions of corporate social responsibility (CSR) and their corporate brand loyalty towards retail banks in Romania, a typical developing country and one of the largest countries of Central and Eastern Europe. The investigation is based on data collected within a survey conducted among a sample of 1,449 Romanian retail banking customers, based on a questionnaire including a specific set of items drawn up from the literature, intended to reflect corporate brand loyalty, as well as perceptual CSR dimensions, from a sustainable development and stakeholder-based perspective. After an exploratory factor analysis, the observed variables were grouped into several latent variables regarding perceived CSR and brand loyalty and, further on, these were included into a multiple regression model which was tested comparatively within various sample groups generated based on consumer demographics variables. The results emphasize several significant dissimilarities between gender, age, education and residence type based consumer segments in what concerns the impact of various CSR dimensions, as perceived by customers, on brand loyalty towards corporate brands in the banking sector. Thus, brand loyalty is significantly influenced by: perceived responsibility towards the environment – only in the case of female, younger and/or higher educated customers; perceived responsibility towards public authorities – only in the case of customers who are male, older, less educated and/or residing in larger cities; by perceived responsibility towards shareholders – only when for customers who are older, higher educated and/or residing in larger cities. The findings have practical implications for enhancing corporate brand loyalty in the regional retail banking sector market by outlining those CSR policies, actions and attitudes which should have priority within local banks' marketing communications.

Key Words: CSR, brand loyalty, consumer demographics, retail banking.

JEL Classification: M31.

DOI: 10.15240/tul/001/2017-4-013

THE EFFECTS OF PERCEIVED SATISFACTION WITH SERVICE RECOVERY EFFORTS: A STUDY IN A HOTEL SETTING

Estrella Díaz, Mar Gómez, David Martín-Consuegra, Arturo Molina

Introduction

Innovation and the adoption of new business practices related to customer satisfaction are essential to improve social performance and sustainability, specifically in the tourism sector. While some tourism companies have developed new work strategies, it is difficult to consider issues such as quality certification, environmental policies, human resource training, or customer service norms, among other aspects. For example, in the case of hotels and restaurants, improved sustainability policies have been promoted through regulations and special actions (such as the ITQ 2000 ® RS norm), which generate more effective approaches to planning, innovation and customers and stakeholder relations (Buckley, 2012). Therefore, corporate model innovation is essential, and it must consider, as a fundamental element, the satisfaction of direct customers.

Numerous studies on customer satisfaction and relations management have been conducted in recent years as a result of company efforts aimed at offering quality services to target populations via quality certification. However, errors or customer complaints have often arisen through service provision processes. More specifically, it is important to note that within the service sector, the hospitality sector involves a high degree of personal contact between hotel staff and customers, during which various misunderstandings can result in service failures (Lewis & McCann, 2004). Thus, failed service provisions are viewed as lower quality services, causing potential negative effects on customer satisfaction, future consumption choices, and word-of-mouth communication (WOM) (Morrison & Huppertz, 2010). Tourists and customers of hotel establishments typically have excessively high standards and expect hotels to achieve such standards, e.g., sustainability (Doran & Larsen, 2014). To minimize the

negative effects of previous failures, companies can apply service recovery strategies that are designed to address problems and unsatisfied customers to maintain customer loyalty to the company (Miller, Craighead, & Karwan, 2000).

In this context, service recovery paradox (SRP) has become a key issue for companies in the competitive market place (Petnji, Marimon, & Casadesus, 2013). SRP is not a new concept, but from years researchers have been trying to solve the existence and standardize this phenomenon. They have been consistently trying to identify reasons why and how successful service recovery may cancel the impact of service failure (Krishna, Dangayach, & Sharma, 2014). A growing framework of literature has analyzed the relationships between service quality/recovery, satisfaction and loyalty, however few recent field empirical studies have addressed the influence of service failure/recovery encounters on customer evaluations in the hospitality industry. Specifically, there is a number of studies that have examined consumer satisfaction and recovery strategies in the context of the service sector (Chang & Chang, 2010; Kim & Jang, 2014; Río, Vázquez, & Díaz, 2009; Sánchez, Pieters, Zeelenberg, & Bigné, 2012) and in hotels (Mount, 2012; Mount & Mattila, 2009). The major limitation is most of the research in this area has been exploratory, scenario-based experiments and non-generalizable, and the outcome of the theoretical and empirical results of these studies appeared to be contradictory (Petnji et al., 2013). Additionally, few studies have examined instances of service failure and relationships between system failure recovery and effects on future hotel customer behaviors. The study of Mount (2012) introduces methods to calculate dollar amounts for revenue recovered through recovery efforts in the hotel industry, but this research does not measure

the actual future behavior of responding guests. By other hand, following the research outcomes of Boshoff (2005), researchers may assess the validity and reliability of RECOVSAT (an instrument to measure satisfaction with service recovery) in other service industries, such as the hospitality industry. Furthermore, Krishna et al. (2014) state that even after so many researches, they cannot conclude the existence of SRP, because SRP phenomenon needs to be further explored to give answer for various questions such as cultural difference. Moreover, limited research of service recovery is focused on the customer perception (Krishna et al., 2014).

Following the previous literature (e.g. Kim & Jang, 2014), this research is justified by the calls for more studies investigating the effectiveness of recovery efforts, extending previous research on post-recovery satisfaction and behavioral outcomes with a field study on the hospitality industry in a Western country, based on three main reasons: (1) it would be better to investigate if customers of different services would display similar behavior; (2) the previous findings cannot be generalized to other industries until further empirical studies are conducted and multi-item measures are used; and (3) while they claim that it will be interesting to see the findings gleaned from a similar study conducted on hotel guests from a European environment, there are no relevant studies following their call yet. Thus, the main objective of this work is to examine empirically the relationship between service recovery strategies following hotel service failures and their effects on consumer satisfaction and actual future behavior in Spain. The study examines the hospitality sector given this industry's focus on inspiring feelings of customer satisfaction via service recovery strategies. The results and primary conclusions and management implications of this study are presented in this research article.

1. Theoretical Framework

Services play a significant role in the dynamic economy (Singhal, Krishna, & Lazarus, 2013) and it shows an intense research and debate (Mount & Mattila, 2009). Because of their intangible nature, there is a possibility of failures from both the operational and the employee perspective (Petnji et al., 2013). Maintaining good relationships between companies and customers is an important issue

for academics and practitioners due to the rise of service orientation (Lin, Wang, & Chang, 2011). However, in spite of this positioning, service failures are inevitable, even in the best organizations (Mount & Mattila, 2009). Service failures are defined as a disaster of the core service, and several consequences can be derived: dissatisfaction or a declined customer confidence, among others (Miller et al., 2000). For most companies, service failure is the main reason for the loss of actual customers. Thus, service providers should learn how to respond to the various types of service failures (Lin et al., 2011). On occasion, service provision failures occur when suppliers cannot offer a service that would meet consumer expectations.

The service provider can satisfy the customer if a favorable response to the customer's expectations is given, although appropriate responses vary depending on socio-demographic factors such as gender or age, paradigms of sustainable tourism or approaches to service recovery execution (Boo, Mattila, & Tan, 2013; Cambra-Fierro, Berbel-Pineda, Ruiz-Benítez, & Vázquez-Carrasco, 2013; Ferguson & Moreno-Alarcón, 2015; Kwon & Jang, 2012). Service recovery refers to the actions that an organization or service supplier makes in response to service failure (Parasuraman, Zeithaml, & Malhotra, 2005; Tax & Brown, 2000). Marketing should lead to a firm-wide customer orientation, especially in service firms to manage service recovery. In recent years, extant literature present several contributions to service recovery, including both theoretical, and empirical assessments. Moreover, some authors have even quantified the service recovery efforts to provide a numerical measure to the effects of recovery on intent to return (Mount, 2012).

Additionally, service recovery strategies have traditionally been presented as key organizational elements, and especially in relation to the hospitality, banking, health care, retail, air transport sectors, tourism, and leisure and hotels (Krishna et al., 2014; Lin et al., 2011; Moreno, Hudson, & Aguilar, 2006; Vázquez-Casielles, Suárez-Álvarez & Díaz-Martín, 2010; Weber & Sparks, 2010).

1.1. Service Recovery, Customer Satisfaction and Subsequent Behaviors

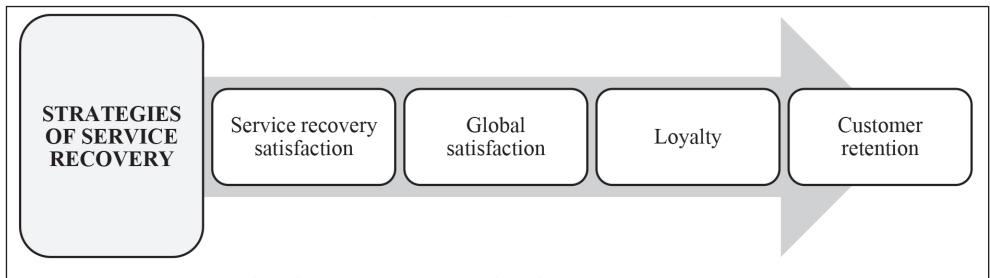
A recovery strategy is a process through which a supplier maintains customer

satisfaction following a service provision failure (Alexander, 2002). Some researchers design recovery processes to get maximum advantage of service recovery (Krishna et al., 2014). Recovery strategies serve as the most important determining factors of service quality and customer retention, having a direct impact on company profitability (Fig. 1).

Zeithaml, Berry and Parasuraman (1993) stated that customers are more emotionally involved and engaged when a recovery strategy is delivered than when original services are provided. Recovery situations have given rise to a complex phenomenon known as the SRP. This term refers to a phenomenon through which a customer, after receiving a failed service, filing a complaint with the company and being addressed through a satisfactory recovery response, experiences a level of satisfaction with the final service that is higher than the satisfaction that he would have achieved if the service were provided correctly from the start. In turn, this customer will become more loyal to

the company and more likely recommend the company to third parties (McCullough, 2010). Satisfaction and customer loyalty are relevant elements for business survival (Vildová et al., 2015). Nowadays, there is a growing body of empirical evidence that confirms the contribution of satisfactory service recovery on repurchase intention and WOM perceptions (Boshoff, 2005). Previous studies suggest that a highly effective service recovery provides a change to achieve higher satisfaction and customer retention (Lin et al., 2011). Successful service recovery can enhance customers' perceptions enhancing customer satisfaction, building longer customer relationships and leading to positive WOM (Michel, Bowen, & Johnston, 2009). If not, many negative outcomes will result, such as a negative WOM (Tax & Brown, 2000). The relationship among customer's perceptions of service recovery with satisfaction and customer retention has been also studied taking into account the quality management assurance certification as ISO 9001 (Petnji et al., 2013).

Fig. 1: Strategies of service recovery and subsequent behaviors



Source: Based on Miller et al. (2000) and Varela-Neira et al. (2010)

The marketing literature cites two approaches to consumer satisfaction measurement: cognitive (Fornell, 1992), and affective or emotional (Giese & Cote, 2000). According to the cognitive perspective, satisfaction is defined as a consumer response based on the consumer's evaluation of the relationship between the resulting product and a standard for comparison (Oliver, 1980). Among the cognitive theoretical approaches, the expectations disconfirmation approach is particularly noteworthy (Yoon & Kim, 2000). According to this perspective, the individual develops expectations of a product both

prior to purchase and after the consumption experience, and thus the individual compares the resulting product with his preconceived expectations. Thus, consumer satisfaction serves as a basis for the formation of subsequent attitudes and intentions. This perspective can be applied to tourism services due to expectations that are generated during purchases and due to expectations of enjoyment following the attainment services. Unlike prior approximations, the affective approach includes conceptualizations that define this phenomenon as a strictly emotional consumer response reflected through feelings, with the

result being an experience with a product or with certain product attributes (Giese & Cote, 2000). In more recent studies, a combination of both approaches has typically been applied (Johnson & Grayson, 2005; Varela-Neira, Vázquez-Casielles, & Iglesias-Argüelles, 2010).

On the other hand, consumer loyalty can be defined as non-random behaviors that express in-time factors depending on psychological processes and brand commitments, implying return purchases and favorable attitudes towards the product (Flavián & Guinalú, 2006). This phenomenon has been examined through two different approaches. From an attitudes-based perspective, feelings motivate the customer to establish commitment towards a product or service, which is measured by the customer's intention to repurchase, resistance to superior alternatives, price tolerance and intention to recommend the product or service (Vázquez-Casielles et al., 2010). On the other hand, loyalty from a behavioral perspective is based on other aspects that are indicative of the purchasing act such as the establishment visitation frequencies or expenditure percentages, thereby defining loyal customers as those who repurchase a brand or product. Consequently, loyalty is considered to be one of the main factors that supports company success and causes reductions in future transactions and sustainability overtime (Flavián & Guinalú, 2006). In this competitive marketplace, customer loyalty is critical to conducting business (Komunda & Osarenkhoe, 2012). There are some authors that contemplate both behavioral and attitudinal loyalty (Petnji et al., 2013).

Finally, WOM communication can be defined as informal conversations with other consumers on the properties, uses, and characteristics of goods, services and providers (Westbrook, 1987). Customers who experience service failure tell the incident to other ten people, while those not experiencing a negative service only tell to five people (Oliver, 2010). WOM has been studied using positive and negative approaches, with positive WOM serving as a manifestation or dimension of consumer loyalty towards a given product or establishment (Molinari, Abratt, & Dion, 2008). Therefore, positive WOM is configured as a consumer's possible reaction to a satisfactory consumption experience. A number of studies have empirically found such a relationship between satisfaction and WOM (East, Hammond, & Lomax, 2008).

In general terms, it has been proven in the literature that a higher degree of consumer satisfaction promotes higher levels of individual loyalty (Belás & Gabčová, 2016; McCollough, 2010). Positive effects of satisfaction on loyalty are reflected in consumer intentions to repurchase a product or service or to engage in positive WOM (Weber & Sparks, 2010). Consequently, companies can benefit from securing a base of stable customers or by reducing marketing costs (Doom & Verhoef, 2008), leaving the organization in a more competitive position (Kim, Kim, & Kim, 2009). In this context, the following research questions are studied:

RQ1: Is there a direct and positive relationship between satisfaction, failed service recovery strategies and overall consumer satisfaction?

RQ2: Is there a direct and positive relationship between consumer intentions to repurchase and overall consumer satisfaction after service provisions fail and are recovered?

RQ3: Is there a direct and positive relationship between positive WOM about a service provider and consumer intentions to repurchase after a failed and recovered service is encountered?

2. Method

To address the proposed questions, an empirical study of the hospitality industry was conducted. Scenarios methodology has been frequently used in service failure and recovery research (i.e., Kim & Jang, 2014; Liu & Mattila, 2015; Sengupta et al., 2015). However, Chebat and Slusarczyk (2005) highlight two major limitations for scenarios methodology used in service failure and recovery studies. Firstly, the reaction to the scenarios is not to real service failure. Secondly, manipulated lab situations don't reflect customers' actual behavior. Because this study focuses on evaluating the effectiveness of service recovery actions in response to real service failure, data were collected using critical incident technique within a questionnaire survey design, (i.e., any event that significantly deviates, both positively and negatively, from normal expectations) rather than a simulated scenario-based procedure. The study focuses on negative critical incidents (Gardial, Flint, & Woodruff, 1996), i.e., the most recent problems of special relevance that customers had experienced throughout their stay at a hotel.

Since this study focused on the service recovery effects within the hospitality industry, the targets were adults of both genders older than 18 years of age who had stayed at least one night at one of the nine 4-star hotels or four 5-star hotels in the Historic City of Toledo (Spain), which has the elite title of UNESCO World Heritage City. Additionally, they had complained for problems that occurred during the stay in the hotel and have perceived some type of recovery effort. During the fieldwork, an average occupancy of 81.42% with an average guest stay of 1.6 nights was observed (INE, 2015). In order to avoid response biases, three interviewers spent two months conducting a random sampling in different places and situations within the city (hotels' surroundings, historical center, principal monuments, and popular restaurants' surroundings). The questionnaire was applied on different days and times. If the subject approached was not stayed in any of the 4-star or 5-star hotels, had not any complaint or was not experienced any recovery effort, the interviewers thanked them for their time and concluded the interview. The respondents were not offered an incentive for participating. No significant variations in data collection across the different interviewers or systematic differences in samples by locations were found before adopting a single sample for further analysis.

A total of 986 clients of those hotels were intercepted. Unfortunately, 698 interviewees did not have a service failure experience or was not solved yet, 14 interviewees did have a complaint but did not completely finish the survey, and 274 questionnaires were completed and valid from clients who had experienced failed service provisions. Of the 274 consumers surveyed, who are representative of the study population, 60.1% were male and 39.9% were female. Over 56% had graduated from university and had an average age of 34.3 years. The age distribution was: 23.0% between 18 and 30 years of age, 35.4% between 31 and 40 years of age, 23.7% between 41 and 50 years of age and 17.9% fifty years of age or older. Most of the respondents travelled two-three times a year, and their major reservation method was to use a travel agency. The majority of the service failures (72.5%) were personnel-related failures, i.e., slow servicing, and only 27.5% percent were other failures.

For data collection purposes, a structured questionnaire was used. The study questionnaire is divided into sections. The first section includes

socio-demographic questions. The second bloc contains questions on customer relations with respective hotel establishments and on critical incidents experienced. A final section includes measurement scales related to the main objective of the study. The measurement scale used was adapted from scales used in prior studies. In all cases, Likert 7 point scales were used to measure the following variables (1 = completely disagree, 7 = completely agree).

Literature review presents different instruments to assess customer satisfaction with their service recovery efforts. In this sense, RECOVSAT is a valid instrument for service managers to assess customer satisfaction with service recovery efforts (Boshoff, 2005). This author highlights the multi-dimensional nature of service recovery. Therefore, service recovery strategies were measured using RECOVSAT that was developed and redefined by Boshoff (1999; 2005). The scale is composed of six dimensions: communication, training, response, apology, explanation and tangible features (Tab. 1). A six-item instrument adapted from the Oliver (1980) scale was used to measure consumer satisfaction with the service received. Repurchase intention was measured based on four items according to the Reynolds and Beatty (1999) scale. The last dimension, which includes three items, refers to positive WOM generated after the service is delivered (see the Maxham and Netemeyer (2002) scale and Zeithaml, Berry and Parasuraman (1996) scale). Individual items for these constructs are listed in the Appendix.

The data obtained will serve to test the research questions proposed in the theoretical framework of this research, which uses multivariate techniques. To be more precise, the method used has been structural equations. This will allow authors to present evidence of the internal structure of the constructs, that is, its reliability and validity. Following recommendations by Hair, Black, Babin, and Anderson (2009), and Anderson and Gerbing (1988), confirmatory factor analysis was done using the EQS 6.1 software.

3. Results and Discussion

A model of structural equations was used to answer the research questions proposed (Hair et al., 2009; Anderson & Gerbing, 1988). Before testing the structural model the measurement model needs evaluation, Bagozzi's (1984)

Tab. 1: Dimensions of the RECOVSAT scale

Dimensions	Activities developed
COMMUNICATION	Hotel employees communicated clearly with customers who had experienced a failure in service, answered questions to understand the situation, exhibited a receptive attitude and were honest in their efforts to solve the problem.
TRAINING	Hotel employees who the received customer complaint solved the problem and did not need to solicit assistance from colleagues or hotel staff members.
RESPONSE	The hotel that failed in its service provision either provided a written response to the unsatisfied customer on the state of the problem or sent a written apology.
APOLOGY	The employees who committed the service failure politely apologized to address economic losses suffered by the customer.
EXPLANATION	The employees who committed the service failure provided an explanation for the error that the customer viewed as satisfactory.
TANGIBLE FEATURES	The hotel employees who committed the service failure offered compensation for inconveniences caused (refund, exchange of goods/ services for similar services or discounts on future purchases).

