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Obsah+Contents

BEHAVIOURAL ECONOMICS OF ORGANIZATION: EMPLOYEES AND MANAGERS

Petr Houdek, Petr Koblovský

Introduction

If you are an economist, you are reading this article without any financial incentive from your employer. It is equally difficult to verify that such activity will contribute to your growth of human capital and increased productivity in research or teaching. (That does not prevent the authors from hoping it will.) The standard economic model, which explains employee's effort only through the wage (determined by productivity), is therefore incomplete. In particular, it does not consider that incentives to work do not have to be monetary; in other words, that there are other things besides the disutility of labour ((Kamenica, 2012) and section 1.3 here). This perspective article aims to make the simple labour economic model more realistic in order to account for the mounting empirical evidence, which might otherwise be dismissed as anomalies. Why do employers pay employees more than their reservation wage? Under what circumstances do workers exert greater level of effort than the contracted one? When does effort decrease in spite of a rising wage (and there being no income effect)? Under what circumstances does yardstick-based remuneration fail?

The answer to these questions does not consist in a mere list of incongruous (and often even opposing) psychological regularities, cognitive biases and heuristics, sometimes presented as a caricature of behavioural economics (as well as of industrial and organizational psychology). This text aims, instead, to record economic agents' behaviour in the traditional economic method – using the usual efficient and coherent system of principles applicable under defined conditions (Barberis, 2013; Rabin, 1998).

The idea of applying behavioural economics to the workplace is supported by the fact that firms will not, in the short run, undertake any optimising corrections: "*Rational arbitrageurs cannot easily limit suboptimal corporate-finance decisions, since it is hard to short-sell a CEO or CFO. Quite the opposite occurs: top executives may be entrenched and hard to get rid of. Biases and mistakes in decision-making are thus much more likely to have a persistent and large effect in corporate finance than on asset pricing*." (Camerer & Malmendier, 2007, p. 236).

To shield ourselves from a charge that behavioural economics' findings are based on artificial laboratory experiments (Levitt & List, 2007), we try to rely on studies using real world data and field experiments (DellaVigna, 2009); not on data from situations involving inexperienced players with weak motivations, mostly students (Henrich, Heine, & Norenzayan, 2010), which often limit the applicability of such findings to environments as stimulation as companies. Still, laboratory experiments of the labour market do enable the researcher to control variables and causal relations in a way not affordable by another empirical method, so the text does refer to those. Falk and Fehr (2003) or more recently List and Rasul (2011) discuss the limitations of such experiments, especially with regard to unrepresentative composition of participants, insignificant rewards, limited number of observations and non-reproducibility of some real world problems in a designed experiment. Yet they conclude that experiments (laboratory and field) are a very useful complement to standard real world data analysis. They afford us a relatively quick and low-cost insight into the functioning of studied phenomena. Another pragmatic reason for using laboratory studies is the dearth of real world data, for example on shirking employees who have no motivation to reveal their true behaviour.

The article is organised as follows: the first section introduces a simple model of a worker's

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decision and then augments it by some realistic aspects of real workers' decision-making inspired by insights of behavioural economics. The second section concentrates briefly on the specifics of decision-making by company managers.

1. Worker's Decision

The standard model of worker's decision exposes worker i to wage w in return for a homogenous product, and she decides how much labour to supply given her marginal disutility of labour, or cost of labour $c(e_i)$ as a function of her effort e_i; under the usual assumptions, $c(e_i)$ is an increasing and convex function. Worker's output is a function of her effort and abilities (human capital) s_i, i.e. $x_i = f(e_i,s_i)+ \theta_i$ where θ_i are random shock in productivity with distribution $m(\theta_i)$. The company receives the output x_i and pays the wage $w(x_i)$ which is either linear in output $w(x_i) = w_k + \beta x_i$ in case of piece-rate remuneration, or fixed at $w(x_i) = w_i$, possibly augmented by an optional bonus b_i upon achieving a certain goal t, i.e. $w(x_i) = \{w_i \mid x_i < t;\ w_i + b_i \mid x_i \geq t\}$. Worker's expected utility of labour is then

$$U(e_i,s_i,w) = \int_{\theta_i} u(w(f(e_i,s_i) + \\ + \theta_i))\, m(\theta_i)\, d\theta_i - c(e_i). \quad (1)$$

Leaving out for simplicity the shocks and the exogenously determined human capital effect, the reduced form of expected utility becomes

$$U(e_i,w) = u(w(e_i)) - c(e_i). \quad (2)$$

Based on this intentionally simple model (Camerer & Malmendier, 2007), we argue that its components and underlying assumptions do not describe (even in an "as if" mode) workers' behaviour since their decisions employ different mechanisms and are influenced by other important factors. We highlight 4 areas worth incorporating into the standard model (cf. similarly (Bewley, 2007; DellaVigna, 2009, ch. 2.2; Fehr, Goette, & Zehnder, 2009; Al-Ubaydli & List, 2016)).

When choosing their effort, workers are not influenced only by the wage level or its change, but also by i) comparison of the wage offer to a reference level (Additionally, the relationship between wage and output is not necessarily linear: low productivity is still possible even at exceptionally high remuneration rates since the stress from worrying about losing such high reward will be reflected in a greater frequency of errors (Ariely, Gneezy, Loewenstein, & Mazar, 2009)). Such reference level does not have to be a wage in the form of a financial reward; it can also be interpreted as ii) a quality signal of the social relationship between the employer (principal) and the employee (agent). The reward contains elements of mutual reciprocity. As a result, then, employees do not consider the wage to be the only reward, but value also other, iii) "psychological" rewards of employment: intrinsic motivation – which can in some situations be even more powerful. Indeed, monetary rewards can go as far as to crowd out this intrinsic motivation. Eventually we'll also consider here the observation that in case of yardstick competition, i.e. rewards being based on measuring worker's output relative to other workers' output, one needs to consider also iv) social preferences, i.e. cooperative, reciprocal or indeed subversive motives for relationships among employees.

1.1 Reference-Dependence Decision-Making

An important contribution of the Prospect Theory (Kahneman & Tversky, 1979) are reference-dependence models which emphasise that economic agents use narrow bracketing and changes against reference points (Köszegi & Rabin, 2006) rather than final and absolute wealth levels and their marginal changes.

In their seminal paper, Kahneman and Tversky (1979, p. 273) illustrate reference-dependent decision making in problems 11 and 12. Consider first the choice: 1,000 has just been given to you and added to whatever you already own. Choose between alternatives A: 50% chance of getting another 1,000, or B: 100% chance of getting 500.

Now consider an alternative choice: 2,000 has just been given to you and added to whatever you already own. Choose between the alternative C: 50% chance of losing 1,000, or D: 100% chance of losing 500. Most participants in the experiment chose B in the first case and C in the second (84% and 69%, respectively). Subjects displayed risk aversion on bets with positive payoffs, but exhibited risk-seeking over bets with negative payoffs. Seen from the point of view of the final and total state, however, both sets of bets are identical, A = (2000, 0.5; 1000, 0.5) = C and B = (1500) = D.

Preference reversal is a consequence of considering the bet alone without any regard to its impact on possible income, with subsequent revelation of risk aversion. As Kahneman and Tversky put it, "*A salient characteristic of attitudes to changes in welfare is that losses loom larger than gains. The aggravation that one experiences in losing a sum of money appears to be greater than the pleasure associated with gaining the same amount*," (1979, p. 279). The act of overemphasising losses against equivalent gains is also used to explain the status quo bias (unwillingness to change the current state of things since any change would imply a loss of the current state), or to account for riskier behaviour as long as the decision maker fears a loss vis-a-vis his reference point (Imas, 2016).

When deciding about alternatives, therefore, people discount the level of income (a final state) which already became a part of their expected wealth and does not, according to Prospect Theory, influence their decision in any significant way anymore. Agents evaluate possible alternatives according to how they can move agents' expected wealth away from a reference state. In case of workers' decisions, agents will care not only about wage, but they will also get utility from the difference between current and expected reference wage w^r:

$$U(e_t w; w^r) = u(w(e_i)) - c(e_i) + \vartheta R(w; w^r), \quad (3)$$

where

$$R(w; w^r) = \begin{cases} r(w - w^r), & \text{for } w \geq w^r \\ s(w - w^r), & \text{for } w < w^r \end{cases}$$

where r is increasing and concave, s is increasing and convex, whereby loss aversion implies that $-s(-x_i) / r(x_i) \approx 2$; and $\vartheta > 0$; is a weight showing how much more intensively the agent considers the distance from reference wage compared to the standard utility from ordinary wage level.

There is no single unique way of determining agent's reference wage. Usually it is set at the level of past nominal wage $w^r = w_{t-1}$. Loss aversion can then explain workers' unwillingness to accept nominal wage reduction and a relatively stronger willingness to accept hidden reduction of the real wage (Kahneman, Knetsch, & Thaler, 1986). Employers anticipate this and instead of reducing wages they tend to reduce the number of employees (Bewley, 2007). Nevertheless, the idea of a reference wage as well as the whole concept of a reference point suffer from significant problems associated with trying to ascertain how they are actually determined by economic agents. Worker can arbitrarily consider almost anything to be the reference wage: her reservation wage, average or median wage in the profession or in some field, all can be influenced also by any anticipated (desired) changes. Any applied study must therefore always include a conceptualisation, a model of agents' interpretation of gains and losses in different contexts. The most widely used approach is to use the concept of expectations, meaning that people observe (derived) consumption levels and then consider the difference between expected and actual consumption (Bewley, 2007).

Linda Babcock and George Lowenstein (1997) showed, for example, that when negotiating over wages, teachers' unions were using comparisons to nearby school districts with higher wages, while school councils (their opponents) were making references to nearby schools with lower wages. The difference between these references then correlated with strike intensity (8% of disputes came to a strike, on average, lasting over 2 weeks). And yet these strategies were probably not intentionally and strategically engineered for the negotiation – for neither party was the difference between the reference groups correlated with the number of previous negotiations and therefore with experience. Both sides simply attributed different importance to different aspects of reality, thus producing a difference in expectations about their "correct" reference wage.

The effect of reference wage can be most easily identified on short-term labour supply. New York City cab drivers have to decide every day for how long they are going to offer their services, given the day-to-day variability of demand they face (peaking during bad weather and/or when big conferences and public events are taking place in the city). In the standard model, hours worked should grow in line with any growth in demand for their services (one day's earnings will have only a negligible income effect in the longer run). And yet actual cabbies work less on a demand-heavy day. One of possible explanations suggests that drivers expect a certain income – they have set themselves a specific target (reference) income they want to achieve every day. During

low demand for their services, then, they work longer hours to reach the target, while during peak demand their referential income is achieved quickly and they only work short hours. Elasticity of hours worked with respect to their earnings is therefore negative (Camerer, Babcock, Loewenstein, & Thaler, 1997). However, their income can be influenced also by other factors, and the data are also consistent with possible shifts on the labour supply side: the nature of work can worsen during the more intensive days and $c(e_i)$ may grow; see for example (Farber, 2015; Stafford, 2015) for a cautionary note on the generalization of these target earning findings.

Such difficulties in identifying causality are fortunately absent from a field experiment, which rewarded one group of messengers with an expected wage rise of 25% and their productivity was compared with a similar group whose members did not enjoy a raise. The next month the roles reversed and it was (only) the second group who was given a higher wage. This design allows for measuring the supply side reaction (number of shifts worked and deliveries delivered) to an exogenous increase in the wage rate (Fehr & Götte, 2007). Messengers did work more shifts (usually lasting 5 hours) in the higher paying month, but they worked less intensively: the average number of delivered packages was lower. This finding is also more consistent with the theory of referential income. Workers are motivated by the higher wage to go to work more often, but achieving their reference income faster they can then reduce their work effort. Another explanation could also be tiredness after an intensive shift, but messengers were also lab-tested for loss aversion by means of a lottery; messengers who refused a lottery offering 50-50 odds of winning 8 CHF or losing 5 CHF were exactly those who exhibited a reduction of deliveries after wage increase. This again is suggestive of the existence of reference dependent preferences.

Applying equation (3) at a company level implies that even when the final state of the worker's reward is the same, her efforts can differ, depending on whether the reward is offered as an improvement or deterioration relative to a reference point. The influence of framing on productivity was tested in a real field experiment in a Chinese electronics factory Wanlida Group Company (Hossain & List, 2012). When employees got a provisional bonus before the start of the workweek but were warned that they would lose it on payday unless they achieve the productivity norm, they worked more productively than employees of a control group who were merely given the standard promise to receive a bonus upon achieving the norm. The effect was relatively small, however; productivity grew by 1%. Interestingly, the effect of framing as a loss was stronger when whole teams were rewarded this way – social pressure came to bear on the less productive tea members. Long-term productivity gains were achieved through bonuses paid by both methods (*ex post* and *ex ante*) compared to workers receiving no bonuses at all.

Even though the framing of "reward as loss avoidance" was more effective and led to productivity gains, in some situations workers can interpret the mechanism as a sign of distrust. This brings up a more complex methodological problem: as a researcher one could be trying to model specific situations as part of one and the same scheme – even though the actual decision-making agents can interpret it differently. The incongruence between the actual decision-making mechanism by actual people and the researcher's structural model that describes it then leads to un-predictive models (Hudík, 2012; Rusinova & Houdek, 2013). In spite of all this, there may be yet another factor acting more strongly than loss aversion: reciprocity (as demonstrated e.g. in Christ, Sedatole and Towry, (2012)).

1.2 Reciprocity, Employment as a Gift Exchange

Compared to simple piece-rate remuneration, which clearly states (and enforces) both the product and the reward, actual work contracts are usually highly incomplete since they cannot capture the whole complexity of the job description expected from the worker. There are vague specifications of outcomes, outcomes are either impossible or costly to fully verify and therefore a fixed wage $w(x_i) = w_i$ is often specified. All these things, however, enable the worker to shirk, or at least greatly vary her work effort. And on real workplaces shirking is not actually monitored all that much. Akerlof (1982) famously argued that employment contracts should be seen as "exchanges of gifts". The employer gifts the employees a higher-than-reservation wage and (some) employees in

return gift to the employer a higher effort than the minimum observable requirement.

Under reciprocity, equation (3) applies with the specification that the reference point is higher than the required reservation wage, i.e. $c\ (e_i \mid g) < 0$ since on the one hand the gift g reduces the disutility of work effort, and on the other hand utility is obtained from the reciprocal behaviour towards the employer. Therefore, equation (2) can be reformulated as

$$U(e_i,w) = u(w(e_i)) - c(e_i(g)), \quad \text{given the expected } \dot{e}_t(g) < 0. \tag{4}$$

First field experiments to test this theory were undertaken by List and Gneezy (2006). In one of them day labourers were hired and offered a wage of 12 USD per hour to catalogue books in the library for six hours. First group of such workers really got this reward upon completing the work. The second group, however, was told before the beginning of their work that there is suddenly more money available for wages and that they would receive 20 USD per hour. Productivity of both groups was then analysed. The group getting paid more than originally promised did indeed work much more intensively, to start with. However, over time the effect of the promise evaporated and after the third hour of work their productivity was indistinguishable from workers in the first group. Other studies also imply that in general it is ineffective to pay gifts in the form of higher wages: the initial early boost to production eventually expires and does not cover the extra wage costs as productivity falls quickly over time (Fehr et al., 2009). Most of these studies, however, are testing only one-off temp jobs, which do not allow for building up reputation, a form of firm-specific social capital.

A similar experiment with cataloguing books was also undertaken in Germany, except this time it studied negative reciprocity (Kube, Maréchal, & Puppe, 2013). A job adverts again promised that workers will get "most probably" 15 EUR. As workers turned up, they were divided into three groups. One was given what was promised, the second one was told it would only get 10 EUR and the third group started working under the impression that they would get 20 EUR. Nobody from the less receiving group actually left; however, their productivity was consistently 20% below that of the normally-paid workers. Unlike quantity, the quality of their work was unaffected: workers merely reduced their effort instead of outright sabotaging the output. By contrast, the group, which was being paid more than promised was more productive by about 5%, but this was not significant. Physical limits of output were controlled for throughout. Members of the last group were paid piece rate $w(x_i) = w_k + \beta w_i$ at 0.4 EUR per book. This group consistently achieved 25% higher productivity.

These results indicate that workers interpret the decision about the wage level as a social interaction, they surmise how justly or unjustly they are being treated by the employers and they react to it reciprocally. Positive reciprocity cools off over time, influence of negative reciprocity persists. Therefore, negative reciprocity is yet another factor explaining the downward rigidity of wages observed in the real world: companies rightly fear revenge activity from workers.

In a follow-up study (Kube, Marechal, & Puppe, 2012), the original authors adjusted the experimental design in order to test whether workers would be motivated more if they get 7 euros' worth in the form of a physical gift or as a higher monetary reward (compared to the benchmark treatment). Productivity was consistently higher in the monetary-gift-rewarded group (the sense of fulfilling one's duty may therefore be stronger in Germans than in Americans), but the effect was insignificant. However, the physical gift of a thermal cup worth 7 EUR elicited a permanent increase (by 30%) in productivity compared those who were gifted 7 EUR in cash. Physical gift apparently implies good intentions of the employer and therefore a greater increase of commitment than through mere cash. These results indicate that results differ both across countries and across the form of an otherwise equally valued gift.

Evidence from real world labour relations is difficult to get since workers are understandably motivated to hide their true work effort, if they're shirking. Labour market data also do not suggest that positive reciprocity is a strong factor determining labour supply – estimates of elasticity of output with respect to wage changes range from mere 0.07 to 0.38 (Kube et al., 2012). Even more problematic is trying to derive causality from these estimates: workers may be less productive as a result of reciprocal behaviour following a reduction in wages, or they may no longer feel any bond with the company and are looking for a new job which lowers their work discipline, etc.

There are only a handful of real world studies testing similar behaviour rigorously. Management of one American Bridgestone/ Firestone tires factory wanted to lengthen the shifts from 8 to 12 hours in July 1994 and to lower the wages of new workers. Employees went on strike, which lasted with some adjustments for 2 years; but they partly continued working in the factory – the production was highly dependent on human labour and workers could therefore vent their frustration on the product. Data on car accidents then revealed that tyres produced in that factory over that time period were faultier and contributed to many deadly accidents (271 dead and 800 injured; and one of every 400 tires produced in the factory was returned under warranty). The frustration felt by employees was reflected in the lower quality of work (Krueger & Mas, 2004).

Similar reaction was identified among New Jersey policemen between 1978 and 1996. After wage negotiations, which did not meet policemen's demands, the rate of crime detection dropped by 12% compared to periods where their demands were met. There was even a drop in the average number of years of prison time the convicted criminals were getting at trial (suggesting that the policemen had not done their work thoroughly). Additionally, crime rate went up by 6% after policemen lost their negotiation (Mas, 2006).

1.3 Extrinsic and Intrinsic Motivation, Crowding Out

It should by now be obvious that the standard worker's expected utility model is incomplete. As we will show in this section, work effort can even bring positive utility of fulfilling intrinsic motivation, m, to some workers (or under some circumstances). If we have $i = \{g\}$ just like in the gift exchange case, we get $c(e_i|i) < 0$ (Gneezy, Meier, & Rey-Biel, 2011; Kamenica, 2012). In this framework the workers' effort is not so much influenced by extrinsic motivation such as money or extensive oversight by the employers, it can even be destroyed by them.

Worker's productivity is a function of various aspects of the employer's behaviour, his trustworthiness, his attention to the worker's individuality, his use of symbolic bonuses, intensity of supervision, and so on. Ellingsen and Johannesson (2007) illustrate these points with a case (David Packard's memory of his General Electric's experiences) when excessive control of issued material and tools in a General Electric factory did not lead to a reduction of thefts. On the contrary, theft became chronic since workers interpreted the measure as a sign of distrust and took up stealing from the company as a sport. Still, in general better supervision usually does increase productivity and reduce cheating (Pascual-Ezama, Prelec, & Dunfield, 2013). It is a regularity, which is likely to be culturally more universal.

Another study made important strides towards our understanding how meaningful workers consider their job to be. An experiment (Ariely, Kamenica, & Prelec, 2008) divided subjects into three groups which were tasked with simple mechanical job – in random sequences of letters printed on sheets of paper to mark chosen letters (there was a reward of $0.55 for finding 10 instances of two consecutive letters 's'). All workers were rewarded through piece rate, with every successive sheet of paper offering a linearly lowered wage. They were free to stop working at any point. For the first group, the experimenter/supervisor always accepted their marked sheet without even checking it for mistakes. The second group was asked merely to place their marked papers on a growing pile (the experimenter/supervisor ignoring their work). The third group's output was both ignored and destroyed, the experimenter/ supervisor immediately feeding their submitted sheets into a shredder. Although subjects could cheat in their work in all three groups (whereby the risk of discovery was the lowest in the third group), the gross output should not be very different across the groups. In reality the respective average outputs were 9, 6.8 and 6 sheets of paper. In spite of obvious monetary rewards, workers were not ready to participate in meaningless work. We can find an effect similar to "meaningfulness" also in the degree to which a worker identifies with the company and its goals (as demonstrated by "economics of identity" (Akerlof & Kranton, 2005)).

It seems that monetary reward cannot fully compensate for an intrinsic drive to have a meaningful and fulfilling job. At the same time, as just described, the relationship between the employer and the employee can be founded on trust and reciprocity; any monetary reward or supervision by the employer can weaken these motivations or even crowd them out completely. Productivity can suffer as a result (Gneezy et al., 2011). However, mutual influence of

individual motivations is not fully predictable and depends on specific context (Vranka & Houdek, 2015). Even in non-profit organisations operating mostly on the basis of trust and intrinsic fulfilment there are marked increases in efficiency once stringent supervision of activity is introduced (Bengtsson & Engström, 2013).

1.4 Relative Remuneration

Things get more complicated when work effort is influenced by worker's relationships to other co-workers. We shall concentrate here on the effect of remuneration. For effects on firm culture, peer pressure and others, see e.g. (Camerer & Malmendier, 2007, ch. 7.3).

Data of one British fruit company were used to test several remuneration mechanisms (Bandiera, Barankay, & Rasul, 2005). The first one, "yardstick competition", set a decreasing piece-rate dependent on the average productivity of all workers (workers' pay depends on the ratio of his/her productivity to average productivity among all co-workers). Under these conditions, workers who consider the well-being of others have an incentive to exert low level of work effort. The second one was a simple piece-rate. Even though the implicit wage was lower, productivity in this group was 50% higher. It is impossible to distinguish from these results whether workers were being altruistic towards each other or whether they created a cartel against the employer, assuming they could check each other's effort levels. The latter option seems more likely, since for those fruit pickers who could not see each other working there were no differences in productivity under different remuneration mechanisms (moreover Bandiera et al.'s findings thus casts doubt on the income targeting hypothesis).

Other studies on relative remuneration do not yield such clear-cut results. Introduction of relative evaluations, whether in the form of bonuses or sanctions (Kuběna, Houdek, Lindová, Příplatová, & Flegr, 2014), or the probability of promotion, will make a sabotage of co-workers' labour more attractive (Harbring, Irlenbusch, Kräkel, & Selten, 2007). Those co-workers in turn, realising the risk of being harmed, may themselves reduce their productivity (Chen, 2003).

On the other hand, workers may be subject to positive social pressure and associated increased productivity. A study of productivity of cashiers in one large American supermarket revealed that augmenting a group of cashiers with one highly productive cashier (who is able to see other cashiers) will increase their productivity. This effect is relatively high; a 1% more productive observing-cashier will result in a 0.23% increased productivity of observed-cashier. This finding is true even after controlling for possible cooperation between the more and less productive cashiers (such as helping each other out with manually entered codes of unmarked and with un-scannable items) (Mas & Moretti, 2009; Herbst & Mas, 2015).

2. Decision-Making by Managers

If we said that it is difficult to monitor (or motivate) individual work effort in workers, in managers it is doubly difficult. They may appear to be subject to transparent evaluation criteria in terms of the company's financial health (or share price), but attaching their specific contribution to these aggregates co-influenced by plethora of other factors is very hard indeed.

Equation (2) abstracted from effects of chance or an external shock θ_i on worker's remuneration, $w(f(e_i, s_i) + \theta_i)$, though in reality exogenous shocks do indeed affect the output especially of top managers. Not even owners can often identify such influences and *set* $w_{CEO}\,(f(\theta_i))$. Bertrand and Mullainathan (2001) showed that CEO's reward is also a function of chance or "luck", not just of their own effort: CEOs receive substantial bonuses even in situations when profits come through a positive movement of the exchange rate or through an increase in the world price (e.g. of oil in case of oil company CEOs) – events which they had no way of achieving directly. It has also been shown that CEOs lower their productivity after receiving a prestigious prize for their management skills, and yet continue to be paid even better than before (Malmendier & Tate, 2009).

Managers often do not admit to (or are unaware of) their own mistakes (Houdek & Koblovský, 2016; Houdek, 2016) and hold on to unproductive investments or company workflows. This can be explained by the principal-agent problem (the manager-agent has a reputational incentive not to publicise his mistakes since the owner-principal is unlikely to uncover them). But sticking to status quo can also imply avoidance of (psychological) loss that would obtain from admitting a mistake. Pedace and Kiholm Smith (2013) studied managing

coaches of baseball teams and showed that loss aversion plays a substantial role in their decision-making. When a player of the managed team suffers from low game productivity, he stands a lower risk of being replaced if it was the current coach who originally hired him. Should the coach change, however, the probability of letting go of an unproductive player increases. This can also hardly be attributed to the coach's reputational vested interest since the effect is the same independent of the length of his career and therefore also of his future career prospects. This study therefore nicely highlights the importance of replacing top managers frequently enough to open up the possibility of re-evaluating set procedures and the ability to terminate ineffective ones – now that they are no longer tied with former decisions of current managers.

When supervision by owners-principals is weak, psychological tendencies of managers-agents can be even stronger than those of employees. To illustrate the point – even events like the birth of their child influence CEOs' decision-making (Dahl, Dezső, & Ross, 2012). Danish CEOs increase their own remuneration following the birth of their child (especially if it is a son). Perhaps that is a rational move trying to provide better for the family. But there are signs that they also lower wages to employees, but less severely to women. That may imply increased empathy towards them after their own close encounter with childbirth – a psychological motive.

Camerer and Malmendier (2007) summarise other heuristics of managerial behaviour – biases in attaching responsibility, in directing effort, etc. Here we shall limit ourselves only to excessive optimism and overconfidence. Two papers (Malmendier & Tate, 2005; 2008) show that managers overestimate their ability to select successful projects, resulting in investment into excessive variance of different projects as well as in overpriced takeover bids and mergers. Excessive self-confidence was measured by the degree to which CEOs held onto their share options until expiry, in spite of most of them having very under-diversified portfolio (such behaviour would make sense only of a CEO overestimates his ability to "create" high future profitability of the company, assuming away any fraudulent insider-information trading).

Overconfidence and excessive optimism also explains the dependence of company's investment on its available liquidity (and not on availability of credit or on entrepreneurial opportunities, for example). CEOs prefer internal, mentally "cheaper" financing. It is, however, important to interpret these results in the right context, since risk aversion will tend to be lower with CEOs or businesspeople in general, compared with the rest of the population. Equally, self-confidence or optimism will tend to be necessarily higher (Ben-David, Graham, & Harvey, 2013; Graham, Harvey, & Puri, 2013).

Conclusions

Behavioural industrial organisation is a new field and many results of its empirical studies are unique and/or based on specific sectors and contexts. There is no doubt that the low geographic, cultural and legal diversity of sources is a shortcoming of our current state of knowledge. The vast majority of studies use data from Anglo-Saxon (USA, UK) or German-speaking (Switzerland, Germany) economies. The intensity of reciprocity of workers still differs greatly even among these developed economies, as we have shown in section 1.2. It remains an open question to what extent one can reproduce the aforementioned results in post-communist, Latin American or Asian countries with different values and legal traditions on the labour market.

It is reasonable to expect that idiosyncrasies of workplace culture, be they sectoral or national, will continue to play an important role. For instance, industrial organisation is influenced also by national levels of interpersonal trust: in countries where people trust each other more, companies have a greater tendency to decentralise decision-making about hiring, production or sales, which leads to a general increase in productivity (Bloom, Sadun, & Van Reenen, 2012). One culture tolerates not turning up to work for personal reasons, another culture frowns upon it (Parboteeah, Addae, & Cullen, 2005), and so on. Future empirical work will therefore have to pay an increasing attention to accounting for agents' heterogeneity in preferences, values and ways of decision-making since they all influence subsequent dynamics of companies. See for example the effect of gender composition of teams on their productivity (Hoogendoorn, Oosterbeek, & Van Praag, 2013), or explaining wage differentials between men and women

not only with traditional variables but also with preferences for competitiveness, bearing of risk (Croson & Gneezy, 2009) etc.

Identification of (psychological) regularities in decision-making (including possible errors and biases) of workers and managers will be necessarily followed by an adjustment in behaviour of the very companies and owners. That will make the resulting behavioural dynamic more difficult to predict. Yet one should not expect that behavioural tendencies will be completely ironed out. One reason is that many of these tendencies take the form of pure economic preference and there is no reason why they should disappear: workers will not stop caring about the way they are treated by their employers. Another one is that some decisions on the labour market are only taken rarely, and therefore do not enjoy the luxury of a direct feedback. Optimal learning might then fail to take place. Behavioural correction or learning itself can be heuristic and result in an error intensification rather than correction. It also seems to be the case that learned behaviour or abilities might not necessarily be transferable between different contexts of one's decision (Loewenstein, 1999).

Further development of the field will be replete with new and detailed data about economic agents' behaviour within firms and outside. The growing popularity of field experiments or randomised controlled trials within economics and the associated further growth in available data will enable a construction of more precise and robust theories of behaviour of workers and managers.

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Abstract

BEHAVIOURAL ECONOMICS OF ORGANIZATION: EMPLOYEES AND MANAGERS

Petr Houdek, Petr Koblovský

This short perspective article presents an overview of empirical evidence on the behavioural organizational economics on the basis of the extended standard model of worker's behaviour. The advancements of behavioural economics theories, new detailed and structured data on actions of economic actors, and increasingly used fields experiments provide a strong basis for the creation of more precise and more robust models of the behaviour of employers and employees. In this article we analyse 4 stylized extensions of standard model of worker's behaviour. Firstly, we give several examples of worker's reference dependent decision-making. Secondly, we utilize Akerlof's hypothesis on the relationship between an employer and an employee which is as predicted very reciprocal, similarly to the gifts exchange paradigm. We show that the more the employee thinks s/he is trusted by the employer, the harder and more efficiently s/he works. Thirdly, we show several instances of the importance of extrinsic and intrinsic motivation in employees and how those two motivations interfere with each other and crowd each other out in some situations. The research shows that meaningfulness of the work can be a significant driver of the employees' efficiency as well. In the last section devoted to employees we provide evidence on the impacts of relative performance compensation on cooperation, reciprocity, and sabotage in firms. The last part is devoted to analysing behavioural regularities of managers in their day-to-day decision-making. The overview briefly expands particularly on their over-optimism and on their possibly undeserved remuneration resulting from random events and market changes rather than from the managerial skills. The article concludes by proposing possible directions for further field research.