Source: Adapted from Boshoff (2005)

methodology for validating multidimensional constructs was used to assess the scale. This study assesses the reliability and validity of all the constructs through an overall confirmatory measurement model (Tab. 2). As evidence of convergent validity, the confirmatory factor analysis results indicate that all items are significantly ($p < 0.01$) related to their hypothesized factors, that the size of all of the standardized loadings are greater than 0.60 and that the averages of the item-to-factor loadings are greater than 0.70.

The findings also demonstrate the high internal consistency of the constructs. In each case, the Cronbach's alpha exceeds Nunnally and Bernstein's (1994) recommended threshold of 0.70. Composite reliability represents the shared variance among a set of observed variables measuring an underlying construct (Fornell & Larcker, 1981). A composite reliability of at least 0.60 is generally considered desirable. This requirement is met for every factor. The average variance extracted (AVE) is also calculated for each construct, resulting in AVEs greater than 0.50 (Fornell & Larcker, 1981).

Evidence for the discriminant validity of the measures is provided in two ways (Tab. 3). First, none of the 95% confidence intervals of the individual elements of the latent factor

correlation matrix contain a value of 1.0 (Anderson & Gerbing, 1988). Second, the shared variance between the pairs of constructs is always less than the corresponding AVE (Fornell & Larcker, 1981). Overall, these results indicate that the measures possess adequate reliability and validity.

The results of the SEM are summarized in Tab. 4. The structural model provides a good fit to the data based on a number of fit statistics ($S-B\chi^2 = 565.335$, $p = 0.00$; Root Mean Square Error of Approximation (RMSEA) = 0.054; Normed Fit Index (NFI) = 0.938; Non-Normed Fit Index (NNFI) = 0.943; Comparative Fit Index (CFI) = 0.964; and Incremental Fit Index (IFI) = 0.954). Fig. 2 presents the factorial loads or intensities relative to existing relationships between various failed service recovery and customer satisfaction features. The figure shows that service recovery strategy satisfaction is directly and positively related to overall customer satisfaction. This answers the first research question. When hotel managers or employees commit a service failure towards a customer but respond appropriately with adequate service recovery strategies, the customer experiences an increase in consumer satisfaction. Recovery strategies carried out by hotel managers or employees can be measured

Tab. 2: Measurement scale validation

Item	RELIABILITY			CONVERGENT VALIDITY		DISCRIMINANT VALIDITY	
	Cronbach's Alpha (α)	CR	AVE	Factor loading	Loading Average	Critical pair	Confidence Interval Test Variance Extracted Test
COM1 COM2 COM3 COM4 COM5	0.94	0.93	0.75	0.858***	0.867	SAT,INT Corr=0.79 Corr ² =0.63	Confidence Interval for $\pm 2\sigma$ = [0.69,0.90] Corr ² _{SA AL} < AVE _{AL} < AVE _{SA}
0.944***							
0.921***							
0.799***							
0.813***							
TRA1 TRA2 TRA3	0.91	0.88	0.72	0.848***	0.844		
0.963***							
0.720***							
RES1 RES2	0.90	0.84	0.72	0.849***	0.853		
0.858***							
APO1 APO2 APO3	0.91	0.88	0.71	0.818***	0.838		
0.743***							
0.954***							
EXP1 EXP2	0.92	0.89	0.80	0.935***	0.899		
0.863***							
TAN1 TAN2	0.89	0.83	0.71	0.904***	0.846		
0.789***							
SAT1 SAT2 SAT3 SAT4 SAT5 SAT6	0.92	0.93	0.72	0.828***	0.848		
0.800***							
0.888***							
0.927***							
0.894***							
0.750***							
INT1 INT2 INT3 INT4	0.93	0.91	0.73	0.849***	0.859		
0.863***							
0.818***							
0.906***							
WOM1 WOM2 WOM3	0.87	0.87	0.69	0.815***	0.831		
0.889***							
0.789***							

***p<0.01; **p<0.05; *p<0.10

Source: own

Note: CR: Composite Reliability, AVE: Average Variance Extracted, COM: communication, TRA: training, RES: response, APO: apology, EXP: explanation, TAN: tangible features, SAT: satisfaction, INT: repurchase intention, WOM: word-of-mouth.

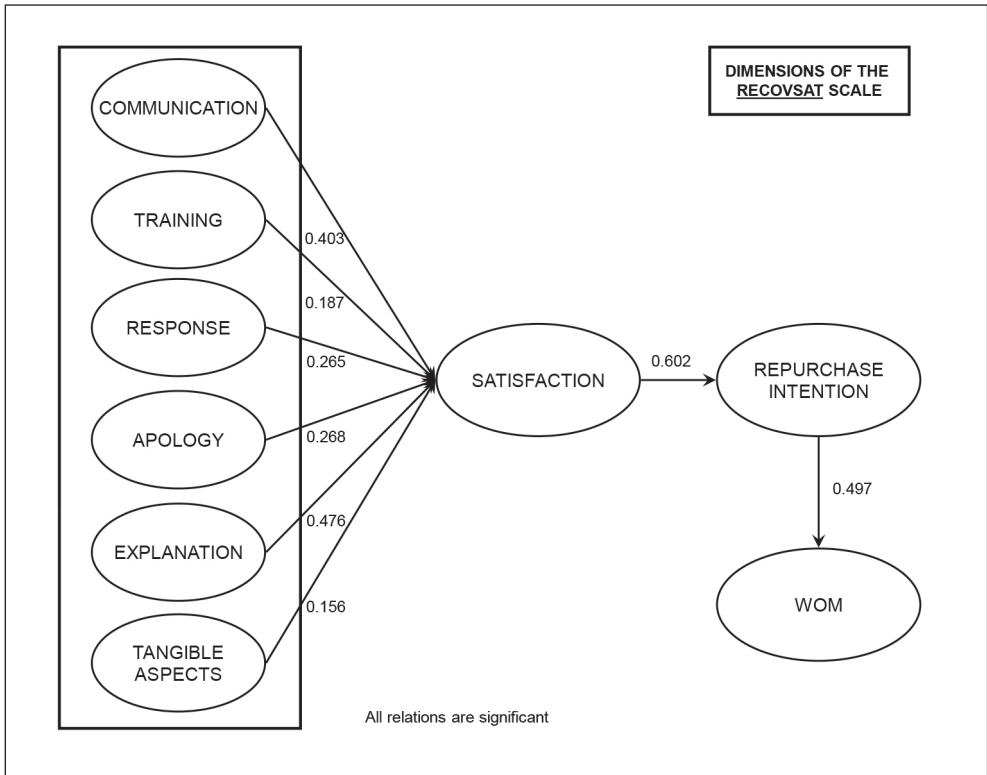
Tab. 3: Validation of the measurement model. Discriminant validity

	COM	TRA	RES	APO	EXP	TAN	SAT	INT	WOM
COM	0.75	0.15	0.10	0.14	0.10	0.04	0.54	0.44	0.43
TRA	[0.29-0.46]	0.72	0.22	0.20	0.06	0.33	0.17	0.46	0.09
RES	[0.23-0.42]	[0.61-0.77]	0.72	0.16	0.17	0.20	0.23	0.50	0.37
APO	[0.51-0.70]	[0.65-0.80]	[0.55-0.73]	0.71	0.11	0.18	0.51	0.62	0.44
EXP	[0.19-0.41]	[0.15-0.33]	[0.56-0.73]	[0.24-0.42]	0.80	0.26	0.57	0.38	0.24
TAN	[0.08-0.31]	[0.47-0.67]	[0.59-0.75]	[0.34-0.52]	[0.41-0.60]	0.71	0.36	0.46	0.30
SAT	[0.66-0.81]	[0.31-0.51]	[0.37-0.57]	[0.63-0.80]	[0.81-0.92]	[0.52-0.67]	0.72	0.63	0.13
INT	[0.59-0.74]	[0.60-0.76]	[0.62-0.80]	[0.57-0.68]	[0.69-0.83]	[0.62-0.74]	[0.69-0.90]	0.73	0.60
WO	[0.56-0.74]	[0.17-0.41]	[0.47-0.75]	[0.54-0.79]	[0.61-0.80]	[0.46-0.64]	[0.27-0.45]	[0.72-0.83]	0.69

Source: own

Note: Diagonal represents the average variance extracted; while above the diagonal the shared variance (squared correlations) is represented. Below the diagonal the 95% confidence interval for the estimated factors correlations is provided.

Fig. 2: Model contrast



Source: own

based on six elements: tangible features ($\beta = 0.156$, $p < 0.01$), i.e., compensation, an adequate explanation made to the customer by the employee who conducted the service failure ($\beta = 0.476$, $p < 0.01$), an apology ($\beta = 0.268$, $p < 0.01$), a positive response to the employee who conducted the service failure ($\beta = 0.265$, $p < 0.01$), sophisticated hotel staff training on responding to service failures ($\beta = 0.187$, $p < 0.01$) and, finally, adequate communication between the employee responsible for the service failure and the dissatisfied customer ($\beta = 0.403$, $p < 0.01$).

Regarding the second research question, Fig. 2 depicts a strong relationship between overall consumer satisfaction and service recovery and repurchase intention ($\beta = 0.602$, $p < 0.01$). This relationship is positive and direct, proving that higher degrees of overall customer

satisfaction with service recovery strategies offered by hotel managers or employees result in greater degrees of repurchase intention from the customer who filed a complaint.

Finally, regarding the last research question, there is a positive and direct relationship between repurchase intention of customers who filed complaints and subsequent positive WOM communication from these customers ($\beta = 0.497$, $p < 0.01$). Thus, higher degrees of repurchase intention among customers who received failed services will correlate with positive recommendations made about these hotels by the same customers to their peers. Additionally, Tab. 4 shows the impact of each construct, including the direct, indirect and total effects. Customer satisfaction also affects WOM through Repurchase Intentions, with a significant indirect effect ($\beta = 0.299$).

Tab. 4: Statistics of model fit measures and the effects of each construct

	χ^2 / df	NFI	NNFI	CFI	IFI	RMSEA			
Model value	2.446	0.938	0.943	0.964	0.954	0.054			
Recommended values	≤ 3	≥ 0.9	≥ 0.9	≥ 0.9	≥ 0.9	≤ 0.08			
	SATISFACTION			REPURCHASE INTENTION			WORD-OF-MOUTH		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
COM	0.403		0.403		0.243	0.243		0.121	0.121
TRA	0.187		0.187		0.113	0.113		0.056	0.056
RES	0.265		0.265		0.159	0.159		0.079	0.079
APO	0.268		0.268		0.161	0.161		0.081	0.081
EXP	0.476		0.476		0.286	0.286		0.142	0.142
TAN	0.156		0.156		0.094	0.094		0.047	0.047
SAT				0.602		0.602		0.299	0.299
INT							0.497		0.497

Source: own

In terms of the indirect effect of WOM, Explanation ($\beta = 0.142$) has the strongest effect, followed by Communication ($\beta = 0.142$).

The results of the study reveal effective failed service strategies for increasing consumer satisfaction and repurchase intentions after requested service provision failures occur. The empirical results also show that communication and explanation are the dimensions of importance to consumers when they report a service failure to a service firm

(Boshoff, 2005). This finding is consistent with the findings of Sparks and Callan (1996), de Ruyter and Wetzels (2000), that the communication and explanation of the service provider can positively influence customer satisfaction. Communication with staff responsible for receiving complaints on defective service provisions directly affects service satisfaction and indirectly affects repurchase intentions and positive WOM through these latter variables. Therefore,

training for hotel staff on ways to attend to service provision problems is imperative. The results also reveal a direct and significant effect on recovery strategies, responses, and apologies on service satisfaction and a mediating effect on future customer behaviors. Additionally, the importance of compensation through tangible features is also reflected in Boshoff (2005) conclusions and partially by Wirtz and Mattila (2004). Customer satisfaction has a positive impact on service recovery, leading to a high-level of positive WOM behavior and repurchase intention. To improve this customer loyalty, hotel managers need policies and systems for service recovery with improved communication and explanation. A failure in reliability is failing once, failing in recovery is failing twice, and that is where the guest is lost. These findings are consistent with the outcomes of Komunda and Osarenkhoe (2012), that if this is not done, it is highly likely that dissatisfied customers will either change service provider or engage in negative WOM to the detriment of the hotel, leading to loss sales and profits (Johnston & Michel, 2008). On the other hand, consumers who receive fair service recovery are more likely to book again and will send the guest away with a positive experience to share with others.

4. Conclusions

According to Oliver (2010), customer conflicts are inevitable; however, a powerful service recovery strategy can turn these conflicts into opportunities to improve performance and raise profitability. This study presents findings based on real service failure cases of an analysis of relationships between the failure recovery strategies and their effects on future customer behaviors in relation to hotel establishments. This work, using data collected from customers who have actually complained to a hotel establishment, stresses the importance of adequate service recovery strategies performed by hotel employees in shaping consumer behaviors following a service provision failure. Thus, customer satisfaction with hotel service recovery strategies affects customers' repurchase intentions and subsequent positive WOM recommendations.

Nowadays, developing and maintaining a relationship with new and existing customers has become a key business strategy. However, throughout the lifetime of customer relationships with a firm, unforeseen situations

such as problems associated with product or service failures may occur and firms must effectively handle these problems to maintain customer satisfaction and loyalty (Boshoff, 2005; Marimon, Petnji, & Casadesus, 2012). Service performances that fail to meet customer expectations implies that adequate service recoveries have to be in place to ensure customer satisfaction. As Zeithaml, Parasuraman and Berry (1990) state, "When a service problem does crop up, however, all is not lost, unless the company ignores it. In other words, by resolving the problem to the customer's satisfaction-by performing the service very right the second time-the company can significantly improve customer-retention rates" (p. 31). The results of this study equip hotel service providers with means of addressing service provision failures in ways that prevent double deviation (a failure of service provisions and recovery strategies). As well, by acting on explanatory variables, hotel service providers can attempt to recover discontented customers. Thus, the results of this study highlight the need to collect information on emotional reactions to failed service provisions.

Complaints are also a very useful form of market information that can be used to make strategic and tactful decisions (Nyer, 2000). It is thus necessary for companies to manage comprehensive complaint management systems to track issues or service failures that can cause customer dissatisfaction. The study also illustrates the effect of employee apologies and explanations on customer satisfaction and future behaviors. These two failed service recovery actions are not costly to implement, and given their ability to "restore" perception of services, they should be incorporated into recovery systems. Additionally, that experienced frontline staff can be trained in appropriate decision-making techniques that build upon their practical abilities and experience to provide these service recovery solutions that benefit both the customer and the organization. To achieve this, service recovery by frontline staff needs to be timely, reassuring, and empathic. Finally, management teams must recognize that it is not possible to establish an overall strategy for addressing service failures, as appropriate recovery actions will vary with each specific case. This study recommends designing recovery process in such a way to get maximum advantage of this

phenomenon. Therefore, organizations should offer dissatisfied customers with the option to choose among various recovery options.

This study also presents various methodological limitations. First, the critical incident technique used to gather data is based on the recollection of past situations, and thus a “memory” bias may be present. Future research in this study area may apply different tools such as controlled experiments. It is also necessary to also comment on the cross-sectional nature of this study and on specific characteristics of the examined sector, which include significant degrees of price competition and seasonality. Future research may thus apply the model to other service spheres via longitudinal study to compare results for various time periods. Furthermore, data obtained through this study refer to only one type of service provider. The study results therefore cannot be generalized to other service providers or hotel establishments such as city-based hotels or business accommodations.

Future research efforts may use other moderating variables such as customer views regarding who is responsible for service failures (the company, the user or environmental factors), the timing of originating causes (stable or transitory) and levels of company control (complete or none). Finally, future research may examine cultural behavior differences between customer segments to determine how characteristics of customers that file complaints affect satisfaction levels or how external factors such as pricing or service provider traits affect customer responses to service failures.

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Appendix 1: Measurement items

Dimensions	Items
Communication	COM 1: The XXX Hotel employees I dealt with, communicated clearly when providing feedback about my complaint. COM 2: When I complained about poor service, the XXX Hotel employees asked questions to help clarify the situation. COM 3: The XXX Hotel employees I dealt with, were very understanding. COM 4: The XXX Hotel employees I dealt with, were reliable COM 5: The XXX Hotel employees I dealt with, were honest in their endeavors to solve my problem.
Training	TRA 1: The employee I complained to first, was able to solve my problem. TRA 2: The employee I complained to first, had to find someone else to solve my problem. TRA 3: My complaint was passed on from one employee to the next.
Response	RES 1: XXX Hotel informed me about the progress made to solve my problem. RES 2: XXX Hotel sent me a written apology.
Apology	APO 1: XXX Hotel apology for the service fail. APO 2: XXX Hotel ensured that I am fine. APO 3: The XXX Hotel employees I dealt with, were polite.
Explanation	EXP 1: XXX Hotel provided me with an explanation of why the problem had occurred. EXP 2: The XXX Hotel employees I dealt with, provided a satisfactory explanation of why the problem had occurred.
Tangible features	TAN 1: The XXX Hotel employees I dealt with, were well dressed. TAN 2: The XXX Hotel employees I dealt with, work in a tidy, professional environment.
Satisfaction	SAT 1: I am satisfied with XXX Hotel. SAT 2: XXX Hotel meets my expectations. SAT 3: My choice was wise. SAT 4: The overall quality of a service offered by XXX Hotel is excellent. SAT 5: I think that I selected the right hotel. SAT 6: I am not happy with XXX Hotel.
Repurchase intention	INT 1: The ability of XXX Hotel to handle conflict well will influence my repurchase intention. INT 2: I feel committed to XXX Hotel. INT 3: After my experience with XXX Hotel, I will not change to other hotels. INT 4: In the future, I intend to book XXX Hotel.
Word-of-mouth	WOM 1: I would recommend XXX Hotel to my friends. WOM 2: I would spread positive word-of-mouth about XXX Hotel. WOM 3: If my friends were looking for a hotel, I would tell them to try XXX Hotel.

Source: Adapted from Boshoff (2005), Reynolds and Beatty (1999), Maxham and Netemeyer (2002) and Zeithaml, Berry and Parasuraman (1996)

Abstract

THE EFFECTS OF PERCEIVED SATISFACTION WITH SERVICE RECOVERY EFFORTS: A STUDY IN A HOTEL SETTING

Estrella Díaz, Mar Gómez, David Martín-Consuegra, Arturo Molina

In the service industry, the importance of achieving the satisfaction of all involved agents is widely recognized. It is important to note that within the service sector, the hospitality sector involves a high degree of personal contact between hotel staff and customers, during which various misunderstandings can result in service failures. Therefore, instruments that enable learning about and solving problems emerging from customers now serve as one of the most important elements of the hospitality industry. In this context, the objective of answering the call for more studies investigating the effectiveness of recovery efforts and discovering their effects to perceived customer satisfaction, following a service recovery process, and customer behavior outcomes towards a hotel which had dropped the ball but later offered a solution. A structural equation model using a sample of 274 valid questionnaires, obtained from hotel establishment customers who had experienced failed service provisions and who had shown their discontent with these services, was used to examine these issues. The results confirm a significant and positive effect between the analyzed relations and also reinforce the importance of recovery efforts on satisfaction in service recovery and also determine the impact of that perceived satisfaction on behavioral outcomes of the affected consumers. Additionally, the empirical results show that communication and explanation are the dimensions of importance to consumers when they report a service failure to a service firm. Based on these results, this study recommends designing recovery process in such a way to get maximum advantage of this phenomenon. Therefore, organizations should offer dissatisfied customers with the option to choose among various recovery options.

Key Words: Hotels; repurchase intention; satisfaction; service recovery; word-of-mouth.

JEL Classification: M31, L83.

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BUSINESS SYSTEM AS AN EQUILIBRIUM OF INTENTION AND CAUSALITY

Václav Řepa

Introduction

More than 20 years after the idea of business process-driven management was born there still exist essential insufficiencies in the understanding of how business processes should be modeled in order to respect this idea. These insufficiencies are manifesting themselves even in the existing modeling standards. As the modeling of business process is a necessary first step in the process of implementing the process-driven management idea, this situation seems to be a main barrier of the needed putting this idea into the real life.