Key Words: *Behavioural economics, firm culture, field experiments, gift exchange, hubris, CEO, intrinsic and extrinsic motivation, loss aversion, reference-dependence model, reciprocity, social preferences, wage, labour.*

JEL Classification: *C93, D86, J41, M54.*

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SPATIALLY BLIND OR PLACE BASED POLICY? A COMPARISON OF INNOVATION SUPPORT IN THE CZECH AND SLOVAK REPUBLIC

Miroslav Šipikal, Valéria Szitásiová, Peter Pisár, Mária Uramová

Introduction

A Cohesion policy as well as innovation support is one of the main criteria and objectives of the European Union. A large part of these two policies are supported together through Structural funds. The past decade has witnessed a gradual shift from policies aimed at reducing disparities towards those aimed at strengthening regional and national competitiveness, with a focus on exploiting regional potential to contribute to national growth (Barca, 2009). Along with the issues of developmental support and related policy responses, studies dedicated to the role of innovation in this process represent a significant part of literature from the last three decades (Asheim, 1996).

Within a cohesion policy, we found two streams of thought about the present policy along with fierce debate about whether it should be „spatially blind" or „place based" including factors that influence success of these policies (OECD 2009a; 2009b; World Bank, 2009; Barca, McCcann, & Rodriguez, 2012). The first approach in general does not support the regionally targeted interventions and favours space-neutral policies with universal coverage in every territory. From this perspective, spatially-blind policies are also seen as "people-based" policies, representing the best approach to guarantee equal access to opportunities, regardless of where they live (Barca, McCcann, & Rodriguez, 2012). One of the key arguments is also the importance of developing the support instruments that do not exclude or discriminate against any group of potential beneficiaries. Using such a policy, it is possible to largely create conditions for development as well as to accept and adapt to the natural circumstances in the business environment (Foray, 2014). It is assumed, by encouraging mobility, that spatially-blind strategies ultimately lead to a more even geographical distribution of wealth and a convergence of lagging areas. Consequently, development intervention should be space-neutral and production factors should simply encourage a move to where they are most productive (Barca, McCcann, & Rodriguez, 2012).

The second strategy would stress regional-specific interventions and argues that properly designed place-based, not "one size fit all" policies are necessary for exploiting the full potential of economic development (Tödtling & Trippl, 2005). The starting point of a place-based policy is the idea that most of the knowledge needed to fully exploit the growth potential of a place and to design tailor-made institutions and investments is not readily available and must be produced through a new process involving all local and external actors. The place-based approach is therefore designed specifically to identify and build on the embedded local knowledge (Barca, McCann, & Rodriquez Pose, 2012).

Empirically, the traditional approach to regional policy is still popular in some member states where a place-based approach is still in the beginning, focusing on financial transfers to firms to compensate for their higher unit capital costs and on public works. In these situations, although cohesion policy funds are not earmarked to sectors, a large part of the resources ends up being allocated to sectoral programmes that lack place-baseness. This is particularly the case for resources – about two thirds of the whole budget is managed by the central administrations (Barca, 2009).

However, only few papers are looking at empirical evidence of spatially neutral or place based policies and mainly in the form of case studies (Ortega & Argilés, 2012; Foray, 2014). This paper is devoted to evidence of spatially neutral policies fostering innovation in two Central European countries, the Czech

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Republic and Slovakia, supported from cohesion policy instruments. In the first part we discuss theoretical concepts we relied on for the evaluation. In the methodology, the objectives of the research are explained and the research questions defined. As such, we are trying to answer these questions through the analysis of specific measures for boosting innovation in both analysed countries. The analytical part presents results of empirical evaluation of innovation support, with particular emphasis on regional and sectoral distribution.

1. Theoretical Background

The support of innovation is one of the most debated issues in regional policy, which is a part of the key factors of development and a source of comparative advantage (Asheim, 1996). This is evidenced by the fact that the European Union and national states allocate huge amounts of resources to promote respectively innovation, research and development. The importance of innovation is declared in scientific literature dealing with its role in regional growth. "If we are to understand why some regions grow and others stagnate, we need to understand the interactions among economic growth, economic geography and economics of innovation." (Acs & Varga, 2002). However, there are different views on how to set up their support in order to achieve the desired impact and results of support measures. The above mentioned debate about place-based versus space neutral policies is highly discussed in innovation support policies. The role of regions in innovation activities could be found in concepts such as innovation districts (Markusen, 1996), regional innovation systems (Cooke, 1997) or learning regions (Asheim, 1996). Contemporary theoretical and practical approaches focused mainly on concept of smart specialization; (Barca, McCann, & Rodriquez Pose, 2012; Foray, 2014) point to the fact that form and type of support should be tailored to individual regional conditions (Capello & Lenzi, 2013; Šipikal 2013).

Another line of discussion deals with adequate distribution of cohesion funds. In both mentioned approaches (spatially blind and place based) the focus has moved towards policies that strengthen aggregate economic growth. Equity issues are addressed as part of the growth package in space-neutral policies (World Bank, 2009). However, according to the principles of the EU cohesion policy, assistance should be directed to the poorest regions, whether these regions are defined by GDP per capita relative to the European average, distribution of structural funds as a ratio of GDP or through other more appropriate socio-economic factors (Crescenzi, 2009; Dall'erba & Le Gallo, 2008). However, experience and analyses of the distribution of aid do not always confirm compliance with the principle of concentration at lower levels. The issue of concentration of assistance in relation to the level of regional development was analysed in the context of other 10 European countries. It turned out that the spatial distribution of European Union funds is not always proportional to the level of socio – economic development of regions. On the one hand, it may mean that GDP per capita is not always the most appropriate indicator for the distribution of aid. On the other hand, if the policy does not respect the principle of concentration, it could be considered as not being a successful implementation (Crescenzi, 2009). According to the analysis of the distribution of aid between regions in the Slovak Republic from the 21 most-funded districts, only four belong to the group of least developed (marginal) regions. Similar results appear when determining the concentration of support. Along the 79 districts of Slovakia the aid is concentrated primarily in 18 districts. Of these 18 districts, only three are marginal (Michalek, 2014). In this context both in literature as well as in political circles we came back to the question, whether the policy has to be so called spatially blind-place-neutral or place-based. Part of this discussion is also the question of whether support policy should be sectoral or regionally oriented, and whose form bring better results and impact on development of regions.

Several evaluation studies analysed the support of innovation in Central and Eastern Europe. The policy of innovation support (or support for research and development) passed through a number of countries and regions in different phases and various forms (Šipikal, Pisár, & Uramová, 2010). Cohesion policy is represented in most countries by key funds for innovation support and also important institutional capacity building (Suurna & Kattel, 2010; Felixova, 2012). Regarding the share of innovation support on the total amount of support in the country, disparities can be seen in the V4 countries. In the previous programming

period of 2004 to 2011 of the total support in Poland 18.8% were allocated to research, development, innovation and entrepreneurship and in the Czech Republic 18.3%. However, this share was 16.3% in Hungary and the latest indicator in Slovakia was only 12.2% (Spišáková, 2011).

Based on the above mentioned paradigms, there are three dilemmas of distribution for European Union funds. The first question is whether the policy should be place-based or space-neutral. The second question is whether the policy should be more directed to the lagging regions. The third question is whether support distribution is followed by its declared objectives. Therefore we will analyse the used regional policy instruments promoting innovation in the Czech Republic and Slovakia. We looked at type of policy used and empirical results of this policy. Part of our research puts into confrontation the planned (desired) promotion and real distribution of funds to these areas. In this context we will examine European Union development assistance in the following sections of the present article.

2. Methodology

The main aim of this research is to evaluate innovation support in Slovakia and the Czech Republic that is funded by the European Union resources from the regional and sectoral point of view. In this regard, the following research questions were stated: "Where are the funds using the spatially blind policies actually heading – was the support directed to the least developed areas of Slovakia and the Czech Republic? Was the support directed to sectors with higher added value in these countries? What are the main differences and similarities between the two analysed countries?"

The reason for selecting the two countries is the long common history, the same accession time into the European Union, and similarities in statistics of innovation – both are moderate innovators and pursuant to the Summary Innovation Index are below the EU average; both show similar development in this index. The principal reason of this option is that we found in both countries very similar instruments for promoting innovation, similar territorial and administrative division of the country and a detailed support system of development. In order to obtain a relevant comparison of policies in two neighbouring countries, we have chosen to analyse two similar measurements of innovation support.

In Slovakia, under the framework of the Operational Programme Competitiveness and Economic Growth, we will analyse the measure 1.1. Innovation and Technology Transfers, namely the Sub-measure 1.1.1 Support for Introducing Innovation and Technology Transfer (a state aid scheme to support the introduction of innovative and advanced technologies in industry and services). Within this sub-measure we analyse six calls for grant applications for businesses in Slovakia. These calls (KaHR-111SP-0801, KaHR-111SP-0902, KaHR-111SP-1001, KaHR-111SP/LSKxP-1101, KaHR-111SP-1101, KaHR-111SP) were announced in the years 2008, 2009 and 2010, 2011 and 2012. They were the only projects of state assistance analyzed (not schemes de minimis). Through available information (from the Ministry of Economy of the Slovak Republic and Slovak Innovation and Energy Agency) a database of approved projects was established that was amended by particular characteristics (year of establishment, legal form, NACE Classification, number of employees, etc.) from the Register of Financial Statements of the Ministry of Finance of the Slovak Republic and the Statistical Office of the Slovak Republic.

In the Czech Republic, under the framework of the Operational Programme Business and Innovation, we will analyse measure 4.1 Increasing the innovative performance of firms, namely the sub-measure "Innovation – Innovation Project". The institution responsible for its implementation is the Ministry of Industry and Trade. The intermediate body for support realization is the Investment and Business Development Agency (CzechInvest). Within this measure we evaluate 4 calls for grant applications for businesses in the Czech Republic. These calls (Innovation – Innovation Project Call I, II, III and IV) were announced in the years 2007, 2008, 2009 and 2010. The last call has been subsequently extended to years 2011 and 2013.

To compare sectoral and regional distribution of aid we used basic descriptive statistics. We used NUTS III level, which consist of self-government administrative unit in both countries. According to the available statistics we analysed the amount of aid in both countries with respect to the number of assisted firms, number of approved projects, and amount of

aid in terms of selected firm characteristics as well as territorial and sectoral aspects. For the conversion of Czech currency to Euro, the exchange rate of the Slovak National Bank at the time of analysis (27.08 CZK/EUR) was used.

When analysing the support of the high-tech sectors, we used the definition given by Eurostat. The high tech sector includes industries with NACE code 21, 26.30 and medium-high sector with NACE code 20, 25.4, 27, 28, 29, 30, 32.5. When analysing the support of innovation poles, we used the definition given by national strategic reference framework (MVaRR SR, 2007). This analysis was made on the level of cities, compare to all other analysis done on NUTS II level.

3. Results of Innovation Support Evaluation

The importance of comparing two investigated neighbouring countries is highlighted in several policy analyses of European Union resources (Bruno, 2005; Spišáková, 2011), starting over from historical reasons to other socio-economic factors. In the following part of the article we proceed with the comparison of basic statistical indicators of both countries in connection with their innovative activity. In further subsections we approach to the analysis of specific measures for boosting innovation in the Czech Republic (hereinafter CR) and Slovakia (hereinafter SR) in terms of regional and sectoral perspective of aid distribution and other aspects.

What will follow is an analysis of the two countries of Central and Eastern Europe with a long common history, which joined the European Union at the same time (01.05.2004). After the breakup of the Czech and Slovak Federal Republic in 1993 two sovereign states, the Czech Republic (approx. 10.5 mil. inhabitants) and the Slovak Republic (about 5.4 mil. inhabitants) were created. Due to the common history, there are many similarities in major economic indicators such as GDP (GDP per capita in PPS Index (EU28 = 100) 2015 – CR 84, SR 76) or the average monthly salary (2015 Euro – CR 934.49 Euro; SR 839 Euro). According to the Innovation Scoreboard 2014 both countries belong to the group of moderate innovators with a Summary Innovation Index for the Czech Republic 0.447 and Slovakia 0.36 and growth rates of summary innovation index for the Czech Republic 2.61% and Slovakia 1.91%. The index values of both countries are below the European Union average. At the beginning and end of the period the trends in the index of both countries are the same, but in the period between the years 2009 to 2012, these countries have different statistics. While the value of Summary Innovation Index rose slightly in the Czech Republic, there was first a decline in Slovakia, but from 2011 to 2012 moderate growth was observed.

3.1 Selected Measures of Innovation Support in the Czech Republic and Slovakia

Promotion of innovation through the European Union regional policy is getting increased attention in every country, due to the significant funding that is available. In both analysed countries, specific measures were identified with promotion of innovation – in the Czech Republic the measure “Innovation – Innovation Project” (hereinafter IIP CR) and Slovakia the measure “Innovation and Technology Transfers” (hereinafter ITT SR).

The two analysed measures have many similar characteristics, starting with the aims of interventions, thus enhancing the competitiveness and innovation potential of supported enterprises along with the development of sustainable and ecological production. There is also a similarity with regard to the eligible beneficiaries. Both measures are designed for small and medium-sized enterprises as well as large companies with up to 1,000 employees. This research was based on data from the Slovak Republic Ministry of Economics and Czech Invest.

The guide for applicants in Slovakia contains a list of economic sectors which are not eligible for assistance, including fishing, shipbuilding, coal and steel industry, synthetic fibres production and selected activities in agriculture and manufacturing providing dairy products. It is identical to measures from the Czech Republic, but in IIP CR, there are manually added NACE codes of activities that can be supported (eligible selected classes were from sections C, E, J, M and S).This is a significant difference from the Slovakian support definition that could influence the distribution of aid.

The application (in both countries) should also contain, in addition to basic identification data, other characteristics (desired types of

data that are not identical in two countries), the number of employees, turnover and total value of annual assets during the last financial year preceding the application. The structure of revenues, share of the largest purchaser of total production and others should also be noted. However, the beneficiaries may not include enterprises in financial difficulty or undergoing restructuring.

Eligible Regions are convergence areas in Slovakia, which means that aid can be implemented in NUTS 2 regions of Western, Central and Eastern Slovakia. The maximum duration of projects in Slovakia is set at 24 months, the intensity of aid, however, is different for different regions, ranging between 0-50% of the support from total project budget. Regarding the Czech Republic, the defined eligible NUTS 2 regions are – Central Moravia, the Northwest, Central Bohemia, Moravia-Silesia, Northeast, Southeast and Southwest, while the intensity is, as in the case of Slovakia, different for each region ranging from 30 to 60%. For both countries, the assistance cannot be implemented in capital cities (it does not mean that firms registered in Prague and Bratislava are not eligible entities – more important is the place of implementation).

Regarding the ITT SR measure, measurable indicators to be pursued during and after the project execution are the so-called results indicators (growth in sales) and impact indicators (number of new jobs created and an increase in added value). In the case of IIP CR, there are more indicators required. The first group consists of the so-called binding indicators – the number of new or innovative products on the market; the number of new or innovative products put into production or service; introduction of new organizational methods in firms and co-operation with other firms and public institutions; and the number of established new sales channels. The second group consists of the so-called monitoring indicators, namely the number of newly created jobs (including women and / or research and development employees). Total sales, sales of innovative products, value added, average number of employees and labour productivity per employee are also tracked. The range of indicators in the Czech Republic is much broader and gives a more detailed picture of the situation than the generally defined indicators in Slovakia.

The evaluation process of all applications in the case of ITT SR consists of two phases, namely the formal and technical evaluation. In the first process, it is evaluated whether or not the application meets the formal requirements. The second phase is carried out by an expert committee. This committee analyses the application for aid according to the so-called evaluation criteria (basic criteria, suitability and effectiveness, method of implementation, budget and efficiency, administration, professional and technical capacity and sustainability of the project). Compared to the Czechs, there are differences. The evaluation process of IIP CR takes place using two sets of criteria. The first group consists of the so-called binary criteria (e.g. financial health of the applicant and other indicators with YES or NO responses) and the second group consists of the criteria to be used in assessing the innovative parameters of the projects.

Regarding the innovation support system itself, they primarily use very similar procedures in both analysed countries with differentiation of only some minor details of support settings. As we can see, the most important finding for our analysis is that the two policies are set as national policies, without any special assessments of regional characteristics. The criteria are set to select the best projects for the promotion of innovation, regardless of region. The application is, in principle, a spatially blind policy. The next section will examine whether the distribution of support is similar to the support system in the Czech and Slovak Republic.

3.2 Selected Characteristics of Analysed Measures

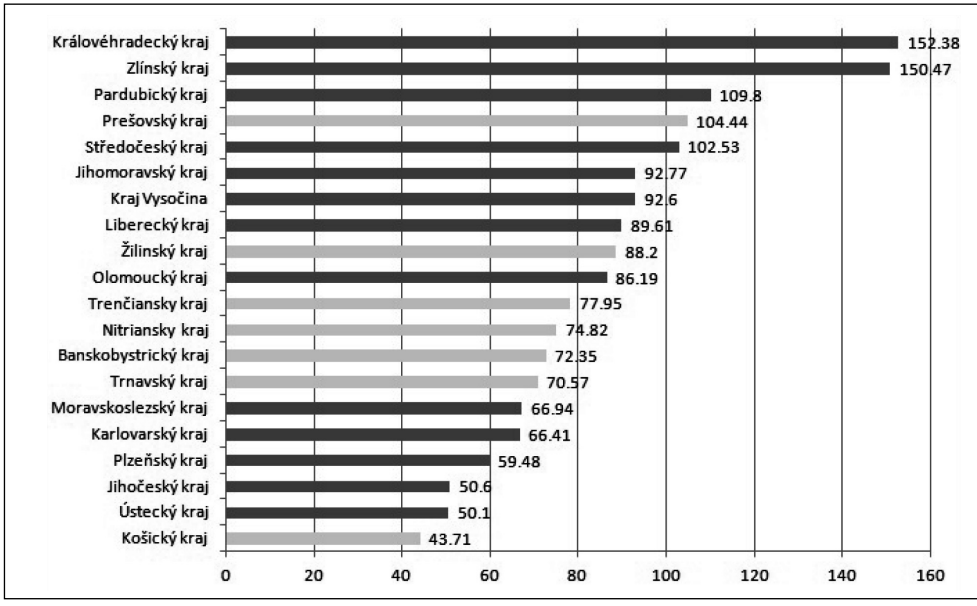
For analysis of the two similar measurements of innovation support, the total of €821,588,884.79 from the Czech Republic and €365,483,003.69 from Slovakia were allocated during the approved programme period of 2007-2013. Overall, there were 1,269 projects approved in the Czech Republic representing 930 companies and 400 projects in 371 companies in Slovakia. The project with the lowest support in the Czech Republic was €36,927.62 while in Slovakia, it was larger with €50,590.32. The project with the highest level of support in the Czech Republic was approx. €5,539,143.28 and in Slovakia it was similar with €5,998,810.98. The average funding amount for projects in the

Czech Republic was €659,443.10, and again Slovakia was higher with €913,707.51. During the mentioned programming period several different calls were issued. Within the calls, a slight increase in the number of approved applications for aid was generally observed and also in the level of support in both analysed countries. In the Czech Republic, the first call had approval of 78 projects in 2007, 158 in 2008, 132 in 2009 and lastly, there was a call for an extension in years 2010, 2011 and 2013 with 901 approved applications. Slovakia was also showing a growing trend with only 25 approved projects in 2008, 66 in 2009, and in the third call 35. However, within two calls in 2011, there were 98 applications and in the last call 176 projects were approved.

Analysis of the Distribution of Support

The total support was rather unevenly distributed at the regional level. In figure 1 we can see the calculated amount of aid per capita. The difference between the most and the least-favored regions is more than three times.

Fig. 1: Regional distribution of support per inhabitant in Czech Republic and Slovak Republic in euros



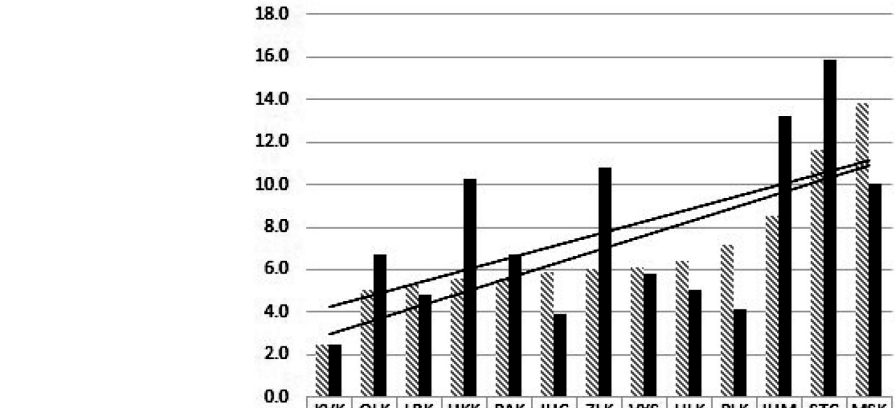
Source: own

(The term "kraj" means region, darker grey are Czech regions, lighter grey are Slovak regions)

The results thus show a very different regions' ability to obtain funding from the EU to promote innovation. The principle of spatially neutral policies would support the argument that the more developed regions have the ability to create better quality and more supportable innovation projects. If we look at the proportion of the support received in terms of more vs. less developed regions, there is an interesting difference between the two countries. While the Czech Republic support approximately follows their level of development (measured in total GDP in region), the Slovak Republic support were more targeted to disadvantaged regions. The correlation between share of support and relative share of GDP of the supported regions were 0.78 in Czech Republic, but –0.59 in the Slovak Republic. So despite the similar spatially neutral criteria, the support was distributed in very different direction.

The similar results could be found if we replace GDP by share of employment in industry. These results are shown in figure 2 and 3.

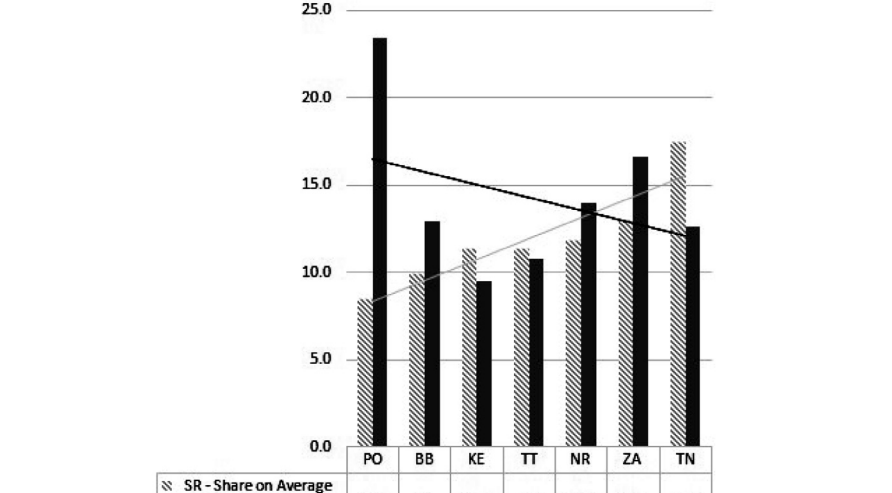
Fig. 2: **Share on number of employees in industry (2013) vs. share of innovation support by regions in the Czech Republic**



	KVK	OLK	LBK	HKK	PAK	JHC	ZLK	VYS	ULK	PLK	JHM	STC	MSK
Share on number of employees in industry	2.5	5.1	5.3	5.6	5.6	5.9	6.0	6.1	6.5	7.2	8.5	11.7	13.8
Support Share	2.5	6.7	4.8	10.3	6.8	3.9	10.8	5.8	5.1	4.2	13.2	15.9	10.1

Source: own

Fig. 3: **Share on number of employees in industry (2013) vs. share of innovation support by regions in Slovakia**



	PO	BB	KE	TT	NR	ZA	TN
SR - Share on Average number of employees in industry	8.6	9.9	11.4	11.4	11.9	13.0	17.5
Support Share	23.4	13.0	9.5	10.8	14.0	16.7	12.6

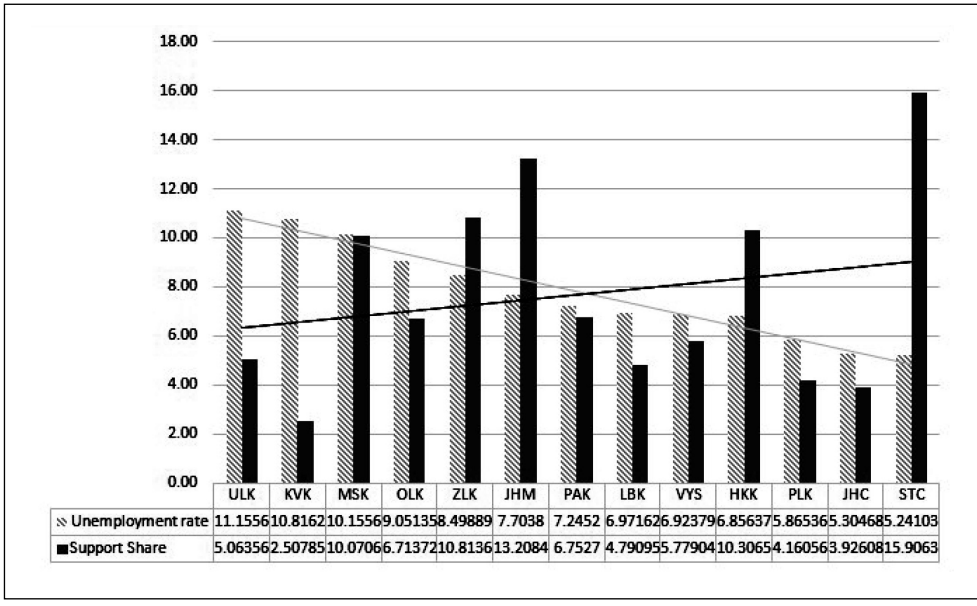
Source: own

(dotted lines are simple trend regression lines, just to see trends more easily)

In the Czech Republic, the correlation between the share of employment in industry and shares gained in support of the region is 0.66. The more employees in a given region, the more support the region received. In contrast, in Slovakia the trend was reversed. The correlation between the share of employment in industry and shares gained support in the region is –0.39, so support was more directed to the regions that have a lower share of total employment in the industry.

When comparing the distribution of support with the unemployment rate in the regions, in the Czech Republic the correlation between these factors is –0.30. So the larger share of support was distributed to the more developed regions. This corresponds more with the theoretical approach of spatially neutral policy. In the Slovak Republic, a correlation coefficient is 0.29, more supporting the principle of concentration for the least developed regions. A more detailed data for the Czech Republic can be seen in the figure 4.

Fig. 4: Unemployment level vs. share of innovation support by regions in Czech Republic



	ULK	KVK	MSK	OLK	ZLK	JHM	PAK	LBK	VYS	HKK	PLK	JHC	STC
Unemployment rate	11.1556	10.8162	10.1556	9.05135	8.49889	7.7038	7.2452	6.97162	6.92379	6.85637	5.86536	5.30468	5.24103
Support Share	5.06356	2.50785	10.0706	6.71372	10.8136	13.2084	6.7527	4.79095	5.77904	10.3065	4.16056	3.92608	15.9063

Source: own

(dotted lines are simple trend regression lines, just to see trends more easily)

As we have seen from the above data, although support schemes in both countries are in terms of their objectives and evaluation criteria very similar, in fact, the final allocation is very different. While the Czech Republic is heading towards support of innovation in the more developed regions, the Slovak Republic support is concentrated in less developed regions. This confirms the fact that setting the types and forms of support are not sufficient factors for achieving the objectives and even with spatially blind policies, we could achieve very different regional distribution of support.

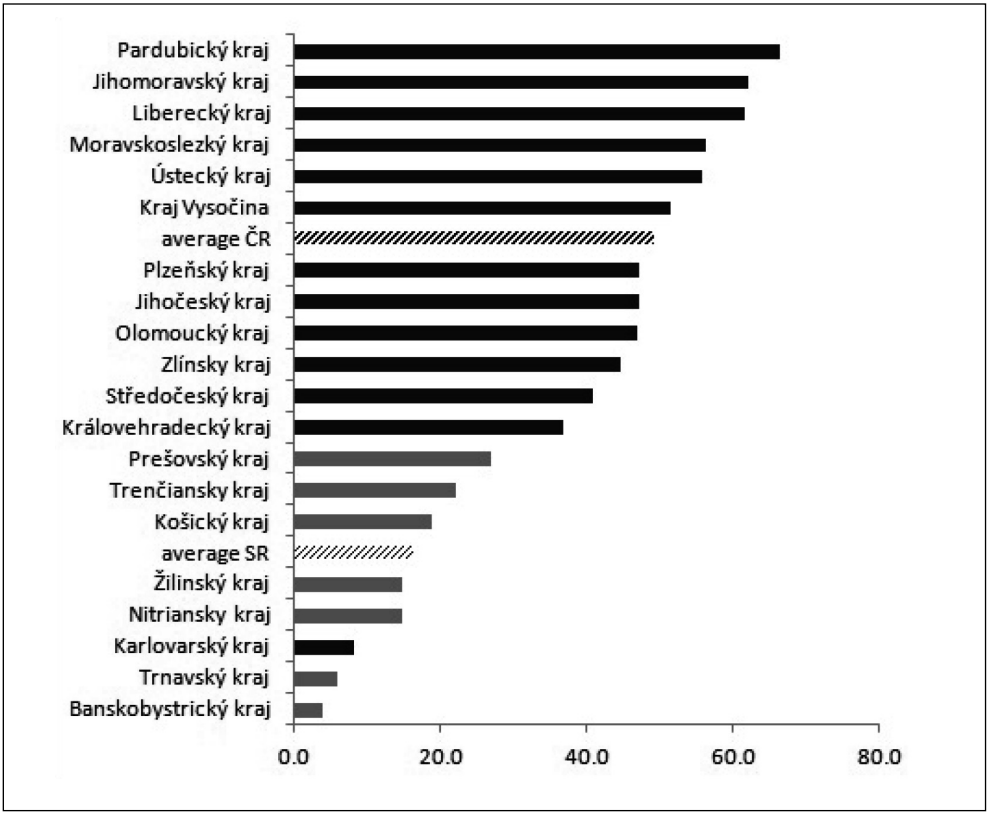
High Tech Support Distribution

One possible view at the regional distribution of support is also the analysis of the high-tech sector support. In terms of key indicators, both countries are similar. Both countries are relatively industrialized countries as the share of employment in industry in the Czech Republic is around 34% and in Slovakia around

31%. Also the share of high and medium high manufacturing is comparable. In the Czech Republic the share is 41.92% (550,000 out of 1,328,000 employees in the industry) and in Slovakia 40.54% (223,000 out of 550,000 employees in the industry) (Eurostat, 2015). Nevertheless, significant differences can be seen in the distribution of the support.

Generally, in the Czech Republic, a growing share of the industrial sector on total sales results in its growing share on the total amount of aid for innovation. In Slovakia, however, it is not typical that individual industrial sectors involved in the promotion have a similar share in total sales in the industry. Looking at the sectoral distribution of aid we found that more traditional sectors are supported more. The largest volume of support in the Czech Republic went into machinery, rubber and metals and in the Slovak Republic to rubber, food processing, wood processing and engineering industries. However, we mainly focused on the regional distribution of support for the high-tech sectors. We expected that the support for these sectors could generate the greatest added value and lead to more efficient use of support. Again, we wanted to find out whether the underdeveloped regions are able to develop appropriate projects in sectors with higher added value. The individual results are shown in figure 5.

Fig. 5: Share of high and medium high companies support as percentage of total support



Source: own

We see very different results between the Czech and Slovak republic (in figure 5 lighter grey are Slovak regions, darker grey are Czech regions). Although the proportion of the sectors in both countries is approximately the same, and the selection criteria were set in much the same way, the support is significantly different. While the Czech Republic indicates above-average support for these sectors compared to their share of the total industry, in Slovakia, these sectors have been much less supported. With one exception, high tech and medium high tech sectors in all regions in the Czech Republic have been supported to a relatively greater extent than in Slovakia. Another interesting paradox is that in Slovakia, the sectors that have been the most supported are in the most backward region. Conversely, the proportion in the second most developed region in Slovakia was less than 10%. Correlation between shares of high tech and GDP is 0.22 in the Czech Republic and –0.29 in Slovak Republic. The Czech Republic thus has a higher share of high tech industries being supported in more developed regions, contrary to the Slovak republic.

Innovation Poles

Support in the Slovak Republic had one more special feature. In developing national strategic reference frameworks, there has been established "innovation growth poles", with the focus on support of innovation. These poles were declared to be the most appropriate for achieving effective support to innovation in disadvantaged regions. The first major difference from the declared intention to allocate support to innovation growth poles can be seen in the fact that there were no additional points for projects from innovative growth poles. This confirms the important sectoral orientation support and then applying the spatially neutral policy. If we look at the real distribution of this support, we find that the innovation growth poles obtained 66% of the total support, which is more compared to the proportion of the population (40%) in these cities, but again less than the proportional number of companies in these cities. So the real support was not concentrated in cities that have been declared as the most suitable for supporting innovation. This again shows difference between formal targets (concentrate support to innovation poles) and real distribution. This allocation follows the distribution of support on higher level (regions), where there was also support oriented towards the most lagging regions.

Conclusions

In the present article we examined the real distribution of European Union funds intended to promote innovation in two neighbouring member countries, namely the Czech Republic and Slovakia. Theoretical part was devoted to discussion between spatially blind and place based policy. We also looked at the role of innovation and the importance of the European Union cohesion policy evaluation. We dealt with important paradigms of development and its systems of support, the so-called place – based policy vs. space neutral policy. We also discussed the issue of theory and practise of distribution of funds to the least developed regions.

The distribution of the support was very different among the regions. Regarding the average amount of aid for the project, Slovakia (approx. 915,000 EUR) is characterized by a higher amount than the Czech Republic (approx. 660,000 EUR). If we look at the amount of aid per capita, of all analysed NUTS 3 regions the first three places are the only regions of the Czech Republic with an amount of 153 to 110 EUR, while the Slovak NUTS 3 region Prešov takes the fourth place with 105 EUR per inhabitant. The least amount of this funding was earmarked also for Slovak Košice NUTS 3 region with a level of support of only 44 euros. We must also consider that the various regions are not internally homogenous, as there are large regional disparities, whether in the amount of aid but also in the level of development, which is examined more deeply in the next part of the research. We looked only at innovation poles at the city level and it confirmed that objectives of innovation support differ from real funds distribution.

Regional distribution of aid was examined in the context of level of development of individual regions and their share in the total amount of aid in both countries. Here, it needs to be emphasized that two very similar instruments of innovation support were analysed. In the Czech Republic, the more developed region is (measure by its share of GDP), the higher its share of the total amount of innovation support. Conversely, in Slovakia, the region that had the lowest share of GDP compare to other

regions received most support from the EU. If we look at another indicator of development, the unemployment rate, the Czech Republic received the most support for regions with the lowest unemployment rate; while in Slovakia, we observe again an opposite trend – the region with the second highest unemployment rate had the largest share on total support.

In regards to sectoral distribution of support in both analysed countries, the largest share in overall support is given to industry; therefore we examined this sector in more detail than in other parts of the analysis. Generally, in the Czech Republic, as an industry increases its share on total sales, it also increases its share in the total amount of aid for innovation. In Slovakia, however, it is not typical that individual industrial sectors involved in funding will have a similar share of total sales in the industry. Most support went to subsectors of metal production and food. We also analysed the high tech sector separately and we again found very different results. While in the Czech Republic indicates above-average support for these sectors compared to their share of the total industry, in Slovakia these sectors have been much less supported.

Based on our evaluation of aid distribution, it should be noted that in spite of the same settings of support in each country, there is not the same real sectoral and regional distribution of support. To know which form of aid distribution is more effective, it is necessary to confront the results of the analysis with the impact of support measures, namely the extent of meeting the stated objectives of the instruments, such as how many patents were created with the help of the various regional and sector support. However, we confirm that even with spatially blind policy, the results could differ substantially in absolute placement of support distribution. This is again a field for further research. Cohesion policy should not only discuss the goals and forms of policies, but pay much more attention to hidden implementation factors, for example corruption or abilities of evaluators. It looks as if the evaluation process had influence on the distribution of support much more significant than the formal criteria or objectives set in the strategies. Another question that needs to be answered is the real impact of both systems.

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Abstract

SPATIALLY BLIND OR PLACE BASED POLICY? A COMPARISON OF INNOVATION SUPPORT IN THE CZECH AND SLOVAK REPUBLIC

Miroslav Šipikal, Valéria Szitásiová, Peter Pisár, Mária Uramová

With the ongoing changes in development of the European Union, also conditions for financial support are changing. For Central Europe, most financial aid comes from Cohesion policies. The same applies for the support of innovations, which are considered to be a driving force of development. One of the main debates concerning cohesion policy is the issue of "placed based" versus "spatially blind" policies. Their role mainly differs within the area of economic growth. This paper deals with the evaluation of innovation support as a driving force for economic growth from structural funds in two neighbouring EU member states – in Slovakia and the Czech Republic. This article provides a picture of what kinds of policies are implemented and how consequently the resources of the European Union are territorially distributed to support innovation. We especially dealt with the question of the support criteria for projects and their role in the implementation of support. Based on this, the paper tries to identify where assistance is concentrated and how the criteria influence the geographical distribution of this support.

As a result, we found that, despite very similar spatially blind policies in both countries and very similar systems of providing support, they still have very different regional effects. In the Czech Republic, support was allocated to developed regions and high tech sectors to a greater extent. In the Slovak Republic, support was concentrated more on disadvantaged regions and in traditional sectors with lower added value. It shows the need to pay much more attention not only to policy set up, but also to policy implementation.

Key Words: *Spatially blind policy, structural funds, cohesion policy, innovation support, place based policy.*

JEL Classification: *R58.*

DOI: *10.15240/tul/001/2017-1-002*

THE EFFECTS OF EUROPEAN ECONOMIC INTEGRATION AND THE IMPACT OF BREXIT ON THE UK IMMIGRANTS FROM THE CEE COUNTRIES

Mihaela Simionescu, Yuriy Bilan, Luboš Smrčka, Zuzana Vincúrová

Introduction

Even if most immigrants come from non-EU states, the EU membership is often considered as the UK's perceived migration issue. Immigration is an actual problem in the UK and one of the main causes of Brexit. The debate regarding the immigrants issue is mostly referred to less developed countries from Central and Eastern Europe which joined the EU the latest. Some Britons considered that immigrants exerted high pressure on public services. Contrary to this opinion, Petroff (2016) showed that immigrants contribute to the country's budget and stimulate economic growth. Most immigrants come to work and therefore, they pay taxes. Moreover, they often compensate for the ageing local population. According to the Brexit scenario, migration will be limited, which from the economic point of view implies lower economic growth and higher burden of the exchequer.

According to the principle of free movement of persons, goods, services and capital, non-British EU citizens have the right to work in the UK (Boswell, 2016). As Staiger (2016) explained, the UK can completely control its borders and it is exempt from common standards in immigration and some asylum regulations. The number of the UK immigrants from the CEE countries increased after their entrance into the EU, but actually most of these emigrants preferred such countries as Germany, Spain, Italy and France (Čajka et al., 2014; Tilford, 2015).

Rumpel et al. (2013) showed that migrants from CEE countries prefer cities or urban regions because of the employment opportunities. Moreover, microeconomic determinants of migration were identified by Merkevicius et al. (2015) who consider that deficiencies in human resources management in the developing countries determined migration in developed countries.

The main aim of this paper is to evaluate the question of migration in the context of economic development in the UK, to show the positive impact of the UK immigrants from the CEE countries on the UK economy after their economic integration, and the possible negative consequences of Brexit on the migration process from some CEE countries to the UK. We will focus only on the increase of the number of UK immigrants from these countries due to the EU membership, making comparisons with other CEE countries that did not entered the EU. The sample of the CEE countries was selected to include the available data on ethnic communities with a consistent number of immigrants. Due to the nature of data and the existence of some mixed effects in explaining the emigrants' behaviour, some specific Poisson models were estimated. Moreover, a counterfactual analysis by comparing the EU countries with the group represented by Russia, and Ukraine was conducted. The influence of Brexit itself might reduce the number of immigrants from the CEE countries twofold, and potential future migration policies may reduce it further. The CEE emigrants might come back home or they can go to other EU countries (countries with a large number of CEE immigrants or on the opposite, to the countries with less immigrants).

Moreover, we empirically check the assumptions regarding the impact of CEE countries' emigrants on the main macroeconomic indicators in the UK, proving that the results are consistent with the previous

studies on the immigrants overall. Emigrants from the CEE countries had a positive impact on the UK economy and their arrival in the UK should be stimulated after Brexit.

The paper is organized as follows. After the Introduction, a literature review is presented. The methodological framework is set up and the empirical results are interpreted. Conclusion is the final part of the paper.

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1. Literature Review

This research focuses on the impact of economic integration and Brexit on the UK immigrants from less developed countries, namely, from the CEE. This assessment is necessary because both public opinion and literature show positive and negative effects of immigration on the UK economy. Our position is consistent with the empirical findings presented in economic literature that show the positive impact of the EU immigration on the UK. In this case, the reduction of EU immigrants after Brexit will bring along lower economic growth and austerity measures. One of our tasks is to measure the decrease in the number of the UK immigrants from the CEE countries and to propose policies to alleviate this decline.

Considering any sort of economic integration, four freedoms specific to internal markets are affected: free movement of goods, persons, services and capital. In this context, Ebell and Warren (2016) showed that EU membership had a positive impact on the UK immigrants, because of free movement of capital and because of free movement of goods and services, including labour mobility and passporting that made the UK an attractive destination for emigrants from the entire Europe. Robinson (2015) stated that probably the most important consequence of Brexit would affect the movement of capital that will affect businesses by bringing more uncertainty. Investment would fall as a result, especially by footloose multinationals who would find the UK a less attractive location. The resulting damage to the UK´s long term prospects for growth in national income, and hence company revenues and profits, could have a negative impact on the share prices.

According to economic theory, mobility of production factors ensures better resource allocation at international level which brings along welfare increase (Grosu & Dinu, 2016). This applies to capital (Jäger-Ambrożewicz & Matthes, 2012) and also to labour mobility even if the policies are very sensitive to the migration problem (Lodewyckx et al., 2010; Giovanni et al., 2012; Wadsworth, 2015; Aichele & Felbermayr, 2015). According to the endogenous growth theory, a liberal trade mode generates benefits to the industries with an obvious competitive advantage (Rebelo, 1991; Romer, 1994; Vitunskiene & Serva, 2015; Stefaniak-Kopoboru & Kuczewska, 2016). This theory proves that faster economic growth can be achieved through specialisation and the reduction of product unit costs. Taylor et al. (1993), Duczynski (2000) noted that countries with higher level of trade openness have higher opportunities to exploit technological innovations, which also determines faster pace of their economic growth. According to the product life cycle theory, having standardized product technologies, companies tend to relocate their production to countries with comparatively low capital intensity (Hirsch, 2009; Farmer & Schelnast, 2012). This is the reason for advanced innovations and technologies flow from leading economies to followers via trade openness. Greater rate of innovation and technology absorptions promotes the raise of human resources skills and capacities (Balcerzak, 2016), which, in turn, leads to economic growth in the long run (Pilinkiene, 2016).

The Central and Eastern European Countries (CEEs) are experiencing high growth rates in terms of trade openness. The total trade openness index for the CEEs in 2014 reached 136.4 percent, and in comparison to 2000 increased by 45 percent. Slovak Republic (trade openness index is equal to 180%), Estonia (167%) and Lithuania (163%) are attributed to CEEs countries with the highest degree of trade openness whereas Romania (82%) and Poland (78%) show the lowest degrees in this respect. It is important to note that trade openness index for the least trade open CEEs is equal to the average of the EU (81.3%), which proposes that the old EU member-states are substantially more closed for international trade, but have higher degree of competitiveness. With the reference to the data of the World Economic

Forum, in 2014 Germany, one of the most competitive EU states, occupied the 5th position in the Global Competitiveness Index, but had trade openness index equal to 85 percent, i.e. slightly higher than the EU average. Hence, it is purposeful to research whether higher degree of country's competitiveness leads to lower degree of trade openness and vice versa, and to define the conditions for this interrelation (Pilinkiene, 2016; Lelek, 2014).

A major argument for Brexit was the possibility to control more the immigration to the UK from the other EU countries. The level of net inward migration has been at record high levels in recent years, with the latest data showing net inflows of 323,000 over the year to Q3 2015. Net immigration from the EU countries was 172,000 over this period, only a touch lower than 184,000 recorded over the year to Q1 2015 (Goodwin, 2016). British population common perception is that uncontrolled immigration will affect their wages, their jobs and overall life quality. Immigration reduction is demanded by a high percentage of population (between 44% according to Ipsos-Mori and 71% according to 5 News and YouGov) because of the burden on public services, salaries, unemployment and cultural issues (Boswell, 2016). 58% of the Britons consider that the EU emigrants should first have a definite job, before their arrival in the UK (Daily Express, 2016).

Economists have a different perception of the migration issue. Most of the arguments encourage the EU immigration. Usually, these immigrants are younger, more educated and ready to work, having fewer benefits than the UK-born. While the Britons are concerned with higher competition for jobs, immigrants would actually use services and goods, thus increasing the overall demand and creating more job opportunities. Moreover, immigrants might have complementary skills. There are many studies analysing the impact of immigration on jobs and salaries of the UK-born workers (Wadsworth, 2015; Portes, 2016; Dustmann et al., 2005). All these studies indicated that immigration increase did not significantly affect jobs and salaries of the UK-born workers in a negative way. The empirical evidences of Wadsworth et al. (2016) suggested that the zones with high growth in the EU immigrants did not registered greater fall in jobs and wages paid to the UK-born people. The real cause for the decrease in salaries after 2008 was in fact the world financial crisis and the problems with achieving fast economic recovery but not the immigration increase. On the other hand, there is little evidence regarding less jobs and salaries for low skilled UK-born workers because of the EU immigrants that are more educated.

Immigrants bring in extra resources that might be further used to increase spending on local health and education for the UK-born people. By reducing the EU immigration greater austerity is required. The economic literature demonstrates a consensus regarding positive effects of foreign direct investment and trade on the UK productivity. But there is less of a consensus regarding the consequences of immigration on productivity in the UK. Previous studies found a strong evidence for positive effects in case of more educated immigrants ((Ortega & Peri, 2014; Ottaviano et al., 2016) for the UK service productivity). For overall immigration, most of empirical researches detected positive or even insignificant effects. An evaluation carried out by Felbermayr et al. (2010) showed that a 10% increase in the immigrant stock generates the gain of 2.2% in per capita income in general.

The EU immigrants diminish the budget deficit, because they pay more taxes as compared to the money for welfare and utilization of public services. Immigrants do not negatively affect the local services on the problems regarding education, healthcare, crime or social housing.

Regarding the impact of immigrants on public finances, Dustmann and Frattini (2014) showed that the EU immigrants have a positive fiscal contribution by paying more taxes than getting benefits in terms of welfare. On the other hand, the UK-born citizens receive more benefits than they pay taxes. Springford (2013) and Milaszewicz et al. (2015) considered that the main determinant of the migration from the CEE countries to the UK is the welfare gap. Springford (2013) showed that only 0.8 percent of the EU immigrants received unemployment benefit one year after their arrival in Britain. Most immigrants come to Britain only to find jobs and not for higher welfare. 71% of immigrants come to the UK for jobs and 6% of them are unemployed, but they do not require allowance support (Petroff, 2016).

The Office for Budget Responsibility (2013) forecasted a national debt for UK by 40 percentage points higher till 2062 if

net immigration will become null. If the EU immigrants are net contributors, there is not any evidence they will ask for public services. They bring more resources that might be used to increase spending on education and healthcare for the UK-born people. Reduction of the EU immigration would bring greater austerity. Dhingra et al. (2016) showed that one of the measures in these cases would be cutbacks determined by slower economic growth. The cutting backs on public services could not be attributed to immigrants.

Some Britons claim about that social disruptions are often caused by immigrants, but their assumption has no proof when it comes to the actual crime rates. The empirical findings of Bell et al. (2013) suggested that high increase in immigration after 2004 when many East European countries entered the EU did not have any impact on crime level as such.

There is also no impact of immigration on educational attainment as proved Geay et al. (2013). The immigrants' pupils work hard at school to overcome the disadvantage of having English as a second language.

The EU immigrants are younger than non-EU ones and the chances to use healthcare services are thus fewer. Moreover, Wadsworth (2013) explained that there is lower usage of hospitals and doctors by immigrants as compared to the UK-born. Giuntella et al. (2015) found little effect of immigration on the waiting time in the National Health System.

The perception that immigrants receive better treatment when they apply for social housing is declined by Battiston et al. (2013) who showed there are lower chances for immigrants to be in social housing.

Many Britons are concerned about the impact of immigration on housing prices. Housing supply is low even if disregarding the EU immigrants. The main reason is a weak planning system that does not provide suitable infrastructure decisions (Hilber, 2015). Moreover, Sa (2015) emphasized there is no empirical evidence that immigration had a positive impact on house pricing.

All these arguments basing on the empirical evidences show that immigration has positive effects on the UK economy. The following issue discussed in literature is related to immigration restrictions after Brexit. Our research shows that the number of immigrants in the UK from the CEE countries will automatically decrease in a natural way. In this context, the UK policies should be oriented towards the attraction of new immigrants. Restrictions reducing the CEE emigration will not be beneficial for the UK economy.

If the UK will remain the member of the European Economic Area or European Free Trade Area, it should apply no restrictions on the EU immigration, like Switzerland and Norway do today. Restriction could appear when the UK imposes a looser trading agreement with more trade costs. A visa scheme might be adopted like in the case of non-EU countries if the UK wants to reduce the number of EU immigrants after Brexit. Moreover, the UK will cut the skilled EU immigration that might not be replaced with non-EU skilled immigration. The skills' gap will be narrower because when the job market becomes saturated, labour immigrants will be rejected and thus they will leave the UK.

Office for Budget Responsibility (2015) forecasted an increase in unemployment of 60,000 people which will also affect immigrants. After Brexit, the minimum salary is expected to increase. Growing productivity brought by immigrants might increase national wages. However, in the lack of labour force with high productivity, wages might not increase. By cutting the EU immigrants to 80,000 people per year, Boubtane et al. (2015) showed that labour productivity might decrease by 0.16% and in 10 years after Brexit GDP per capita could be 1.6% lower as compared to the case when UK would have remained in the EU.

Migration Watch considered that the UK needs a stable population growth and this might be achieved by bringing migration back to its level of the 1980s and 1990s. The reconsidered policies should ensure increasing outflows and a more temporary migration. ITV (2016) considers that free movement end will not reduce dramatically the number of immigrants, but our empirical evidence will show that this impact will be very large.

The people who sustained Brexit considered that the EU migration will be controlled, but in case of trade agreements with the EU there will be still free movement of persons for the EU citizens like in Switzerland and Norway.

If the UK follows the Norway model, it has to accept free movement of persons and also higher proportion of the EU immigrants than it prefers (Staiger, 2016). If the Switzerland model will be taken into account, only partial access to

the Single Market is allowed, with uncontrolled immigration from Europe.

After Brexit, Boswell (2016) and Booth (2015) proposed policies ensuring better wages and better training and education of British labour force mostly in the construction sector. Drastic reduction of labour will have damaging effects on such sectors as food processing, manufacturing, cleaning, health, and tourism (Boswell, 2016). Migration reduction while stabilizing the population rate might bring along negative trade-offs and costs; mostly in low-salary sectors like the care work (The Migration Observatory, 2012).

Boronska-Hryniewiecka (2016) considers that the output will decrease by more than 1% by 2010 if the number of immigrants is reduced annually by 100,000 people. Government policies could focus more on skills rather than on workers' origin countries. This policy might promote the productivity growth, according to Woodford (2016). After Brexit, the immigrants' unemployment could rise and the salary could decrease. In case of a significant reduction in the number of immigrants as we stated, the benefits for even highly skilled sectors are rather doubtful (Boronska-Hryniewiecka, 2016; Boswell, 2016). Chu (2016) considers that the decrease in economic performance after Brexit might be alleviated if immigration reduction becomes insignificant. This will help GDP stabilize and the income per capita will grow. A liberal policy on migration will increase GDP till 2030, according to Booth (2015). For covering the necessity in low-skilled jobs, the UK might continue receiving the EU immigrants.

In the case of post-Brexit points system, the solutions might include a specific temporary migration scheme for the EU migrants or preferential treatment for these migrants (Ruparel, 2016). Another scenario might be the bilateral agreements with the selected EU states.

PwC (2016) proposed a CGE model for the UK economy to measure the effects of changes in migration policies after Brexit. The long-run impact on the UK economy is related to lower long-term potential growth as compared to the situation of remaining in the EU. Less flexibility of the labour market is expected after Brexit and a more cyclical economy with more frequent recessions.

Taken into account the anticipated effects of Brexit on immigration and further negative consequences on economic growth due to immigration, we consider necessary to assess Brexit impacts on immigration. Moreover, some policy measures are proposed to alleviate the negative consequences for the UK economy. To achieve this goal, a specific methodology is proposed here. It is described in the next section.

2. Methodology and Data

In this paper, two types of methods are applied to explain the number of immigrants in the UK when the origin countries are represented by some CEE states: mixed-effects Poisson regression models and counterfactual analysis based on difference-in-difference estimator. The mixed-effects Poisson models are employed when we want to analyze the counts number in a period (in our case, the number of immigrants in the UK in a certain period). Mixed-effects models include both fixed and random effects. These models allows for predictions of unobserved levels of random-effects factors. The Poisson models based on count data eliminate the necessity of normal distributed errors. Difference-in-difference estimator is an approach used to make comparison between two groups of countries before and after an event: treatment group (the CEE countries that are in the EU) and control group (the CEE countries that are not members of EU). The event considered in this study is the entrance in the EU of some CEE countries.

The mixed-effects Poison regression model describes the expected counts number in a certain period when specific events are registered (t_{ij}):

$$E(y_{ij}) = \mu_{ij} = t_{ij} exp\,[x'_{ij}\beta + z'_{ij}\vartheta_i]$$

where

i = 1,2,…,N level – 2 units which are for clusters.

j = 1,2,…,n_i level – 1 units which are for multiple observations.

y_{ij} – dependent variable counting the number of events.

t_{ij} – period when the events are registered (this is the offset variable).

$t_{ij} = t$, when all observations are related to the same period when the events are registered.

t_{ij} varies if the observations are related to varying periods; this variable is essential in modelling process.

x_{ij} – covariates at the first, the second level or cross-level interactions; this variable can include polynomials, dummy variables, interactions etc.

β – regression coefficients corresponding to covariates.

z_{ij} – random effect variable or variables that can be, mostly, an intercept for longitudinal data and for clustered data or time.

ϑ_i – random effects that follow a normal distribution of null average and a certain variance-covariance matrix Σ_ϑ.

The random effects describe how a certain cluster i influences the observations within the cluster and the way in which a cross-section starts and makes any progress in time.

$$log\ (\mu_{ij}) = log\ (t_{ij})\ [x'_{ij}\beta + z'_{ij}\vartheta_i]$$
$$log\ (\mu_{ij}) = log\ (t_{ij}) = x'_{ij}\beta + z'_{ij}\vartheta_i$$
$$log\ (\mu_{ij} / t_{ij}) = x'_{ij}\beta + z'_{ij}\vartheta_i$$

In case of the Poisson regression, the link function is represented by the log link function. The incidence (event rate ratio or) is equalled to exp β.

If an offset variable is not included in the model, the mixed-effects Poison regression is expressed as:

$$log\ (\mu_{ij}) = x'_{ij}\beta + z'_{ij}\vartheta_i$$

The model with offset variable is represented as:

$$log\ (\mu_{ij}) = log\ (t_{ij}) + x'_{ij}\beta + z'_{ij}\vartheta_i$$

The logarithm of the offset variable works as an explanatory variable having a slope equalled to 1. For Poisson models, we consider that the mean and the variance are equalled. The overdispersion is specific to cases when the variance is higher than the mean. This overdispersion, often met in a real data, produces estimated distortion. The chances of overdispersion can be considerably reduced by including random effects and the individual differences. For a Negative Binomial model, an overdispersion parameter is considered for relaxing this assumption. In other words, the Poisson model is a special case of the Negative Binomial Model when the overdispersion parameter is zero.

Gibbons et al. (2008) described three methods of estimating the parameters of a Poisson regression: parametric fully Bayes (FB) or semi-parametric estimation and empirical Bayes (EB) estimation. The differences between approaches consist in the different ways of specifying and estimating the random coefficients vector distribution. A normal distribution is considered for parametric FB and EB. The distribution's coefficients for EB method are inferred using point estimation in case of maximum marginal likelihood. The inference uses posterior distribution for FB method. In the case of semi-parametric FB estimation, a non-parametric prior is associated to random effects distribution. The EB approach has as a disadvantage the assumption of known random effect covariance matrix. FB approaches overcome this limit by including a prior distribution for the coefficients that are associated to random effects distribution. Parametric FB method employed by El-Sayyad (1973) makes inferences for mixed-effects Poisson regressions, an improper prior being considered. For large shape parameter the distribution for gamma variable logarithm is approximated by the normal distribution. In this case, the posterior density follows a multivariate normal repartition. A more flexible approach is the semi-parametric FB method, because Dirichelet process stands for the entire space of repartitions corresponding to random effects. All the normal distributions are included.

For making comparisons between groups after a certain treatment or intervention, the entrance into the EU in our case, the differences-in-Differences (DD) estimation might be used. It is used to estimate causal relationships. The differences in outcomes (number of the UK emigrants from some CEE countries) are compared before and after the entrance into the EU for countries that supported the intervention to the same difference for states that did not become EU member states. Beside its simplicity, the DD approach surpasses many issues regarding the endogeneity determined by comparisons between heterogenous cross-sections (Meyer, 1995). The method is recommended for random interventions which are conditioned by fixed effects and time. In case of intervention's endogeneity the results become invalid. In many cases, DD estimators and the associated standard errors use the Ordinary Least Squares on cross-section or panel data. In this particular research, there are countries in treatment (those that entered into the EU at a certain time) and control countries

for years before and after the European economic integration. If Y_{ist} is the outcome for country i from group s (country s) by moment t, a dummy variable I_{st} is included for marking the effect of the intervention (entrance in the EU) of that group at a certain moment.

$$Y_{ist} = A_s + B_t + cX_{ist} + \beta I_{st} + e_{ist}$$

A_s, B_t – fixed effects.
X_{ist} – individual control.
e_{ist} – error term.

The impact of the intervention is measured by the estimate of β. The confidence intervals are based on this parameter and the OLS standard error that are sometimes corrected with the shocks' correlation in each country and each year. The presented specification is the general form of the DD estimation with 2 periods and 2 groups. The results are valid if the changes in time in the dependent variable would have been the same in both groups in the lack of the intervention I. When errors' serial correlation occurs, the t-statistics and the associated significance levels are overestimated. There are various causes for serial correlation, but different procedures are employed for correcting it.

In this study, the dependent variable refers to the number of immigrants in the UK where the origin countries are represented by some of the Central and Eastern Europe (CEE) states: Poland, Bulgaria, Romania, Latvia, Lithuania, the Czech Republic, Cyprus, Slovakia, Hungary, Russia and Ukraine. Excepting the last three countries, all the other ones are member states of the European Union. These particular CEE countries were selected from the representative sample of 60 countries with the significant number of emigrants in the UK. For the other CEE countries the data are not available and the number of emigrants is not too high. The explanatory variables are represented by: real GDP per capita, real wage, distance between London and the capital of each state and unemployment rate in these origin countries for immigrants. A dummy variable called the EU member is introduced to mark the states that are in the EU from a certain year. The models are based on panel data, covering these 12 countries and the period from 2004 to 2014. Bulgaria and Romania entered into the EU in 2007, while the rest of the mentioned CEE states, excluding Russia and Ukraine, are the members since 2004. The number of immigrants was taken from the database of the Office for National Statistics in the UK. The distances were measured in kilometres and they refer to air distances, being provided by http://www.distancefromto.net/. The data for the rest of the variables are provided by the World Bank.