On the other hand, there are existing theories, methods and ideas, already known in other contexts, which directly address the problems and features behind the above mentioned insufficiencies of the current state. As usually, the root of the problem is not the insufficient basic knowledge but rather the insufficient realization of the proper context.

The aim of this article is to draw attention to the essential features of the business processes and business systems in the context of their modeling. The needed reflection of these essential features in the modeling language and methodology will be analyzed. In addition, the basic insufficiencies of the contemporary approaches to the business process modeling will be pointed out together with the outline of possible ways of their overcoming.

As a basis of the main principles used in considerations in this article we use the MMABP methodology Řepa (2003), OpenSoul project (2015). MMABP (Methodology for Modeling and Analysis of Business Processes) is a 'language independent' methodology based on the set of meta-models which define the basic concepts and express the basic principles of the methodology, and completed with the set of techniques, consistency rules and patterns. MMABP is generally open in terms

of principal ability to be completed with newer concepts, principles, techniques, etc. if they are consistent with its principles and the meta-models. As the MMABP is based on meta-models instead of particular languages it can be also used as a basis for the evaluation of any modeling language towards the principles.

The root idea, this article is based on, is that business process is an equilibrium of intention and causality. This idea is based on the fact that business process always represents the way of following some intention. Every business process has the goal which represents the meaning of the process. Every action performed in the process than should be targeted to its goal. The above described features of the business process mean that business process is always subjective. On the other hand, business process always exists in some environment which defines the conditions that have to be respected by the process actions. These conditions have different forms: the restrictions of possible actions, time and other types of limits, admitted of prohibited consequences, etc. Although the conditions become from different resources: the nature itself, legislation, habits, or specific local restrictions or features, they all have to be respected in the process unconditionally. From the process point of view all conditions given by the process environment are objective. Therefore, we call the summary of all these mandatory conditions, no matter where they come from, the causality of the business system.

Concluding from previous two paragraphs one can see the business process as a way of following some intention in the environment which particularly restricts its actions. The correct business process thus must balance between its purpose and the given causality of the environment.

The article is divided into five sections. In the second section, after this introduction, we

follow the root ideas of cybernetics in order to explain the concept of intentionality and its consequences in business system modeling as well as its impact on the business process modeling methodology and language. Third section is focused on the concept of causality in business systems. Relevant informatics theories and techniques for modeling the real world causality are introduced in this context. In the fourth section the relationships between both basic types of the business system models (intentional business process versus causal ontology model) are discussed together with the methodological consequences. In this section we also introduce basic consistency rules from the MMABP methodology. In the final section we summarize the main ideas from the article, discuss connected insufficiencies of the current approaches and outline some basic task for the future development.

1. Intentionality in Business System

In the legendary article Rosenblueth, Wiener and Bigelow (1943) authors expressed the idea which essentially influenced the later development of cybernetics: *'all purposeful behavior may be considered to require negative feed-back'*. The concept of negative feed-back is explained there as follows: *'...the behavior of an object is controlled by the margin of error at which the object stands at a given time with reference to a relatively specific goal. The feed-back is then negative, that is, the signals from the goal are used to restrict outputs which would otherwise go beyond the goal'*.

According to the basic work in the field of process-driven management (Hammer, & Champy, 1993) business process always follows some goal. The goal is a fundamental attribute of a business process as it is regularly used in matured methodologies like in Eriksson and Penker (2000) for instance. That means that business process is always an intentional process. By the term intentional process we mean the process of purposeful behavior of interested object following some goal.

Concluding from previous two paragraphs one can find that the business process, as it is an intentional kind of process, have to have some negative feed-back which ensures restriction of its outputs in order to keep them in the margins of its goal. This characteristic strongly distinguishes the business process from the process in general (i.e. in just technical

/physical sense) as well as from processes which do not need any feed-back like machine-managed or automated processes running without a contact with their environment.

In the case of business process the feed-back is represented by the input to the process from its environment which is causally connected with some process output. The value of the input should influence the following behavior of the process in terms of keeping it in the margins of its goal. This means that 'intermediate' inputs to the process (i.e. none-starting inputs to the process coming between its starting and end points) are critically important parts of the business process distinguishing it from other, non-intentional (i.e. non-business), processes. Working with processes we have to take into the account even the time dimension; every input to the process from its environment has to be synchronized with the process run. Thus, in each part of the process where some input which influences the following process run is expected the process state has to be placed. Process state means such point in the process structure where nothing can be done before the input to the process occurs, i.e. point of waiting for the input.

1.1 The Concept of Process State in the MMABP Methodology

The ideas presented in this article are systematically elaborated in the MMABP methodology (Methodology for Business Processes Analysis and Design). MMABP distinguishes between two main types of models: business process versus business object models. In both types of model the methodology recognizes the global model (system view) and the detailed model. The modeling tools used by the methodology are based on common standards BPMN (Business Process Model and Notation (2011)), UML (Unified Modeling Language™ Infrastructure Specification version 2.4.1 (2015)), and Eriksson/Penker Notation (Eriksson and Penker (2000)). The essence of the methodology is defined in the formal meta-model (Business System Modeling Specification (2015)) as a part of the development project OpenSoul (OpenSoul project (2015)). The meta-model consists of three main packages which correspond to the main dimensions of the business system model: Business Substance Meta-model, Business Process Meta-model, and Business Models Consistency Model.

The 'intentional' part of the business system is a subject of the Business Process Meta-model (see Fig. 1). Business Process Meta-model defines the essential concepts in the field of business processes and their relationships, and express the principles which the modeling of business processes should be based on.

As it is visible from the meta-model the concept of 'state' is, together with 'stimulus' and 'activity', one of the basic building blocks of the business process description. Meta-model also expresses its essential relationships to other basic concepts:

- State is a mandatory consequence of both types of the process activity (processing and control, the difference is only in the cardinality of the relationship which depends on the type of the activity). This principle expresses the fact that every process activity (i.e. an action performed in the process) needs to be followed by waiting for the reaction from outside the process (a feed-back).

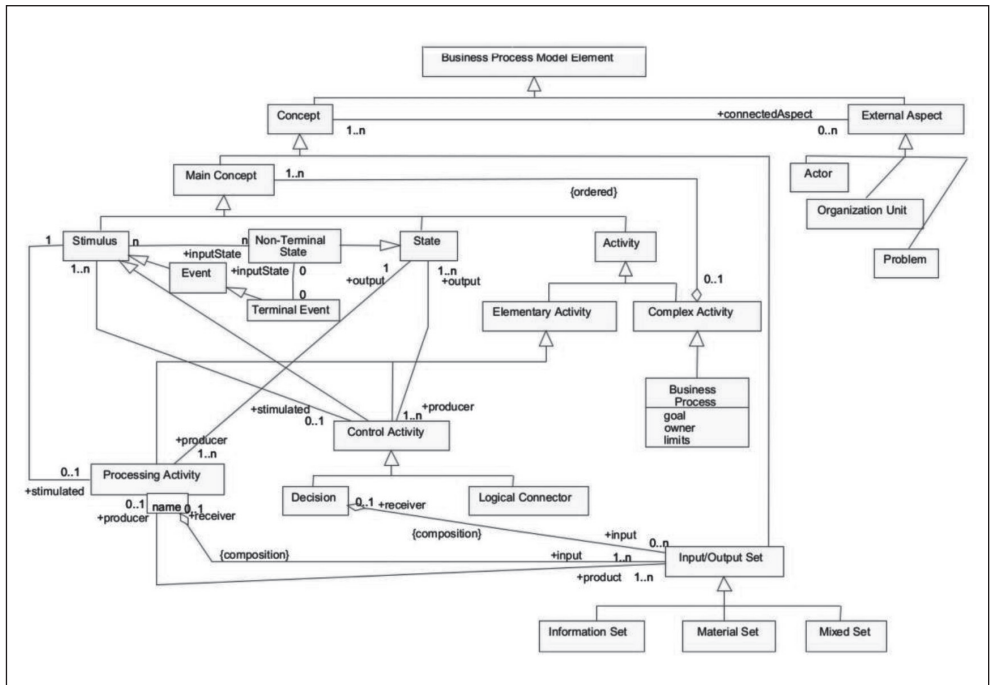
- State has to be connected with at least one 'event' type of 'stimulus'. This principle expresses the fact that following process activity can be performed after the reaction from outside the process (a feed-back) occurs. The feed-back comes to the process in the form of 'event'.

The definition of basic principles in the meta-model is absolutely exact, nevertheless (and therefore) it is very hardly readable. Moreover, the meta-model in just defining the principles but does not explain their meaning and purpose. Therefore, the meta-models in the MMABP methodology are completed with partial, not so exact but more easily readable, definition of some principles in the form of so-called process patterns.

There are two main kinds of Business Process Patterns in the MMABP:

- Basic Business Process Flow Pattern** which defines the basic procedure and decision points of the process of model

Fig. 1: MMABP Business Process Meta-model



Source: OpenSoul project (2015)

creation. This pattern is essential in the MMABP, it expresses the main principles, rules, and other aspects of the MMABP approach to the business process modeling. It also defines and explains the role of the process state in the process description and therefore it is explained in detail in this article.

- **BP patterns for particular situations** which cover typical situations frequently occurring in business process models where it is possible to find some generally valid structures, principles and constructions which should be fulfilled by the process description undoubtedly. There are several most general process patterns in the MMABP:
 - **Complementary Events Pattern,**
 - **Repeating State Pattern,**
 - and some other specific patterns.

The first two mentioned complementary patterns for particular situations are also connected with the problem of process intentionality through their focus on two main concepts relevant to the problem: state and

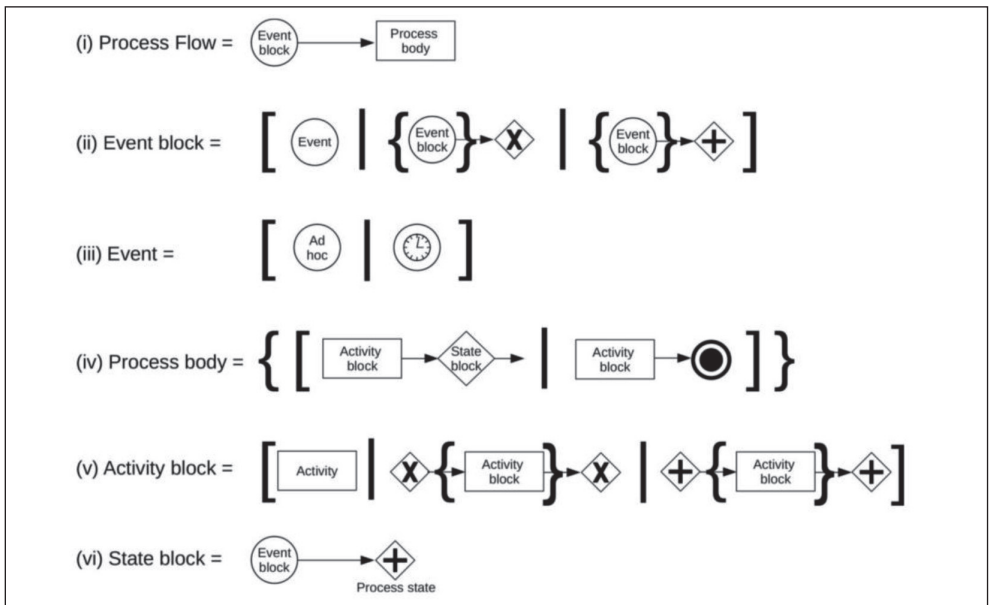
event. Thus, these two patterns are also explained in detail in following text.

1.2 Basic Process Flow Pattern

Basic Process Flow Pattern expresses the basic structure of the process model which respects the essential rules of the MMABP methodology. These rules express the ‘technical’ necessities which mainly follow from the general theory of algorithms as well as the specific aspects of the business process which distinguish the business process from a process in general (i.e. just technical) sense. The lately mentioned rules follow from the theory of BP management and re-engineering which is anchored already in the basic work in this field: Hammer and Champy (1993), Davenport (1993). Basic Process Flow Pattern (see Fig. 2) expresses the essence of the process flow using three methodically essential types of the process elements: events, activities, and states.

According to the Basic Process Flow Pattern the business process should be described as a sequence of *Activity blocks* interrupted by *State blocks* starting with just one *Event block* (starting event) and resulting in

Fig. 2: Definition of basic blocks and concepts of the BPF Pattern



Source: Business System Modeling Specification (2015)

one or more *End states*. The definition is written in the semi-formal metalanguage based on the simplification of the standard Extended Backus-Naur Form (for details and explanation of the EBNF see Syntactic Metalanguages ISO/IEC International Standard 14977 (1996)). Used meta-symbols have following meanings:

- $A = [element1 | element2 | element3]$ means that the item *A* can be either *element1* or *element2* or *element3* exclusively.
- $A = \{ elementX \}$ means that the item *A* consists of one or more *elementsX*.

Particular definition sentences can be read as follows:

- Def (i): Process flow begins with starting Event block followed by the Process Body.
- Def (ii): Event block is either a single event, or structure of mutually exclusive Event blocks, or structure of mutually synchronized Event blocks.
- Def (iii): Event can be either an ad-hoc event or a timer.
- Def (iv): Process body consists of one or more pairs where each pair consists of an Activity block followed by either State block or End State. If the pair ends with State block the description should continue with another pair (see the arrow after the State block). End state always means the end of the process.
- Def (v): Activity block is either a single Activity, or structure of mutually exclusive Activity blocks, or structure of parallel Activity blocks.
- Def (vi): State block is a synchronization of internal process flow with expected event(s) expressed as an Event block (in other words: waiting for the event(s)).

Event block represents the external influence which the process always has to respect. It works either as a trigger or a limiter of the process. In both cases it has to be unambiguous which means, among others, that is has to represent a single point of time. Therefore, it can be either a single event or a time-elementary structure of events. If it is a structure it can express either the synchronization of parallel events (event blocks) or the set of possible mutually exclusive

alternative events (event blocks) in order to be time-elementary.

Activity block represents an action element of the process. It can be either a single activity or a structure of activities (activity blocks). Similarly, as in the case of event also an activity should be unambiguous. Therefore, if it is a structure, it can express either the synchronization of parallel activities (blocks) or the set of possible mutually exclusive activities (blocks). It cannot express a sequence of activities as it would be a violation of the elementariness rule. The methodical reasons and meaning of the need for the elementariness of activities in the process description is discussed in more detail below.

State block represents the essential need to synchronize the process run with expected events. This need follows from the fact that the event is always an objective external influence and thus it must be respected. From the physical point of view such respect means synchronization – waiting for the event (event block). As the BPMN notation do not recognize the concept of process state there is no other way than to express the process state with the general symbol for synchronization – the ‘AND gate’. In order to distinguish between the general synchronization and its specific meaning as a process state we complete the BPMN with the stereotype <<process state>>.

One of the most important ideas expressed in this pattern is that there *cannot be a sequence of process activities uninterrupted by the process state*. This rule reflects the essence of the definition of an elementary process activity:

(a) the process activity is regarded as elementary if there is no objective reason for its interruption,

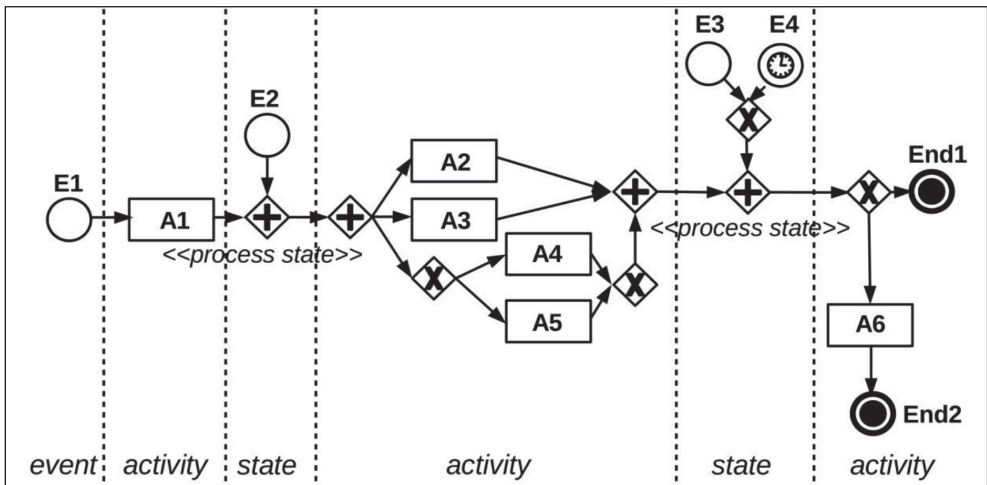
(b) the reason for the interruption of the activity is objective if it comes from outside of the process.

Rule (b) of this definition means that each objective reason for the process interruption is represented by an event (external influence) in fact. Thus, any activity of the process, no matter how technically complex it is, must be regarded as elementary if there does not exist an external influence (event) which the process has to respect (i.e. wait for). This consequence well illustrates the fact that the elementariness of a business process activity is not only its physical but much more a functional attribute as

the business process itself is always more than a physical process (algorithm) only. This way the methodology prevents the analyzer from the pointless unlimited dividing of the process activities which is a frequent mistake in the field of business process modeling. The necessity of such safety fuse in the methodology against the unlimited division of activities is given by the fact that in the field of process-oriented modeling the aggregation is a dominating type of abstraction (unlike in the field of object-oriented modeling

where the generalization is a dominating type of abstraction). This fact manifests itself in the principally unlimited possibilities of division of activities known as a rule: any single process activity can be decomposed into the structure of sub-activities – a process (as it is also defined by the process meta-model at Fig. 1). As the division of activities is physically unlimited the methodology has to define some logical – functional definition of the very low level: the level of the process elementariness.

Fig. 3: Correct business process flow example



Source: own

Fig. 3 shows the symbolic example of the process which can be regarded as correct according to the Basic Business Process Flow Pattern. The process can be seen as a sequence of several parts each representing one block of a particular basic type (see the division of the whole process by vertical dashed lines). It is beginning by the starting event block which consists of just single event E1 in this case – the starting event of the process. The starting event is followed by the activity block consisting of just single processing activity A1. According to the pattern the activity block is followed by the state block in the form of synchronization of the process run with just a single event E2. Following activity block represents more complex structure of activities: it consists of

the structure of three parallel activities where the first two are single processing activities A2 and A3, and the last one is a structure of two alternative processing activities A4 or A5. Following state block represents the waiting for two alternative events E3 or E4. The last activity block is a structure of two alternatives: the processing activity A6 followed by the process end End2 or the immediate process end End1.

The example in the Fig. 3 illustrates that and how any algorithmic structure of the process can be checked whether it fulfills the basic definition of the business process expressed by the Basic BP Flow Pattern: *business process is a sequence of Activity blocks interrupted by State blocks starting with just one Starting Event block and resulting in one or more End states.*

In the MMABP the Basic Process Flow Pattern is completed by a number of process patterns which model the specific typical situations which are often occurring in business process models. These situations are generalized and should be therefore instantiated for the use in the particular process.