Tab. 1: The number of UK immigrants from some CEE countries (thousands persons)

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Poland	69	137	249	399	502	538	564	654	713	736	790
Lithuania	22	31	54	57	61	80	99	131	143	161	170
Czech Republic	12	20	24	25	26	30	37	41	43	42	47
Romania	10	15	14	19	37	57	78	98	108	135	170
Cyprus (European Union)	10	12	12	17	22	25	17	55	21	13	15
Bulgaria	9	12	14	15	29	35	46	50	56	51	65
Slovakia	9	24	47	50	45	54	50	61	66	55	68
Hungary	7		12	18	22	26	37	48	50	73	88
Latvia		13	18	21	29	27	49	61	71	89	101
Russia	21	20	19	21	27	19	28	43	37	35	31
Ukraine	9	10	13	17	15	14	13	12	13	17	19

Source: World Bank data

As Tab. 1 shows, the most UK immigrants from the CEE countries are from Poland with an obvious tendency of increase over 2004-2014. Ukraine and Russia which are not the EU states are among the countries with the fewest emigrants to the UK. The number of Poland emigrants to the UK increased, in average, by 1.27 times over 2004-2014 and by 11.44 times in 2014 compared to 2004. After Poland's entrance into the EU, Great Britain was among the few countries that gave Polish people the right to work in the UK immediately. Around 2 million Poles left their country since 2004 and came in Britain being determined by high unemployment rate and low salaries in their state of origin. The Polish citizens represent the largest group of European foreigners in the UK. Like in the case of the other CEE countries, Polish people brought benefits to the Britain economy, because of the cheap labour force. According to Migration Advisory Committee Report (July 2014) immigrants from the CEE countries represent 3% of all employed people in UK. They work mostly in low-skill employment (4% of labour force), less in high-skill employment (2% of labour force). The total number of immigrants from these CEE countries rose by 7 times in 2014 in relation to 2004.

The impact of immigration on main macroeconomic indicators in the UK, when the origin countries are in CEE, is assessed using Bayesian linear regression models over the period 2004-2014. These models are suitable for small sets of data, like in this case. The variables used in this analysis refer to: real GDP rate (%), (2005 = 100), inflation rate (%), unemployment rate (%), real interest rate (%), share of manufacturing, foreign direct investment (FDI) as a percent of GDP, the global competitiveness index, political stability, homicide rate, education spending as a percent of GDP, health spending as a percent of GDP, a number of the immigrants from the CEE countries.

The Global Competitiveness index is based on 12 pillars of competitiveness: basic requirements (Macroeconomic Stability, Infrastructure, Institutions, Health and Primary Education), efficiency enhancers (Goods Market Efficiency, Higher Education and Training, Labour Market Efficiency, Technological Readiness, Financial Market Sophistication, Market Size) and innovation and sophistication factors (Innovation, Business Sophistication). The global competitiveness index decreased from a year to another during 2007-2009 in the UK on the basis of the global economic crisis. A slow increase of the index was observed since 2010 with a lower decrease in 2013. Even if the Global Competitiveness Report 2015-2016 placed the UK on the 10th place in the world, the UK in the last few years faced problems like budget deficit, low quality of the education system and the difficulties countered by companies to take loans.

General government expenditure on education (capital, current, and transfers) as a percentage of GDP includes expenditure based on transfers from international sources to government. The source of data is represented by UNESCO. The education spending increased since 2008, but the education quality is still not at an acceptable level in the UK.

Total health expenditure indicator by the World Bank includes public and private health expenditure. It covers the family planning activities, provision of health services (curative and preventive), emergency aid for health and nutrition activities, but it does not include provision of sanitation and water. The health expenditure registered a very low average increase by 1.3% over that period.

Inflation based on consumer price index shows the annual percentage change of the cost of acquiring a basket of services and goods by the average consumer that could be fixed or changed at specified times, mostly yearly. The inflation rate registered a low average increase by 1.4%. In the post Brexit period, a high increase in prices is expected.

The real interest rate which is the lending interest rate adjusted for the GDP deflator measured in percent is provided by the International Monetary Fund. Since 2009, the interest rate in the UK registered the negative values. There are a few reasons for this: the decline in the global interest rates because of the world financial crisis, distortions in the government bonds market, the secular trends to ensure the long-run decline.

Manufacturing takes into consideration the industries belonging to ISIC divisions 15-37. Value added represents a sector net output after adding up the outputs and subtracting intermediate inputs. Deductions for depreciation of fabricated assets or depletion and degradation of natural resources are not made.

The value added is based on the International Standard Industrial Classification (ISIC), third revision 3. The share of manufacturing begun to decrease since 2005 and since 2007 in the context of the economic crisis reached a value under 11%.

Unemployment rate represents the share of the labour force without work, but seeking employment and available for the job. The data series for these variables and for political stability are provided by the World Bank. A high increase in the unemployment rate was registered in 2009, because of the world economic crisis, which translates into increase by 44.44% compared to 2008. Since 2009, the unemployment rate continued to increase, but in 2014 it reached a lower value of 6.3%.

Homicide rate represents the number homicides per 100,000 people. The data series is provided by the UN office on drugs and crime. This indicator registered a persistent decrease over 2004-2014 with an average decrease of almost 6.5%.

3. Results

The use of count data for dependent variable allows us to consider the Poisson models as the most suitable method of analysis. We work under the hypothesis that the quality of EU member is related to distance. There is a lower distance between London and the capitals of countries that are already EU member states.

Tab. 2: Mixed-effects Poisson model for explaining the number of UK immigrants (M1) from main CEE (2004-2014)

Variable	Coefficient	z-calculated	P>|z|
Wage	0.0102	82.13	0.000
GDP per capita	–0.00034	–78.15	0.000
Unemployment rate	–0.085	–22.23	0.000
EU member	10.0523	40.02	0.000
Constant	2.8835	11.67	0.000
Random effects parameter			
EU_member: independent	Estimate		
sd(ln(distance))	0.00302	0.0010	–
sd(constant)	$3.15*10^{-9}$	0.0503	–

Source: own

Prob. > chi-square=0.000

The M1 mixed-effects Poisson model indicated that the EU membership had a positive impact on the emigrants from the CEE countries that chose the UK as a destination country. The increases in the GDP per capita in the selected CEE countries had a very low and negative impact on the emigration process towards the UK.

Contrary to the expectations, unemployment rate had a negative effect on the number of the UK immigrants from the CEE countries while the wage had a positive effect. In case of Brexit, the number of immigrants from the CEE countries that are the EU members in the UK might decrease by 99.4%, according to M1 Poisson model. However, the results should be cautiously considered, because many of the labour resources were not actually considered in the computation the unemployment rate in the origin country, being part of the underground economy.

The M2 mixed-effects Poisson model indicated again that the EU membership had a positive impact on the emigrants from CEE countries that chose the UK as a destination country. The distance is not relevant in explaining the immigration process in the UK from the CEE countries. The result is contrary to the conclusion of Hatton and Wiliamson (2005) for migration between continents. The correlation between GDP per capita and migration is still negative, but not so strong,

Tab. 3: Mixed-effects Poisson model for explaining the number of the UK immigrants (M2) from main CEE (2004-2014)

Variable	Coefficient	z-calculated	P>|z|
Distance	0.0056	0.56	0.000
GDP per capita	–0.00003	–21.74	0.000
EU member	6.2386	28.55	0.000
Constant	–1.8926	–6.48	0.000
Random effects parameter			
EU_member: independent	Estimate		
sd(ln(distance))	0.0022	0.0009	–
sd(constant)	$2.56*10^{-8}$	0.0386	–

Source: own

Prob. > chi-square = 0.000

because underground economy still could offer jobs in the origin country. In the case of Brexit, the result is consistent with the previous model. The number of immigrants in the UK from the CEE countries that are the EU members might decrease by 99.6%, according to M2 Poisson model.

Another approach supposes to make a comparison between the CEE countries that are in the EU and Russia and Ukraine. The counterfactual analysis is suitable for measuring of the impact of an intervention (CEE countries entrance in the EU) and the difference-to-difference estimator will be provided.

The difference-in-difference estimator approach indicated that the entrance of some CEE countries into the EU had a positive impact on the number of immigrants in the UK that increased by 12 times compared to Russia and Ukraine. The coefficient for *year* is not significant at 5% level of significance which implies that even before the entrance into the EU, CEE countries sent many migrants in the UK.

There are no studies that assess the impact of the UK immigrants from the CEE countries on these variables. However, comparisons may be done with the previous studies that evaluate this impact for all UK immigrants. From our point of view, it is more relevant to assess the impact on the CEE countries immigration, because pro Brexit group complained more about the immigration of the citizens from these countries. According to Akaike information criterion, the data are stationary at 5% level of significance.

According to Bayesian model, the number of immigrants originating from the CEE countries had a positive, but low impact on the real economic growth over 2004-2014.

The number of immigrants in the UK from the CEE countries had a negative, but very low (almost 0) influence on the price stability in the UK. This means that the increase in the immigration from the CEE countries will slowly decrease the inflation.

There was a positive correlation between the inflation and the unemployment rate in the

Tab. 4: Linear regression model based on difference-to-difference estimator for explaining the number of the UK immigrants (M3) from the main CEE countries (2004-2014)

Variable	Coefficient	t-calculated	P>|z|
Year	1.2245	1.67	0.066
EU member	–25,336.67	–2.55	0.023
Year x EU member	12.0286	2.60	0.023
Constant	–2,398.554	–1.34	0.078

Source: own

Prob. > chi-square=0.000

Tab. 5: **Bayesian linear regression for explaining the real GDP rate in the UK over 2004-2014**

Variable	Posterior mean of coefficient	Posterior standard deviation of coefficient
Constant	–5.5202	9.7633
Inflation rate	0.4529	0.8220
FDI	0.0303	0.2976
Unemployment rate	–1.6433	1.0202
Real interest rate	–0.5633	0.79934
Immigrants	0.0034	0.0026
Share of manufacturing	1.2855	0.7867
Variance	3.0394	1.6112

Source: own

Tab. 6: **Bayesian linear regression for explaining the inflation rate in the UK over 2004-2014**

Variable	Posterior mean of coefficient	Posterior standard deviation of coefficient
Constant	0.2776	1.4734
Unemployment rate	0.3886	0.3287
Immigrants	–9.0654e-005	8.9884e-004
Variance	0.9988	0.4437

Source: own

Tab. 7: **Bayesian linear regression for explaining the unemployment rate in the UK over 2004-2014**

Variable	Posterior mean of coefficient	Posterior standard deviation of coefficient
Constant	0.5688	8.9557
Inflation rate	0.2639	0.3558
Real GDP rate	0.0769	0.3117
Political stability	–5.606	4.9654
Competitiveness	1.2477	1.7496
Immigrants	0.0013	0.0048
Variance	0.8391	0.5583

Source: own

UK over 2004-2014. Ormerod et al. (2013) showed the instability of the empirical Phillips curve on short-run with the endemic cause.

There is a very low and negative impact of the UK immigrants from the CEE countries on the homicide rate. Moreover, we can state that the homicide rate decreased after 2004.

The influence of immigrants on the education spending is positive, but very low. The immigrants' children usually work harder at school to overcome the disadvantage of having English as second language.

The impact of immigrants on the health spending is positive, but quite low. Usually, the

Tab. 8: Bayesian linear regression for explaining the homicide rate in the UK over 2004-2014

Variable	Posterior mean of coefficient	Posterior standard deviation of coefficient
Constant	1.8835	0.3034
Immigrants	–5.2288e-004	2.7056e-004
Variance	0.2034	0.07764

Source: own

Tab. 9: Bayesian linear regression for explaining the education spending in the UK over 2004-2014

Variable	Posterior mean of coefficient	Posterior standard deviation of coefficient
Constant	4.8971	0.4058
Immigrants	4.2239e-004	2.9988e-004
Variance	0.2365	0.09834

Source: own

Tab. 10: Bayesian linear regression for explaining the health spending in the UK over 2004-2014

Variable	Posterior mean of coefficient	Posterior standard deviation of coefficient
Constant	8.0475	0.4533
Immigrants	0.0016	3.5673e-004
Variance	0.5036	0.1584

Source: own

immigrants are young people that are able to work and have no major health problems.

All in all, we validated the assumptions for the CEE countries emigrants in the UK that were previously checked in literature for the all UK immigrants. These showed that arguments of pro Brexit group regarding immigration are not, actually, plausible. The UK immigrants coming from the CEE states slowly stimulated the economic growth in the UK and had a low positive influence on the unemployment. They contributed to the prices stability and lower crime rate and did not significantly affect the increase in health and education spending. So, there are reasons not to control too strictly the CEE countries immigrations after Brexit.

4. Discussion

As expected, the EU membership had a positive impact on the emigration process to the UK. Many EU states put restrictions to migrants from new EU members that entered in 2004 and 2007, excepting Cyprus and Malta, considering the concerns about negative impact of migration on their labour market. Only the UK, Ireland and Sweden decided to open their labour market immediately after 2004 (Kahanec et al., 2009) and many migrants came to work. The UK proposed only one restriction consisting in the adoption of a scheme that asks for the registration of the EU-28 workers with the Home Office.

The increases in the GDP per capita in the mentioned CEE countries had a very low and

negative impact on the migration towards the UK. As we expected, the countries with low GDP per capita send the migrants to developed countries like the UK. A lower GDP per capita is related to higher poverty and less available jobs. All the CEE countries had lower GDP per capita than UK and a big part of migrants came to this state. This migrants' behaviour is explained by economic reasons which is consistent with other results from literature. For example, Hatton and Wiliamson (2005) proved the correlation between changes in the GDP per capita in host country and the migration flow in the destination country that is richer. If the GDP per capita in the states from West Europe increases by 10 percent, the migration to the US decreases by 12.6 percent. In our empirical study, if the GDP per capita in the CEE countries doubles, the number of migrants to the UK decreases by only 0.04 percent. If these results are compared with the previous ones for EU membership, we can state that CEE migrants were attracted more by the jobs opportunities in the UK than by the poverty in the origin country.

The negative impact of unemployment in the origin country on the number of immigrants in the UK might be explained by different arguments. The fact that the CEE emigrants are not necessarily represented by people that do not have any job in the origin country might be an explanation for these results. They were looking for a higher salary in the UK, while the wage in the origin country was low. The recent economic literature is focused on the brain drain phenomenon in the Central and Eastern Europe (Ienciu & Ienciu, 2015). High skilled labour resources go to developed countries where the salaries are higher. The public policies in the origin countries are not in favour of qualified adults and the brain drain represents an important capital loss. On the other hand, the brain drain might have long run positive effects in terms of remittances sent to origin countries (Kim & Lee, 2016).

The lack of statistical significance of the distance between London and the capitals of CEE countries is in line with other empirical findings from literature. In this context, Pytlikova (2006) indicated that the distance has a low influence in selecting emigrants' destination country in the last decades.

The positive impact of EU membership on the migration behaviour in the CEE countries was also confirmed by the difference-in-difference approach. Actually, the political context after 1990s when CEE states made the transition from communist regime to a market economy and a democratic society changed the migration behaviour. Since 1990 these CEE countries sent many emigrants to developed states from the West of Europe. The 2004 EU enlargement intensified the labour mobility from seven of the CEE countries to the UK. The 2007 enlargement increased the number of immigrants from Romania and Bulgaria in the UK (Pemberton & Scullion, 2013).

The positive impact of immigration on the real economic growth is consistent with Petroff (2016) who showed that immigration stimulates the economic growth in the UK. Moreover, according to expectations, the FDI was an engine of the economic growth. The unemployment rate negatively affected the GDP growth, while the highest positive impact on economic growth was registered by the share of manufacturing. According to Cadman et al. (2016), manufacturing has a central position in British economy, even if its importance declined over the past decades. In 1948, its contribution was about 36 percent of GDP, while now it is about 10 per cent. The number of employees in the manufacturing sector declined faster than the output share, but the new technology made this sector more productive because of the higher value goods. Exports are the principal weak spot for manufacturing sector, being hit by the slowdown in the euro area. Domestic demand is rather strong in the UK, but the overall industry was smaller than it was before the downturn.

The negative impact of immigration on inflation was also obtained by Frattini (2014) who showed that immigration contributed to the inflation reduction for goods and services over 1995-2006. Sa (2015) showed that there is no empirical evidence that the immigration had a positive impact on house pricing. The same result was also found by Wadsworth (2012). His study also shows no impact on rents, while the immigrants are much more likely to be in private rental accommodation in comparison with UK-born individuals. According to Wadsworth (2012) 5.5% of immigrants represent 10.9% of workers in the construction industry. That is relatively fewer than in other sectors of British economy and it has no effect on cost of construction.

The positive relationship between the inflation and unemployment was also described by Batini et al. (2005) over 1987-1999. The number of immigrants had a positive, but very low impact on the unemployment rate in the UK. Contrary to expectations, the political stability was negatively correlated to unemployment. It was shown that the political stability did not solve the problem of unemployment in the UK. Dustmann et al. (2003) showed a positive impact of immigration on the unemployment rate over 1971-1991. Regarding the EU immigrants, the Centre for Economic Performance confirmed our results by showing that there is a little evidence that EU migrants had a positive effect on the UK unemployment. And more, according to the Department for Business Innovation & Skills (February 2015) migrants fill the gaps in the UK workforce. The jobs taken by the immigrants would be either empty or filled with under-qualified staff. We found no impact of immigration on homicide rate, the conclusion being in line with Bell et al. (2013) who showed that there was no impact of immigration on crime rate. We proved the low impact of immigration on education spending. Geay et al (2013) also showed the lack of significance of immigration on education spending in the UK.

Immigration in the UK also had a very low effect on health spending. A similar result was obtained by Wadsworth (2013) who found little evidence for the positive impact of EU immigration on the health spending. A possible explanation would be the fact that EU immigrants are younger and do not need special medical care.

Our findings confirmed the results of previous studies that were also based on empirical researches. The CEE immigrants played an important role in the UK economic growth with a very low impact on unemployment rate, health and education spending or crime rate, Moreover, the immigrants contributed to prices stability in the UK. After Brexit, if policies that restrict the access of immigrants from CEE countries on the UK labour market will be implemented, the economic growth and prices stability will be negatively affected.

Conclusions

As expected, in this paper we showed that the number of the UK immigrants from the CEE countries that are in the European Union significantly increased due to the EU membership. In case of Brexit, this number might decrease by 2 times, according to mixed-effects Poisson model. Compared to Russia, and Ukraine, the number of CEE emigrants increased, in average, by 13 times over the period 2004-2014 because of the EU membership. The empirical research is limited by the data availability. For the rest of the CEE countries the number of UK immigrants is not provided by the Office for National Statistics.

Our empirical evidences showed that CEE emigrants to the UK brought a positive impact on the UK economic growth, price stability and lower homicide rate. On the other hand, migration from the CEE states slightly increased the unemployment rate, health and education spending. The results are consistent with previous studies for all UK immigrants. A lower number of EU immigrants was also anticipated by Portes and Forte (2016).

Two main migration policies could be considered after Brexit. The UK imposed a cap of 20,700 Tier 2 visas per year. If this restriction will be applied to EU nationals, the number of EU workers will diminish. A second policy supposes that most of the non-EU nationals with Tier 2 visas might stay permanently in the UK only in case of a minimum earning of £35,000 per year. Most of the migrants earn less than this valueand could stay maximum 6 months in the UK. If this restriction is applied, most of the EU migrants have to leave the UK or stay less time (Vargas-Silva, 2016). So, our empirical findings are in line with the current migration policies that could apply after Brexit. If the government will chose to drop these restrictions for the EU migrants, the situation of migrants might change. Moreover, all the studies regarding Brexit underlined the uncertainty regarding the UK policies and the number of immigrants.

After Brexit, a policy of limiting the migration would lower the economic growth trend, even if GDP per capita might not be affected to the same magnitude. The UK policy options after Brexit might be various. The Norway or Switzerland models will encourage free movement of persons, goods, services and capital, but bilateral agreements with few countries will negatively affect the economic performance of the UK. If the UK will not implement policies for a lower reduction of immigration, the productivity and the labour market flexibility will cause problems to the UK economy that might face more frequent

recessions. Our recommendation consists in policies that more focus on the labour market flexibility after Brexit than policies that offer measures regarding the origin countries of the immigrants.

Our empirical findings could be a suitable support in designing new migration policies for the UK, if this country will not be interested in reducing the number of immigrants from CEE countries, because most of them are workers that contribute to the UK economic growth. In a future research, a comparison between our predictions regarding the reduction in the number of immigrants and the real decrease is necessary.

This study might be also continued by considering other determinants of immigration in the UK. The poverty in the CEE countries might explain the orientation towards the UK, but long data series for poverty rate are still not available for all the CEE countries. In the context of Brexit's impact on the UK immigration, the emigrants from the CEE countries should take into account other EU countries as destination. The number of the actual UK immigrants might be influenced by the policy measures after Brexit, but the chances to leave the UK are lower for stable immigrants.

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Abstract

THE EFFECTS OF EUROPEAN ECONOMIC INTEGRATION AND THE IMPACT OF BREXIT ON THE UK IMMIGRANTS FROM THE CEE COUNTRIES

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Considering the debates regarding lower increase in the economic growth after Brexit, the main objective of this paper is to measure the positive impact of economic integration of Central and Eastern European (CEE) countries on the UK economy and the effect of Brexit on the immigration from these countries to the UK. The European Union membership of some CEE countries increased, in average, the number of the UK immigrants by 12 times in the period 2004-2014 compared to the group of countries formed by Russia and Ukraine. The empirical findings show positive economic effects of immigration on the UK's economy, even if the pro Brexit group claimed that a control of immigration is necessary. CEE countries emigrants stimulated the UK economic growth, price stability and reduced the homicide rate. The effects of immigration on the unemployment rate, health and education spending were positive, but very low. According to mixed-effects Poisson models estimations, after Brexit the number of the UK immigrants from the CEE countries that are member of the EU might decrease by 2 times. This significant decline in immigration might impose austerity measures, because of the fall in the economic growth trend with negative impact on the UK economy. Therefore, we recommend policies that focus more on high-skilled labour force than on the reduction of the number of immigrants. The UK should propose measures to slow the expected immigration decline in order to alleviate economic issues like decline in economic growth, decrease in labour productivity, cutting backs on public services.

Key Words: *Immigrants, CEE countries, economic integration, Brexit, Poisson regression.*

JEL Classification: *C51, C53, J61.*

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MULTI-CRITERIA GROUP DECISION-MAKING USING AN EXTENDED EDAS METHOD WITH INTERVAL TYPE-2 FUZZY SETS

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Introduction

Multi-criteria decision-making (MCDM), which is a sub-discipline of operations research (OR), includes many methods and problems, which are related to many fields such as economy, engineering, military and management (Zavadskas et al., 2014; Lazauskas et al., 2015; Tošenovský, 2015). There are different classifications of MCDM problems and methods. We can classify them as multi-criteria evaluation problems and multi-criteria design problems (Chakraborty et al., 2015; Triantaphyllou, 2013). The first class is also known as the multi-attribute decision-making and consists of a finite number of alternatives known in the beginning of the decision-making process, and each alternative is represented by its performance in multiple criteria (Mardani et al., 2016; Faraji Sabokbar et al., 2016). The second class is also known as the multi-objective decision-making, and an alternative (solution) can be found by solving a mathematical model (Yu et al., 2016; Mahdiraji et al., 2016). This study focuses on the first class of MCDM problems.

Because of the characteristics of the decision-making problems, the uncertainty of information is usually inevitable in the MCDM problems. Fuzzy set theory is an efficient tool for modeling the human knowledge and evaluations which are used in the decision-making process (Stanujkic et al., 2015). To handle the uncertainty of multi-criteria decision-making problems, the weights of criteria and the performance of alternatives are usually characterized by type-1 fuzzy sets that proposed by Zadeh (1965). Many researchers have studied the MCDM methods and problems in the type-1 fuzzy environment (Ecer, 2015; Karabasevic et al., 2016; Aliakbari Nouri et al., 2015; Li et al., 2015; Razavi Hajiagha et al., 2015). Mardani et al. (2015) reviewed the MCDM methods and their applications in fuzzy environment.

Type-1 fuzzy sets are efficient in modeling the multi-criteria decision-making problems and have many applications for extending MCDM methods in an uncertain environment. However, we may confront with situations that more degrees of flexibility are needed to deal with the decision-making process. Type-2 fuzzy sets (T2FSs), which was introduced by Zadeh (1975), are more flexible than type-1 fuzzy sets in the modeling of uncertainty. Interval type-2 fuzzy sets (IT2FSs) are a special type of T2FSs. Some basic definitions of IT2FSs were proposed by Mendel et al. (2006). IT2FSs have increasingly been considered by researchers in applications and extensions of multi-criteria decision-making methods. Chen and Lee (2010) developed a new ranking method for interval type-2 fuzzy sets and used it in a new fuzzy MCDM method. Chen et al. (2012) proposed a new ranking method and a new multi-criteria decision-making method with interval type-2 fuzzy sets. Wang et al. (2012) introduced a multi-criteria group decision-making (MCGDM) method in type-2 fuzzy environment, which can be used with incomplete information about criteria weights. Hu et al. (2013) developed a new ranking method based on the possibility degree for IT2FSs and applied it in multi-criteria decision-making process. Keshavarz Ghorabaee et al. (2014) presented a new fuzzy ranking method and extended COPRAS (Complex Proportional Assessment) method in the context of IT2FSs to evaluate suppliers in a supply chain. Celik et al. (2014) proposed an interval type-2 fuzzy MCDM method to identify and evaluate critical success factors for humanitarian relief logistics management. Balin and Baraçli (2015) developed a fuzzy MCDM methodology based on the IT2FSs for evaluating renewable energy alternatives in Turkey. Chen (2015) proposed a new likelihood-based interval type-2 fuzzy

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MCDM method using the concepts of likelihood-based performance indices, likelihood-based comprehensive evaluation values, and signed distance-based evaluation values. Sang and Liu (2016) presented ranking method for IT2FSs and extended an IT2FSs-based TODIM method for green supplier selection in automobile manufacturers. Keshavarz Ghorabaee et al. (2016b) extended the WASPAS method with IT2FSs and applied it to evaluation of green suppliers. Celik et al. (2015) performed a comprehensive review of MCDM methods with interval type-2 fuzzy sets.

Keshavarz Ghorabaee et al. (2015b) introduced the evaluation based on distance from average solution (EDAS) method. This method was also extended for decision-making in fuzzy environment and was applied to supplier selection problem (Keshavarz Ghorabaee et al., 2016c). However, the previous versions of this method are not appropriate to deal with MCGDM problems with IT2FSs. In this study, we propose a new extended EDAS with interval type-2 fuzzy sets (EDAS-IT2FSs). A numerical example is employed to illustrate the process and show the effectiveness of the proposed method. A comparison and a sensitivity analysis are also performed to represent the validity and stability of the ranking result. The results of these analyses show that the proposed extended EDAS method is stable in different weights of criteria and well-consistent with some existing methods.

The rest of this paper is organized as follows. In Section 1, some basic concepts and arithmetic operation of T2FS are summarized. In Section 2, EDAS-IT2FSs is presented to deal with MCGDM with interval type-2 fuzzy sets. In Section 3, we use a numerical example to illustrate the procedure of using the EDAS-IT2FSs method. In Section 4, a sensitivity analysis is performed to show the validity and stability of the results of the proposed method. Finally, conclusions are discussed.

1. Concepts and Arithmetic Operations

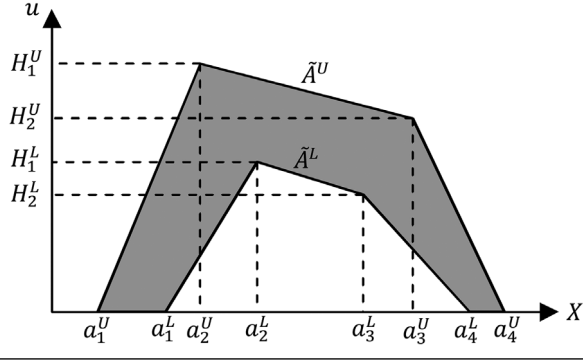
Type-2 fuzzy sets are one of the main extensions of the type-1 fuzzy sets. T2FSs are represented by primary and secondary membership values. These types of fuzzy sets could be very useful in many fields of sciences, especially decision-making theory. In this section, the basic concepts and arithmetic operations of this type of fuzzy sets are defined.

Definition 1. A T2FS $\tilde{\tilde{A}}$ is described by a type-2 membership function, expressed as follows (Mendel et al., 2006):

$$\tilde{\tilde{A}} = \int_{x\epsilon X} \int_{u\epsilon J_x} \mu_{\tilde{\tilde{A}}}(x,u) / (x,u) \quad (1)$$

where X denotes the domain of $\tilde{\tilde{A}}$, $\mu_{\tilde{\tilde{A}}}$ refers to the membership function (secondary membership function) of $\tilde{\tilde{A}}$, $J_x \subseteq [0,1]$ denotes the primary membership function and $\int \int$ denotes the union over all admissible x and u. For a T2FS $\tilde{\tilde{A}}$, if all $\mu_{\tilde{\tilde{A}}}(x,u) = 1$, then $\tilde{\tilde{A}}$ is called interval type-2 fuzzy set.

Fig. 1: An example of a trapezoidal IT2FS



Source: Chen and Lee (2010)

Definition 2. An IT2FS is called trapezoidal IT2FS if and only if the UMF (Upper Membership Function) and the LMF (Lower Membership Function) are both trapezoidal fuzzy sets. Let $\tilde{\tilde{A}}$ be a trapezoidal IT2FS. $\tilde{\tilde{A}}$ can be expressed as follows (Chen and Lee, 2010):

$$\tilde{\tilde{A}} = (\tilde{A}^T \mid T \in \{U,L\}) = (a_i^T; H_{1A}^T; H_{2A}^T \mid \mid T \in \{U,L\}, i = 1,2,3,4) \quad (2)$$

where $\tilde{A}^U$ and $\tilde{A}^L$ denote the UMF and LMF of $\tilde{\tilde{A}}$, respectively, and $H_j^U \in [0,1]$ and $H_j^L \in [0,1]$ $(j = 1,2)$ denote the membership values of the corresponding elements a_{j+1}^U and a_{j+1}^L, respectively. An example of a trapezoidal IT2FS is shown in Fig. 1.

Definition 3. Suppose that $\tilde{\tilde{A}}$ and $\tilde{\tilde{B}}$ are two trapezoidal IT2FSs and d is a crisp number where,

$$\tilde{\tilde{A}} = \left(\tilde{A}^T \mid T \in \{U,L\}\right) = (a_i^T; H_{1A}^T, H_{2A}^T \mid T \in \{U,L\}, i = 1,2,3,4)$$

$$\tilde{\tilde{B}} = \left(\tilde{B}^T \mid T \in \{U,L\}\right) = (b_i^T; H_{1B}^T, H_{2B}^T \mid T \in \{U,L\}, i = 1,2,3,4)$$

Then the arithmetic operations of IT2FSs are defined as follows (Keshavarz Ghorabaee et al., 2015a; Keshavarz Ghorabaee et al., 2016a):

- Addition:

$$\tilde{\tilde{A}} \oplus \tilde{\tilde{B}} = (a_i^T + b_i^T; \min(H_{1A}^T, H_{1B}^T), \min(H_{2A}^T, H_{2B}^T)) \mid T \in \{U,L\}, i = 1,2,3,4) \quad (3)$$

$$\tilde{\tilde{A}} + d = (a_i^T + d; H_{1A}^T, H_{2A}^T \mid T \in \{U,L\}, i = 1,2,3,4) \quad (4)$$

- Subtraction:

$$\tilde{\tilde{A}} \ominus \tilde{\tilde{B}} = (a_i^T - b_{5-i}^T; \min(H_{1A}^T, H_{1B}^T), \min(H_{2A}^T, H_{2B}^T) \mid T \in \{U,L\}, i = 1,2,3,4) \quad (5)$$

- Multiplication:

$$\tilde{\tilde{A}} \otimes \tilde{\tilde{B}} = (X_i^T; \min(H_{1A}^T, H_{1B}^T), \min(H_{2A}^T, H_{2B}^T) \mid T \in \{U,L\}, i = 1,2,3,4) \quad (6)$$

$$X_i^T = \begin{cases} min(a_i^T b_i^T, a_i^T b_{5-i}^T, a_{5-i}^T b_i^T, a_{5-i}^T b_{5-i}^T) \ if \ i = 1,2 \\ max(a_i^T b_i^T, a_i^T b_{5-i}^T, a_{5-i}^T b_i^T, a_{5-i}^T b_{5-i}^T) \ if \ i = 3,4 \end{cases} \quad (7)$$

$$d.\tilde{\tilde{A}} = \begin{cases} (d.a_i^T; H_{1A}^T, H_{2A}^T \mid T \in \{U,L\}, i = 1,2,3,4) & if \ d \geq 0 \\ (d.a_{5-i}^T; H_{1A}^T, H_{2A}^T \mid T \in \{U,L\}, i = 1,2,3,4) & if \ d \leq 0 \end{cases} \quad (8)$$

Definition 4. The crisp score of a trapezoidal IT2FS is defined as follows (Keshavarz Ghorabaee et al., 2015a):

$$\mathfrak{S}\left(\tilde{\tilde{A}}\right) = \frac{1}{2}\left(\sum_{T \in \{U,L\}} \frac{a_1^T + (1 + H_{1A}^T)a_2^T + (1 + H_{2A}^T)a_3^T + a_4^T}{4 + H_{1A}^T + H_{2A}^T}\right) \quad (9)$$

Definition 5. A function is defined in the following to find the maximum between a trapezoidal interval type-2 fuzzy set fuzzy number and zero.

$$\mathcal{Z}\left(\tilde{\tilde{A}}\right) = \begin{cases} \tilde{\tilde{A}} & if \quad \mathfrak{S}\left(\tilde{\tilde{A}}\right) > 0 \\ \tilde{\tilde{0}} & if \quad \mathfrak{S}\left(\tilde{\tilde{A}}\right) \leq 0 \end{cases} \quad (10)$$

where $\tilde{\tilde{0}}$ = ((0,0,0,0;1,1),(0,0,0,0;1,1)).

2. EDAS-IT2FSs Method

The EDAS method was developed by Keshavarz Ghorabaee et al. (2015b). By comparing this method with some existing MCDM method, it was demonstrated that the EDAS method is efficient to handle decision-making problems with multiple criteria. In this section, an extended version of the EDAS method is proposed to deal with MCGDM problems in the interval type-2 fuzzy environment. The concepts and arithmetic operations of the IT2FSs, which has been presented in Section 1, are utilized for extending the EDAS method. The current study is focused on a situation that all evaluations of decision-makers are subjective. However, the proposed method can be used in a situation with both subjective and objective evaluations. Suppose that we have a set of n alternatives $(\mathcal{A} = \{\mathcal{A}_1, \mathcal{A}_2, \dots, \mathcal{A}_n\})$, a set of m criteria $(\mathcal{C} = \{\mathcal{C}_1, \mathcal{C}_2, \dots, \mathcal{C}_m\})$ and k decision-makers $(\mathcal{D} = \{\mathcal{D}_1, \mathcal{D}_2, \dots, \mathcal{D}_k\})$. The steps of EDAS-IT2FSs method are presented as follows:

Step 1. Construct the average decision matrix (X), shown as follows:

$$X = \left[\tilde{\tilde{x}}_{ij}\right]_{n \times m} \quad (11)$$

where,

$$\tilde{\tilde{x}}_{ij} = \frac{1}{k} \bigoplus_{p=1}^{k} \tilde{\tilde{x}}_{ij}^p \quad (12)$$

and $\tilde{\tilde{x}}_{ij}^p$ denotes the performance value of alternative $\mathcal{A}_i$ $(1 \leq i \leq n)$ with respect to criterion $\mathcal{C}_j$ $(1 \leq j \leq m)$ assigned by the pth decision-maker $(1 \leq p \leq k)$.

Step 2. Construct the matrix of criteria weights, shown as follows:

$$W = \left[\tilde{\tilde{w}}_j\right]_{1\times m} \tag{13}$$

where,

$$\tilde{\tilde{w}}_j = \frac{1}{k}\bigoplus_{p=1}^{k} \tilde{\tilde{w}}_j^p \tag{14}$$

and $\tilde{\tilde{w}}_j^p$ denotes the weight of criterion $\mathcal{C}_j$ $(1 \le j \le m)$ assigned by the pth decision-maker $(1 \le p \le k)$.

Step 3. Determine the matrix of average solutions, shown as follows:

$$AV = \left[\tilde{\tilde{\mathcal{M}}}_j\right]_{1\times m} \tag{15}$$

where,

$$\tilde{\tilde{\mathcal{M}}}_j = \frac{1}{n}\bigoplus_{i=1}^{n} \tilde{\tilde{x}}_{ij} \tag{16}$$

The elements of this matrix ($\tilde{\tilde{\mathcal{M}}}_j$) represents the average solutions with respect to each criterion. Therefore, the dimension of the matrix is equal to the dimension of criteria weights matrix.

Step 4. Suppose that B is the set of beneficial criteria and N is the set of non-beneficial criteria. In this step the matrices of positive distance from average (PDA) and negative distance from average (NDA) are calculated according to the type of criteria (beneficial and non-beneficial), shown as follows:

$$PDA = \left[\tilde{\tilde{p}}_{ij}\right]_{n\times m} \tag{17}$$

$$NDA = \left[\tilde{\tilde{n}}_{ij}\right]_{n\times m} \tag{18}$$

$$\tilde{\tilde{p}}_{ij} = \begin{cases} \dfrac{\mathcal{Z}\left(\tilde{\tilde{x}}_{ij} \ominus \tilde{\tilde{\mathcal{M}}}_j\right)}{\mathfrak{S}(\tilde{\tilde{\mathcal{M}}}_j)} & if \quad j \in B \\ \dfrac{\mathcal{Z}\left(\tilde{\tilde{\mathcal{M}}}_j \ominus \tilde{\tilde{x}}_{ij}\right)}{\mathfrak{S}(\tilde{\tilde{\mathcal{M}}}_j)} & if \quad j \in N \end{cases} \tag{19}$$

$$\tilde{\tilde{n}}_{ij} = \begin{cases} \dfrac{\mathcal{Z}\left(\tilde{\tilde{\mathcal{M}}}_j \ominus \tilde{\tilde{x}}_{ij}\right)}{\mathfrak{S}(\tilde{\tilde{\mathcal{M}}}_j)} & if \quad j \in B \\ \dfrac{\mathcal{Z}\left(\tilde{\tilde{x}}_{ij} \ominus \tilde{\tilde{\mathcal{M}}}_j\right)}{\mathfrak{S}(\tilde{\tilde{\mathcal{M}}}_j)} & if \quad j \in N \end{cases} \tag{20}$$

where $\tilde{\tilde{p}}_{ij}$ and $\tilde{\tilde{n}}_{ij}$ denote the positive and negative distance of performance value of ith alternative from the average solution in terms of jth criterion, respectively.

Step 5. Calculate the weighted sum of positive and negative distances for all alternatives, shown as follows:

$$\tilde{\tilde{sp}}_i = \bigoplus_{j=1}^{m} \left(\tilde{\tilde{w}}_j \otimes \tilde{\tilde{p}}_{ij}\right) \tag{21}$$

$$\tilde{\tilde{sn}}_i = \bigoplus_{j=1}^{m} \left(\tilde{\tilde{w}}_j \otimes \tilde{\tilde{n}}_{ij}\right) \tag{22}$$

Step 6. The normalized values of $\tilde{\tilde{sp}}_i$ and $\tilde{\tilde{sn}}_i$ for all alternatives are calculated as follows:

$$\tilde{\tilde{np}}_i = \frac{\tilde{\tilde{sp}}_i}{\max_i\left(\mathfrak{S}(\tilde{\tilde{sp}}_i)\right)} \tag{23}$$

$$\tilde{\tilde{nn}}_i = 1 - \frac{\tilde{\tilde{sn}}_i}{\max_i\left(\mathfrak{S}(\tilde{\tilde{sn}}_i)\right)} \tag{24}$$

Step 7. Calculate the appraisal score ($\tilde{\tilde{\mathcal{h}}}_i$) for all alternatives, shown as follows:

$$\tilde{\tilde{\mathcal{h}}}_i = \frac{1}{2}\left(\tilde{\tilde{np}}_i \oplus \tilde{\tilde{nn}}_i\right) \tag{25}$$

Step 8. Rank the alternatives according to the decreasing ranking values of appraisal scores ($\mathcal{RV}$). In other words, the alternative with the highest appraisal score is the best choice among the candidate alternatives. It should be noted that the method proposed by Keshavarz Ghorabaee et al. (2014) is used in this step for computing the ranking value of trapezoidal IT2FSs.

3. Numerical Example

In this section, the application of the EDAS-IT2FSs method in an MCGDM problem is represented. For this aim, we use an example of multi-criteria evaluation of subcontractors in the construction industry. Suppose that a company, which is the main contractor involved in a construction project, intends to subcontract some parts of the project to a qualified subcontractor. The board of directors of the company performed an initial screening, and eight alternatives ($\mathcal{A}_1$ to $\mathcal{A}_8$) remained for further appraisal. A group of three decision-makers ($\mathcal{D}_1$, $\mathcal{D}_2$ and $\mathcal{D}_3$) from the experts of the

Tab. 1: Linguistic terms and their corresponding interval type-2 fuzzy sets

Linguistic terms	Interval type-2 fuzzy sets
Very low (VL)	((0,0,0,0.1;1,1),(0,0,0,0.05;0.9,0.9))
Low (L)	((0,0.1,0.15,0.3;1,1),(0.05,0.1,0.15,0.2;0.9,0.9))
Medium low(ML)	((0.1,0.3,0.35,0.5;1,1),(0.2,0.3,0.35,0.4;0.9,0.9))
Medium (M)	((0.3,0.5,0.55,0.7;1,1),(0.4,0.5,0.55,0.6;0.9,0.9))
Medium high (MH)	((0.5,0.7,0.75,0.9;1,1),(0.6,0.7,0.75,0.8;0.9,0.9))
High (H)	((0.7,0.85,0.9,1;1,1),(0.8,0.85,0.9,0.95;0.9,0.9))
Very high (VH)	((0.9,1,1,1;1,1),(0.95,1,1,1;0.9,0.9))

Source: Keshavarz Ghorabaee et al. (2014)

Tab. 2: Performance values of alternatives

DMs	Alternatives	Criteria						
		$\mathcal{C}_1$	$\mathcal{C}_2$	$\mathcal{C}_3$	$\mathcal{C}_4$	$\mathcal{C}_5$	$\mathcal{C}_6$	$\mathcal{C}_7$
$\mathcal{D}_1$	$\mathcal{A}_1$	M	ML	M	M	MH	ML	VH
	$\mathcal{A}_2$	L	MH	MH	VH	VH	H	M
	$\mathcal{A}_3$	VL	VH	MH	MH	H	H	M
	$\mathcal{A}_4$	H	VH	VH	L	H	MH	VL
	$\mathcal{A}_5$	VH	M	VH	L	MH	M	ML
	$\mathcal{A}_6$	VH	H	MH	L	VH	H	VL
	$\mathcal{A}_7$	M	MH	VH	H	ML	MH	MH
	$\mathcal{A}_8$	MH	L	ML	MH	VL	M	VH
$\mathcal{D}_2$	$\mathcal{A}_1$	M	M	ML	M	MH	L	H
	$\mathcal{A}_2$	ML	H	MH	H	H	MH	ML
	$\mathcal{A}_3$	L	H	M	MH	MH	MH	M
	$\mathcal{A}_4$	H	VH	H	L	H	M	L
	$\mathcal{A}_5$	H	MH	VH	VL	M	M	L
	$\mathcal{A}_6$	VH	H	H	ML	VH	VH	VL
	$\mathcal{A}_7$	MH	MH	H	MH	M	M	M
	$\mathcal{A}_8$	H	ML	L	MH	ML	ML	MH
$\mathcal{D}_3$	$\mathcal{A}_1$	MH	ML	ML	ML	H	M	H
	$\mathcal{A}_2$	ML	MH	M	MH	VH	H	MH
	$\mathcal{A}_3$	ML	MH	M	M	MH	MH	M
	$\mathcal{A}_4$	MH	H	H	L	H	H	ML
	$\mathcal{A}_5$	H	MH	H	VL	H	MH	M
	$\mathcal{A}_6$	VH	H	H	VL	VH	VH	VL
	$\mathcal{A}_7$	M	M	MH	M	M	H	MH
	$\mathcal{A}_8$	M	VL	L	M	L	MH	VH

Source: own

company was formed for making a decision on these alternatives. These experts chose seven criteria ($\mathcal{C}_1$ to $\mathcal{C}_7$) to appraise alternatives. The list of the selected criteria is represented as follows (Vahdani et al., 2013; Plebankiewicz, 2012; Abbasianjahromi et al., 2013):

- Management capability ($\mathcal{C}_1$);
- Technical capability ($\mathcal{C}_2$);
- Experience level ($\mathcal{C}_3$);
- Tender price ($\mathcal{C}_4$);
- Safety and quality ($\mathcal{C}_5$);
- Financial strength and stability ($\mathcal{C}_6$);
- Completion time ($\mathcal{C}_7$).

The tender price ($\mathcal{C}_4$) and completion time ($\mathcal{C}_7$) are non-beneficial criteria, and the other criteria are beneficial. To assess the importance of the criteria and appraise the performance values of alternatives with respect to each criterion, the decision-makers use the linguistic terms shown in Tab. 1 (Keshavarz Ghorabaee et al., 2014). The corresponding interval type-2 fuzzy sets of these linguistic terms are also defined in Tab. 1. The performance values of the alternatives on each criterion given by the decision-makers are presented in Tab. 2. The importance weights of the criteria determined by these decision-makers are represented in Tab. 3. The process of using the extended EDAS method with IT2FSs is illustrated as follows:

Step 1. The average decision matrix X can be calculated based on the Tab. 1, Tab. 2 and Equations (11) and (12). Tab. 4 shows the IT2FSs related to the elements of X matrix

Step 2. The matrix of the criteria weights is calculated based on Tab. 3 and Equations (13) and (14).

$$W = [\tilde{\tilde{w}}_1 \ \tilde{\tilde{w}}_2 \ \tilde{\tilde{w}}_3 \ \tilde{\tilde{w}}_4 \ \tilde{\tilde{w}}_5 \ \tilde{\tilde{w}}_6 \ \tilde{\tilde{w}}_7]$$

The results are shown in Tab. 5.

Tab. 3: Weights of the criteria evaluated by the decision makers

Criteria	Decision-makers		
	$\mathcal{D}_1$	$\mathcal{D}_2$	$\mathcal{D}_3$
$\mathcal{C}_1$	H	VH	VH
$\mathcal{C}_2$	MH	H	MH
$\mathcal{C}_3$	M	M	ML
$\mathcal{C}_4$	VH	VH	H
$\mathcal{C}_5$	H	H	MH
$\mathcal{C}_6$	M	MH	M
$\mathcal{C}_7$	MH	MH	M

Source: own

Tab. 4: The elements of the average decision-matrix (X) – Part 1

	$\tilde{x}^U_{ij}$						$\tilde{x}^L_{ij}$					
	x^U_1	x^U_2	x^U_3	x^U_4	H^U_1	H^U_2	x^L_1	x^L_2	x^L_3	x^L_4	H^L_1	H^L_2
$\tilde{\tilde{x}}_{11}$	0.37	0.57	0.62	0.77	1	1	0.47	0.57	0.62	0.67	0.9	0.9
$\tilde{\tilde{x}}_{21}$	0.07	0.23	0.28	0.43	1	1	0.15	0.23	0.28	0.33	0.9	0.9
$\tilde{\tilde{x}}_{31}$	0.03	0.13	0.17	0.30	1	1	0.08	0.13	0.17	0.22	0.9	0.9
$\tilde{\tilde{x}}_{41}$	0.63	0.80	0.85	0.97	1	1	0.73	0.80	0.85	0.90	0.9	0.9
$\tilde{\tilde{x}}_{51}$	0.77	0.90	0.93	1	1	1	0.85	0.90	0.93	0.97	0.9	0.9
$\tilde{\tilde{x}}_{61}$	0.90	1	1	1	1	1	0.95	1	1	1	0.9	0.9
$\tilde{\tilde{x}}_{71}$	0.37	0.57	0.62	0.77	1	1	0.47	0.57	0.62	0.67	0.9	0.9

Tab. 4: **The elements of the average decision-matrix (X) – Part 2**

	$\tilde{x}^U_{ij}$						$\tilde{x}^L_{ij}$					
	x^U_1	x^U_2	x^U_3	x^U_4	H^U_1	H^U_2	x^L_1	x^L_2	x^L_3	x^L_4	H^L_1	H^L_2
$\tilde{\tilde{x}}_{81}$	0.50	0.68	0.73	0.87	1	1	0.60	0.68	0.73	0.78	0.9	0.9
$\tilde{\tilde{x}}_{12}$	0.17	0.37	0.42	0.57	1	1	0.27	0.37	0.42	0.47	0.9	0.9
$\tilde{\tilde{x}}_{22}$	0.57	0.75	0.80	0.93	1	1	0.67	0.75	0.80	0.85	0.9	0.9
$\tilde{\tilde{x}}_{32}$	0.70	0.85	0.88	0.97	1	1	0.78	0.85	0.88	0.92	0.9	0.9
$\tilde{\tilde{x}}_{42}$	0.83	0.95	0.97	1	1	1	0.90	0.95	0.97	0.98	0.9	0.9
$\tilde{\tilde{x}}_{52}$	0.43	0.63	0.68	0.83	1	1	0.53	0.63	0.68	0.73	0.9	0.9
$\tilde{\tilde{x}}_{62}$	0.70	0.85	0.90	1	1	1	0.80	0.85	0.90	0.95	0.9	0.9
$\tilde{\tilde{x}}_{72}$	0.43	0.63	0.68	0.83	1	1	0.53	0.63	0.68	0.73	0.9	0.9
$\tilde{\tilde{x}}_{82}$	0.03	0.13	0.17	0.30	1	1	0.08	0.13	0.17	0.22	0.9	0.9
$\tilde{\tilde{x}}_{13}$	0.17	0.37	0.42	0.57	1	1	0.27	0.37	0.42	0.47	0.9	0.9
$\tilde{\tilde{x}}_{23}$	0.43	0.63	0.68	0.83	1	1	0.53	0.63	0.68	0.73	0.9	0.9
$\tilde{\tilde{x}}_{33}$	0.37	0.57	0.62	0.77	1	1	0.47	0.57	0.62	0.67	0.9	0.9
$\tilde{\tilde{x}}_{43}$	0.77	0.90	0.93	1	1	1	0.85	0.90	0.93	0.97	0.9	0.9
$\tilde{\tilde{x}}_{53}$	0.83	0.95	0.97	1	1	1	0.90	0.95	0.97	0.98	0.9	0.9
$\tilde{\tilde{x}}_{63}$	0.63	0.80	0.85	0.97	1	1	0.73	0.80	0.85	0.90	0.9	0.9
$\tilde{\tilde{x}}_{73}$	0.70	0.85	0.88	0.97	1	1	0.78	0.85	0.88	0.92	0.9	0.9
$\tilde{\tilde{x}}_{83}$	0.03	0.17	0.22	0.37	1	1	0.10	0.17	0.22	0.27	0.9	0.9
$\tilde{\tilde{x}}_{14}$	0.23	0.43	0.48	0.63	1	1	0.33	0.43	0.48	0.53	0.9	0.9
$\tilde{\tilde{x}}_{24}$	0.70	0.85	0.88	0.97	1	1	0.78	0.85	0.88	0.92	0.9	0.9
$\tilde{\tilde{x}}_{34}$	0.43	0.63	0.68	0.83	1	1	0.53	0.63	0.68	0.73	0.9	0.9
$\tilde{\tilde{x}}_{44}$	0.00	0.10	0.15	0.30	1	1	0.05	0.10	0.15	0.20	0.9	0.9
$\tilde{\tilde{x}}_{54}$	0.00	0.03	0.05	0.17	1	1	0.02	0.03	0.05	0.10	0.9	0.9
$\tilde{\tilde{x}}_{64}$	0.03	0.13	0.17	0.30	1	1	0.08	0.13	0.17	0.22	0.9	0.9
$\tilde{\tilde{x}}_{74}$	0.50	0.68	0.73	0.87	1	1	0.60	0.68	0.73	0.78	0.9	0.9
$\tilde{\tilde{x}}_{84}$	0.43	0.63	0.68	0.83	1	1	0.53	0.63	0.68	0.73	0.9	0.9
$\tilde{\tilde{x}}_{15}$	0.57	0.75	0.80	0.93	1	1	0.67	0.75	0.80	0.85	0.9	0.9
$\tilde{\tilde{x}}_{25}$	0.83	0.95	0.97	1	1	1	0.90	0.95	0.97	0.98	0.9	0.9
$\tilde{\tilde{x}}_{35}$	0.57	0.75	0.80	0.93	1	1	0.67	0.75	0.80	0.85	0.9	0.9
$\tilde{\tilde{x}}_{45}$	0.70	0.85	0.90	1	1	1	0.80	0.85	0.90	0.95	0.9	0.9
$\tilde{\tilde{x}}_{55}$	0.50	0.68	0.73	0.87	1	1	0.60	0.68	0.73	0.78	0.9	0.9
$\tilde{\tilde{x}}_{65}$	0.90	1	1	1	1	1	0.95	1	1	1	0.9	0.9
$\tilde{\tilde{x}}_{75}$	0.23	0.43	0.48	0.63	1	1	0.33	0.43	0.48	0.53	0.9	0.9
$\tilde{\tilde{x}}_{85}$	0.03	0.13	0.17	0.30	1	1	0.08	0.13	0.17	0.22	0.9	0.9
$\tilde{\tilde{x}}_{16}$	0.13	0.30	0.35	0.50	1	1	0.22	0.30	0.35	0.40	0.9	0.9
$\tilde{\tilde{x}}_{26}$	0.63	0.80	0.85	0.97	1	1	0.73	0.80	0.85	0.90	0.9	0.9

Tab. 4: The elements of the average decision-matrix (X) – Part 3

	$\tilde{x}^U_{ij}$						$\tilde{x}^L_{ij}$					
	x^U_1	x^U_2	x^U_3	x^U_4	H^U_1	H^U_2	x^L_1	x^L_2	x^L_3	x^L_4	H^L_1	H^L_2
$\tilde{\tilde{x}}_{36}$	0.57	0.75	0.80	0.93	1	1	0.67	0.75	0.80	0.85	0.9	0.9
$\tilde{\tilde{x}}_{46}$	0.50	0.68	0.73	0.87	1	1	0.60	0.68	0.73	0.78	0.9	0.9
$\tilde{\tilde{x}}_{56}$	0.37	0.57	0.62	0.77	1	1	0.47	0.57	0.62	0.67	0.9	0.9
$\tilde{\tilde{x}}_{66}$	0.83	0.95	0.97	1	1	1	0.90	0.95	0.97	0.98	0.9	0.9
$\tilde{\tilde{x}}_{76}$	0.50	0.68	0.73	0.87	1	1	0.60	0.68	0.73	0.78	0.9	0.9
$\tilde{\tilde{x}}_{86}$	0.30	0.50	0.55	0.70	1	1	0.40	0.50	0.55	0.60	0.9	0.9
$\tilde{\tilde{x}}_{17}$	0.77	0.90	0.93	1	1	1	0.85	0.90	0.93	0.97	0.9	0.9
$\tilde{\tilde{x}}_{27}$	0.30	0.50	0.55	0.70	1	1	0.40	0.50	0.55	0.60	0.9	0.9
$\tilde{\tilde{x}}_{37}$	0.30	0.50	0.55	0.70	1	1	0.40	0.50	0.55	0.60	0.9	0.9
$\tilde{\tilde{x}}_{47}$	0.03	0.13	0.17	0.30	1	1	0.08	0.13	0.17	0.22	0.9	0.9
$\tilde{\tilde{x}}_{57}$	0.13	0.30	0.35	0.50	1	1	0.22	0.30	0.35	0.40	0.9	0.9
$\tilde{\tilde{x}}_{67}$	0.00	0.00	0.00	0.10	1	1	0.00	0.00	0.00	0.05	0.9	0.9
$\tilde{\tilde{x}}_{77}$	0.43	0.63	0.68	0.83	1	1	0.53	0.63	0.68	0.73	0.9	0.9
$\tilde{\tilde{x}}_{87}$	0.77	0.90	0.92	0.97	1	1	0.83	0.90	0.92	0.93	0.9	0.9

Source: own

Tab. 5: The elements of the matrix of criteria weights

	$\tilde{w}^U_j$						$\tilde{w}^L_j$					
	w^U_1	w^U_2	w^U_3	w^U_4	H^U_1	H^U_2	w^L_1	w^L_2	w^L_3	w^L_4	H^L_1	H^L_2
$\tilde{\tilde{w}}_1$	0.83	0.95	0.97	1	1	1	0.90	0.95	0.97	0.98	0.9	0.9
$\tilde{\tilde{w}}_2$	0.57	0.75	0.80	0.93	1	1	0.67	0.75	0.80	0.85	0.9	0.9
$\tilde{\tilde{w}}_3$	0.23	0.43	0.48	0.63	1	1	0.33	0.43	0.48	0.53	0.9	0.9
$\tilde{\tilde{w}}_4$	0.83	0.95	0.97	1	1	1	0.90	0.95	0.97	0.98	0.9	0.9
$\tilde{\tilde{w}}_5$	0.63	0.80	0.85	0.97	1	1	0.73	0.80	0.85	0.90	0.9	0.9
$\tilde{\tilde{w}}_6$	0.37	0.57	0.62	0.77	1	1	0.47	0.57	0.62	0.67	0.9	0.9
$\tilde{\tilde{w}}_7$	0.43	0.63	0.68	0.83	1	1	0.53	0.63	0.68	0.73	0.9	0.9

Source: own

Step 3. The matrix of average solution can be calculated by using the results of Step 1 and Equations (15) and (16).

$$AV = [\tilde{\tilde{M}}_1 \ \tilde{\tilde{M}}_2 \ \tilde{\tilde{M}}_3 \ \tilde{\tilde{M}}_4 \ \tilde{\tilde{M}}_5 \ \tilde{\tilde{M}}_6 \ \tilde{\tilde{M}}_7]$$

The elements of the matrix of average solutions are represented in Tab. 6.

Step 4. Based on Tab. 4 and Tab. 6 and Equations (17) to (20), the positive and negative distances (the PDA and NDA matrices) are calculated.

The positive distances are shown in Tab. 7 and the negative distances are represented in Tab. 8.