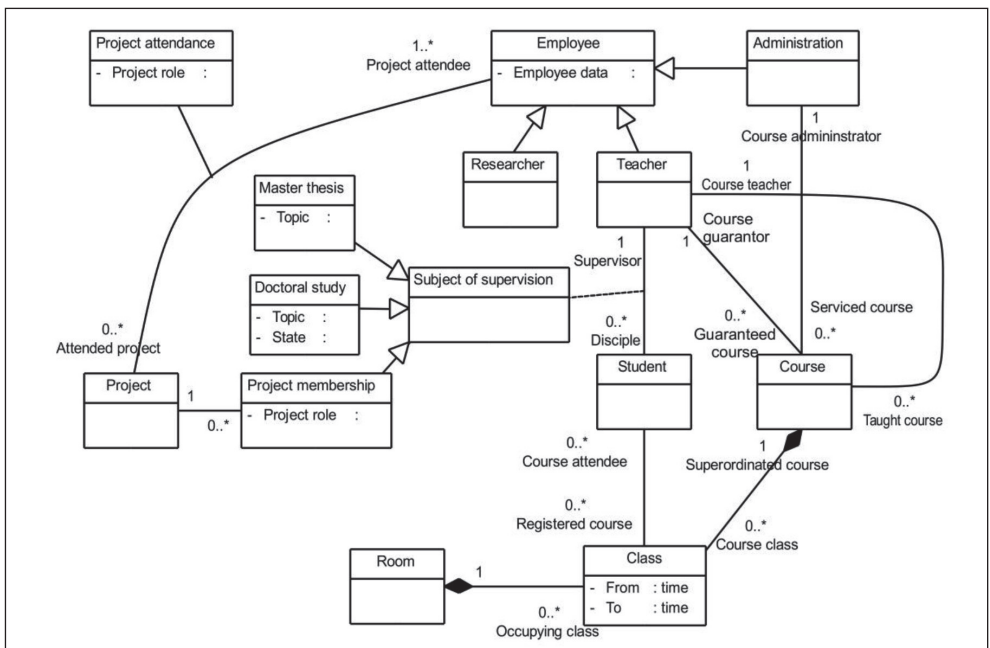
2. Causality of Business System

By the term 'causality' we understand an aggregate of basic facts, conditions, rules, relationships, presumptions, consequences, and other aspects of the given business system which can restrict the possible actions in a business process. As it follows from this definition, the causality of the business system is always superordinate to any action in the system, to any activity of any business process.

The traditional informatics technique for description of the real world causality is called Conceptual Modeling. The origin of conceptual modeling is closely connected with the database technology. The original purpose of the *technique for data modeling* was to create

the concept of the database whose structure is so flexible to be able to accept as much as possible needed future changes. The need for future changes of the database comes from the changes in the real world. As the real objects and their relationships are naturally changing, the contents of the database should change as well. The root motivation for data modeling is the need to design the database which would be able to accept as much as possible necessary changes in the real world without the need to change its own structure. Chen (1976) expressed the crucial idea that these criteria best fulfill such structure of the database which is similar as much as possible to the structure of the real world concepts. Therefore, the modeling technique has to be primarily aimed on analyzing the structure of the real world concepts. For that purpose he proposed a data model, called the *entity-relationship model*, which incorporates the important semantic information about the real world by modeling the real world concepts and their relationships. *Conceptual Modeling* was born.

Fig. 4: Example of the system model of objects (Class Diagram)



Source: own

Since the mid-nineties the *Class Diagram* from the UML (Unified Modeling Language™ Infrastructure Specification version 2.4.1 (2015)) has been accepted by the informatics community as a standard tool for conceptual modeling. Class Diagram describes the static structure of the system in the form of classes and relationships among them. Class Diagram is a basic diagram of the whole UML repertoire of diagrams. In the following decades there have come the new generation of the Real World modeling which can be also regarded as a successor of the traditional conceptual modeling: *ontology modeling* and *ontology engineering*. A comprehensive description and explanation of relationships among the conceptual modeling, ontology modeling and the UML can be found in Guizzardi (2005).

We understand the term 'system of business objects' to mean the global view of objects. This model expresses which objects in which mutual relationships form the business system. For an example of a particular system of business objects see Fig. 4 above. In principle, the system view of objects can simply recognize their existence and mutual context, not their dynamic details. This model is a conceptual model in the traditional meaning, in fact. Particular object classes in the model represent concepts which identify possible real objects from the business system. Relationships among object classes then identify possible links among real objects from the business system. Nevertheless, both real objects and their mutual links are naturally dynamic in the real world; they are changing in time. These dynamic aspects cannot be described in this model as it principally only represents a static view of objects. For the description of object's dynamics the detailed objects model (life cycles of objects) is intended.

One of the main reasons for using the UML Class Diagram as a standard is the fact that this diagram, as a part of the consistent system of diagrams UML, allows direct linking with the detailed object models – object life cycles in the form of UML State Charts.

2.1 Modeling Dynamics of Objects (Object Life Cycles)

Like in business process models, even in the field of business objects there is a need for a detailed view on some particular objects. Like in the case of business processes, even

the detailed view of a business object means viewing the object as a process. This process represents everything that can happen during the lifetime of the particular instance of the object class. Therefore, this detailed model of an object is called the *object life cycle*.

The object life cycle expresses the internal dynamics of each object of given class. It describes the mechanism of the object evolution during the time. As the tool for the Object life cycle description, the MMABP methodology uses the State Chart diagram from the UML (Unified Modeling Language™ Infrastructure Specification version 2.4.1 (2015)). MMABP regards the State Chart as a most suitable tool from the Unified Modeling Language for the purpose of the object life cycle description. Nevertheless, the State Chart has not been originally intended as a tool for description of life cycle. Its roots are in the field of state machines theory, and it is closely connected with the concept of so called 'real-time processing'. However, the concept of the state machine in general is not substantially reducible to just the area of real-time processing. There is also a need for recognizing the states and transitions among them in the area of data processing. The best proof of this idea is the concept of the object life cycle itself – once we think about the objects generally (i.e. in terms of their classes), then we have to strongly distinguish between the class and its instance. In the case of the object life this requires determining those points in the life of all objects of the same class, which we will be able to identify, and which it is necessary to identify in order to describe the synchronization of the object life with life cycles of other objects. Such points of the object life are its states. So each object instance lives its own life while the common structure of lives of all instances of the same class is described as a common life cycle of the object class.

Fig. 5 shows the example of the life cycle of the object class Teacher from the model at Fig. 4. For the understanding of the life cycle contents the relationships of the Teacher to other object classes from the ontology model are essential. There are four main states in the life of the Teacher:

- The state *Vacant* means that the teacher does not supervise any student and does not teach or guarantee any course (i.e. has no relationships to objects *Student* and *Course*). There are two possible ways from

this state: either the new student or course is assigned to the teacher which causes the transition to the state Occupied or the teacher is released (transition to the finite state Released).

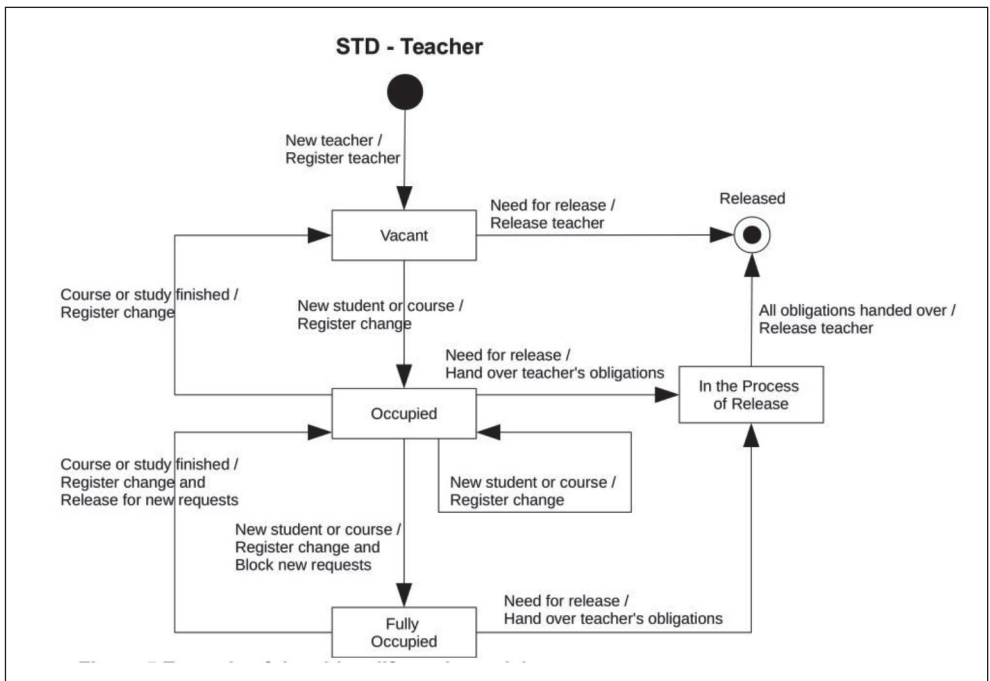
- The state *Occupied* represents the situation when the teacher supervises some students and/or teaches or guarantees some courses but he/she still has a free capacity for more students and/or courses (i.e. has some relationships to objects *Student* and *Course* but still in the given borders of his/her capacity). From this state the teacher can transit to any state including itself (see the self-transition in the case of the change which does not overflow the teacher's capacity and does not mean lose of the last student and/or course).
- The state *Fully Occupied* represents the situation when the teacher has no more capacity for any student and/or course. From this state the teacher can transit just back to the state *Occupied* or to the finite

state *Released* through the mid-state *In the process of release*.

- The state *In the process of release* is a necessary mid-step from the states *Occupied* and *Fully Occupied* to the finite state *Released* as the release of the teacher requires prior hand over of all supervised students as well as taught and guaranteed courses (i.e. redirecting all existing relationships to objects *Student* and *Course* to other *Teachers*).

Each described life cycle has to correspond to the particular object class in the Class Diagram. In such way the State Chart specifies the general mechanism of the life of all possible instances of the given class. Described states and transitions among them consequently correspond to the attributes and methods of the class. In fact, life cycle states represent the specific attribute of the class (no matter whether this attribute is present in the class description or not it always exists by

Fig. 5: Example of the object life cycle model



Source: own

the definition – it is necessary to distinguish among particular states/values of this ‘hidden’ attribute). Each transition between life cycle states then represents the use of the particular class method.

Every transition between states is described by the pair of attributes divided by slash (see Fig. 5). The first one represents the reason for the transition (why), the second one represents the way of the transition (how). The reason for the transition is an event (i.e. some external influence of the given object) while the way of the transition is a method of the given object (i.e. some action performed by or applied to the given object). The concept of events, as a common concept existing in both main points of view on the Real World dynamics, allows linking of the description of object life cycles with the description of business processes. Events used as reasons for transitions in object life cycles are the same events as those which trigger business processes. This way the *object life cycle serves as a bridge between intentional models of business processes and the description of the system causality in the form of the ontology model.*

Although the object life cycle as well as the business process are both process descriptions (description of the dynamics), there is a dramatic difference between them in the meaning of the ‘process’ concept. During the Real World modeling it is necessary to clearly distinguish between the ‘business process’ and ‘process in general’ concepts. On one hand it is necessary to model just the Real World processes and not the infrastructure processes (i.e. ‘software processes’, organizational procedures, performance of IS, etc.). On the other hand, the model of objects also describes the behavior – in the form of entity life algorithms (ordering of methods). Such behavior is seen from the point of view of objects and their relationships. It does not represent any intention. So, the ‘behavior of objects’ should be regarded as a structural aspect of the real world, i.e. something completely different from the business process which is intentional in principle. In the form of the process the Object life cycle thus describes just the set of rules which are given by the essence of the business and therefore have to be respected by all objects of the given class (so-called business rules). Unlike the process of the object life (object life cycle) representing the general internal logic of the object behavior,

the business process always represents some external business goal or any other form of intention. From the point of view of the object the business process thus expresses the *intentional combination of actions from the object’s life.*

3. Harmonizing Intentional Processes with the Causality of Business System

The main idea this article is based on is that business process should be taken as an equilibrium of intention and causality. Equilibrium is never axiomatic. Keeping a system in the equilibrium state requires permanent effort. Ensuring the equilibrium of intention and causality in business system models requires permanent *harmonization of both main business models* in order to ensure the *consistency of the process model with the business ontology.*

General overview of the consistency of business system models can be found at Fig. 6. There are two main general kinds of consistency:

- Correctness.
- Completeness.

Completeness means that nothing essential is missing in the model.

Correctness means that nothing in the model is in contradiction with anything in this model as well as in other models of the same system.

Fig. 6 also shows that the concept of consistency is relevant for a single model (i.e. internal consistency of the model, consistency of different parts of the same model) as well as for the whole system of models. Nevertheless, the difference between completeness and correctness can be clearly distinguished just in the single model. In the case of cross-models consistency (consistency of the parts of different models) both types of consistency coincide.

For instance, completeness of the object life cycle is defined as follows: ‘life cycle has to cover the whole life of the object since the moment of its nativity until all different kinds of its possible death’. Similarly, completeness of the business process is defined: ‘business process has to cover the whole process since the moment of the starting event until all possible ends of the process’. General completeness of the conceptual model is defined: ‘every class defined in the conceptual

model has to be associated to at least one another class of the same model'. In all bilateral and even more in the trilateral intersection of models the completeness is always relative to other model(s) and therefore may be viewed as a specific kind of correctness. For example, completeness of object roles (intersection of the Class Diagram and Business Process Diagrams) means that all objects from the Class Diagram have to occur in at least one role in at least one process. In the same time it means that every role from business processes has to be represented as a class or relationship, or the combination of both in the Class Diagram. Completeness thus always depends on what is expressed in other connected diagrams, it cannot be more regarded as absolute and the clear difference between completeness and correctness consequently disappears.

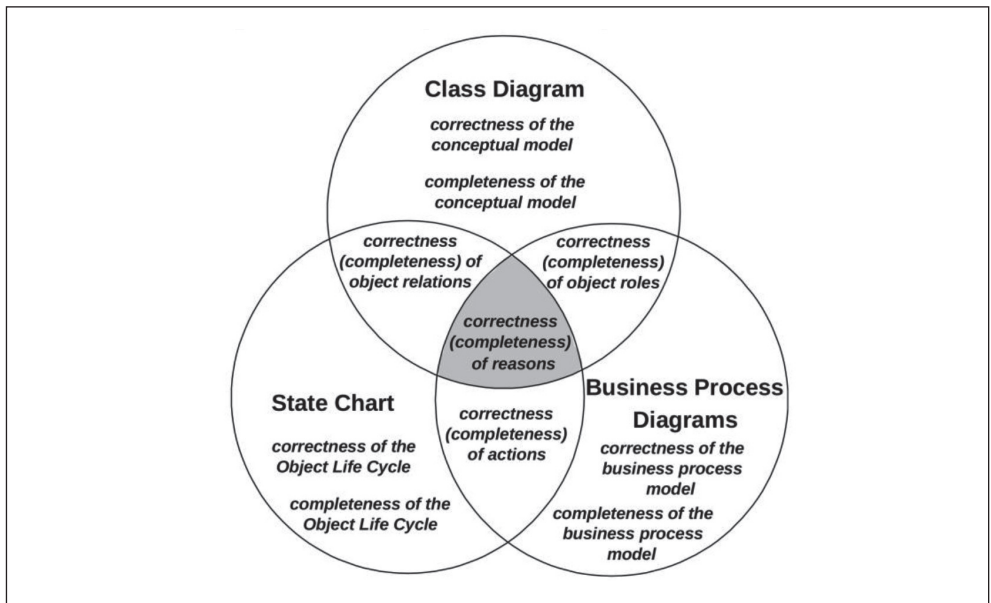
Despite this, from the methodology point of view the classification of these two main meanings of consistency remains the powerful tool for creating particular consistency rules.

Rules for internal completeness and correctness in a single model always follow from the basic definitions in the given domain:

ontology, business processes, and life cycles (see mutually exclusive parts of sets at Fig. 6. In contrary, the cross-models consistency rules are always connected with specific meaning of the common concept of given set of models (see mutual intersections of the sets at Fig. 6):

- Common concept of the global model of objects and detailed view on the particular object class is the *relation*. Relationships to other objects how they are visible in the Class Diagram are manifesting themselves in transitions of states in the object's life cycle. The transition usually means creation, deletion or some modification of the relation to some particular other object.
- Common concept of the global model of objects and detailed view on the particular connected business process is the *role*.
- Common concept of the particular object life cycle and detailed view on the particular connected business process is the *action*. The meanings of actions which are the basic building blocks of the business process directly correspond to the meanings of actions by whom the object can transit between states (methods of the object).

Fig. 6: Consistency of business system models



Source: own

- Common concept of all three basic views on the business system is the *reason*. Reason is represented by the concept of *event* which is the only concept existing in all views: as a trigger of the process actions, trigger of transitions among states in the object life cycles, as well as the trigger of any change in the ontological status of the business system (creation, expiration or modification of objects and/or their relationships).

3.1 Structural Consistency

Besides the regular consistency rules based on the existence of diagram elements MMABP recognizes also the specific kind of consistency – so-called *structural consistency*. In this kind of consistency we work not only with particular elements of models but with their structures. The idea of structural consistency is based on the Jackson's idea of the *correspondence of structures* (Jackson, 1997; Jackson & Cameron, 1983). Jackson (1997) introduced the method for designing the computer programs based on keeping the correspondence between the structure of data and the structure of program actions. He shows the essential dependency of the ordering of processing actions on the ordering of processed data. This idea is even more elaborated in (Jackson & Cameron, 1983) for the purpose of designing the program systems working with databases.

In MMABP we generalize this idea in order to make it applicable in all possibly relevant areas. As a basis for this generalization we use the general classification of two basic types of hierarchy of concepts:

- *Generalization* where the superordinate concept is a generic concept which covers all subordinated concepts as its specific variants.
- *Aggregation* where the superordinate concept is an aggregate (according to Jackson a *collective concept*) which covers all subordinated concepts as its parts.

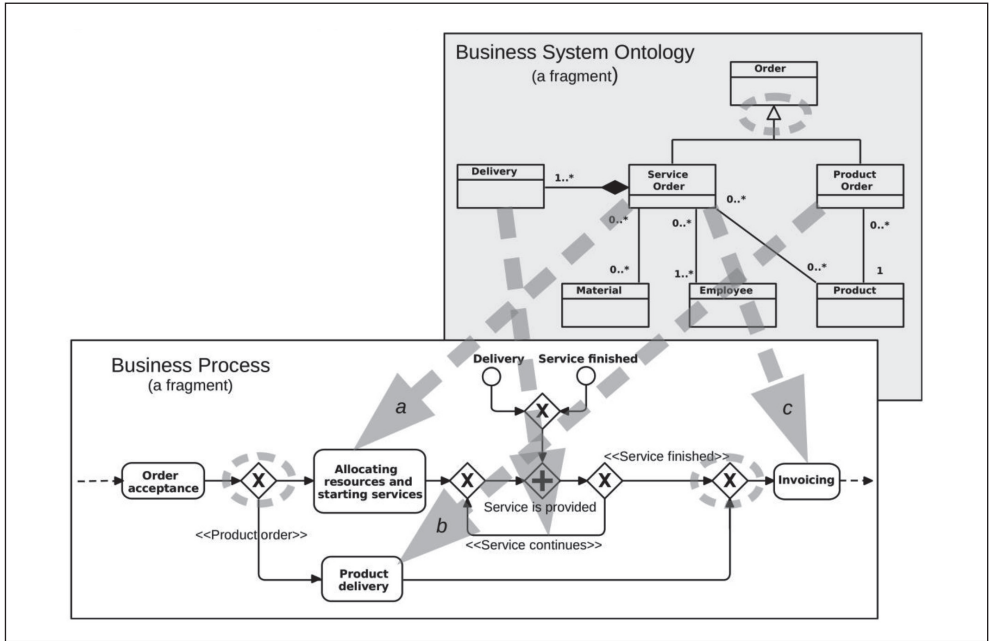
These two basic types of hierarchy can be watched in various forms in various models: as a cardinality (aggregation) or optionality (generalization) of relationships of concepts, as a fork (generalization) or a cycle (aggregation) in the process structure, etc. Any structure of elements in one model has to correspond to the structure of elements of the same generic type (generalization / aggregation) in other connected models (see example in the Fig. 7).