Tab. 6: The elements of the matrix of average solutions

	$\widetilde{\mathcal{M}}_j^U$						$\widetilde{\mathcal{M}}_j^L$					
	$\mathcal{M}_1^U$	$\mathcal{M}_2^U$	$\mathcal{M}_3^U$	$\mathcal{M}_4^U$	H_1^U	H_2^U	$\mathcal{M}_1^L$	$\mathcal{M}_2^L$	$\mathcal{M}_3^L$	$\mathcal{M}_4^L$	H_1^L	H_2^L
$\widetilde{\widetilde{\mathcal{M}}}_1$	0.45	0.61	0.65	0.76	1	1	0.54	0.61	0.65	0.69	0.9	0.9
$\widetilde{\widetilde{\mathcal{M}}}_2$	0.48	0.65	0.69	0.80	1	1	0.57	0.65	0.69	0.73	0.9	0.9
$\widetilde{\widetilde{\mathcal{M}}}_3$	0.49	0.65	0.70	0.81	1	1	0.58	0.65	0.70	0.74	0.9	0.9
$\widetilde{\widetilde{\mathcal{M}}}_4$	0.29	0.44	0.48	0.61	1	1	0.37	0.44	0.48	0.53	0.9	0.9
$\widetilde{\widetilde{\mathcal{M}}}_5$	0.54	0.69	0.73	0.83	1	1	0.63	0.69	0.73	0.77	0.9	0.9
$\widetilde{\widetilde{\mathcal{M}}}_6$	0.48	0.65	0.70	0.83	1	1	0.57	0.65	0.70	0.75	0.9	0.9
$\widetilde{\widetilde{\mathcal{M}}}_7$	0.34	0.48	0.52	0.64	1	1	0.41	0.48	0.52	0.56	0.9	0.9

Source: own

Tab. 7: The positive distances from the average solution (PDA matrix) – Part 1

	$\tilde{\mathcal{P}}_{ij}^U$						$\tilde{\mathcal{P}}_{ij}^L$					
	$\mathcal{P}_1^U$	$\mathcal{P}_2^U$	$\mathcal{P}_3^U$	$\mathcal{P}_4^U$	H_1^U	H_2^U	$\mathcal{P}_1^L$	$\mathcal{P}_2^L$	$\mathcal{P}_3^L$	$\mathcal{P}_4^L$	H_1^L	H_2^L
$\tilde{\tilde{\mathcal{P}}}_{11}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{\mathcal{P}}}_{21}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{\mathcal{P}}}_{31}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{\mathcal{P}}}_{41}$	-0.21	0.24	0.38	0.82	1	1	0.07	0.24	0.38	0.58	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{51}$	0.01	0.40	0.52	0.87	1	1	0.25	0.40	0.52	0.69	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{61}$	0.22	0.56	0.62	0.87	1	1	0.41	0.56	0.62	0.74	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{71}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{\mathcal{P}}}_{81}$	-0.42	0.05	0.20	0.66	1	1	-0.15	0.05	0.20	0.39	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{12}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{\mathcal{P}}}_{22}$	-0.36	0.09	0.23	0.68	1	1	-0.10	0.09	0.23	0.42	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{32}$	-0.16	0.25	0.36	0.73	1	1	0.08	0.25	0.36	0.52	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{42}$	0.04	0.40	0.49	0.78	1	1	0.26	0.40	0.49	0.62	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{52}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{\mathcal{P}}}_{62}$	-0.16	0.25	0.39	0.78	1	1	0.10	0.25	0.39	0.57	0.9	0.9
$\tilde{\tilde{\mathcal{P}}}_{72}$	0	0	0	0	1	1	0	0	0	0	1	1

Tab. 7: **The positive distances from the average solution (PDA matrix) – Part 2**

	$\tilde{\mathcal{P}}_{ij}^{U}$						$\tilde{\mathcal{P}}_{ij}^{L}$					
	$\mathcal{P}_1^U$	$\mathcal{P}_2^U$	$\mathcal{P}_3^U$	$\mathcal{P}_4^U$	H_1^U	H_2^U	$\mathcal{P}_1^L$	$\mathcal{P}_2^L$	$\mathcal{P}_3^L$	$\mathcal{P}_4^L$	H_1^L	H_2^L
$\tilde{\mathcal{P}}_{82}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{13}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{23}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{33}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{43}$	-0.06	0.31	0.42	0.76	1	1	0.17	0.31	0.42	0.58	0.9	0.9
$\tilde{\mathcal{P}}_{53}$	0.04	0.38	0.47	0.76	1	1	0.24	0.38	0.47	0.61	0.9	0.9
$\tilde{\mathcal{P}}_{63}$	-0.26	0.16	0.29	0.71	1	1	-0.01	0.16	0.29	0.48	0.9	0.9
$\tilde{\mathcal{P}}_{73}$	-0.16	0.23	0.34	0.71	1	1	0.07	0.23	0.34	0.51	0.9	0.9
$\tilde{\mathcal{P}}_{83}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{14}$	-0.75	-0.10	0.10	0.83	1	1	-0.37	-0.10	0.10	0.43	0.9	0.9
$\tilde{\mathcal{P}}_{24}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{34}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{44}$	-0.02	0.63	0.83	1.35	1	1	0.37	0.63	0.83	1.05	0.9	0.9
$\tilde{\mathcal{P}}_{54}$	0.27	0.85	0.98	1.35	1	1	0.59	0.85	0.98	1.12	0.9	0.9
$\tilde{\mathcal{P}}_{64}$	-0.02	0.59	0.76	1.27	1	1	0.33	0.59	0.76	0.97	0.9	0.9
$\tilde{\mathcal{P}}_{74}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{84}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{15}$	-0.38	0.03	0.15	0.55	1	1	-0.15	0.03	0.15	0.32	0.9	0.9
$\tilde{\mathcal{P}}_{25}$	0	0.31	0.39	0.65	1	1	0.18	0.31	0.39	0.51	0.9	0.9
$\tilde{\mathcal{P}}_{35}$	-0.38	0.03	0.15	0.55	1	1	-0.15	0.03	0.15	0.32	0.9	0.9
$\tilde{\mathcal{P}}_{45}$	-0.19	0.17	0.29	0.65	1	1	0.04	0.17	0.29	0.46	0.9	0.9
$\tilde{\mathcal{P}}_{55}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{65}$	0.09	0.38	0.43	0.65	1	1	0.25	0.38	0.43	0.53	0.9	0.9
$\tilde{\mathcal{P}}_{75}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{85}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{16}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\mathcal{P}}_{26}$	-0.29	0.15	0.29	0.73	1	1	-0.02	0.15	0.29	0.49	0.9	0.9

Tab. 7: The positive distances from the average solution (PDA matrix) – Part 3

	$\tilde{p}_{ij}^{U}$						$\tilde{p}_{ij}^{L}$					
	p_1^U	p_2^U	p_3^U	p_4^U	H_1^U	H_2^U	p_1^L	p_2^L	p_3^L	p_4^L	H_1^L	H_2^L
$\tilde{\tilde{p}}_{36}$	-0.39	0.07	0.22	0.68	1	1	-0.12	0.07	0.22	0.41	0.9	0.9
$\tilde{\tilde{p}}_{46}$	-0.49	-0.02	0.12	0.58	1	1	-0.22	-0.02	0.12	0.31	0.9	0.9
$\tilde{\tilde{p}}_{56}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{p}}_{66}$	0.01	0.37	0.47	0.78	1	1	0.23	0.37	0.47	0.61	0.9	0.9
$\tilde{\tilde{p}}_{76}$	-0.49	-0.02	0.12	0.58	1	1	-0.22	-0.02	0.12	0.31	0.9	0.9
$\tilde{\tilde{p}}_{86}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{p}}_{17}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{p}}_{27}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{p}}_{37}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{p}}_{47}$	0.08	0.64	0.78	1.22	1	1	0.40	0.64	0.78	0.96	0.9	0.9
$\tilde{\tilde{p}}_{57}$	-0.32	0.27	0.44	1.01	1	1	0.03	0.27	0.44	0.70	0.9	0.9
$\tilde{\tilde{p}}_{67}$	0.49	0.97	1.04	1.28	1	1	0.73	0.97	1.04	1.13	0.9	0.9
$\tilde{\tilde{p}}_{77}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{p}}_{87}$	0	0	0	0	1	1	0	0	0	0	1	1

Source: own

Tab. 8: The negative distances from the average solution (NDA matrix) – Part 1

	$\tilde{n}_{ij}^{U}$						$\tilde{n}_{ij}^{L}$					
	n_1^U	n_2^U	n_3^U	n_4^U	H_1^U	H_2^U	n_1^L	n_2^L	n_3^L	n_4^L	H_1^L	H_2^L
$\tilde{\tilde{n}}_{11}$	-0.50	-0.01	0.13	0.63	1	1	-0.21	-0.01	0.13	0.36	0.9	0.9
$\tilde{\tilde{n}}_{21}$	0.03	0.52	0.67	1.12	1	1	0.33	0.52	0.67	0.87	0.9	0.9
$\tilde{\tilde{n}}_{31}$	0.25	0.71	0.83	1.17	1	1	0.51	0.71	0.83	0.98	0.9	0.9
$\tilde{\tilde{n}}_{41}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{51}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{61}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{71}$	-0.50	-0.01	0.13	0.63	1	1	-0.21	-0.01	0.13	0.36	0.9	0.9
$\tilde{\tilde{n}}_{81}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{12}$	-0.13	0.35	0.49	0.97	1	1	0.16	0.35	0.49	0.70	0.9	0.9

Tab. 8: The negative distances from the average solution (NDA matrix) – Part 2

	$\tilde{n}_{ij}^{U}$						$\tilde{n}_{ij}^{L}$					
	n_1^U	n_2^U	n_3^U	n_4^U	H_1^U	H_2^U	n_1^L	n_2^L	n_3^L	n_4^L	H_1^L	H_2^L
$\tilde{\tilde{n}}_{22}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{32}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{42}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{52}$	-0.53	-0.06	0.08	0.56	1	1	-0.25	-0.06	0.08	0.30	0.9	0.9
$\tilde{\tilde{n}}_{62}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{72}$	-0.53	-0.06	0.08	0.56	1	1	-0.25	-0.06	0.08	0.30	0.9	0.9
$\tilde{\tilde{n}}_{82}$	0.28	0.73	0.84	1.17	1	1	0.54	0.73	0.84	0.98	0.9	0.9
$\tilde{\tilde{n}}_{13}$	-0.11	0.36	0.49	0.96	1	1	0.17	0.36	0.49	0.70	0.9	0.9
$\tilde{\tilde{n}}_{23}$	-0.51	-0.04	0.09	0.56	1	1	-0.23	-0.04	0.09	0.31	0.9	0.9
$\tilde{\tilde{n}}_{33}$	-0.41	0.06	0.19	0.66	1	1	-0.13	0.06	0.19	0.41	0.9	0.9
$\tilde{\tilde{n}}_{43}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{53}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{63}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{73}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{83}$	0.19	0.65	0.79	1.16	1	1	0.47	0.65	0.79	0.95	0.9	0.9
$\tilde{\tilde{n}}_{14}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{24}$	0.19	0.81	0.98	1.48	1	1	0.56	0.81	0.98	1.21	0.9	0.9
$\tilde{\tilde{n}}_{34}$	-0.39	0.34	0.54	1.19	1	1	0.01	0.34	0.54	0.81	0.9	0.9
$\tilde{\tilde{n}}_{44}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{54}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{64}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{74}$	-0.25	0.45	0.65	1.26	1	1	0.16	0.45	0.65	0.92	0.9	0.9
$\tilde{\tilde{n}}_{84}$	-0.39	0.34	0.54	1.19	1	1	0.01	0.34	0.54	0.81	0.9	0.9
$\tilde{\tilde{n}}_{15}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{25}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{35}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{45}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{55}$	-0.46	-0.06	0.07	0.47	1	1	-0.22	-0.06	0.07	0.24	0.9	0.9
$\tilde{\tilde{n}}_{65}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{75}$	-0.13	0.30	0.42	0.85	1	1	0.13	0.30	0.42	0.62	0.9	0.9

Tab. 8: The negative distances from the average solution (NDA matrix) – Part 3

	$\tilde{\tilde{n}}_{ij}^{U}$						$\tilde{\tilde{n}}_{ij}^{L}$					
	n_1^U	n_2^U	n_3^U	n_4^U	H_1^U	H_2^U	n_1^L	n_2^L	n_3^L	n_4^L	H_1^L	H_2^L
$\tilde{\tilde{n}}_{85}$	0.34	0.75	0.85	1.13	1	1	0.58	0.75	0.85	0.97	0.9	0.9
$\tilde{\tilde{n}}_{16}$	-0.03	0.45	0.60	1.03	1	1	0.26	0.45	0.60	0.79	0.9	0.9
$\tilde{\tilde{n}}_{26}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{36}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{46}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{56}$	-0.43	0.06	0.20	0.68	1	1	-0.14	0.06	0.20	0.42	0.9	0.9
$\tilde{\tilde{n}}_{66}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{76}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{86}$	-0.33	0.16	0.30	0.78	1	1	-0.04	0.16	0.30	0.52	0.9	0.9
$\tilde{\tilde{n}}_{17}$	0.26	0.77	0.91	1.32	1	1	0.58	0.77	0.91	1.11	0.9	0.9
$\tilde{\tilde{n}}_{27}$	-0.68	-0.04	0.13	0.72	1	1	-0.33	-0.04	0.13	0.37	0.9	0.9
$\tilde{\tilde{n}}_{37}$	-0.68	-0.04	0.13	0.72	1	1	-0.33	-0.04	0.13	0.37	0.9	0.9
$\tilde{\tilde{n}}_{47}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{57}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{67}$	0	0	0	0	1	1	0	0	0	0	1	1
$\tilde{\tilde{n}}_{77}$	-0.41	0.23	0.40	0.99	1	1	-0.06	0.23	0.40	0.64	0.9	0.9
$\tilde{\tilde{n}}_{87}$	0.26	0.77	0.87	1.26	1	1	0.54	0.77	0.87	1.04	0.9	0.9

Source: own

A reciprocal relation between corresponding elements of PDA and NDA matrices can be seen in Tab. 7 and Tab. 8. If an element of one of these matrices is equal to $\tilde{\tilde{0}}$, the corresponding element of the other matrix is a positive IT2FS, and vice versa.

Steps 5 to 7. Based on the Tab. 7 and Tab. 8 and Equations (21) to (25), the weighted sum of positive and negative distances ($\widetilde{\widetilde{sp}}_i$ and $\widetilde{\widetilde{sn}}_i$), the normalized values of them ($\widetilde{\widetilde{np}}_i$ and $\widetilde{\widetilde{nn}}_i$) and the appraisal scores are calculated for all alternatives. The results of these steps are shown in Tab. 9.

Step 8. According to Tab. 9, the ranking values of appraisal scores ($\mathcal{RV}$) can be calculated. The results are represented in Tab. 10. It can be seen that the ranking order of alternatives (subcontractors) is $\mathcal{A}_6 > \mathcal{A}_4 > \mathcal{A}_5 > \mathcal{A}_3 > \mathcal{A}_2 > \mathcal{A}_7 > \mathcal{A}_1 > \mathcal{A}_8$. Therefore, $\mathcal{A}_6$ is the best subcontractor in terms of the seven criteria.

4. Comparison and Sensitivity Analysis

A comparison and a sensitivity analysis are performed in this section to validate the results of the proposed method. In recent years, many multi-criteria decision making methods have been introduced and developed in the interval type-2 fuzzy environment. Some methods which have good efficiency and could be implemented in the considered MCDM problem have been selected for the comparison. The selected methods for the comparative analysis are the methods proposed by Chen et al. (2012), Wang et al. (2012), Baležentis and Zeng (2013), Hu et al. (2013), Keshavarz Ghorabaee et al. (2014)

Tab. 9: **The weighted sum of distances, their normalized values and the appraisal scores – Part 1**

$\tilde{\tilde{K}}$		$\tilde{K}_{ij}^{U}$						$\tilde{K}_{ij}^{L}$					
		k_1^U	k_2^U	k_3^U	k_4^U	H_1^U	H_2^U	k_1^L	k_2^L	k_3^L	k_4^L	H_1^L	H_2^L
$\tilde{\tilde{s}}\tilde{p}$	$\tilde{\tilde{s}}\tilde{p}_1$	-1.12	-0.08	0.23	1.37	1	1	-0.49	-0.08	0.23	0.71	0.9	0.9
	$\tilde{\tilde{s}}\tilde{p}_2$	-0.56	0.40	0.70	1.82	1	1	0.04	0.40	0.70	1.14	0.9	0.9
	$\tilde{\tilde{s}}\tilde{p}_3$	-0.81	0.25	0.55	1.74	1	1	-0.16	0.25	0.55	1.01	0.9	0.9
	$\tilde{\tilde{s}}\tilde{p}_4$	-0.76	1.78	2.62	5.46	1	1	0.71	1.78	2.62	3.77	0.9	0.9
	$\tilde{\tilde{s}}\tilde{p}_5$	-0.02	1.52	1.97	3.55	1	1	0.85	1.52	1.97	2.61	0.9	0.9
	$\tilde{\tilde{s}}\tilde{p}_6$	0.13	2.48	3.16	5.62	1	1	1.42	2.48	3.16	4.15	0.9	0.9
	$\tilde{\tilde{s}}\tilde{p}_7$	-0.47	0.08	0.24	0.89	1	1	-0.12	0.08	0.24	0.48	0.9	0.9
	$\tilde{\tilde{s}}\tilde{p}_8$	-0.42	0.05	0.19	0.66	1	1	-0.14	0.05	0.19	0.39	0.9	0.9
$\tilde{\tilde{s}}\tilde{n}$	$\tilde{\tilde{s}}\tilde{n}_1$	-0.60	1.15	1.74	4.04	1	1	0.39	1.15	1.74	2.67	0.9	0.9
	$\tilde{\tilde{s}}\tilde{n}_2$	-0.70	1.22	1.73	3.55	1	1	0.44	1.22	1.73	2.48	0.9	0.9
	$\tilde{\tilde{s}}\tilde{n}_3$	-1.01	1.00	1.51	3.38	1	1	0.17	1.00	1.51	2.24	0.9	0.9
	$\tilde{\tilde{s}}\tilde{n}_4$	0.00	0.00	0.00	0.00	1	1	0.00	0.00	0.00	0.00	0.9	0.9
	$\tilde{\tilde{s}}\tilde{n}_5$	-1.27	-0.06	0.25	1.51	1	1	-0.50	-0.06	0.25	0.75	0.9	0.9
	$\tilde{\tilde{s}}\tilde{n}_6$	0.00	0.00	0.00	0.00	1	1	0.00	0.00	0.00	0.00	0.9	0.9
	$\tilde{\tilde{s}}\tilde{n}_7$	-1.71	0.76	1.46	4.07	1	1	-0.22	0.76	1.46	2.54	0.9	0.9
	$\tilde{\tilde{s}}\tilde{n}_8$	-0.12	2.32	3.08	5.76	1	1	1.21	2.32	3.08	4.12	0.9	0.9
$\tilde{\tilde{n}}\tilde{p}$	$\tilde{\tilde{n}}\tilde{p}_1$	-0.40	-0.03	0.08	0.49	1	1	-0.17	-0.03	0.08	0.25	0.9	0.9
	$\tilde{\tilde{n}}\tilde{p}_2$	-0.20	0.14	0.25	0.65	1	1	0.01	0.14	0.25	0.40	0.9	0.9
	$\tilde{\tilde{n}}\tilde{p}_3$	-0.29	0.09	0.19	0.62	1	1	-0.06	0.09	0.19	0.36	0.9	0.9
	$\tilde{\tilde{n}}\tilde{p}_4$	-0.27	0.63	0.93	1.94	1	1	0.25	0.63	0.93	1.34	0.9	0.9
	$\tilde{\tilde{n}}\tilde{p}_5$	-0.01	0.54	0.70	1.26	1	1	0.30	0.54	0.70	0.93	0.9	0.9
	$\tilde{\tilde{n}}\tilde{p}_6$	0.05	0.88	1.12	1.99	1	1	0.50	0.88	1.12	1.47	0.9	0.9
	$\tilde{\tilde{n}}\tilde{p}_7$	-0.17	0.03	0.08	0.32	1	1	-0.04	0.03	0.08	0.17	0.9	0.9
	$\tilde{\tilde{n}}\tilde{p}_8$	-0.15	0.02	0.07	0.23	1	1	-0.05	0.02	0.07	0.14	0.9	0.9

Tab. 9: **The weighted sum of distances, their normalized values and the appraisal scores – Part 2**

$\tilde{\tilde{K}}$		$\tilde{K}_{ij}^{U}$						$\tilde{K}_{ij}^{L}$					
		k_1^U	k_2^U	k_3^U	k_4^U	H_1^U	H_2^U	k_1^L	k_2^L	k_3^L	k_4^L	H_1^L	H_2^L
$\tilde{\tilde{\tilde{n}}}$	$\tilde{\tilde{\tilde{n}}}_1$	-0.49	0.36	0.58	1.22	1	1	0.02	0.36	0.58	0.86	0.9	0.9
	$\tilde{\tilde{\tilde{n}}}_2$	-0.31	0.36	0.55	1.26	1	1	0.09	0.36	0.55	0.84	0.9	0.9
	$\tilde{\tilde{\tilde{n}}}_3$	-0.24	0.44	0.63	1.37	1	1	0.17	0.44	0.63	0.94	0.9	0.9
	$\tilde{\tilde{\tilde{n}}}_4$	1.00	1.00	1.00	1.00	1	1	1.00	1.00	1.00	1.00	0.9	0.9
	$\tilde{\tilde{\tilde{n}}}_5$	0.45	0.91	1.02	1.47	1	1	0.72	0.91	1.02	1.19	0.9	0.9
	$\tilde{\tilde{\tilde{n}}}_6$	1.00	1.00	1.00	1.00	1	1	1.00	1.00	1.00	1.00	0.9	0.9
	$\tilde{\tilde{\tilde{n}}}_7$	-0.50	0.46	0.72	1.63	1	1	0.06	0.46	0.72	1.08	0.9	0.9
	$\tilde{\tilde{\tilde{n}}}_8$	-1.12	-0.13	0.14	1.04	1	1	-0.52	-0.13	0.14	0.55	0.9	0.9
$\tilde{\tilde{\hbar}}$	$\tilde{\tilde{\hbar}}_1$	-0.44	0.17	0.33	0.85	1	1	-0.08	0.17	0.33	0.55	0.9	0.9
	$\tilde{\tilde{\hbar}}_2$	-0.25	0.25	0.40	0.95	1	1	0.05	0.25	0.40	0.62	0.9	0.9
	$\tilde{\tilde{\hbar}}_3$	-0.27	0.27	0.41	0.99	1	1	0.06	0.27	0.41	0.65	0.9	0.9
	$\tilde{\tilde{\hbar}}_4$	0.37	0.82	0.96	1.47	1	1	0.63	0.82	0.96	1.17	0.9	0.9
	$\tilde{\tilde{\hbar}}_5$	0.22	0.72	0.86	1.36	1	1	0.51	0.72	0.86	1.06	0.9	0.9
	$\tilde{\tilde{\hbar}}_6$	0.52	0.94	1.06	1.50	1	1	0.75	0.94	1.06	1.23	0.9	0.9
	$\tilde{\tilde{\hbar}}_7$	-0.33	0.25	0.40	0.97	1	1	0.01	0.25	0.40	0.62	0.9	0.9
	$\tilde{\tilde{\hbar}}_8$	-0.64	-0.06	0.11	0.64	1	1	-0.28	-0.06	0.11	0.34	0.9	0.9

Source: own

Tab. 10: **The ranking values of appraisal scores**

Alternatives	$(\mathcal{RV})$
$\mathcal{A}_1$	0.1633
$\mathcal{A}_2$	0.1767
$\mathcal{A}_3$	0.1778
$\mathcal{A}_4$	0.1957
$\mathcal{A}_5$	0.1938
$\mathcal{A}_6$	0.1964
$\mathcal{A}_7$	0.1753
$\mathcal{A}_8$	0.1049

Source: own

and Keshavarz Ghorabaee et al. (2015a). The symbols M-1 to M-6 are utilized for representing these selected methods, respectively.

For comparing the extended EDAS method with the other methods, the numerical example is solved using the selected methods separately, and the Spearman's rank correlation coefficient (r_s) is used to analyze the ranking results. We can say that there is a significant statistical correlation between results if the values of r_s are greater than 0.6 (Keshavarz Ghorabaee et al., 2016a). Tab. 11 represents the results of the comparison between the proposed method and the other methods. All correlation coefficients are greater than 0.6 according to this table. This fact demonstrates a strong or very strong relationship between the ranking results of the extended EDAS method and the other methods. Therefore, it can be said that the result of the proposed method is consistent with the results of other methods.

Tab. 11: Comparing different methods' results and the corresponding correlation (r_s)

Alternatives	Methods						
	M-1	M-2	M-3	M-4	M-5	M-6	EDAS-IT2FSs
$\mathcal{A}_1$	7	7	7	7	7	4	7
$\mathcal{A}_2$	5	4	5	5	4	6	5
$\mathcal{A}_3$	4	5	6	4	5	7	4
$\mathcal{A}_4$	2	2	2	2	2	2	2
$\mathcal{A}_5$	3	3	3	3	3	3	3
$\mathcal{A}_6$	1	1	1	1	1	1	1
$\mathcal{A}_7$	6	6	4	6	6	5	6
$\mathcal{A}_8$	8	8	8	8	8	8	8
r_s	1	0.98	0.9	1	0.98	0.76	—

Source: own

Tab. 12: The generated weights for sensitivity analysis

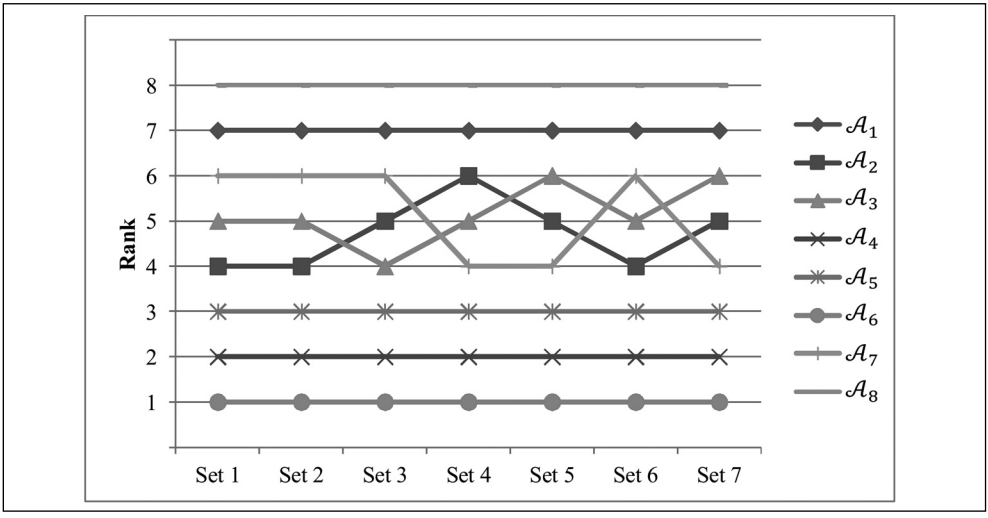
Sets	Criteria						
	$\mathcal{C}_1$	$\mathcal{C}_2$	$\mathcal{C}_3$	$\mathcal{C}_4$	$\mathcal{C}_5$	$\mathcal{C}_6$	$\mathcal{C}_7$
1	0.0357	0.0714	0.1071	0.1429	0.1786	0.2143	0.2500
2	0.0714	0.1071	0.1429	0.1786	0.2143	0.2500	0.0357
3	0.1071	0.1429	0.1786	0.2143	0.2500	0.0357	0.0714
4	0.1429	0.1786	0.2143	0.2500	0.0357	0.0714	0.1071
5	0.1786	0.2143	0.2500	0.0357	0.0714	0.1071	0.1429
6	0.2143	0.2500	0.0357	0.0714	0.1071	0.1429	0.1786
7	0.2500	0.0357	0.0714	0.1071	0.1429	0.1786	0.2143

Source: own

In addition to this comparison, a sensitivity analysis based on varying the weights of criteria is performed. For this aim, according to the number of criteria in this problem, we generate seven sets of criteria weights with a simple pattern. In the pattern which is used for sensitivity analysis, one criterion has the highest weight, and one criterion has the lowest weigh, and the other criteria have a weight between them. Using this pattern helps us to investigate the impact of changing the weights of criteria in a more effective way. The weights of criteria in each set are represented in Tab. 12.

As can be seen, a crisp weight is assigned to each criterion in these sets. The numerical example is solved with each set of generated weights separately. The ranking results with different sets are shown in Fig. 2. This figure represents less change in the rank of alternatives within different sets of generated criteria weights. Therefore, we can say that the proposed method has good stability when the weights of criteria are varied. These analyses demonstrate the validity and stability of the results of the extended EDAS method in the decision-making problem with multiple criteria and uncertain data.

Fig. 2: The ranking results of the sensitivity analysis



Source: own

Conclusions

The uncertainty is usually inevitable in the multi-criteria decision-making process. The fuzzy set theory is one of the efficient tools to deal with the MCDM problems in an uncertain environment. IT2FSs are flexible and give more degrees of freedom to decision-makers for modeling the decision-making problems. In this study, we have proposed an extended EDAS method with interval type-2 fuzzy sets. The concepts and arithmetic operations of IT2FSs have been utilized for extending this method. A numerical example of multi-criteria subcontractor evaluation problem has been used to illustrate the process of the proposed method. Moreover, to validate the results, this example has been solved by some existing methods. Also, we have performed a sensitivity analysis with seven sets of criteria weights. These sets have been designed according to the number of criteria in the problem, and a pattern has been used to generate the weights of criteria in each set. These analyses show that the results of the extended EDAS method are relatively consistent with the other methods of the comparison and have good stability

in different sets of criteria weights. Future research can apply the proposed method to the MCDM problems such as supplier selection, robot selection, personnel selection, material selection and project selection.

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Abstract

MULTI-CRITERIA GROUP DECISION-MAKING USING AN EXTENDED EDAS METHOD WITH INTERVAL TYPE-2 FUZZY SETS

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Multi-criteria decision-making (MCDM) methods are very useful in the real-world decision-making problems. We are usually confronted with the decision-making process in an uncertain environment, and the fuzzy set theory is an efficient tool to handle this uncertainty. Interval type-2 fuzzy sets are one of the extensions of the fuzzy sets which are very flexible to model an uncertain environment. This study is related to MCDM problems within the context of interval type-2 fuzzy sets (IT2FSs). The evaluation based on distance from average solution (EDAS) method is a new and efficient MCDM method, and assessment of alternatives in this method is based on the distance of them from average solution with respect to all criteria. In the EDAS method, each alternative has positive and negative distances which are used to determine the appraisal score of it. In this research, we present an extended EDAS method, which is named EDAS-IT2FSs, for dealing with multi-criteria group decision-making problems with interval type-2 fuzzy sets. Basic concepts of interval type-2 fuzzy sets and the arithmetic operations of trapezoidal IT2FSs are used to develop the extended EDAS method. A numerical example of multi-criteria subcontractor evaluation problem is used to illustrate the process of using the extended EDAS method. The example involves eight subcontractors that need to be evaluated with respect to seven criteria. A comparison and a sensitivity analysis based on different sets of criteria weights are also performed to show the validity of the proposed method. The results of these analyses show the efficiency and stability of the extended EDAS method.

Key Words: *Multi-criteria decision-making, interval type-2 fuzzy sets, fuzzy MCDM, EDAS method.*

JEL Classification: *C02, C44, C61, C63, L7.*

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DETERMINING FACTORS OF THE BENEFITS DERIVED FROM THE IMPLEMENTATION OF EN 9100 STANDARDS

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Introduction

The aerospace sector is one of the most important in global economy. The invoicing of the first 100 aerospace companies worldwide was in 2011 665,970 million dollars, which represents 5% of the world's gross domestic product (PwC, 2012). In Spain, this sector is equally important, since according to the data of the year 2011 (DBK, 2012), it represents the fifth industry of the sector in the European Union, both due to the employment level (40,200 employees) and the annual invoicing (6,715 million euros, which represent approximately 6% of Europe's total invoicing). Aerospace sector is clearly exports-oriented, since nearly 75% of its total invoiced in the year arises from exporting.

By contrast, the progressive complexity of the systems employed in this sector, and the greater importance of the projects to be undertaken have caused that nowadays there is a lack of end-product manufacturers (that is airplanes, helicopters, satellites, etc.). On the contrary, the development of these products is the result of the collaboration of a number of systems and subsystems manufacturers, together with other specialized companies, which leads to considerable subcontracting relations, as well as a progressive internationalization of manufacturing and development activities (TEDAE, 2010). This degree of complexity, subcontracting and internationalization, along with the fact that "security" is a basic element supporting the activity of this sector, implies that aerospace products are subject to high demands regarding quality and reliability issues; hence the standards of quality in the sector are some of the most demanding in the industrial field (Grijalbo & Prida, 2005). Standardization is a mechanism that favors exchange and international trade in today's global economy, removing the obstacles that arise from each country practices (Heras & Boiral, 2013) and providing answers to the international character of the joint projects among companies located in different countries that are common in this industry.

The purpose of Quality Management Systems (QMS) is the quality continuous improvement not only in products/services, but also in all the processes in the firms, allowing customers satisfaction and encouraging the efforts and responsibility of everyone in the organization (Fonseca, 2013). Among these QMS we can cite the quality assurance standards, being the ISO 9000 standard the most widespread. This standard is a series of norms that strive to standardize processes, functions, and roles but do not necessarily prescribe goals or results (Guler et al., 2002; Braun, 2005). The main purpose of ISO 9001 is to give confidence in the organization's ability in order to provide consistently conforming products to the requirements of its customers (Pawliczek & Piszczur, 2013). In view of all the foregoing, quality assurance standards in the aerospace sector are certainly widespread, both the ISO 9001 Standards, and the series of EN 9100 Standards, that takes into account specific aspects of this industry with respect to ISO 9001, which is of more generic nature.