The example in the Fig. 7 shows how the business process structure should meet the structural aspects of the business system. There are fragments of two mutually connected models at the example: business process model and business system ontology (conceptual model). According to the business system ontology there are two mutually exclusive types of order: service order and product order. While the delivery of the *product* is a one-off action as the *product order* always contains just one *product* (see the cardinality of the association between these concepts), the *service order* can be fulfilled by a number of *deliveries* (according to the relationship between them the *service order* is an aggregate of *deliveries*). This difference is reflected in the process by two mutually exclusive ways of handling these two basic types of the *order* (see the thick gray arrows a and b between the models). The fact that the concept *order* is a generic concept which covers both concepts *service order* and *product order* corresponds to the way of handling these objects in the process. The actions *order acceptance* and *invoicing* which are connected with the generic concept *order* are principally common for both order types while actions connected with specific sub-concepts *allocating resources*, *product delivery* etc. are specific just for the given type of the *order* (see the thick gray ovals in both models and the gray arrow c). Similarly, the fact that the *service order* consists of potentially more *deliveries* is reflected in the process by the possible repetition of the state *service is provided*, i.e. repeated waiting for the delivery (see the remaining thick gray arrow).

This example also illustrates that the business system ontology is principally superordinate to any business process as the causality of the Real World is principally superordinate to any intention of its actors. For example, the fact that two basic types of *order* are mutually exclusive can never be changed by any intention, by any business process. Conversely, this fact has to be respected in the structure of any business process otherwise the process allows generally incorrect behavior of business actors.

On the other hand, the Real world causality is also a subject of evolution which the actors collaborate on as well. Thus, the intentions represented by business processes and their eventual conflicts with the Real World causality are important signals for needed (wanted / possible,

Fig. 7: Structural consistency (example)



Source: own

etc.) changes in the Real World. For this purpose the consistency rules which can emphasize these differences are very powerful tools.

For other views and classifications of the consistency see (Bruckner, Řepa, & Chlapek, 2014), relatively complete overview of the particular consistency rules can be found in Řepa (2010).

Conclusions

In section 2. Intentionality in Business System we discussed the essential need to respect the principle of negative feed-back in process modeling languages. In case of business process the feed-back means that there is an input to the process from its environment which is causally connected with some process output. This part of the process which represents the communication with the environment in terms of its contents as well as time is called 'process state'. Process state means such point in the process structure where nothing can be done before the input to the process occurs, i.e. point of waiting for the input.

The concept of process state is present just in some process modeling standards (like IDEF, see (Mayer, Menzel, Painter, deWitte, Blinn, & Perakath, 1997) or Petri Nets based languages (Billington, Christensen, van Hee, Kindler, Kummer, Petrucci, Post, Stehno, & Weber, 2003)), partially present in some others (like ARIS methodology (Scheer, 1992) which mixes the concept of process state with the concept of event which is confusing and may even contradict with the idea of negative feed-back.), some standards do not support it. Widely accepted process modeling standard BPMN (Business Process Model and Notation, 2011) does not recognize this concept at all.

Regarding the importance of the above outlined problem together with the insufficient support in most of process modeling standards it can be said that the primary task for every process modeling methodology is to *allow the modeling of process states* in order to ensure critically important presence of the negative feed-back no matter which notation and/or modeling standard is used.

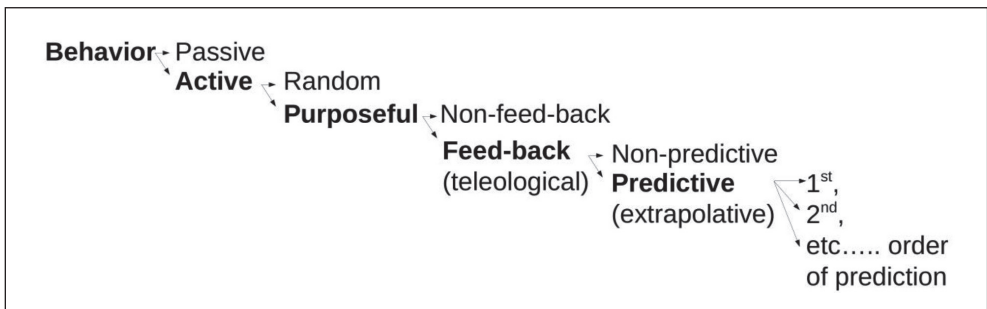
In the above mentioned essential article (Rosenblueth, Wiener, & Bigelow, 1943) the authors generally classify behavior in terms of explain its teleological meaning (see Fig. 8). Regarding the purposeful behavior from this point of view we have to take into the account even the feed-back. As the figure shows the feed-back may be either non-predictive or predictive. Non-predictive type of feedback represents just primitive reactions on events without the ability of the future improvement of the behavior based on the gathered experience. The authors use the example of the predator which follows its target exactly the same way as it runs. On the other hand, predictive feed-back requires from the subject of behavior the ability of some extrapolation of the future events.

The authors classify predictive behavior in different hierarchical orders. The first order of prediction can be understood as a simple use of the information about the followed target to predict the future changes connected with it. The second level of prediction means the ability of the subject to predict the changes of the chased target together with the consequences of its own behavior. The second order behavior allows making shortcuts to catch the target, for instance. The authors state that *'Predictive behavior requires the discrimination of at least two coordinates, a temporal and at least one spatial axis.'* In their essay they are solely focused on the movement of behaving objects in space. For the purpose of our analogy in the field of business processes we can better speak about a temporal and factual axes. Instead of just the spatial information the management of the business process generally requires

working with the information about important facts of any kind. So we can generalize this definition as follows: *'Predictive behavior requires the discrimination of at least two coordinates, a temporal and at least one factual axis.'* Particular orders of prediction then differ according to the number of 'factual axes', i.e. information sets (about different factual aspects) simultaneously considered in decisions. The topic of orders of prediction, generalized to the topic of orders of intentionality, became popular in the field of philosophy and related fields (see Dennett (1988) and Heyes (1987) for instance). This work offers a huge amount of inspiration for the field of business process management as well. Nevertheless, in this article we would like to outline just some basic challenges for the nearest development of the business process management methodology inspired just by the original classification of the first two orders of prediction from (Rosenblueth, Wiener, & Bigelow, 1943) which we regard as basic.

Business process modeling languages sometimes have problems even with the basic dimension – a time axis. Some languages do not support the modeling of this kind of process aspects sufficiently. Especially BPMN does not suppose a need for discrimination of this axis as it primarily takes the process as an automata (which is in direct contradiction with the main idea of the process-driven management, in fact). Consequently, it does not support well the coordination with other processes from the process internal point of view as it is discussed in the beginning of this section as a problem of modeling process states. This problem, as a consequence of the insufficient respect to

Fig. 8: Classification of behavior from the teleological perspective



Source: Rosenblueth, Wiener, & Bigelow (1943)

the time aspects of the intentional character of business processes, appears also in some other business process modeling languages.

Prediction of facts ('factual axis') always requires some knowledge about the causality of the real world. Even for the first order prediction it is necessary to know the supposed further consequences of the given facts. From the modeling methodology point of view it requires the permanent connection between the process and the ontology models. This need is a challenge more for the methodology and supporting computer tools than for languages. Currently, the connections between ontology and process models is possible just in some modeling tools and just on the basic – general level. It is possible to address objects from the ontology model in process models or to address in the ontology model the process activity connected with the given object, for instance. Nevertheless, most modeling tools do not support connections between UML and process models at all.

To achieve higher orders of prediction the business process has to permanently monitor itself and predict the consequences of its actions in the real world. Even this need is a challenge mainly for the methodology (how to model self-monitoring and which methodological consequences it has) and also for computer tools aimed on supporting the real-time management of process instances.

Summarizing the conclusions it is obvious that the idea of business system as an equilibrium of intention and causality brings following challenges in the field of business process modeling methodology and languages:

- Business process has to be always taken as a purposeful process respecting all consequences of this fact, mainly:
 - *Importance of the process goal.* This fact requires to strongly distinguish between the business process and the process in general. The need to act in order to achieve the process goal excludes regarding the business process to be automata for instance. Once the set of actions is automated it cannot be more regarded as a business process. From the business process point of view it is just a single action as there is no way to change its run therefore the only meaning of it lies in its function (i.e. predefined result). This fact also

requires two different points of view on business processes. Besides the process view when we see the process as a structure of actions there is the need for the contextual view when we see the process as a part of the system of processes (Global Process Model). Process goal and other global, relatively stable, process attributes (like output, information responsibility and others) have to be independent of the structure of actions which has to be dynamic (i.e. the subject of possible change) by definition as it follows from the idea of process-driven management.

- *Need for communication with its environment.* This need mainly supposes to distinguish between the process 'interior' and its environment ('exterior'). Therefore, it is necessary to regard any events as an external influence to the process. Besides the fact that it also excludes regarding the business process to be automata, it leads to the need for process states as points in the internal process structure where the communication with the environment occurs in the form of awaited event.
- Achieving the second and higher orders of prediction (as a main condition for needed purposefulness, intentionality) particularly requires the *self-perception of the process.*
 - The basic level of such self-perception is provided by the above mentioned process states which represent the information about what has been done in the process and what could be done in the future. Moreover, the process state represents the point of *sharing the responsibility for the process result with other processes* in both factual and time dimensions: the quality and time of the future process results are determined by the quality of awaited inputs and the particular time when the awaited event will come.
 - From the factual point of view the process also needs to use some additional general information about the environmental facts often called 'business rules'. Therefore, the *close relationship with the model of business causality - ontology model is necessary* as well. Even this relationship should cover both factual and time dimensions

of causality. Thus, it is necessary to include to the ontology model even the *process aspects of the causality in the form of so-called object life cycles*.

Many of above mentioned methodological challenges are reflected in the MMABP methodology (OpenSoul project, 2015; Řepa, 2003), other challenges will be reflected in its future development. Some reflection of them can be also find in other methodical resources in the field of business systems modeling (methodologies, languages and tools) Nevertheless, regarding the general validity of the root idea of this paper, the reflection of them should mainly become the regular part of the professional standards in the field.

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Abstract

BUSINESS SYSTEM AS AN EQUILIBRIUM OF INTENTION AND CAUSALITY**Václav Řepa**

The article is aimed to draw the attention to the essential features of the business processes and business systems in the context of their modeling. We follow the root ideas of cybernetics in order to explain the concept of intentionality and its consequences in business system modeling as well as its impact on the business process modeling methodology and language. Possible way of reflecting these ideas in the business processes modeling methodology is outlined using the example of the process meta-model and business process patterns from the MMABP methodology. Then the concept of causality in business systems is explained and relevant informatics theories and techniques for modeling the real world causality are introduced in this context. Particular attention is paid to the topic of relationships between both basic types of the business system models: intentional business process and causal ontology model. General rules and principles of the consistency of models are discussed together with their methodological consequences. Basic types of the consistency of models – completeness and correctness – are identified and also the specific topic of 'structural consistency' is introduced in this context. In the conclusions section the needed reflection of these essential features in the modeling languages and methodology is analyzed and the basic insufficiencies of the contemporary approaches to the business process modeling are pointed out together with the outline of possible ways of their overcoming. As the main challenges in the field of business process modeling methodology and languages we particularly identify the need for respecting all consequences of the fact that business process has to be always taken as a purposeful process as well as the need for implementing the self-perception of the process in order to allow it achieving the higher orders of prediction.

Key Words: Business process management, business process modeling, conceptual modeling, ontology, object dynamics, cybernetics.

JEL Classification: M10.

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DIGITAL TRANSPARENCY IN THE PUBLIC SECTOR – CASE STUDY CZECH REPUBLIC

Hana Mohelská, Marcela Sokolová

Introduction

Transparency in the public sector is still a topical issue in contemporary society. The concept of transparency has been one of the most discussed topics within good governance over the last 20 years, and therefore it attracts interest for academic study. The consequences of transparency and also the circumstances that trigger transparency, are studied intensively. The attention given to the concept of transparency appears to have increased, mainly due to the spread of the Internet; hence, this paper particularly focuses on transparency enabled by the Internet (Sičáková-Beblavá, Kollárik, & Sloboda, 2016).

In the Czech Republic, this is evidenced by the adoption of Act No. 340/2015 Coll. On the register of contracts, effective from 1st of July 2016, which imposes public contracts to be published in the register of contracts. The transparency of information provided reflects confidence in decision-making by a group of authorised or elected people. The practices of the elected bodies that respect transparent governance and the use of public funds should belong to the foundations of a modern democratic society. In modern society, interlinked concepts related to transparency and governance have been defined:

- Public-sector transparency,
- Government transparency or Organisational transparency.

How to provide (Sičáková-Beblavá et al., 2016) here transparency is therefore perceived as an essential aspect of rationality, progress and good governance (Florini, 2007), and “as a *conduct of public affairs in the open or otherwise subject to public scrutiny*” (Birkinshaw, 2010). Piotrowski and Van Ryzin (2007) stress the role of transparency in discovering what is going on inside government, and Strathern (2000)

emphasises the proposition that “*if procedures and methods are open to scrutiny, then the organisation is open to critique and ultimately to improvement.*” Prat (2006) stresses the aspects of controlling transparency within organisations using principal – agent model. Here, transparency is an instrument in the hands of principal where it is used to make sure that the agent is acting in line with principal through the delegation of power (Prat, 2006). Within the given model transparency is an instrument in the hands of the principal, who can use it to make sure that the agent – acting on the behalf of the principal via delegation of the power – doesn’t promote their own interests instead of those of the principal. When information asymmetry is to the agent’s advantage, this may lead to governance abuse and failures. Such problems are believed to be remedied by transparency (Bannister & Connolly, 2011).

Cases of corruption, embezzlement, theft and fraud, abuse of discretion, favouritism, nepotism, clientelism, and a government’s abuse of power have led to a growing demand from society to access public information. In response to this demand, governments have been forced to be more transparent in their activities conduct. The information transparency index (TI) may be conditioned by local governments economic and political characteristics affecting the information provided (Araujo & Tejedro-Romero, 2016; Bennis, 2013).

Canares (2016) argues that the use of ICT can make more transparent and accountable revenue generation systems possible to benefit both government and taxpayers. However, these results are differentiated depending on the political leadership levels, the nature of articulation of demand for ICT use, the ratio of benefit against cost, and the technical skills and resources availability at sub-national level. It is within this context that an eco-system analysis

is argued to be useful in analysing how ICT can be adopted, scaled, and used by subnational governments to achieve better governance (Canares, 2016).

Also, further research shows that *...our findings show that level of e-participation, population size, the income levels and level of indebtedness of citizens' have an impact on the local governments use of Facebook. High levels of Facebook use would suggest that local governments tend to enable citizens to oversee government making more transparent information, data and processes. Therefore, this study makes a contribution to the debate on local government transparency and provides important guidelines for developing appropriate social media strategies and policies.* (Guillamón, Ríos, Gesuele, & Metallo, 2016).

According to Bachmann (2011), the principle of transparency is synonymous with openness, responsibility, communication ability, management transparency, disclosure of services provided, and the activities of organizations. An inalienable sign of the transparency principle is compliance with generally binding legal regulations and moral values of a company. Breaking the private interests of public officials out of the public interests on the basis of which they were elected. Providing real-time public and substantial information. Handling public funds entails a potential risk of corruption. Control of self-government activities is carried out by public authorities. Exercising decision-making processes entails the risk of corruption, so it's in the interests of the public to start public control of these decision-making processes. It is transparency that allows public control in the areas where public funds are spent. Public control is both efficient as well as one of the cheapest means of control, but it only makes sense if it follows the detection of maladministration and public funds management, correction and possible sanctions.

The basic duty of municipalities, self-governing communities of citizens, is to provide their citizens with public services and public finance management. Municipal activities affect most citizens, so it is important that municipal decisions that impact everyday life are justified, transparent and reviewable. Observing the transparent behaviour of municipalities contributes to the trust between citizens and their elected authorities. (Morris & Shin, 2002)

state that the quality of the information provided increases the credibility and openness of public institutions, prevents corrupt behaviour and develops the comfort of the municipality's citizens.

The key question is whether Czech Republic citizens actually monitor this information at all and require it.

The international Communicating City Project (Komunikující město, 2000) has brought evidence in the second half of the 1990's on how communication with citizens is useful for city and municipality managements. It was clearly shown, for example that the more public government can inform the public, the more satisfied the citizens are.

Furthermore, the research results regarding the Czech public's views on the state's 2016 information campaign for AKA Company (AKA, 2016), carried out by KANTAR TNS agency, show that most respondents are more interested in local information than in national information. Inhabitants of small municipalities are more interested in local information than inhabitants of large municipalities and cities/towns, although this difference is of no importance.

The presented study focuses on three major research areas:

- The municipality's communication with its citizens – the extent of published information in the municipal office and the municipal events.
- Municipal management and documents on their activities – publishing mandatory information and documents on the municipality's activity.
- Web accessibility – with the following two research questions:
 - 1) *What levels are the websites of Czech municipalities?*
 - 2) *Does the number of inhabitants in the municipality or the region to which the municipality falls, affects the website quality?*

The creation of the transparency principle is protected in the Czech Republic's constitutional order and it is shaped by a set of legal regulations which are based on it, international and European law and particularly European Union law. It is the responsibility of each municipality in the Czech Republic to publish and provide information on the basis of applicable legal regulations. Voluntary information publication is

far more neglected, which is also of valuable character to illustrate activities, cultural and social events in the village. The complete information then strengthens the justification of the municipality leadership, openness and, last but not least, the trust of citizens in the municipal funds economic management.

1. Defining Transparency

There are several approaches to the conceptualisation of transparency. Some definitions are descriptive, others are normative. A common denominator of many of those definitions is a belief in information as a *sine qua non* of transparency (Rawlins, 2008). In a modern society, interlinked concepts related to transparency and governance have been defined: public-sector transparency, government transparency or organisational transparency. Here transparency is therefore perceived as an essential aspect of rationality, progress and good governance (Florini, 2007), and *“as a conduct of public affairs in the open or otherwise subject to public scrutiny”* (Birkinshaw, 2010). Piotrowski and Van Ryzin (2007) stress the role of transparency. Prat (2006) stresses the control aspects of transparency in organisations using principal – agent model. Here, transparency is the instrument in the hands of principal where it is used to make sure that the agent is acting in line with principal through the delegation of power. Within the given model transparency is an instrument in the hands of the principal, who can use it to make sure that the agent – acting on the behalf of the principal via the delegation of the power – does not promote their own interests instead of those of the principal. When information asymmetry is to the agent’s advantage, this may lead to governance abuse and failures. Such problems are believed to be remedied by transparency (Bowles, Hamilton, & Levy, 2014). Some family resemblance concepts are related to transparency as well – such as openness, insights or clarity (Oliver, 2004). Links between transparency, openness and information are, however, often vague and unclear. One way of explaining the relations is provided by Christensen (2015), when he states that organisational openness may be a precondition for transparency, and information accessibility is seen as a precondition for openness and transparency (Christensen & Cornelissen, 2015).

2. Research Methodology

The research sample consists of 100 Czech municipalities, which were randomly selected from a set of all Czech Republic municipalities with populations ranging between 2,000 to 10,000 inhabitants. The size of the population includes larger municipalities and towns, they have a larger budget and more social and cultural events take place within them. Most municipalities with more than 2,000 inhabitants have over 15 representatives and thanks to this, they elect the municipality government. Each municipality belonging to a defined population has been allocated a number according to the position in the alphabetical order of the municipalities. The numbers representing the municipalities were generated by an online Itnetwork pseudo-random number generator, which was previously tested for the randomness of the generated numbers. Municipalities were randomly generated using assigned numbers, with the condition that at least six municipalities must be selected in each region. The analysed sample is made up of 73% of municipalities with 5,000 inhabitants, most of which have the status of a town. A one-factor scattering analysis was used to identify the impacts that impact the transparency analysis.

Municipalities with population ranging from 2,000 to 9,999 inhabitants were included in the analysed sample of municipalities, as of 1st of January 2017, according to the Czech Republic Ministry of the Interior (2017). The selection includes the representation of all regions in the Czech Republic, with the exception of the Capital City of Prague, with the following representation:

- South-Bohemian region – 7 municipalities;
- South Moravian region – 8 municipalities;
- Karlovy Vary region – 7 municipalities;
- Hradec Králové region – 9 municipalities;
- Liberec region – 8 municipalities;
- Moravia-Silesian region – 7 municipalities;
- Olomouc region – 6 municipalities;
- Pardubice region – 7 municipalities;
- Pilsen region – 11 municipalities;
- Central Bohemian region – 11 municipalities;
- Ústí nad Labem region – 6 municipalities;
- Vysočina – 6 municipalities;
- Zlín region – 7 municipalities.