The implementation of these standards of quality assurance is associated with a series of temporary and organizational monetary investments, both initial and maintenance investments, which is expected to maximize its return (Whitford & Bird, 1996). Nonetheless, these investments are not always offset with positive results, which sometimes may be scarce as indicated by previous studies about ISO 9001 (Quazi et al., 2002; Martínez-Costa et al., 2009; Boiral & Amara, 2009). All this seems to indicate that it is not enough to obtain the certification associated to these Standards,

nonetheless there are certain factors that may condition these positive results (Lee et al., 2009; Psomas et al., 2010; Boiral, 2011). Logically, the implementation of EN 9100 supposes higher costs than those derived from implementing ISO 9001 generic standards, since it includes a number of additional requirements characteristic of the aerospace sector. In theory, to be adhered to said standards should be compensated by earning higher profits, as compared to those that could arise from implementing ISO 9001.

Previous studies in the field of EN 9100 Standards are not very numerous; some of them focus on describing the standards' general characteristics, as well as their main differences with respect to IS0 9001 (Beltran, 2002; Juny, 2005; Gutierrez, 2008); others describe the level of implementation of the EN 9100 Standards, which in major manufacturers and suppliers of the sector is widespread, while it is more unequal in second and third level suppliers (Grijalbo & Prida, 2005); other studies include models and guidelines to adhere to these standards (IAT, 2003). Finally, other studies describe how was EN 9100 implemented in some of the major aerospace companies, as EADS, SENER, etc. (Murga, 2002; Vilar, 2003; Mugarra, 2005). However, none of them analyzes specifically the benefits derived from the implementation of EN 9100, nor their determining factors. Regarding ISO 9001 Standards, which was its predecessor in the sector, it has indeed been subject of multiple studies, although none of them makes specific reference to the aerospace sector.

Based on the foregoing, this research aims to begin covering the virtual lack of studies about the results arising from the implementation of quality assurance standards in this sector. In particular, the objective of the research involves analyzing whether the appearance of the various positive effects that may arise as a result of implementing EN 9100 Standards is influenced by the following factors: a) size of the company; b) implementation of EN 9100 seniority; c) prevailing type of motivation (external and/or internal) to adhere to such standards.

Following this introduction, which provides a context for the basic elements of the study, there is a description of the theoretical framework of the research under the second heading, including basic aspects of quality management in the aerospace industry and a review of the literature available that is relevant to these standards. In the third section there is a description of the samples and methodology used, and detailed information of results and conclusions is provided in sections four and five respectively.

1. Conceptual Framework

Currently, the high levels of competitiveness and globalization applicable to almost all sectors, have led to an extensive development of the quality management concept as a strategic approach to address quality in a company, which is based on customer-oriented, continuous improvement, focus on people and global vision principles of the organization (Camison et al, 2009). Ultimately, quality management systems enable companies to implement management tools in order to establish policies and responsibilities, allocate resources, and identify key activities (Criado & Calvo, 2009).

1.1 Quality Management in the Aerospace Sector

As aforementioned, the aerospace industry has always been at the forefront of the development of quality management systems, since their standards are significantly higher than those found in other industrial sectors, with the exception of the automotive sector (Gutierrez, 2008). The "Self-assessment scheme" constituted the first step in the evolution of quality systems in the industry. Subsequently, companies in the sector have used the "second part schemes", which consist on auditing suppliers' quality systems based on each customer's own criteria and methods. This system involves elevated costs for the sector, since the same company may be audited regularly by several entities, thus multiplying the costs that are incurred.

In order to increase efficiency, a tendency towards the development and adoption of systems based on "third part schemes" took place during the nineties, among them stands out the ISO 9001 Standards that spread within the sector as the only quality management system that should be taken into consideration. Nevertheless, these standards did not entirely apply to the specificities of the aerospace industry, hence the majority of the most important companies in the sector continued to produce their own supplements

to the standards, with the consequent proliferation of the requirements established for the providers, which again caused the same problems resulting from the second part schemes (Grijalbo & Prida, 2005). In December 1998 the largest providers, manufacturers and commercial associations of America, Europe and Asia joint together to form the International Aerospace Quality Group (IAQG), that in 1999 promoted the EN 9100 Standards family, with the purpose of standardizing the additional requirements of the sector at a more concrete level than ISO 9001.

The EN 9100 Standards (AS 9100 in America and SIAC 9100 in Asia), includes both the requirements derived from the ISO 9001 and 83 specific additional requirements for the aerospace industry, giving special importance to the areas that were considered could have a higher impact on security and reliability of aerospace products, such as: design, purchasing, process control, inspection and testing, and control of non-compliances. These additional requirements aim at the reduction of variability in the production of goods, for which companies must have continuous improvement systems that enable a more solid interaction between processes, and therefore reduce the chances that the product is outside pre-established limits.

In December 2012 the OASIS database of IAQG, where the companies that have implemented these standards were registered, hold 14,300 headquarters of certified companies around the world, of which 448 were located in Spain (OASIS database contained certified headquarters, hence a company with several offices will appear more than once, which is common for large companies; therefore, the number of certifications on the database exceeds the total number of companies in this sector both globally and in Spain).

The group of EN 9100 Standards of generic content, issued by the IAQG, is composed by the following (IAQG, 2009):

- EN 9100 – Model for quality assurance in design, development, production, installation and servicing.
- EN 9110 – Aerospace Series, Model for quality assurance applicable to maintenance organizations.
- EN 9120 – Aerospace Series, Model for quality assurance applicable to Stockist Distributors.

1.2 Literature Review

As specified in the introduction, there are few papers related to EN 9100 Standards, and none of them refers to the effective results derived from their implementation. Regarding ISO 9001 Standards family, it has been subject to multiple studies, although none of them makes specific reference to the aerospace sector. Given the objective of this research, a revision has been made to the main studies that specifically or among other issues, refer to the positive effects generated by the adherence to ISO 9001, and especially what may be the influence of the factors that shall be considered in regards to EN 9100, i.e., the size of the company, the seniority in the implementation of these standards, as well as the prevailing type of motivation [external an or internal] to adhere to such standards.

a) Positive Effects Generated when Implanting ISO 9001 Standards

In general, it may be noted that most studies conclude that ISO 9001 entails beneficial effects for the companies; notwithstanding the foregoing, and even though they are a minority, there are other studies that do not reflect these positive effects, or at least not in all cases or circumstances (Quazi et al., 2002; Martínez-Costa et al., 2009; Boiral & Amara, 2009).

In regards to the positive results generated by the adherence to the standards, it should be remarked that diverse studies (Sampaio et al., 2009; Tari et al., 2012), classified them into positive effects concerning *"internal aspects"*, and *"external aspects"*. Based on the conclusions of these studies, these positive effects could be itemized as presented on table 1.

Comparing the relative importance of the two types of benefits associated with the implementation of ISO 9001, there are some previous researches that prioritize the positive effects on internal aspects (Bhuiyan & Alan, 2005; Martínez-Costa et al., 2008; Lo et al., 2009), whereas other studies emphasizes those related to external aspects (Benner & Veloso, 2008; Dick et al., 2008). Notwithstanding the foregoing, most of the previous studies reveal positive results both of internal and external nature (Rodríguez-Escobar et al., 2006; Calisir, 2007; Lo & Chang, 2007).

Tab. 1: Typology of positive effects resulting from adherence to ISO 9001

INTERNAL ASPECTS	
Related to organizational processes	Production management control, definition of responsibilities and rules, process documentation, etc.
Related to operational execution	Efficient use of resources, inspection and logistic cost decrease, decline in nonconformity, etc.
Related to HR	Job satisfaction, work team dynamics, employee suggestion systems, etc.
EXTERNAL ASPECTS	
Related to finance and marketing	Sales volume, market share, sales-per-employee ratio, etc.
Related to customer relations	Client retention, number of complaints, public image, etc.

Source: own

b) Influence of the Companies' Size Factor on the Positive Effects Derived from Implementing ISO 9001 Standards

Previous researches are not conclusive concerning the influence of companies' size factor on the beneficial effects of implementing ISO 9001. In this regard, there are studies which indicate that in smaller companies it is more difficult to obtain positive results, since they usually lack certain internal resources which are important to have a successful adherence (at least with respect to internal benefits), and furthermore, the initial costs and investments necessary to obtain the certification are proportionally more significant in comparison with larger companies (Gustafsson et al., 2001; Rodríguez-Escobar et al., 2006).

Nevertheless, it is also possible to find numerous studies which indicate that the benefits are similar regardless of the size, since the conditions to obtain these benefits are more related to the intensity of the implementation of ISO 9001 than to the size of the companies, although in smaller companies it could be slower (Terziovski et al., 2003; Briscoe et al., 2005; Psomas et al., 2010), and in some cases the benefits perceived in these companies may be even higher taking into consideration that the starting point in the field of quality management tends to be lower, hence the opportunities for improvement are greater (Gotzamani & Tsiotras, 2001).

c) Influence of the Time Factor (Standards Adherence Seniority) on the Positive Effects Derived from Implementing ISO 9001 Standards

Once again, previous researches are not conclusive concerning the influence of this factor on the beneficial effects of implementing ISO 9001. In this regard, there are studies which reveal that time is a positive factor for the appearance of the aforementioned beneficial effects caused by the adherence to ISO 9001 (Climent, 2005; Martinez-Costa et al., 2008; Lo et al., 2009). According to these studies, the principles underlying ISO 9001 as a quality management system need certain time to be internalized within the companies, and obtain the benefits sought in all of their intensity.

Nevertheless, there are other studies which state that time has no influence whether companies obtain positive effects from ISO 9001, or at least not in all cases (Terziovski et al., 2003; Gotzamani et al., 2006; Lee et al., 2009), or that it may even cause a reduction on the initial benefits derived from the implementation of said standards (Casadesus & Karapetrovic, 2005; Sampaio et al., 2009; Karapetrovic et al., 2010). According to these studies, when the intended purpose is almost exclusively to obtain the certification in order for the company not to be excluded from the market, this benefit appears immediately after implementing these standards.

d) Influence of the Prevailing Motivation (External or Internal) for the Adherence to ISO 9001 Standards Factor, on the Positive Effects Derived from Their Implementation

According to previous researches, the motivations for the adherence may refer to "external aspects", such as image improvement

and market position of the company, aspects regarding commercial, financial and customers' relations nature, as well as "internal aspects" such as the improvement of organizational, execution of operations, and human resources management processes of the company (Boiral & Amara, 2009; Sampaio et al., 2009).

Furthermore, it has been noted that there is a majority of researches where the motivations related to "external aspects" are the ones that prevail (Bhuiyan & Alam, 2005; Rodríguez-Escobar et al., 2006; Martínez-Costa et al., 2008), compared to those which considered that both types of aspects are balanced, or even those where "internal aspects" prevail (Chang & Lo, 2005; Magd, 2008; Fotopoulos & Psomas, 2010).

Likewise, attention must be drawn to the fact that, in regards with previous studies related to ISO 9001 on the possible relation between the prevailing type of motivation for obtaining the adherence [external and/or internal], and the results, the studies stating that a higher level of external motivation entails a greater level of benefits are an exception (Bhuiyan & Alam, 2005), given that, in general there is an agreement in which if the adherence to the standards is due to an attempt to improve internal aspects of the company, instead of an external pressure (customers/regulators), or to obtain improvement on merely external aspects (image improvement / following a trend), the global benefits observed after the implementation of ISO 9001 are greater (Rodríguez-Escobar et al., 2006; Sampaio et al., 2009; Prajogo, 2011). According to these researches, if the only motivations for the adherence to ISO 9001 are those of external character, there is a high risk that the company shall not acquire new capacities nor obtain no sustainable competitive advantage, except for not seeing itself excluded from the market thanks to the certification; nevertheless, when motivations of internal type exist, these are the ones that can generate a greater level of implementation of the principles of these standards, which should render operative and organizational improvements, which derive in an improvement of quality and customers satisfaction, which shall later result in financial improvements.

2. Research Methodology

2.1 Sample

The research was addressed to the Spanish aerospace sector, hence based on the criteria listed hereafter; the population subject to the investigation was defined by 317 companies.

This sector is composed of a great diversity of companies, both regarding size and business specialization, so in order to elaborate the census of the companies to be studied, the National Classification of Economic Activities (CNAE according to its Spanish acronym), could not be employed since it lacks one or more categories that compile all the companies belonging to the sector. Therefore, it has been necessary to resort to a compilation of specific databases comprising the companies of the sector. The first census to be considered was TEDAE which at the end of 2010 was the cornerstone association in Spain, since its 52 members, which include the most important companies of the aerospace sector, combined 91% of the turnovers. The second database that was taken into consideration was OASIS (this database registers all the aerospace companies adhered to EN 9100). Finally, other databases related to this industry have been considered for complementary purpose. After eliminating duplications, the final population subject to the analysis is reflected on table 2, detailed hereinafter:

Tab. 2: Survey population breakdown according to census

CENSUS	FIRMS IN AEROSPACE INDUSTRY		AUXILIARY BUSINESSES	TOTAL
	AVIATION SUBSECTOR	AEROSPACE SUBSECTOR		
TEDAE	34	6	12	52
OASIS	96	7	57	160
OTHER	83	5	17	105
TOTAL	211	18	85	317

Source: own

2.2 Questionnaire

In order to develop the questionnaire, the first step was to elaborate a draft analyzing previous researches concerning the ISO 9001 (Gotzamani & Tsiotras, 2001; Mercado et al., 2005), classifying the possible motivations for adherence to EN 9100, as well as the positive effects perceived from the implementation, based on the different "internal" and "external" aspects reflected on table 1. This draft was subject to a pretest elaborated by experts in the field belonging to two of the participating companies (Airbus Spain and Iberia LAE Maintenance); an in-depth interview was held with both experts. Once their opinions were incorporated, the final version of the questionnaire was set forth. Subsequently, the questionnaire was sent by postal mail and e-mail to the directors of quality of all the 317 selected companies.

After finishing the process of questionnaire reception, it was determined that there were 126 valid companies, which represents 39.7% of the total population (317 companies). Furthermore, it should be noted that the EN 9100 Standards are widely implemented on the organizations that have completed the questionnaire (72.2% of the companies, that is 91 of them), with an adherence seniority higher than five years in 88% of the cases, and an elevated level of intensity in the implementation, since 75% of the companies have adhered all their processes to the standards. Both aspects, seniority and intensity of the implementation, reinforce the validity of the answers obtained in the questionnaires received. Afterwards, the data sheet of the study contained in table 3 was elaborated based on all this information:

Tab. 3: Data sheet

Universe	Spanish firms in the aerospace industry
Sampling technique	Random: the survey was sent to all entities in the universe
Methodology	Mail and online survey
Individuals receiving the survey	Director of Quality Assurance or equivalent
Population	317
Sample size	126
Confidence level	95% [z = 1.96; p = q = 0.5]
Sampling error	6.8%
Time period	From October 1, 2011 to January 31, 2012

Source: own

2.3 Variables and Model Proposed

To be able to analyze the influence of the different factors considered in this research on the appearance of the different positive effects derived from the implementation of EN 9100 Standards, a multiple linear regression model has been designed; the variables considered are the following ones:

Dependent Variables Y: different benefits derive from the EN 9100 Standards, according to the typology contained on the table 1 of this study. According to the answers obtained in the questionnaire provided to the participating companies, these variables can take the following values: 1 – very low, 2 – low, 3 – medium, 4 – high and 5 – very high:

Variable Y_1: internal positive effects related to organizational processes (*OrgEN).*

Variable Y_2: internal positive effects concerning execution of operations (*ExecEN).*

Variable Y_3: internal positive effects related to human resources (*HrEN).*

Variable Y_4: external positive effects related to financial and commercial aspects (*FinComEN).*

Variable Y_5: positive external effects related to aspects of customers' relationship (*ClienEN).*

Independent variables X:

Variable x_1: Size of the company (*Size)*. According to the answers obtained in the questionnaire provided to the participating companies, this variable can take the following values: 1 – small, 2 – medium, 3 – large (based on the criteria of the EU recommendation 2003/361/EC).

Variable x_2: Seniority in the adherence to EN 9100 Standards (*Sen)*. According to the answers obtained in the questionnaire provided to the participating companies, these variables can take the following values: 1 – Seniority not exceeding 3 years, 2 – Seniority exceeding 3 years.

Variable x_3: Prevailing type of motivation (external and/or internal) for the adherence (*TypeMot)*. According to the answers obtained in the questionnaire provided to the participating companies, these variables can take the following values: 1 – if the "external" motivations are predominant, 2 – if "internal" motivations are predominant.

Based on these variables the following model of multiple linear regressions has been designed, including the variable u_i that is the statistic error:

$$Y_i = \beta_0 + \beta_1 * x_{1,i} + \beta_2 * x_{2,i} + \\ + \beta_3 * x_{3,i} + u_i \quad (1)$$

$$Effect_I = \beta_0 + \beta_1 * Size_{1,i} + \beta_2 * \\ * Sen_{2,i} + \beta_3 * TypeMot_{3,i} + u_i \quad (2)$$

Tab. 4: Results obtained for the model: independent variable coefficients

Dependent variable	Independent variable	Non standardized coefficients		Standardized coefficients	t	Sig.
		Beta	Standard error	Beta		
OrgEN	[Constant]	0.428	0.546		0.784	0.436
	Size	0.051	0.112	0.450	0.454	0.651
	Seniority	1.132	0.259	0.437	4.379	0.000
	Type of motivation	0.320	0.172	0.185	2.855	0.067
ExecEN	[Constant]	0.070	0.614		0.114	0.910
	Size	0.216	0.126	0.168	1.713	0.091
	Seniority	0.800	0.291	0.274	2.751	0.007
	Type of motivation	0.693	0.194	0.356	3.575	0.001
HrEN	[Constant]	0.781	0.565		1.381	0.171
	Size	-0.195	0.116	-0.163	-1.679	0.097
	Seniority	0.606	0.268	0.222	2.265	0.026
	Type of motivation	0.744	0.178	0.410	4.171	0.000
FinComEN	[Constant]	2.314	0.493		4.696	0.000
	Size	-0.049	0.101	-0.053	-0.488	0.627
	Seniority	0.525	0.233	0.247	2.252	0.027
	Type of motivation	0.218	0.155	0.154	1.406	0.164
ClienEN	[Constant]	1.875	0.458		4.093	0.000
	Size	-0.041	0.094	-0.046	-0.440	0.661
	Seniority	0.664	0.217	0.323	3.063	0.003
	Type of motivation	0.277	0.144	0.202	1.920	0.059

Source: own

3. Results

Table 4 presents the results obtained from the model, in particular the coefficients of the independent variables (size, seniority, and type of motivation) regarding the dependent variables (each of the positive effects). In this table we include the coefficients standardized and the non-standardized of our model variables; these coefficients indicate the weight of the independent variables regarding each dependent variable, that is, each positive effect from the Standard. We include too, the t value (t) and the signification (sig.); these indicate if each independent variable is significant or not regarding each dependent variable. The variables are significant if the t value (t) is bigger than two (t > 2) and a signification (sig.) smaller or equal than 0.05.

The final model with the significant variables would be as follows:

$$OrgEN = 0.428 + 0.437\ (Sen) + 0.185\ (TypeMot) + u \quad (3)$$

$$ExecEN = 0.070 + 0.274\ (Sen) + 0.356\ (TypeMot) + u \quad (4)$$

$$HrEN = 0.781 + 0.222\ (Sen) + 0.410\ (TypeMot) + u \quad (5)$$

$$FinComEN = 2.314 + 0.247\ (Sen) + u \quad (6)$$

$$ClienEN = 1.875 + 0.323\ (Sen) + 0.202\ (TypeMot) + u \quad (7)$$

Therefore, table 4 reveals the following results regarding the independent variables of the model:

The "size of the company" is a variable with a t < 2 for the raised models, hence it is accepted that this variable is non-significant for each one of the internal positive effects (organizational, execution of operations, and human resources management processes), as well as for the external ones (financial-commercial, and customers management processes), thus it has been excluded from the regression model elaborated.

The "seniority of the adherence to EN 9100" is a variable with a t > 2 for the raised models, hence it is accepted that this variable is significant for each one of the internal positive effects (organizational, execution of operations, and human resources management processes), as well as for the external ones (financial-commercial, and customers management processes). When obtaining a positive sign, an increase of this independent variable shall produce an increase (in rate of growth) on the dependent variable, being the rest constant. That is, an increase in 1 unit in the "seniority to the adherence to EN 9100" shall produce an increase of 43.70% on the internal effect "OrgEN", of 27.40% on the internal effect "ExecEN", of 22.22% on the internal effect "HrEN", of 24.70% on the external effect "FinComEN" and of 32.30% on the external effect "ClienEN". The higher the value of the variable, the greater the internal and external effects shall be.

The "prevailing type of motivation (external and/or internal) for the adherence" is a variable with a t > 2, hence it is accepted that this variable is significant for each one of the internal positive effects (organizational, execution of operations, and human resources management processes), as well as for the external ones regarding customers management. When obtaining a positive sign, an increase of this independent variable shall produce an increase (in rate of growth) on the dependent variable, being the rest constant. That is, an increase in 1 unit in the "prevailing type of motivation" shall produce an increase of 18.50% on the internal effect "OrgEN", of 35.60% on the internal effect "ExecEN", of 41.00% on the internal effect "HrEN", and of 20.20% on external effect "ClienEN" (we accept type of motivation on external effect "ClienEN" because it has a t very near 2). The higher the value of the variable, which means internal motivations prevail, the greater the internal and external effects shall be.

On the contrary, the "prevailing type of motivation [external and/or internal] for the adherence" is a variable with one t < 2 (t = 1.406), only for financial-commercial external effects, hence it is considered that this variable is non-significant for the dependent variable "FinComEN". Table 5 presents an overview of the significance of variables in the model.

Finally, table 6 contains the corresponding coefficient of determination (R^2); this is a number that indicates how the data fit in our model. It provides a measure of the percentage of variability of each dependent variable (internal and external "positive effect"), that is explained by each significant independent variable. Based on the results described in this table, the coefficient of determination R^2 has a value that fluctuates between 20% and

Tab. 5: Significance overview

Dependent variable	Independent variable	Sig.
OrgEN	Size	x
	Seniority	√
	Type of motivation	√
ExecEN	Size	x
	Seniority	√
	Type of motivation	√
HrEN	Size	x
	Seniority	√
	Type of motivation	√
FinComEN	Size	x
	Seniority	√
	Type of motivation	x
ClienEN	Size	x
	Seniority	√
	Type of motivation	√

Source: own

Tab. 6: Coefficient of determination

Dependent variable	Independent variable	Standardized coefficients	R^2	Correlation between dependent and independent variable	Explained Variance
OrgEN	Size	0.450	**25.30%**	0.029	*not significant*
	Seniority	0.437		0.467	20.41%
	Type of Motivation	0.185		0.258	4.77%
ExecEN	Size	0.168	**25.80%**	0.155	*not significant*
	Seniority	0.274		0.328	8.99%
	Type of Motivation	0.356		0.399	14.20%
HrEN	Size	-0.163	**27.80%**	-0.174	*not significant*
	Seniority	0.222		0.296	6.57%
	Type of Motivation	0.410		0.449	18.41%
FinComEN	Size	-0.052	**20.10%**	-0.062	*not significant*
	Seniority	0.247		0.274	20.10%
	Type of Motivation	0.154		0.196	*not significant*
ClienEN	Size	-0.046	**27.00%**	-0.058	*not significant*
	Seniority	0.323		0.358	11.56%
	Type of Motivation	0.202		0.256	5.17%

Source: own

27.80% (for results that are significant), which indicates that the independent variables of the "seniority" and "prevailing type of motivation for adherence" models, explain between 20% and 27.80% of the variability of dependent variables (both internal and external "positive effects"). With the aim of identifying the explained variance of each construct (dependent variable) by each independent variable (the percentage of the R^2 coefficient explained for each one), we proceeded to break down the explained variance by variable. This allow us make up a "ranking" of "predictive power" of each independent variable. The explained variance is the result of multiplying the correlation between dependent and independent variables by the standardized coefficient of each independent variable (size, seniority, and type of motivation).

4. Discussion

This study has sought to analyze how certain factors may influence the internal and external benefits derivatives from implementing the EN 9100 Standards. These factors are: the size of the company, the seniority of the implementation of EN 9100 and the prevailing type of motivation (external and/or internal) for the adherence; to that end the companies of the Spanish aerospace sector have been studied. Accordingly, the conducted multiple linear regression states the following:

The "seniority of the adherence to EN 9100 Standards" is a significant variable for each one of the internal positive effects (organizational, execution of operations, and human resources management processes), as well as for the external ones (financial-commercial, and customers management processes), considered for this research ($t > 2$). Ultimately, the longer the time elapsed since the implementation of the standards, the greater the benefits derived from the adherence. This result follows the line of the studies of Climent (2005), Martinez-Costa et al. (2008) and Lo et al. (2009), where the positive influence of this factor is derived from the standards learning curve, as well as the necessary time to internalize within companies a series of context factors (commitment of all members of the company, customers-orientation, continuous improvement, employees training, etc.), necessary for obtaining the benefits sought with the adherence to EN 9100, in particular those related to internal aspects.

The "prevailing type of motivation (external and/or internal) for the adherence to EN 9100 Standards" is a significant variable for each one of the internal positive effects (organizational, execution of operations, and human resources management processes) considered for this study, as well as for the external effects of customers management ($t > 2$), in a manner that such effects shall be greater as long as the prevailing motivations for the implementation of EN 9100 are the pursuit of internal positive effect. This result agrees with the conclusions of the studies of Rodríguez-Escobar et al. (2006), Sampaio et al. (2009) and Prajogo (2011), where it has been indicated that the search for internal improvements is the motivation that can truly cause a real improvement on the quality of the company's performance, and therefore a greater level of positive effects derived from the adherence to these standards.

Nevertheless, the "size of the company" does not represent a significant variable for each one of the internal positive effects (organizational, execution of operations, and human resources management processes), as well as for the external ones (financial-commercial, and customers management processes) considered for the study ($t < 2$), that is, the level of achievement of these effect does not suffer significant variations when taking into consideration the size of the companies. This result is in line with the studies of Terziovski et al. (2003), Briscoe et al. (2005) and Psomas et al. (2010), which is coherent with the specificities of the aerospace sector, where security and quality of products has always being a fundamental characteristic for all the companies, regardless of their size.

Conclusions

The results of the research carried out show that the potential benefits deriving from the implementation of EN 9100, may be more intense as the time since the adherence to that standard is longer. Also, if the predominant motivations for such implementation are seeking internal positive effects, the benefits generated will be higher. On the other hand, obtaining such positive effects it is not influenced by the size of the companies in the aerospace sector.

Based on the above, the directors of the companies in this sector, regardless of the size, should consider the implementation and/or the maintenance of the standard EN 9100, with the

economic costs that this decision involves, not only with the motivation to achieve the positive effect of meeting a requirement to compete and be included in global projects, but as a way to get real internal progress in the quality and the productivity of the work of their companies. These improvements are what ultimately will allow them to avoid heavy penalties and not to be excluded from contracts in the future, given the importance of both safety and quality of work, in this sector.

Also these companies must be aware that quality improvement is a long distance race, so once you finish the implementation of EN 9100, it is necessary to continue investing resources, for the progressive consolidation in the company of the basic principles of this standard (continuous improvement, involvement of the entire company in the quality process, focus on customers, etc.). This way is more likely to get a higher level of positive effects, as a consequence of the adherence to the standard.

Therefore, this study allows to begin to cover the virtual nonexistence of studies related to the results of implementing quality assurance standards in the aerospace sector, as well as the factors that shall be considered by the directors of the companies that belong to this sector, with the purpose of obtaining the benefits derived from the implementation EN 9100 Standards, thus compensating the initial costs and maintenance of the adherence. Notwithstanding the foregoing, by the nature of the study carried out, the results must be interpreted with caution and be considered as approaches, until they can be confirmed with new empirical studies.

With respect to the future lines of investigation, the first of them, given the increasingly global character of this sector, would have to aim to extend the geographic scope of this study to the American and Asian the continent, thus results may be compared, and it could be determined whether this scope is a determining factor for the implementation of the standards, and for the appearance of the positive effects they can entail. Furthermore, another line of future investigation could consist on identifying the reasons for which the prevailing type of motivation (external/internal) is a significant variable for all the internal and external positive effects taken into account in this study, except for financial-commercial external effects. Finally, we must note that in this research respondents were quality managers of the participating companies, so their answers could be biased by a personnel interest of showing positive results generated by the implementation of EN 9100. For this reason other future line of research, could be to extend the scope of the investigation to other groups involved, as others employees, customers and suppliers of the company.

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Abstract

DETERMINING FACTORS OF THE BENEFITS DERIVED FROM THE IMPLEMENTATION OF EN 9100 STANDARDS

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In Spain, as well as in the rest of the world, the aerospace sector is one of the most important. The EN 9100 Standards (AS 9100 in America and SIAC 9100 in Asia), are a quality management system for the aerospace industry derived from the ISO 9001 standard, that include the requirements derived from the ISO 9001 and 83 specific additional requirements for the aerospace industry. This research aims to begin covering the virtual lack of studies about the results arising from the implementation of quality assurance standards in this sector. In particular, the objective of the research involves analyzing whether the appearance of the various positive effects that may arise as a result of implementing EN 9100 Standards is influenced by the following factors: a) size of the company; b) implementation of EN 9100 seniority; c) prevailing type of motivation (external and/or internal) to adhere to such standards. To that end, the research was addressed to the Spanish aerospace sector, and the population subject to the investigation was defined by 317 companies. A questionnaire was sent by postal mail and e-mail to the directors of quality of all the selected companies, and a multiple linear regression model was applied to data from the 126 valid survey responses. The results show that EN 9100 adherence seniority, as well as the prevailing type of motivation (internal or external), are significant variables for the appearance of positive effects arising from the implementation of EN 9100, while the size of the company is non-significant for the emergence of such positive effects.