Municipalities are obliged to publish information or documents in a way that allows remote access - which most municipalities resolve with the establishment and operation of websites. The subject of transparency

research is the provision of mandatory and voluntary information. The municipalities' information obligation in relation to the public is contained in Article 17 paragraph 5 of the Charter of Fundamental Rights and Freedoms, which establishes the constitutional obligation of local authorities to provide information on their activities in a reasonable manner. The conditions and implementation are regulated by Act No. 106/1999 Coll., on free access to information. Decree No. 442/2006 Coll. defines the structure of information published on the municipality in a way that allows for remote access, defines the mandatory published information and its structure. Voluntary information means the publication of the municipality's news, the including inhabitants in discussions regarding the running of the municipality, etc. Municipalities do not have to publish this information, but it is obliged to provide this information on request. However, it is highly recommended to provide such information on a voluntary basis. Therefore, municipalities strengthen citizens' confidence and show that they have nothing to hide.

Based on these pillars, the observation focuses on the following core circuits:

- *Municipalities communication with their citizens;*
- *Management of municipalities and documents on their activities;*
- *Accessibility of websites.*

First area – Municipalities communication with their citizens – focuses on the extent of the published information on the municipal office and the municipal events.

Second area – Management of a municipality and the documents on their activities – focuses on the publication of mandatory information and documents on municipality activities.

Third section – Website accessibility – evaluates the level of orientation and manipulation within the municipality's website. It takes into account the clear arrangement for the general public as well as for citizens with health disadvantages, such as people with poor-vision and the elderly.

The Google search engine was used to find specific municipality websites. Data collection was carried out via the municipalities' websites in January and February 2017.

Each municipality in the selected sample runs its official website. Some of the

municipalities have websites accessible only from the micro-region portal, such websites were considered valid as well.

As discussed above, the content analysis is divided into three sub-sections. The following criteria were chosen in the analysis of municipal communication with citizens, which assess whether the municipality publishes the given criterion or not. The criteria include:

- Basic information on the organisational structure of the Office;
- Office hours for the municipal Office;
- E-filing room;
- Budget;
- Strategic plan for municipality development;
- Annual Report;
- Local Newsletter;
- Hobby clubs;
- Non-profit organisations;
- Discussion forum.

Similarly, the following criteria were assessed in the analysis of municipal management and documents on its activities:

- Notification of a procurement/decision;
- Detailed description of the procurement process;
- Full minutes of Council meetings;
- Full minutes of Board meetings;
- Shortened minutes of Council meetings;
- Shortened minutes of Board meetings;
- Who and how they have voted is listed in the Board minutes;
- Who and how they have voted is listed in the Council meetings minutes;
- Voting record available;
- Resolution of the municipal Council;
- Resolution of the municipality Board.

In the last website accessibility analysis, the following criteria were selected:

- Increase font - This doesn't concern an internet browser function.
- Search – With the use of the search box.
- Advanced search - Allows you to define the term with multiple parameters.
- Individuals with poor-sight.

The individual criteria are described and explained in detail in the application part of the thesis.

For a clearer analysis of results, tables, graphs and outputs from the IBM SPSS Statistics 24.0 analytical tool customised are used, which are supplemented with explanatory text.

The following hypotheses have been set:

H₁: The quality of municipal websites do not differ with the municipality size according to the population number.

H₂: The quality of community websites do not differ with the region to which the municipality belongs.

3. Analysis of Municipalities Communication with Their Citizens

3.1 Rate of Compliance with the Obligation to Publish Mandatory and Voluntary Information

The first analysis examines the extent of compliance with the obligation to publish information on municipalities in a manner allowing for remote access, as prescribed by Act No. 106/1999 on free access to information, obliges municipalities to publish an annual report on their activities for the previous calendar year by 1st of March at the latest. The structure of the obligatory published information is described in Decree No. 442/2006 Coll. A list of the most important items of the Decree was selected. The examined items include:

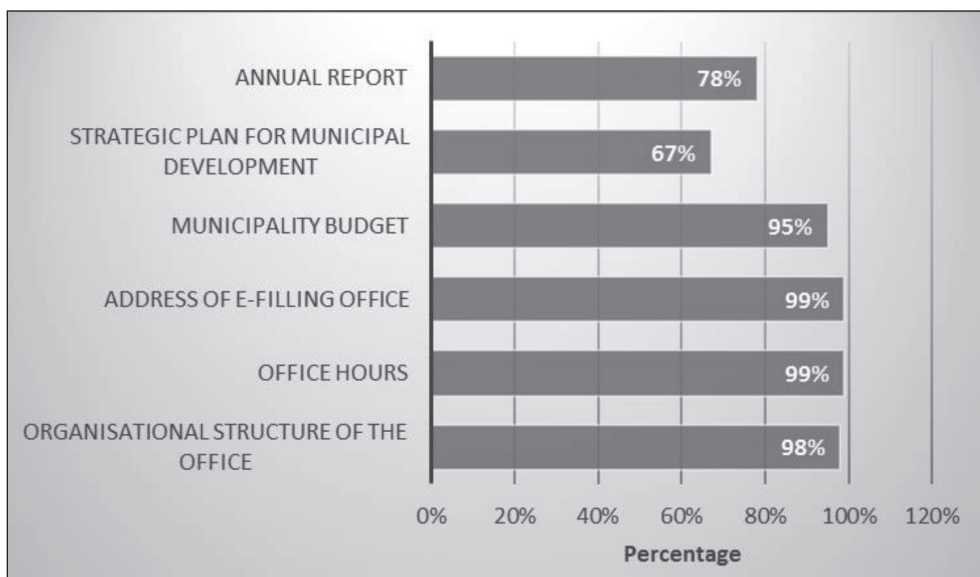
- Organisational structure of the Office,

- Office hours,
- Address of e-filing office,
- Municipality budget,
- Strategic plan for municipal development,
- Annual report.

Of the total number of analysed municipalities, only half of them comply with all 6 criteria. However, when we focus only on mandatory information and neglect the recommended publication of the municipal development plan, reach a 73% success rate. The soothing observation is that each municipality complies with at least part of the given criteria. This analysis was the best of all, its average success rate climbed to satisfying 89%.

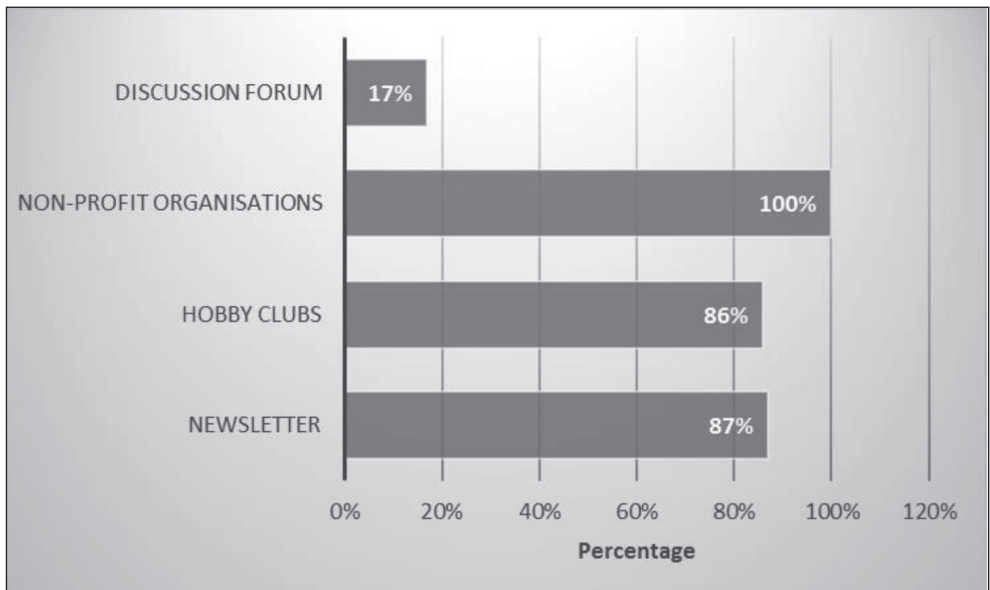
In the Fig. 2 we can see how the sample of surveyed municipalities was doing in each category of voluntarily published information. The regular newsletter is issued by 87% of municipalities. The presence of hobby clubs is in 86%. All municipalities surveyed publish information on their non-profit organisations, which is the only criterion that fills the entire surveyed sample of municipalities and towns. The biggest drop was recorded in the discussion

Fig. 1: Status of mandatory published information



Source: own processing

Fig. 2: Status of voluntarily published information



Source: own processing

forum, when only 17% of municipalities have set them up on their websites.

In this analysis of voluntarily published information of municipalities, 13% of municipalities did not fail in any aspect and complied with the requirements of the criteria at 100%. As can be seen from the graph above, all of the analysed municipalities succeeded in at least one of the four criteria.

4. Municipality Management Analysis and the Documents on Their Activities

4.1 Information on Public Procurements

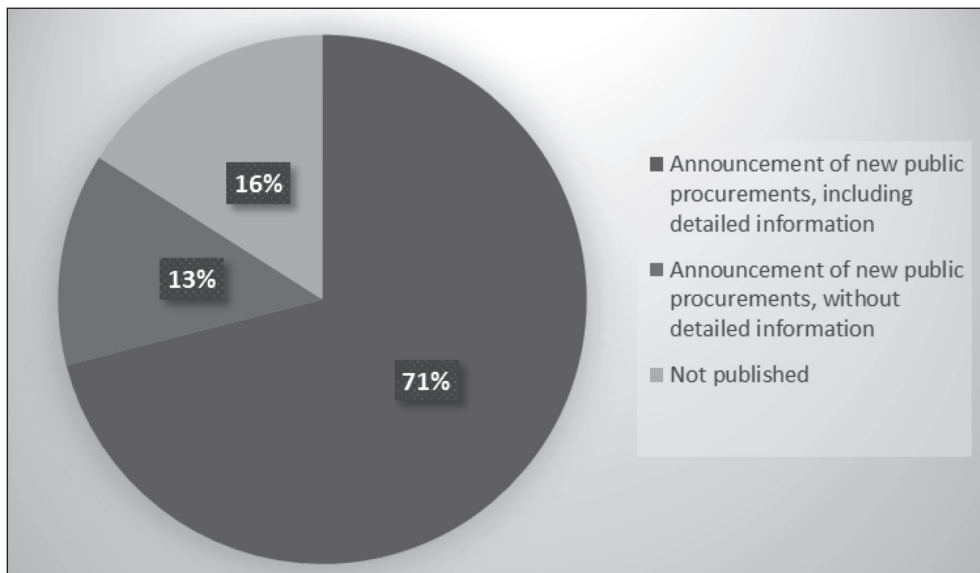
The Public Procurement Act sets out the contracting authority's obligations and procedures in awarding public contracts, which must comply with the principles of transparency and proportionality. The detailed description in Fig. 3 below indicates that the municipality publishes information on the course of the public procurement together with the tender documents necessary for the award procedure. The surveyed municipalities often use external sources for the publication

of public procurements, under which the contracting authorities issue public contracts. By referencing an external resource on its website, as part of the analysis it is understood as if it was published on its site. Of the surveyed municipalities, 71% post the announcement of new public procurements on the website together with detailed tender documentation. From this percentage representation of 71%, it should be noted that two thirds of municipalities publish public procurement information through external websites. 13 of the total number of municipalities lack this detailed description. In the case of 16%, the municipalities do not mention the public procurement in any way, nor do they mention any references to external sources.

4.2 Minutes and Resolutions of the Municipal Council Meeting

This section examines whether municipalities provide minutes and resolutions on their websites from municipal council meetings. Council meetings are public, so citizens can participate too. A document shall be created from each meeting. The Act on Municipalities

Fig. 3: The level of information on public procurement



Source: own processing

imposes the necessary elements, which must be fulfilled by the municipal council meeting. They include:

- the number of members present;
- approved session agenda;
- course and outcome of voting;
- adopted resolutions.

In the research, it was assessed whether the municipality published the minutes and if so, whether it contained the mandatory elements listed above. It was found that in the minutes for municipal council meetings, all the municipalities surveyed publish the compulsory entries. As shown in Fig. 4, 58% of the municipalities do not publish the council meeting minutes.

Municipalities have more opportunities to publish a resolution from a council meeting. The resolution may be part of the municipality meeting minutes or as a separate document in which the resolutions adopted are listed. Another option is the combination of the two previous ones, the municipality then issues two separate documents, which contain more detailed information on the agenda of the meeting and the resolution as well as the resolution as a separate document.

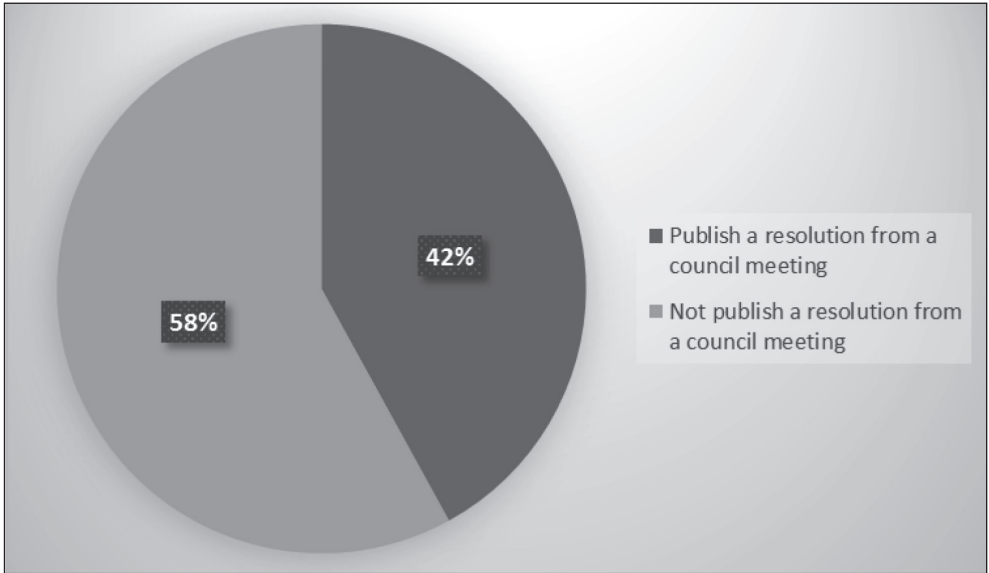
Fig. 5 shows that 96% of the municipalities publish a resolution of the council meeting in one of these ways. It was not possible in only 4% to find any resolution. In more than half of the cases, municipalities only publish the resolution as a separate document. 25% of municipalities list the resolution as part of the meeting minutes and in 18% the resolution is published in the minutes and also as a separate municipality document.

4.3 Municipal Council Meetings Minutes and Resolutions

In a sample of 100 municipalities, there are those who do not have council in their office administration. These are municipalities where less than 15 representatives have been elected to the office. 12% of municipalities in the sample didn't elect and doesn't have a council. As a result, the assessment of publishing municipal council meetings minutes and resolutions couldn't be carried out. The Act on Municipalities stipulates, as in the case of a council meeting, the necessary points of the municipal council minutes. These include:

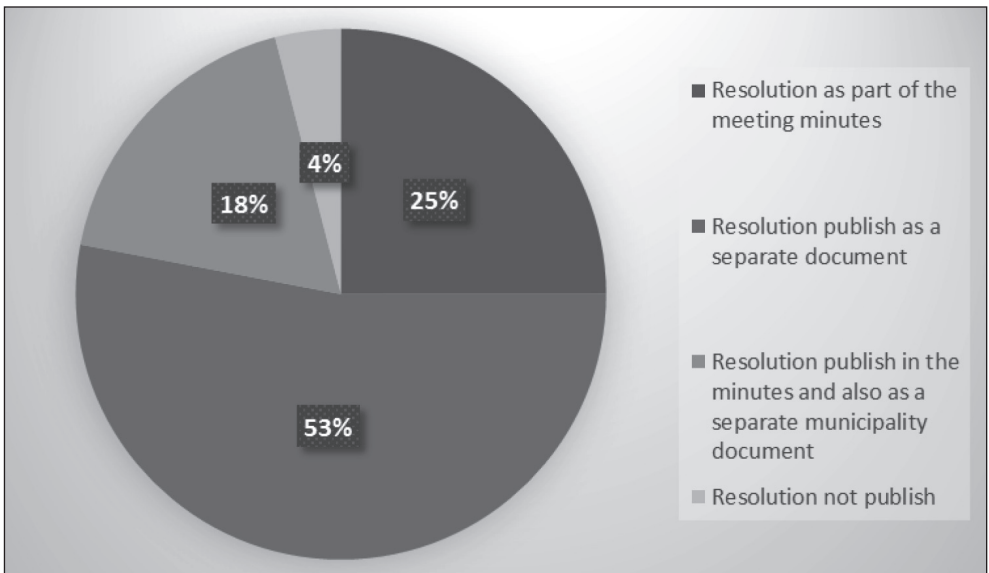
- the number of members present;

Fig. 4: Rate of published municipal council meetings minutes



Source: own processing

Fig. 5: The extent of published resolutions from municipal council meetings



Source: own processing

- approved meeting agenda;
- course and outcome of voting;
- adopted resolutions.

Municipal council meetings are not public, so publishing the minutes can be considered as essential for determining how the municipality council manages the administration of the municipality and with the municipal issues. Publication of council meetings minutes is not as popular with municipalities as in the case of minutes of the board meetings. All the investigated municipal council meetings minutes fulfilled the content obligations according to the Act on Municipalities. However, only 15% of them publish total minutes on the website.

The situation under examination is again identical with the consideration of the municipal council meeting resolution. The resolutions were posted as a separate document, as part of the council minutes, or a combination of the two.

Again, as in the case of resolution of the board meeting, we can see that the largest case of publication was the publication of the municipal council meeting resolution in the form of a separate document, i.e. 62% of the municipalities publish in this way. 10% of the municipalities publish the council's resolution within the minutes. A small number of municipalities (5%), decided to choose the combinations of previous cases. 11% of municipalities do not publish any mention of the municipality council meetings resolution, although they have a council.

4.4 Minutes – Who Voted and How

With the formation of the council meetings minutes, the municipality is obliged to state the voting result. A properly graded report should also include a list of council members/councillors with the details of who and how voted for each item. Just so, the citizens (voters) can find out if the elected municipal administrators act honestly and fulfil their pre-election promises. Votes percentage are calculated from the total number of published minutes; in the case of minutes from council meetings, it is from a total of 42 minutes; in the case of board meetings minutes it is from a total of 15 minutes.

More than half of the municipalities (57%) publish who voted and how they voted on the website, listing the municipal council meeting minutes.

4.5 Record of the Municipal Council Meeting

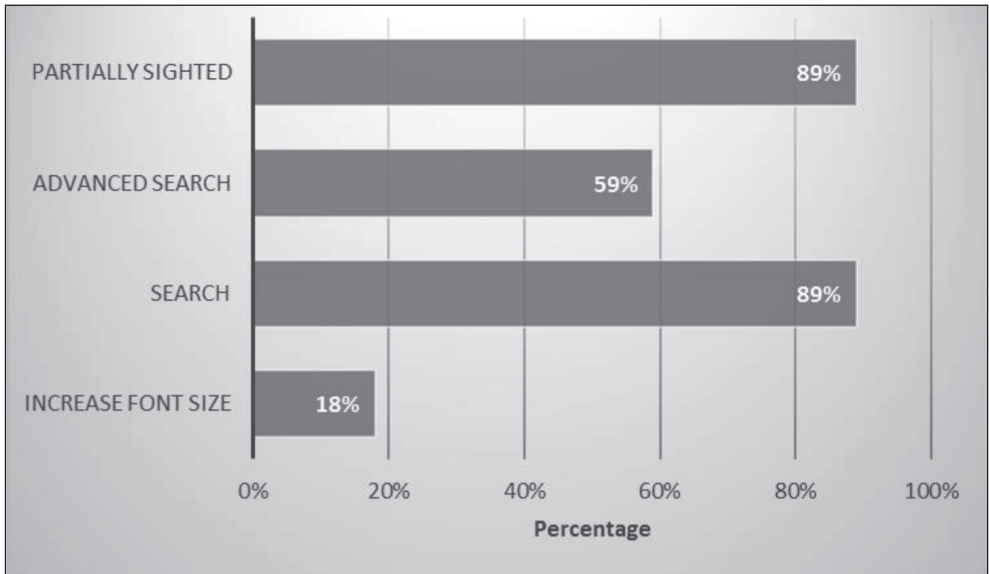
Municipal council meetings are not public, according to the Act on Municipalities. Therefore, examination of publishing the records of the municipal council meetings was carried out only at the municipal council meeting. The assessment was divided into the publication of audio or video recordings. Some of the municipalities publishing records for municipal council meetings were not available for viewing directly on the municipality's site but through a link. This fact is given the same weight as if the municipality publish the record on its website. Posting records from the meetings of municipalities enables citizens to also see the council meeting after the time it took place. It's possible to watch the video repeatedly from anywhere you have an internet connection. It is further confirmation from the municipality that it has nothing to hide and its administration is transparent. Most municipalities do not use the possibility of publishing the council meetings minutes. The percentage is 87%. The video recordings of council meetings is published by 9% of the municipalities and the remaining 4% of municipalities make audio recordings available.

In the second analysis of the municipalities' management and documents on their activities, none of the municipalities succeeded in all criteria, which can be attributed to its larger content and also the fact that none of the criteria in the second analysis gives the municipalities the legal obligation to publish these facts. We can-not say that this analysis was not successful. With the loss of one point out of a total of 9, two municipalities fulfilled all the other criteria.

5. Analysis of Website Accessibility

The third part of the analysis focuses on the accessibility of websites. The accessibility of websites means an intuitive layout of important elements, easy orientation on the municipality website and the ability to search for the required information. Website searching is largely facilitated by a search engine and an advanced search form, which allows you to more specific search data. Another requirement for accessible pages is the possibility of enlarging the font (without using the internet browser features). It helps visually impaired users to intuitively adjust the size of the display

Fig. 6: Website accessibility status



Source: own processing

text. Another option for web presentations of individual municipalities was to switch to a simplified form of display. The simplified version of the pages is redesigned to a text design and cascading styles are disabled. The simplified form of websites makes internet presentations also available to health disadvantaged users. This simple style change option is provided by 55% of webpages.

Fig. 6 shows that 89% gives users the ability to search for information through search engines in the case that advanced search is less than 60%. Only 18% of municipalities can make the font smaller directly through their websites.

Of the total sample of municipalities, only one fifth of them meet all of the partial accessibility analysis criteria.

5.1 Factors Affecting the Quality of Websites

The third part of the analysis focuses on the accessibility of websites. The accessibility of website means an intuitive layout of important elements, easy orientation on the municipality website and the ability to search for the required

information. The search engine and advanced search form largely facilitate searching through the websites, which allows you to search data more specifically. Another requirement for accessible pages is the possibility of font enlargement (without using the Internet browser features). It helps visually impaired users to intuitively adjust the size of the displayed text. Another option for individual municipalities' web presentations was to switch to a simplified form of display. The simplified version of the pages is redesigned and cascading styles are disabled. The simplified form of websites also make internet presentations available to disadvantaged users. This simple style change option is offered by 55% of pages.

The barrier-free access of the municipalities' sites is governed by Decree No. 64/2008 Coll. on the accessibility of websites of public authorities, each municipality is obliged to make information available on its activities to people with disabilities, in accordance with this decree in a way allowing remote access. Rules established by the Methodological Guideline on Decree No. 64/2008 Coll. were developed on the basis of the WCAG 1.0, Section 508 and Blind Friendly Web methodologies (The

Czech Republic Ministry of Interior, 2010). The website accessibility in the Czech Republic is dealt by the Blind Friendly Web project (hereinafter referred to as BFW), which sets out methodological guidelines for creating accessible sites for disabled people and helps in their implementation.

According to the Methodology of Blind Friendly Web 2.3 (Pavlíček, 2005), a quick check of the accessibility of website checked the municipality websites. Webpages can be viewed as fully readable and comprehensible in 99% of all websites under review – the criterion for visually impaired individuals, see Fig. 6. Most webpages can be marked as accessible to visually impaired users.

6. Results

The aim of the analysis was to assess how the Czech municipalities do in keeping with the principle of transparency on their websites. The analysis was divided into three sub-sections:

1. Communications of municipalities with citizens where the publication of mandatory and voluntary information has been investigated;
2. The management of municipalities in the field of public procurement and the publication of documents related to their activities, such as minutes and resolutions from meetings of municipal councils and boards and their particulars;
3. Accessibility of websites to facilitate orientation and the retrieval of information on websites, more accessible use of websites for visually impaired users as well as the elderly.

The results of each partial analysis were different. The first analysis of municipalities' communication with citizens was very good, where the overall rating is an 81% success in publishing the information under re-view. The least successful was compliance with the discussion forum criteria on municipality websites. The criteria for the mandatory disclosure of information also rated very well. All 12 municipalities, from the sample of 100 municipalities surveyed, met all the criteria in this analysis. It should be mentioned that half of the most successful municipalities in the first analysis have a population ranging between 5,000 and 9,999, only 27% of the total number of municipalities surveyed is in this size category.

The evaluation of the analysis dealing with the accessibility of the website ended up slightly worse. Its success rate is 66%. The criterion of font size change was the least fulfilled. On the contrary, the criterion for visually impaired individuals ended up the best. Despite the decline in success in the accessibility analysis, the number of municipalities fulfilling all the criteria of this analysis increased to 20 successful municipalities. Of these 20 municipalities, a total 14 belong to group size ranging between 2,000 and 5,000 inhabitants. Municipalities ranging between 2,000 and 5,000 inhabitants account for approximately 70% of the sample surveyed.

The worst part of the analysis was the part analysing municipalities' management and documents on their activities. Its success reaches only 49%. The criterion examining the publication of the resolution from municipal councils meetings, which achieved a 96% success in this analysis, was the most successful. None of the municipalities managed to meet all the criteria examined. The reason for this may be the difficulty from the point of view of the voluntarily provided information. Two municipalities have failed to meet only one criterion.

In the work, the factors that could influence the quality of the municipalities' websites were examined through a one-factor analysis of scattering.

Within the testing of both hypotheses, it was first necessary to verify that random samples were from a normal distribution. This was verified by the combination of the Lilliefors variant of the Kolmogor-Smirnov test and the Shapiro-Wilk test. Furthermore, homogeneity of scatterings (homoscedasticity) was also tested. Homoscedasticity was numerically tested using the Brown-Forsythe test. At the significance level of 5%, with both hypotheses the normality and homogeneous scattering tests cannot be rejected.

Two hypotheses were identified and examined.

H₁: The quality of municipal websites does not differ with the size of municipalities by population. (test statistic F has a value of 1.919, the corresponding *p-value* is 0.152, at a significance level of 0.050; at the significance level of 5% it was proved that the mean values of municipalities are not different in different groups of municipalities) – **we do not reject the hypothesis**

H₂: The quality of the municipal website does not differ regarding the region to which the municipality belongs. (the tested statistic *F* has a value of 0.946 and the *p*-value is 0.506, at the significance level of 0.050) – **we do not reject the hypothesis**

Both of these hypotheses were not rejected after the calculations carried out. **This means that the quality of municipal websites of individual municipalities does not depend on the number of inhabitants in individual municipalities or on the region where the municipalities are located.**

The overall results of the analysis of compliance with the principle of transparency on the municipalities' websites in the Czech Republic are quite satisfactory. Most municipalities surveyed provide basic information and their webpages are also accessible to disadvantaged clients. The municipalities publish the documents on their activities less often. The overall summary of the research results has risen to a 65% success rate of the surveyed municipalities. This means that 65% of municipalities are concerned with open disclosure of information. As Šolc (2014) states, the conscious municipalities don't wait for the legislation to be tightened, but publish everything that can be published on their websites voluntarily. From the total number of 100 municipalities surveyed, none of them complied with all evaluation criteria divided into three logical units. On the other hand, at least in one partial analysis, 32 municipalities succeeded and publish all the information surveyed, which makes up one third of the sample municipalities. This is more than twice the value compared to the resulting value based on research in my Bachelor Thesis. I evaluate it very positively, but there is still a large area for future improvement in the field of publicity on the municipality websites.

The results of the analyses clearly show that if the legislation in force obliges municipalities to publish specific information in a way that allows remote access, the municipalities' efforts to fulfil these regulations will increase rapidly. It is an open and responsible action for municipalities, which helps to create an anti-corruption environment of municipalities and therefore increases the possibility of citizens' involvement as a tool for public control.

Limiting research limits is the fact that 100 Czech municipalities with population ranging

between 2,000 and 9,999 were surveyed. This research sample of 100 municipalities accounts for 18% of the size group of municipalities on 1st of January 2016. 21% of the Czech Republic's population live in places sized between 2,000 and 9,999 inhabitants. The research sample consists of 73 municipalities with up to 5,000 inhabitants. These are larger municipalities, which in most cases have the status of a town, in a total of 72 cases.

Discussion and Conclusion

Czech municipalities have been heterogeneous in the analysis of digital transparency. Once the legislation precisely defines the scope and form of mandatory disclosure of information on municipalities' websites, there is a great deal of improvement and the efforts of municipalities to fulfil this obligation. The degree of disclosure is decreasing with the freedom for municipalities to publish information. Legislation generally intends to support the openness manifestations of municipalities, but transparent behaviour depends on each municipality. As a suitable approach, it is advisable to define the specification of the requirements more clearly for a way allowing remote access in Czech legislation. Another procedure could be to introduce other legislation that would capture this issue better on the whole. Despite gradual improvements in the quality of the municipality websites, there are still major issues lacking that need to improve.

We are inclined to the opinion of Scott (2006), he states that websites provide the most basic public services and citizens are therefore more connected with the government. Web content and its usage requirements are constantly increasing. Municipalities must monitor and enhance the quality of their websites regularly to attract and satisfy users (Scott, 2006).

In order to improve the quality of municipalities' web content, specialised web portals can contribute and serve as help counsellors. They often help to point out the issues and come up with an inspirational solution. An example is the Open Society Strengthening Civic Society in the Czech Republic or Transparency International.

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Abstract

DIGITAL TRANSPARENCY IN THE PUBLIC SECTOR – CASE STUDY CZECH REPUBLIC**Hana Mohelská, Marcela Sokolová**

The subject of the paper is to carry out evaluation of the current information openness of municipalities through the structured observation method, via their web pages. The aim of the paper is to assess the transparency level of municipalities in the Czech Republic. It focuses on the lawful and voluntary publication of in-formation on the websites of randomly selected group of municipalities. The content analysis on the internet was used. The thesis focuses on qualitative and quantitative data acquisition as the most effective combination. The research sample consists of 100 municipalities, which were randomly selected from a set of all municipalities in the Czech Republic with populations ranging between 2,000 to 10,000 inhabitants. The paper's introductory part defines the basic concepts and obligations, which are laid down to the municipalities by international and especially Czech legislation. It is followed by the analysis of selected municipalities on the Internet, which is divided into municipalities' management and documents regarding their activities, the office's communication with its citizens and accessibility of the sites. A synthesis of findings presents the most transparent municipalities and regions. Czech municipalities have been heterogeneous in the analysis of digital transparency. Once the legislation precisely defines the scope and form of mandatory disclosure of information on municipalities' websites, there is a great deal of improvement and the efforts of municipalities to fulfil this obligation. The degree of disclosure is decreasing with the freedom for municipalities to publish information. The conclusion of the paper is devoted to the overall assessment and recommendations for the given situation in the Czech Republic.

Key Words: Digital transparency, public sector, research, Czech Republic.

JEL Classification: H79, R58.

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RISK-BASED CONTROL OF THE NEGATIVE EFFECT OF DISCONTINUED AUTOMATED PROCESSES – A CASE FROM THE AGRICULTURAL DOMAIN

Athanasios Podaras

Introduction

The emergence of ICT technologies in the modern era has facilitated and ameliorated the execution of critical business processes. Agriculture is a domain where automation is present in various forms, important and enables farmers increase productivity and improve environmental policies. However, the “industries are faced with numerous types of natural and man-made threats and disruptions” (Maboudian & Rezaie, 2017). As a consequence, effective policies against such threats should be developed.

Business Continuity Management (BCM) is a process that allows to efficiently overcome operational disruption whereas the organization should be prepared for an emergency situation e.g. accident to be able to minimize its impact and enable the fastest recovery possible (Malachová & Oulehlová, 2016). Additionally, risk management is a crucial element for understanding the organization in order to implement an integrated business continuity management strategy (ISO 22301, 2012). “Risks are part of every business operation and can never be avoided completely. To minimize the danger of corporate crisis, a conscientious and responsible approach to the handling of risks and the resulting impact on business is essential. Unforeseen events pose an especially great challenge for companies and require quick decision-making and immediate reactions” (Breuer et al., 2015).

Agriculture is a domain where the incorporation of an integrated business continuity management system is a crucial issue. In the agricultural sector “the preservation of processes is not dependent solely on information systems, but on the continuity of all processes that lead to the fulfilment of the global goal of agriculture” (Hajek & Urbancova, 2013). Moreover, agricultural business is highly

exposed to natural hazards. This has been proved by multiple recent facts and studies. A representative study (Okuda et al., 2011) delineates the major impact of an earthquake in East Japan on different agricultural sectors, especially farming and fishery. The early detection and management of risks is an integral part of the strategic management for agricultural organizations (Jankelova et al., 2017).

“Risk management in agriculture is now an essential tool for farmers to anticipate, avoid and react to shocks. An efficient risk management system for agriculture will preserve the standard of living of those who depend on farming, strengthen the viability of farm businesses, and provide an environment which supports investment in the farming sector (OECD, 2011). Risk management is an essential part of an integrated strategy regarding the estimation of the impact of various humanly and technically triggered hazards on the environment (Aukidy et al., 2014).

On the other hand, natural hazards also threaten the continuous and normal operations of critical information systems and business functions. Resumption of critical processes/ functions after the occurrence of any disruptive event is essential from the business continuity (BC) viewpoint (Torabi et al., 2014). It is, thus, important to develop strategies which can predict the maximum accepted resumption timeframes of the interrupted critical activities when a crisis occurs.

Resumption timeframes can be determined after the implementation of business continuity tests. Regular testing increases the ability of employees to respond flexibly to unexpected events (Malachová & Oulehlová, 2016). The official maximum time during which a business process should be recovered is known as Maximum Tolerable Period of Disruption

(MTPD) or Maximum Tolerable Downtime (NIST, 2010; Harris, 2010; Torabi, 2014). Additionally, due to the fact that critical business operations should ideally be recovered before this maximum tolerable downtime period, a Rational Time Objective (RTO) (ISO 22301, 2012; NIST 2010) should be considered as the target recovery time for business functions and information systems. Furthermore, the minimum accepted level regarding the operation of a business function, namely Minimum Business Continuity Objective (MBCO) (Torabi, 2016) should be achieved within the desired MTPD.

The goal of the current paper is the introduction of a semi-quantitative risk management algorithmic procedure for the determination of both the RTO as well as the Maximum Tolerable Downtime (MTD) resumption timeframes, based on the assumption that during the recovery process various environmental hazards can significantly extend the duration of the interruption of an individual business function. The overall risk magnitude of all potential factors is utilized for estimating the time deviation from the recovery timeframes proposed in ideal conditions. The algorithm's evaluation is implemented via the formula which estimates the availability of a system. Availability is defined as the "probability that an item will perform its required function under given conditions at a stated instant of time" (Garcia et al., 2016). The approach is then validated via the information system availability formula by replacing the Mean Time To Repair (MTTR) variable with the new estimated recovery time. The acceptable availability percentage must be greater than or equal to 99%. The approach is further validated via an agricultural case study, namely the irrigation management system in greenhouses. The specific algorithm has interdisciplinary value, yet, its application in the agricultural domain can be highly profitable due to its vulnerability in unforeseeable and hard to assess environmental hazards.

1. Problem Statement and Motivation

The relationship between the environmental conditions with the interruption of critical business activities is, in a sense, bidirectional. On one side, natural disasters and in general environmental hazards are among the factors which can severely impact productivity and growth (Faertes, 2015). Many crucial sectors

of the global economy such as the industry (Maboudian & Rezaie, 2017) and agriculture (Okuda et al., 2011) as well as their core ICT dependent business functions are highly exposed to natural hazards. A recent study analyzes the risks and negative effects of severe weather conditions in agriculture (Stulec et al., 2016). Consequently, these sectors and especially agriculture are highly threatened by unexpected operational failures with a subsequent unpredictable financial impact.

On the other hand, since multiple crucial agricultural business activities are based on information technologies, a possible interruption of these information systems can have an immense impact on the environment. A representative example of such systems is the irrigation systems. For example, in Spain a high percentage of farms have programmable irrigation automata which allow farmers control effectively irrigation parameters (Contreras et al., 2017). It can be thus realized that even a temporary interruption of such systems can result to errors regarding the overall water management process, ranging from water overconsumption (Contreras et al., 2017) to nitrate pollution (Thompson et al., 2007).

The major challenge of the current research is the proposal of an algorithm which can efficiently mitigate the risk of prolonged information system failover in the agricultural sector and prevent, to the fullest possible extent, similar to the above mentioned negative environmental consequences. Risk assessment methodologies are considered to be powerful tools for supporting Business Continuity Plans (Faertes, 2015). Especially, semi-quantitative risk assessment has multiple advantages comparing to the qualitative as well as the quantitative techniques. The former is not consistent enough while the latter requires not only strong mathematical skills but, additionally, it cannot be applied if historical data is missing (FAO, 2009).

The proposed algorithm is based on the quantitative weight calculation for each unexpected factor that may emerge during the recovery process, which stems from the application of the Rank Order Centroid (Barron & Barrett, 1989), a simple and widely utilized method for quantitative weight assignment and ranking (Danielson et al., 2015). Moreover, since the current approach is aimed for recovery scenarios where no past data is at the disposal of domain

or business continuity experts, the estimation of the probability of occurrence of each factor is based on their semi-quantitative opinion. Domain experts are considered to be experienced farmers or agronomists. The approach permits a 1-5 scale for probability evaluation.

2. Material and Methods

2.1 Proposed Business Continuity Resumption Timeframes

Typical proposed recovery timeframes for any interrupted business function (BF) by business continuity experts are the following (Harris, 2010):

- BF Extremely Critical: MTD=24 Hours and RTO<24Hours.
- BF Very Highly Critical: MTD=3 Days and 1Day <RTO<=3Days.
- BF Highly Critical: MTD=1Week and 3 Days<RTO<=1 Week.
- BF Important: MTD= 4 Weeks and 1 Week <RTO<4 Weeks.
- BF Important but not Critical: MTD= 1Month+ and RTO<1Month.

2.2 Risk Magnitude

Risk is a part of life, with both its underestimation and overestimation having the potential for unfortunate consequences (Burns & Slovic, 2012). The risk level is defined by the measurement of severity and likelihood (Borghesi & Gaudenzi, 2013). Risk analysis frameworks with respect to an integrated business continuity management has been already proposed by academics, who indicate that BCM „enables the organizations to improve their resilience in order to cope with the identified risks“ (Torabi et al., 2016). Nevertheless, no technique or similar framework has been proposed for utilizing risk magnitude in order to

estimate the additional, from the initially defined by experts, recovery time effort required to recover an individual business function or information system, when a list of unexpected factors emerge during the recovery process.

The currently proposed framework is based on the idea that experts may estimate a recovery time effort for an individual business function according to its corresponding business continuity exercise without initially considering a set of possible unexpected events (factors) which can significantly delay the recovery process. It is thus reasonable to develop a technique which is able to estimate this additional recovery time required to recover a business function or an information system in these conditions. This additional required time is calculated based on the risk magnitude for a set of unexpected factors.

The derived by the author risk magnitude formula, which is based on the risk level definition provided by Borghesi and Gaudenzi (2013) estimates the overall magnitude for N number of unexpected factors and is provided by the following equation (Eq. 1):

$$RM = \sum_{i=1}^N W_i P_i \tag{1}$$

where W_i and P_i the weight and the probability of occurrence of the i th factor. The method of their calculation is the following:

The Weight Assignment of the considered factors is quantitatively estimated with the Rank Order Centroid Method (Barron & Barrett, 1989) according to the following formula:

$$W_i = \frac{1}{m} \sum_{i=1}^m \frac{1}{n}, \quad \text{and} \quad \sum_{i=1}^m W_i = 1 \tag{2}$$

Tab. 1: The Semi-quantitative probability rating for unexpected factors

Rating	Probability Score
Very Low	1
Low	2
Medium	3
High	4
Very High	5

Source: own

This formula (Eq. 2) prohibits the arbitrary weight assignment of the presence for a given factor during the BF Recovery process. The probability (P_i) of occurrence of a specific factor is semi-quantitatively defined based on following a 1-5 scale (see Tab. 1).

2.3 Availability of an Information System

The availability is calculated according to the following formula (Eq. 3) (García et al., 2016):

$$A = \frac{MTBF}{MTBF + MTTR} \quad (3)$$

where $MTBF$ = Mean Time Between Failure, $MTTR$ = Mean Time to Repair, and A = Availability of a system for a given time period.

The above formulas indicate that when the Availability value is known, and an acceptable number of possible failures is proposed by domain experts, then a Mean Time to Repair (recovery time) can be also estimated.

2.4 Data

a) Data based on the assumed unexpected factors:

The currently proposed algorithm is practically demonstrated via an agricultural case study. At first, 4 possible unexpected factors which can significantly delay the recovery of a greenhouse irrigation management system are considered. The assumed dataset is the following (see Tab. 2).

Moreover, the above estimated RM values are utilized as drivers to calculate the new recovery time effort. The validation of the approach is achieved by applying the derived recovery time to the system availability formula in order to estimate the availability rate for effective irrigation treatment.

b) Data regarding effective irrigation treatments:

During recent experiments that involved intensive irrigation treatment through drip irrigation system, the domain experts proposed that irrigation systems should be programmed to operate effectively as follows (Contreras et al., 2017): "The period of activation of irrigation was the same for all treatment and was 10:00 to 18:00 h in winter and from 8:00 to 20:00 h in the

Tab. 2: The assumed dataset including 4 possible unexpected factors

Considered Unexpected Factors	Impact (Weight Value) based on ROC Method	Probability of Occurrence (based on a 1-5 Scale)	Risk Magnitude for Each Factor
F1 (Flood)	5.2	2	10.4
F2 (Severe Weather Conditions)	2.7	5	13.5
F3 (Network Failure)	1.5	2	3.0
F4 (Staff Unavailability)	0.6	4	2.4

Source: own

Tab. 3: Validation of the algorithm with the system availability formula via the irrigation treatment case study

Winter Irrigation Period	Spring Irrigation Period
A1 (Total Hours in 3 Months) = 8 * 90 = 720 Hours	A2 (Total Hours in 3 Months) = 12 * 92 = 1,104 Hours
Considered Number of Failures: 4	Considered Number of Failures: 4
MTBF1 = 720/4=180 Hours	MTBF2 = 1,104/4= 276 Hours

Source: own

spring". Thus the following calculations can be derived (see Tab. 3).

3. Results

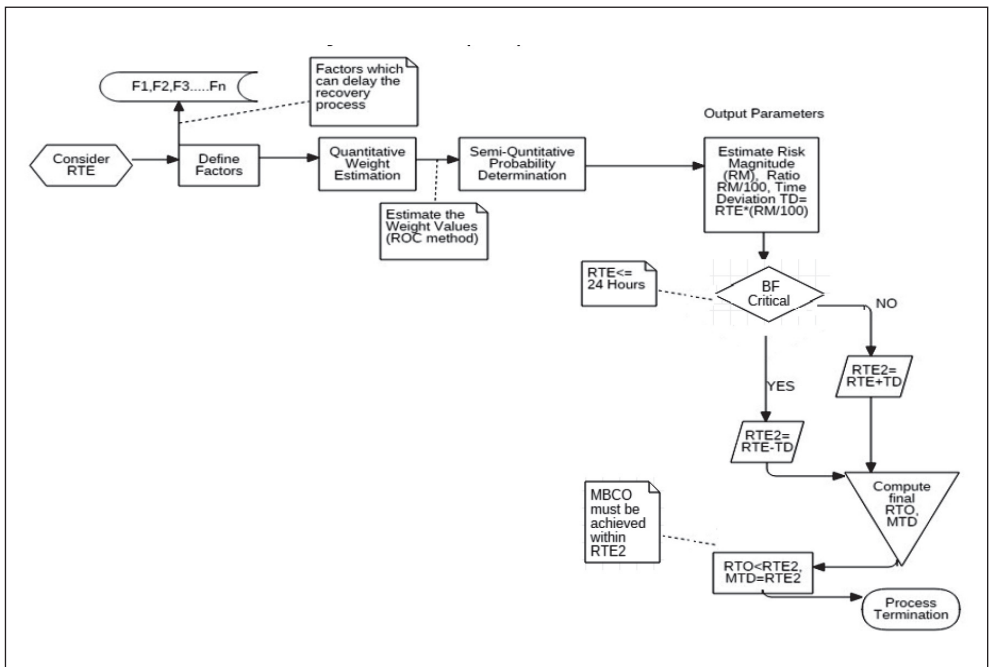
3.1 Representation of the Algorithmic Risk Management Process

The proposed contribution is formulated by combining semi-quantitative and quantitative techniques, and is aimed for assessing the risk of the significantly prolonged information system interruption. In the agricultural domain, some systems are executing highly critical activities including the control of gas emissions (Herbane, 2010) (i.e. in greenhouses), or those which are aimed for managing efficiently the water consumption (Wang & Hu, 2012; Contreras et al., 2017). It can be, thus, realized that the proactive risk mitigation of such a threat is of major importance for multiple agricultural business functions.

The currently proposed framework includes the following algorithmic steps (see Fig. 1):

- Definition of the Estimated Recovery Time for an individual business function.
- Determination of whether the business function is included in the MBCO or not.
- Consideration of a number of factors which can have negative impact on the recovery procedure of the interrupted business function.
- Quantitative weight assignment for all the involved factors with the Rank Order Centroid method (ROC).
- Define semi-quantitative probability of occurrence for each factor.
- Estimation of the total risk magnitude for all factors with regard to the recovery process.
- Estimation of the absolute value of the time deviation from the initially estimated recovery time. The positive or negative value depends on the existence of the specific business function in the MBCO. The Time Deviation is the result of the product of the initial recovery time multiplied by the ratio total risk magnitude divided by 100.
- Termination of the process.

Fig. 1: The flowchart of the risk management algorithmic process for estimating the possible deviation from the initial recovery time effort (RTE)



Source: own

Equations

According to the proposed by the author algorithmic method, if RTE is the time required to recover a business function in ideal conditions, a non-ideal recovery scenario should be considered for estimating the recovery time as follows:

$$RTE2 = RTE + \left| RTE \frac{RM}{100} \right|$$

$$\text{and TimeDeviation} = RTE \frac{RM}{100}$$
(4)

where RTE2 is the new Recovery Time which is based on the assumption that multiple unexpected factors influence the recovery procedure and trigger its significant delay. The Risk Magnitude (Eq. 1) and the Weight Values for all the involved unexpected factors are calculated with the Rank Order Centroid method (Eq. 2).

The final step is to evaluate whether the calculated RTE2 is a satisfactory timeframe to be considered for the recovered business function or system. One secure way to implement the specific task is to measure the availability of the given system by replacing the MTTTR with RTE2 in (Eq. 3). The derived equation is the following:

$$A = \frac{MTBF}{MTBF + RTE2}$$
(5)

Practical Example – Case Study

For a practical demonstration of the current approach, the following recovery scenario is considered (Tab. 4).

We assume an information system outage in a greenhouse (i.e. greenhouse irrigation system: “a chemical injection system shutdown while the irrigation pump continues to operate, possibly causing water to backflow through the chemical supply tank and overflow chemical on the ground“ (University of Nebraska, 2016)).

Its maximum recovery time after a business continuity exercise has been estimated 2 Hours, which indicates the criticality of the specific business function. The specific timeframe indicates that RTO<= 2Hours and MTD = 2Hours in order to ensure minor negative environmental impact.

However, during the recovery exercises, no severe conditions triggered by environmental hazards had been considered. We, thus, consider the following 4 unexpected factors which can significantly delay the recovery procedure:

If RTE = 2Hours, Number of Factors (N) = 4, WF1 = 0.521, WF2 = 0.271, WF3 = 0.146, WF4 = 0.062 and we assume that semi-quantitatively defined probability of occurrence for each factor are PF1 = 2, PF2 = 5, PF3 = 2, PF4 = 4 then:

$$RTE2 = 2 \pm 2 \frac{RM}{100} = 2 \pm 0.59 =$$

$$= 2.59\text{Hours or } 1.41\text{Hours}$$
(6)

It should be noticed that the RM values are normalized by multiplying the weight values of each factor with 10 for obtaining more rational results (w1 + w2 + w3 + w4 = 10).

Tab. 4: The semi-quantitative probability rating for unexpected factors

Considered Unexpected Factors	Impact (Weight Value) based on ROC Method	Probability of Occurrence (based on a 1-5 Scale)	RM/100	RTE2 (BF is critical, because RTE=2Hours, (RTE<24Hours)
F1 (Flood)	5.2	2		
F2 (Severe Weather Conditions)	2.7	5		
F3 (Network Failure)	1.5	2		
F4 (Staff Unavailability)	0.6	4		
			0.29	1.41 Hours

Source: own

According to the above calculated values as well as the proposed algorithm, the Maximum Tolerable Downtime (MTD) should be equal to 1.41 Hours. According to our algorithm, for a critical BF as the one included in our example, the value of the TIME Deviation ($TD = 2 \cdot (RM/100)$) should have a negative sign. In this case the risk management policy leads to the consideration of a lower RTE2 value from the initial RTE ($RTE2 < RTE$), since the latter had been estimated under ideal conditions during the recovery tests.

3.2 Final Validation via the Availability Formula

Since the proposed algorithm is aimed for measuring the time required to recover an individual computer based business function, the specific timeframe can be compared with the proposed by domain experts availability of the system that supports the given function. Based on the proposed irrigation time intervals

the proposed risk assessment algorithm can be validated by replacing the MTTR with the RTE2. The calculations are implemented as follows:

$$A_w = \frac{MTBF_1}{MTBF_1 + RTE2}, \quad \text{and} \quad (7)$$

$$A_s = \frac{MTBF_2}{MTBF_2 + RTE2} \quad (8)$$

where A_w is the irrigation system availability during the winter period, A_s is the irrigation system availability during the spring period, and $MTBF_1$, $MTBF_2$ are the corresponding Mean Time Between Failure calculated values (Tab. 3).

By applying the above mentioned formulas (Eq. (7) and Eq. (8)) to the specific irrigation treatments, the following results should be obtained (Tab. 5):

Tab. 5:

Validation of the algorithm with the system availability formula via the irrigation treatment case study

Winter Irrigation Period	Spring Irrigation Period
Achieved System Availability (if MTTR1 = 1.41h): 99.22%	Achieved Availability (if MTTR2 = 1.41h): 99.49%

Source: own

Thus, it can be concluded that the estimated RTE2 value can be effectively used in order to predict the Availability of a critical agricultural processes information system, such as the irrigation system, even when unexpected factors may negatively influence and delay the recovery procedure.

4. Discussion

When novel contributions are developed and proposed for specific domains, various issues regarding their value should be considered. Firstly, a contribution should rely on scientifically valid and globally accepted methods and tools. Secondly, the method's novelty, differentiation from similar proposed approaches, practicality and necessity within a specific domain should be justified. Thirdly, when the method is developed scientific issues like the model's consistency and the validity of the obtained results should be demonstrated. Finally, when practical explanatory examples and case studies that

include real data are incorporated (i.e. data proposed throughout past experiments), the value of the proposed algorithm becomes more evident. Thus, the selection of the appropriate case study is crucial for the evaluation of the newly introduced contribution.

The currently proposed algorithm is based on all the above mentioned criteria. At first, the contribution is based on mathematical formulas which are utilized for the quantitative and semi-quantitative risk management. The main input parameters in the proposed model parameters are factors which can trigger information system outages in industrial (Torabi, 2016; Maboudian & Rezaie, 2017) as well as the agricultural systems (Contreras et al., 2017) (i.e. environmental hazards, technical threats, human threats). Especially, though not exclusively, in the case of agricultural systems such factors can delay their recovery procedure and cause significant damage to the environment. Moreover, the method's

practicality is demonstrated via the utilization of simple equations used for estimating the new recovery time for interrupted business functions.

The novelty of the method is based on the study of the available literature. Even if multiple studies focus on environmental risk management and business continuity, like business continuity in agriculture (Hajek & Urbancova, 2013) and environment (Madoubian & Rezaie, 2017), risk management for business continuity (Torabi, 2016), no method combines all disciplines in order to suggest a procedure for estimating the extended recovery time of an individual business function (not groups of business functions (Torabi, 2014)) based on the magnitude of factors which can affect and delay its recovery. However, through the available literature it is highlighted that risk analysis, regarding the recovery of business functions, is a step after the estimation of their recovery time from experts during the Business Impact Analysis (BIA) process (Torabi, 2016). This sequence is followed by the proposed contribution. The definition of the initial recovery time (RTE) is a task that occurs during recovery exercises and is directly linked to the Business Impact Analysis process.

Scientific issues of the method are mainly related to the reliability of the initial RTE sources, and the negative sign of the time deviation. The reliability of the initial RTE sources is ensured based on the recovery time aspect of domain and business continuity experts. The negative sign of the Time Deviation from the initial RTE, has a meaning that a lower time should be afforded when a business function is critical ($RTE \leq 24$ Hours). Moreover, In order to adjust the RTE2 values to the needs of the currently developed model, the weight values are normalized on a 0 to 10 scale. As a consequence, the Maximum value of RM should be equal to 50, since the maximum value of Weight is 10 and maximum probability is 5. As a result, the above mentioned 1-5 scale for the Probability of Occurrence, along with the ROC approach for the weight assignment of the specified factors, prohibits negative or zero values regarding the RTE2 (Eq. 4). Simultaneously, a maximum extended time is proposed, and that is the double time from the initially estimated ($RTE2_{MAX} = 2RTE$). The practical example utilized includes unexpected factors as above analyzed. Furthermore, the

validity of the obtained results is ensured by applying the RTE2 value to the formula which estimates the availability of the business function/information system. For highly critical activities an availability rate 99% should be achieved, otherwise the recovery policy for the specific business function must be reconsidered.

Finally, a practical example which describes a scenario of an irrigation system interruption is utilized as an approach to evaluating the proposed algorithm. The specific example was selected due to the fact that irrigation system controls water consumption and management which is an environmentally crucial activity. In agriculture, technological problems are highly involved in the adoption of a sustainable water management (Chartzoulakis & Bertaki, 2015). Thus, from every aspect, the adoption of risk management policies for predicting possible extended failover of irrigation systems is remarkably valuable.

Due to the multiple negative environmental effects caused by a possible irrigation system failover, high availability (more than 99%) of the specific system is required. A challenging issue is the determination of a policy when predicting lower availability for such systems. In such cases, a reengineering during the business continuity tests can improve the performance of the algorithm and increase the percentage of its predictability. One solution is to consider longer MTBF time intervals or to decrease the number of permitted system failures during a given period when executing the recovery tests.

Conclusions

The interruption of any information system may result to significant financial, operational and environmental losses. Especially in agriculture interruption of information systems can have a dramatic impact on the environment. Moreover, apart from the environmental damage, such interruptions can be proved economically harmful since they may negatively affect critical agricultural business tasks like vegetable production and distribution based on internet and mobile technologies (Ahrary & Ludena, 2015).

The currently presented algorithmic approach can achieve an approximate and realistic risk assessment of extended information system interruption as well as a subsequent calculation of the specific time

deviation from a primarily defined by business continuity experts resumption timeframes (RTO, MTD). The main advantages of the approach are firstly, the mathematical risk assessment based on the risk magnitude formula, the non-arbitrary quantitative definition of the weights of unexpected factors which can trigger time deviation, which relies on the Rank Order Centroid method, and the validation of the new recovery timeframes via the information system availability formula. The idea behind the validation process is the replacement of the Mean Time To Repair (MTTR) value with new recovery time (RTE2) value. The specific action when applied to the greenhouse irrigation system which required availability greater than 99%, demonstrated that the predicted RTE2 ensured 99.22% system availability during the winter period irrigations, and 99.49% availability for the spring period.

The currently proposed interdisciplinary algorithmic model can be applied to multiple domains. However, its value to the agricultural field is remarkable since it can be utilized by domain experts in order to reduce the risk of environmental damages caused by such interrupted information systems in agricultural business as the water management systems.

The future work which will complete the current research is the termination of a software solution which will support the currently delineated algorithm. A draft version of a Visual Basic for Applications (VBA) Excel interface has been terminated. The already developed part includes the risk assessment procedure. The currently ongoing work aims to support the validation task via an additional functionality to the specific VBA tool. The VBA excel platform has been selected due to the fact that simple user interfaces for non-expert users can be developed with the specific Microsoft package. Moreover VBA Excel tools are widely used within the agricultural domain (Wang & Hu, 2012), even when modern technologies i.e. cloud and mobile tools are incorporated (Ahrary & Ludena, 2015). An additional future research target is the application of the current algorithm in mathematical models that measure the concentration of pollutants over time, as is the Air Quality Index (Plaia & Ruggieri, 2011).

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Abstract

RISK-BASED CONTROL OF THE NEGATIVE EFFECT OF DISCONTINUED AUTOMATED PROCESSES – A CASE FROM THE AGRICULTURAL DOMAIN**Athanasios Podaras**

The current paper delineates a modern algorithmic procedure for estimating the risk and calculating a realistic duration of interrupted critical computerized business activities, in order to mitigate or prevent their corresponding negative consequences. The contribution is formulated via merging risk management and business continuity concepts. The formulation of an integrated business continuity management policy includes the proactive determination of approximate recovery timeframes for critical business functions. Practically, this estimation is based on recovery tests which are executed under ideal conditions, and unexpected factors which may emerge during a real process interruption and significantly delay its recovery are ignored. Agriculture is a domain where the incorporation of an integrated business continuity management system is a crucial issue. The interruption of agricultural computerized activities can be triggered by and can result to various undesirable environmental phenomena. Thus, especially for agriculture, the consideration of unexpected factors when executing recovery tests is highly demanded. The currently presented algorithm accepts as initial input the estimated recovery time which is based on recovery exercises executed under ideal conditions. Then, a precise number of potential unpredictable hazards (factors) are taken into consideration and the risk magnitude of each threat is semi-quantitatively estimated. The total risk magnitude is utilized to estimate the time deviation from the initially defined recovery time. After the risk analysis process is terminated, a new recovery timeframe is proposed. The time deviation from the initially defined recovery time is calculated in its absolute value. The algorithm is finally validated by applying the calculated extended timeframe to the system availability formula which measures the achieved system availability levels for any information system. The validation of the approach is demonstrated via a practical case study from the agricultural domain, namely the greenhouse irrigation scheduling system interruption scenario.

Key Words: Risk management, business continuity, agriculture, environmental hazards, availability.

JEL Classification: Y80, M150.

DOI: 10.15240/tul/001/2017-4-017

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