Key Words: *Quality management, quality assurance standards, EN 9100 Standards, ISO 9001 Standard, Spanish aerospace industry.*

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THE SPECIFICITY OF KNOWLEDGE MANAGEMENT IN THE FOOD INDUSTRY IN POLAND

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Introduction

Knowledge management is presently of specific interest to economists dealing with corporate governance, as over the last four decades they have noted a lack of influence of the traditional factors of competitive advantage due to the growing impact of global processes, diffusion of innovation and the widespread uptake of modern technologies in production processes. Information and knowledge, which are elementary resources for the blossoming of societies functioning on a modern basis, their economies, and most of all companies, are increasingly important for development. Since Poland's accession to the EU, managers of enterprises have attempted to position them on the market, using mostly traditional, price-cost sources of competitive advantage, which can certainly be beneficial in the initial period, but it will not help to build solid foundations of competitiveness in the future. Education and the development of integrated sets of diverse, unique skills, crucially affecting the value for customers (Pierscionek & Jurek-Stępień, 2006), are considered to be the most important for them. Improving competitiveness should take the inter-relationships and dependencies arising from the implementation of innovative processes, creating organisational aspects of management in the processes of modernization and revitalization of enterprises into account (Firlej, 2012). A knowledge-based economy, which increasingly requires research on the social sciences, for the most part to strengthen the activities of individual entrepreneurs, should be considered as the economy currently in force (Firlej & Rydz, 2012a).

1. Overview of Literature

Economics theorists point out that the global economy is in the age of information and knowledge, which occurred after the agrarian and industrial revolution. A. Toffler defines the current period as the era associated with the emergence of modern technologies using unlimited communication between individuals, which enabled the development of services and the move away from mass production. P. Drucker, who predicted the formation of a new type of society – "knowledge society", and with it the knowledge-based economy, also presented his position. Whatever you call the now emerging social macrostructures (the following terms are interchangeable: the network society, the knowledge society, digital society, post-industrial society), and the fundamental changes taking place concurrently in the economy, it must be noted - that knowledge is centrally located in the place of changes (Firlej & Żmija, 2014). Knowledge is designed to contribute to the development of the society, improve the competitiveness of the economy, and should also help to achieve better results for companies and an increase in their value. The market economy began to impose new rules of action on farmers and agri-food sector companies, as a result of which economic categories such as: competition, efficiency and profit (Firlej & Rydz, 2012b) have gained key importance. The chosen area of study in this paper is the enterprises of the food industry, in which the same mechanisms affect competition on the market, as in other sectors of the economy. Unfortunately, the agribusiness sector in Poland, in which the food industry sector plays a major role, is considered by OECD methodology standards as a low-tech sector. However, its functioning is dependent on innovativeness, the introduction of new product and process solutions and modern technologies. Possibilities in the area of obtaining information and access to the world's knowledge strengthens the productive

potential of the food industry in Poland, as well as is enables the ongoing modernization and restructuring that lead to change. The food industry is characterized by an exceptional, almost unique specificity, which is manifested in dependence on many macro- and microeconomic factors. The implementation of modern technological solutions based on knowledge transfer and diffusion of innovation has become a source of competitiveness of enterprises in the food industry, not only in Poland but also on the international arena. Knowledge plays a special and important role in the development of any industry and it is "*information, skills in some area acquired through learning, life experience, etc., as well as a resource for news of the domain and ability to become aware of something*" (Słownik, 1996). Managers of food industry companies often wonder how to manage knowledge and innovation in order to make optimal use of their capabilities, as well as create the right conditions for their development. The implementation of these plans can promote the proper use of knowledge that will enable the identification and implementation of necessary innovation, leading to stable development in the long term (Firlej, 2008). Creativity developing innovative processes raises the level of an enterprise's competitiveness. The inter-relationships and dependencies occurring in carrying out the processes of innovation, creating organisational aspects of management in the processes of modernization and revitalization of the operation of enterprises should be considered as necessary to raise the level of that competitiveness.

2. Factual Material, Purpose and Research Methodology

Since 2000, the food industry in Poland has experienced a period of prosperity, as with the accession to the European Union in 2004, the barriers for Polish products disappeared, allowing for the export of food and encouraged producers to increase production. As A. Kowalski notes, cold meats, cheeses, fruits and sweets have become products sought after due to their price, which was the result of lower production costs, and lower raw materials as well as increasing the quality level of the product, as the effect of modernizing the food products sector.

Currently, apart from agriculture, the food industry is the primary department agribusiness sector in our country and one of the fastest growing, and its growth rate is dependent on the rate of economic growth (Urban, 2010). In the years 2000-2013 the structure of the economy was changing, as the subsequent transformation of privatization occurred, a majority of the companies were modernized, which resulted in the activation of the pro-market behaviour, as well as the maintenance of the high position of the national economy on the international arena (Firlej, 2010).

The agri-food industry is divided into the following sectors (according to the European Classification of Economic Activities introduced in 1991):

1. The processing and preserving of meat and production of meat products;
2. The processing and preserving of fish and fish products;
3. The processing and preserving of fruit and vegetables;
4. The manufacture and animal oils and fats;
5. The manufacture of dairy products;
6. Manufacture of grain mill products, starches and starch products;
7. Manufacture of bakery and farinaceous products;
8. Manufacture of other food products;
9. Manufacture of beverages.

To illustrate the accepted research, the total number of organisational units of the food industry in Poland were taken, meaning a complete list of companies from the REGON [National Business Entity Register] as at 30 October 2012, which, according to the Polish Classification of Economic Activities (PKD 2007) are classified as Section C Manufacturing, Chapter 10 Manufacture of food products, Chapter 11 Manufacture of beverages and Chapter 12 Manufacture of tobacco products.

3. Subjects and Study Area and Their Characteristics

A representative sample of entities for the study population was based on a probabilistic (simple random) sampling techniques. Practical analytical tests were performed in the questionnaire survey. By using random sampling techniques its representativeness was provided, which authorized a reference to the conclusions drawn from the research to the entire study population.

Then, the minimum sample size was determined using the following formula (Szreder, 2004):

$$n = \frac{z^2_{\alpha/2} \cdot \hat{p} \cdot (1-\hat{p}) \cdot N}{z^2_{\alpha/2} \cdot \hat{p} \cdot (1-\hat{p}) + (N-1) \cdot d^2} \quad (1)$$

where:

$z_{\alpha/2}$ – the value of the random variable Z with standardized normal distribution, for which, $P(|Z| \leq z_{\alpha/2}) = 1 - \alpha$

$\hat{p}$ – sample fraction,

p – unknown, estimated fraction in the population,

N – population size,

d – statistical error.

In determining the minimum sample size the initial sampling was dropped and the value maximizing $\hat{p}\ X\ (1-\hat{p})$ was adopted for $\hat{p}$. This move ensures that regardless of the actual value of the estimated fraction of the population, the calculated sample size n will be sufficient, to ensure that estimation of $\hat{p}$ will not be different from p more than $\pm d$. In view of the fact that the maximum of the above result the interval [0,1] is 0.5, the formula (1) will have the form:

$$n = \frac{0.25 \cdot z^2_{\alpha/2} \cdot N}{0.25 \cdot z^2_{\alpha/2} + (N-1) \cdot d^2} \quad (2)$$

Also, the maximum error of statistical results was adopted in the range ± 5%, and the fact that it will be calculated at a confidence level of 0.9. With the help of equation (2) the sufficient minimum sample size was determined (33,662 business entities – 267 surveyed companies). The probabilistic sample selection technique allowed for the calculation of the 330 companies that were selected for the study, of which 267 sent questionnaire were completed correctly.

The aim of this study was to examine the issue of knowledge management, which turns out to be one of the reinforcing elements improving the competitiveness level of the organisational units of the food industry in Poland. Attempts were made to identify relations between expenditures incurred on knowledge management, and an increase in the competitiveness of these units. The authors of the study sought to verify the following research hypothesis: the transfer of knowledge and its proper consideration of the adaptation to the existing environmental conditions affect permanently increase the competitiveness of enterprises of the food industry in Poland. Based on the conducted research, we sought to determine the extent to which knowledge, information and their quality are useful in achieving success by food business operators, what are significant factors reinforcing success, how successful the market is strengthened by its technology and modern information technology, where is positioned intellectual capital and corporate actions when it comes to generating competitive food businesses, as well as management culture, organisational climate, and the value of social responsibility.

The initial task for the extensive research on the issues of knowledge management in the food industry enterprises in Poland were analyses of food companies listed on the Warsaw Stock Exchange WIG Food Sub-index carried out in 2007. Then the opportunities and strengths of knowledge management in the studied companies were verified, and research showed that:

- Knowledge, information, and their quality and timeliness are reinforcing factors for a business' success, which is expressed in increasing their competitiveness and better market position.
- The use of information technology in the current functioning of the company assists in the use qualifications and skills in a structured way, and to manage the capital held.
- The value of the company, high positioned intellectual capital and corporate actions (due to its well designed and functioning system of corporate governance can ensure the targeted prospects for the development of the capital market, which will translate into the development of the whole economy).
- In building a competitive firm, managing the organisational culture and climate, and high social responsibility role of the organisation should be deemed as essential (Firlej, 2008).

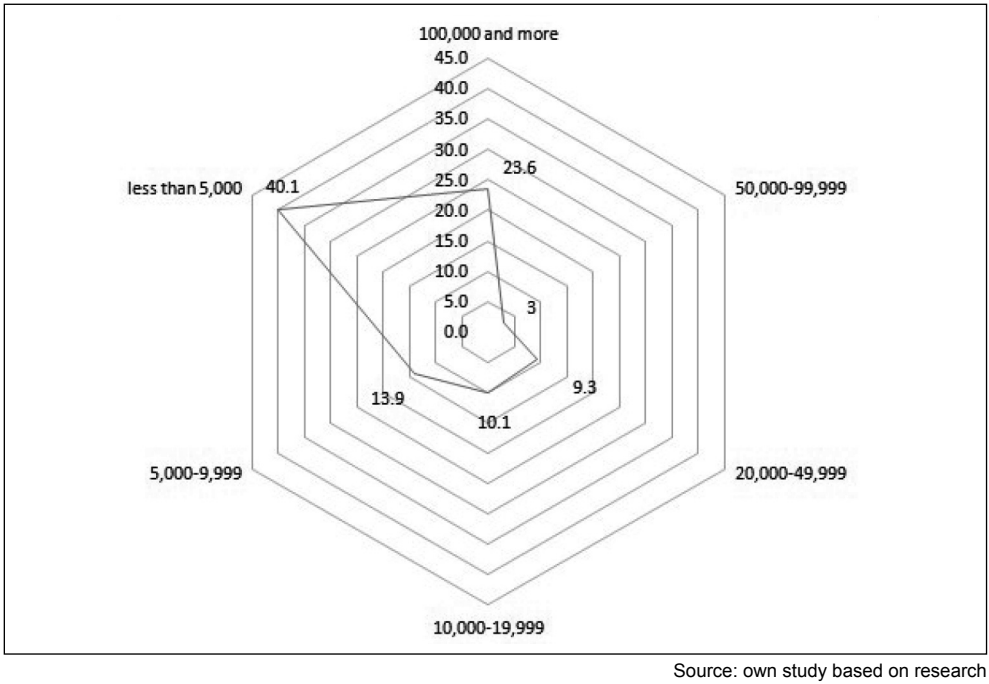
On the other hand, a study conducted in 2012 and 2013 year on a select group of 267 food businesses related to the verification of such issues as:

- Knowledge of the company, indicating its sources used.
- Determination of the suitability of activities that support the acquisition and transfer of knowledge which is or have been implemented in companies in the last 5 years.

- An indication of the systems and tools are used in companies, which are raising the effectiveness of management expertise.
- Clarification of whether the company has a strategy of development in the form of a document and whether issues related to knowledge management are determined in it.
- Verification if the company incurred investments in the last 5 years related to the implementation of knowledge management elements.
- Evaluation of the effects that enterprise knowledge management brings.
- Determination of the level of funding allocated by the company for knowledge management in the following years.
- Indication of whether knowledge management has helped to improve the economic performance of the enterprise.
- Examination whether knowledge management has contributed to the increase in the value of sales of the company.
- Examination whether knowledge management has contributed to the increase in turnover of the company.
- Examination whether knowledge management has contributed to the expansion of markets.

The study began by identifying the economic situation in which the food businesses found themselves in the period from 2007-2012. In the analysed period, the companies operating in the food industry skilfully used the possibility of obtaining funds from the EU structural funds. Businesses had a range of Operational Programmes at their disposal, the most important of which included: 5 national Operational Programmes – Infrastructure and Environment, Innovative Economy, Human Capital, Development of Eastern Poland, Technical Assistance; 16 Regional Operational Programmes; European Regional Cooperation programmes. The great advantage was the ability to take advantage of CIT exemptions (rate 19%), as well as the availability of favourable conditions in terms of doing business in the Special Economic Zones in separate regions of Poland. Businesses take advantage of income tax exemptions, which amount to about 30-50% of their investment, or

Fig. 1: Location of surveyed companies in % according to the size of the population



Source: own study based on research

the two-year employment costs - depending on which is higher. In addition, they also apply for the exemption from property tax, which is often used by the new entrepreneurs.

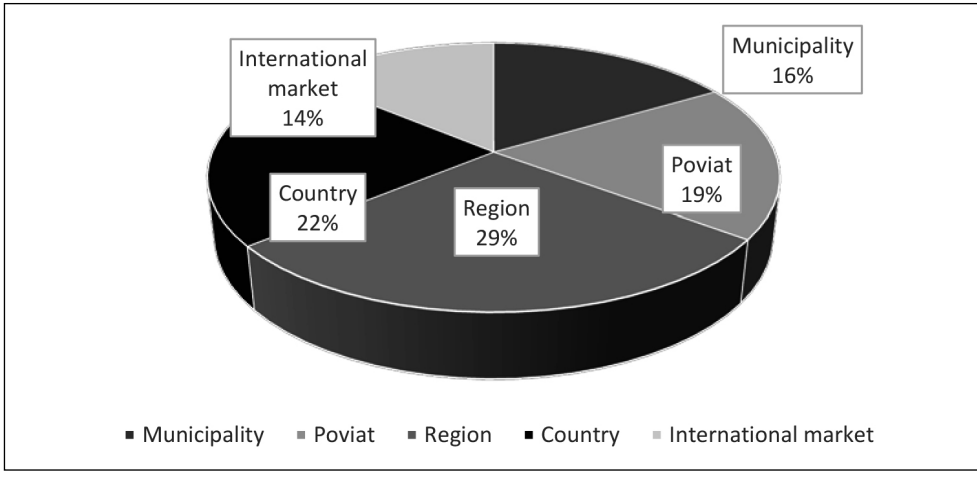
Presenting the surveyed companies it was calculated that most of them have operated on the market for more than 20 years (30.7%), 20.2% functioned in the ranges of 11-15 years and 16-20 years, 16.1% functioned in the range of 6-10 years and 12.7%in the range of 0-5 years. The study involved 65% of companies, in which had headquarters in the city and 35% in rural areas. Interesting results were obtained by asking about the size of the place in which the company operates, since most of them were located in the smallest towns with a population of less than 5 thousand residents (40.1%) and in cities with a population of 100,000 and above (23.6%). This represented a total of 63.7%, which is almost 2/3 of the total population, and the remaining 1/3 (26.3%) was comprised of companies from towns with a population between 5 thousand to 99,000 residents (Fig. 1). The present study also determined the activity or hypothetical market for businesses. It should be noted that respondents themselves determined the extent of their company's activities, which was to obtain information on the existing market, as well as comment on the possibility of obtaining new markets. The results obtained showed that the largest number of companies situate their activities in the region (28.8%), followed by the country (22.1%), the poviats (18.7%) and municipalities (16.5%). Unfortunately, only 13.9% of respondents indicated that their company's activities are on international markets (Fig. 2).

The ownership structure of the surveyed enterprises (Fig. 4), in which the private domestic enterprises occupied the dominant position (87.6%) and foreign private property (7.5%) was very interesting.

Property belonging to the cities and villages (3.4%), the State Treasury (0.7%) and other (0.7%) can be treated as an insignificant part of market. This type of business structure formation indicates very strong privatization of food industry enterprises, which in the new reality of the EU have chosen a clear path directed to submit to the generally applicable mechanisms of the free market. The period of our country's membership in the EU structures favoured the privatization particularly of small and medium-sized enterprises in the agri-food sector, which provided them with the normal functioning on the market and the emergence of new opportunities in capital inflows, and above all the use of the financial resources of the European Union structural funds.

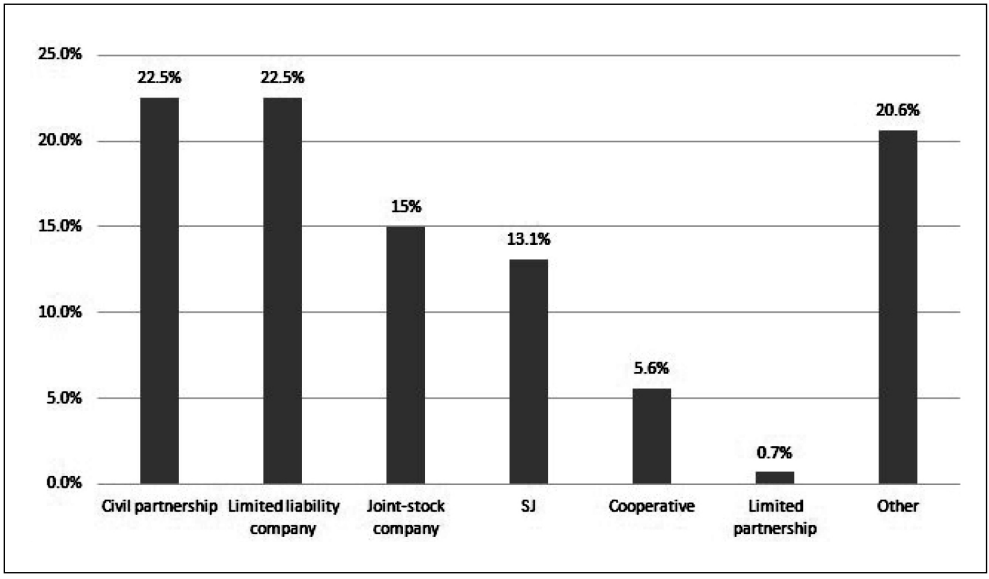
In the studied period the legal form of companies also changed. The changes were more favourable for them and more adequate to

Fig. 2: Declared market area



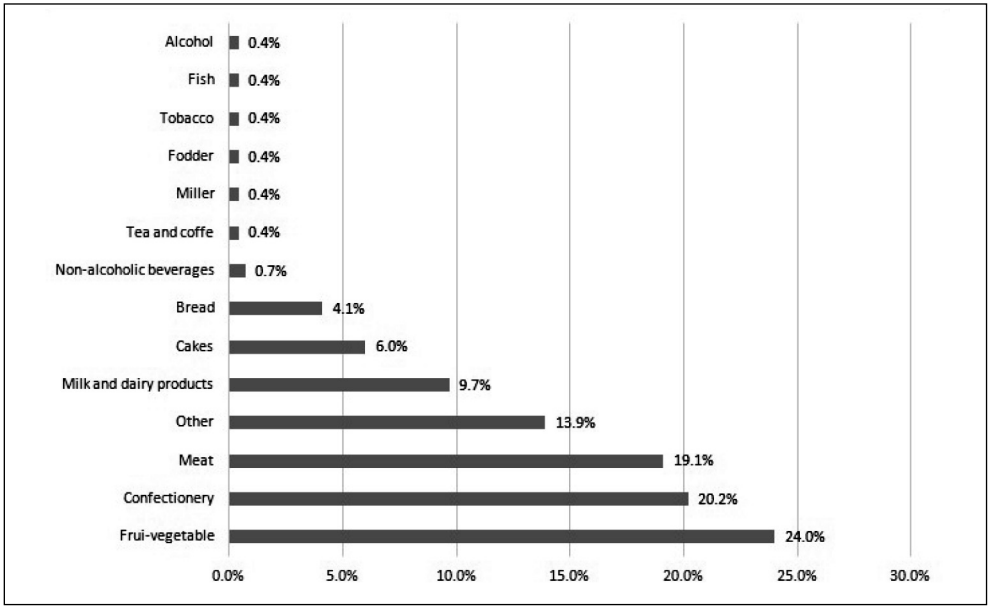
Source: own study based on research

Fig. 3: Declared ownership structure



Source: own study based on research

Fig. 4: Branches of studied enterprises



Source: own study based on research

the current market conditions. Civil partnerships (22.5%) and limited liability companies (22.5%), and other legal forms, which were up to 20.6%, were deemed as the most popular.

A joint stock company (15%) and general partnership (13.1%) as the average share in the types of legal forms. Cooperatives, which amount to 5.6% and limited partnerships 0.7% (Fig. 3) made up the smallest amounts. The following industries participated in this study: fruit and vegetables (24%), confectionery (20.2%), meat (19.1%), dairy (9.7%), pastry products (6%), bakery (4.1%), non-alcoholic beverages (0.7%), coffee and tea processing (0.4%), miller (0.4%), fodder (0.4%), tobacco (0.4%), fish (0.4%), alcohol (0.4%) and other (13.9%). The other group included companies that were not able to accurately determine their leading sector, as their activities related to the most two or more branches (Fig. 4).

Taking into account the criterion of the surveyed companies, it is clear that most of them are considered as medium (88%) and large (12%). Medium-sized enterprises are those that employ on average less than 250 full-time employees and have an annual turnover not exceeding EUR 50 million or an annual balance sheet total not exceeding EUR 43 million. Large enterprises are those that employ on average more than 250 full-time employees and an annual turnover exceeding EUR 50 million or an annual balance sheet total exceeding EUR 43 million.

4. The Results of the Research in the Area of Knowledge Management in the Polish Food Industry

In order to investigate the sources of knowledge, which the company can benefit from, as well as use in the current activities, they were initially selected in the external environment, where it was noted among new employees and acquired companies, strategic investors, as well as from benchmarking (Fig. 5). The statements of the respondents confirmed the possibility of obtaining knowledge from new employees. Based on our results, it was found that in food industry enterprises, sources of knowledge derived from new employees can be very useful (16.20%) and useful (49.80%). This shows the great interest of companies recruiting personnel, introducing new types of knowledge into the companies, which in the future may translate into generated profits. Nevertheless, 1/3 of the respondents considered these sources not very useful for the operation of companies (27.30%) and 6.70% had no opinion on this subject. Sources of knowledge derived from the acquired companies were evaluated quite differently, as little more than a quarter of the respondents assessed them positively. They were assessed as very useful by 7.8% and useful by 19.9%, but of little use by 54.3%.

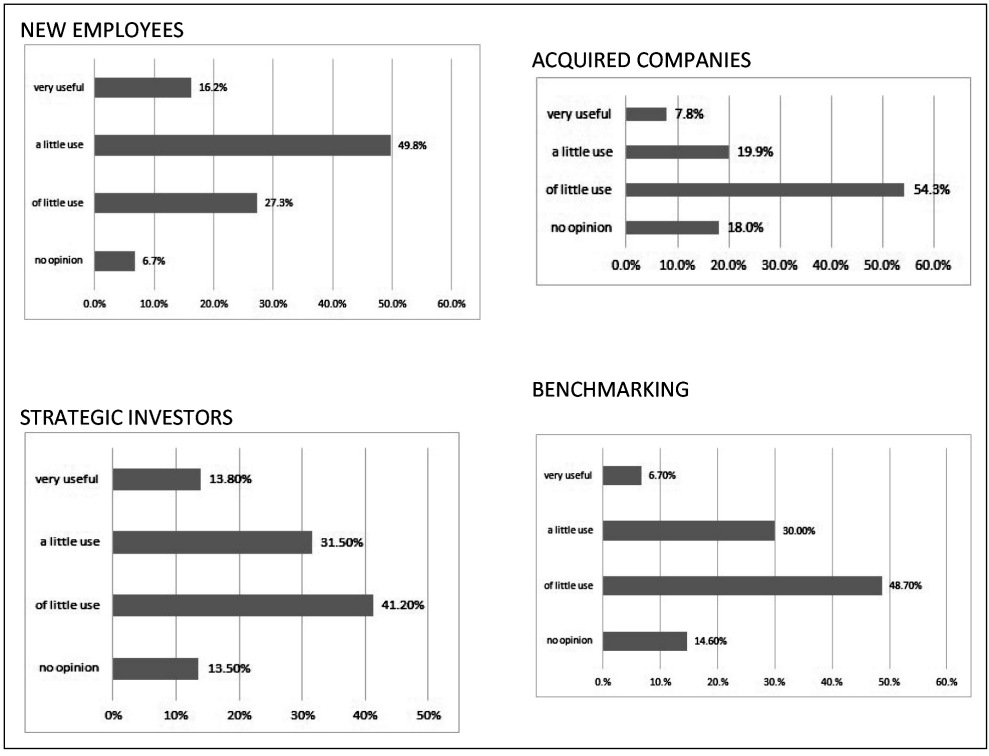
A relatively large group, as many as 18% of the respondents had no opinion on the subject. This behaviour is quite controversial in food businesses, as an innovative approach to mergers and acquisitions recommends even taking over companies along with their intellectual resources, which should be used to achieve the company's goals. The sources of knowledge derived from strategic investors have been assessed as very useful (13.8%) and useful (31.5%), which accounted for less than half of the respondents. As many as 54.7% of the respondents felt these sources are of little use (41.2%) and 13.5% of them had no opinion on the matter.

One may question whether such a look at the sources of knowledge derived from the strategic investor is the preferred solution of the food business. The strategic investor, in addition to the acquisition of a significant stake in the company, should have significant influence on its management, which should significantly be supported by the possessed intellectual capital, know-how, skills and experience gained.

The strategic investor should even take care of the transfer of technical skills, conceptual, political and interpersonal skills to the company, on which they spend part of their resources. In practice, in the functioning of the food businesses in most cases, participation in the management of the company is limited to the transfer of a certain amount of financial resources and the withdrawal of the corresponding benefits. In taking benchmarks into consideration, food businesses see many opportunities in the development of this branch. Its part in the agri-food sector is a measurable definition of raw material purchase costs or savings in the production phase. Among the respondents, 6.7% of respondents considered its use to be "very useful", and 30% "useful". As many as 48.7% consider its use as being of little use, and 14.6% have had no opinion on this subject.

In further order, an attempt was made to assess the sources of used knowledge

Fig. 5: **Sources of knowledge derived from new employees of the acquired companies, strategic investors and benchmarking**



Source: own study based on research

stemming from the cooperation with suppliers and customers (Fig. 6). The results of this study showed that the food business entrepreneurs highly appreciate any cooperation with them in this regard.

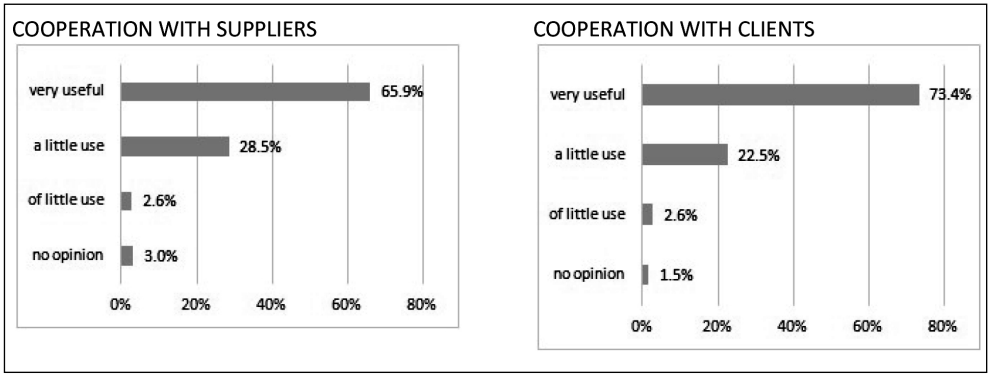
In the case of co-operation with suppliers, it was rated as very useful by 65.9% of the respondents, and in the case of cooperation with customers – 73.4%, what clearly demonstrated that this is the highest form of cooperation among evaluated knowledge sources used. These sources were found useful by 28.5% of the respondents in the case of cooperation with suppliers, and 22.5% for cooperation with customers. Minute numbers referred to this form of cooperation as "not useful" (2.6% and 2.6% respectively), and some did not have an opinion (3% and 1.5%).

Poorer results were obtained when testing companies regarding their collaboration with universities or research centres. Unfortunately this cooperation is not very popular among respondents, as only 2.5% considered it to be very useful for the current operation and development of enterprises and 15.4% as helpful.

As many as 65.2% considered this cooperation to be of little use, and 16.9% did not have their own opinion. Businesses, however, declared their willingness to cooperate in the implementation of projects, especially co-financed by the European Union, with local governments, or the creation of university companies in order to commercialize the results of research and development (Fig. 7).

Similar results were obtained in evaluating cooperation by the enterprises with consulting companies, where only 4.4% of the respondents considered this to be very useful, and 25.5% as helpful. More than half of the respondents, as

Fig. 6: Sources of knowledge derived from suppliers, customers

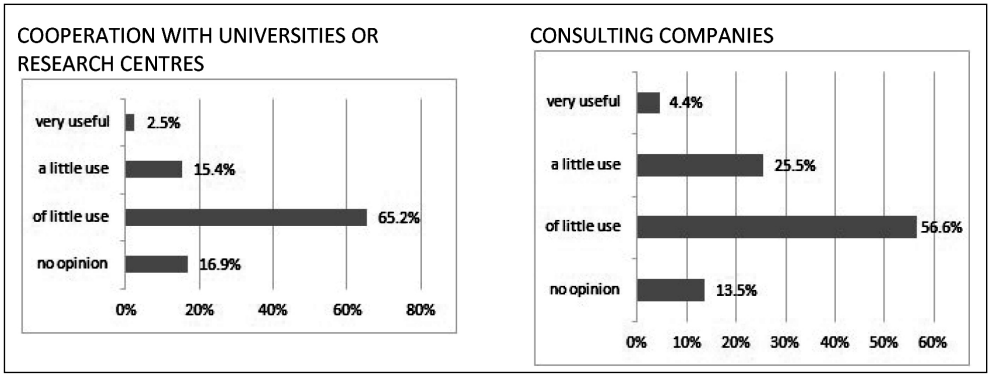


Source: own study based on research

many as 56.6% considered the cooperation to be of little use and 13.5% had no opinion on this subject. From the statements and opinions of respondents on this topic, it can be concluded that this kind of cooperation does not fully meet the needs of producers who frequently find their market insights to be sufficient for their needs. Respondents assessed the need for conducting market research in a different manner, as respondents in Poland generally view them as strengthening their information needs and esteem impacting the direction of the assortment production. Abroad, particularly in the United States, food and human nutrition has been the subject of many foresight studies, in which experts continually review trends in international trade in food and create development scenarios that are used in the establishing the company's production plans of the agri-food sector and companies engaged in the wholesale of food. Among the respondents, 33.4% rated the study as very useful, and 36.3% as useful, which represents almost 70% of respondents. The remaining respondents recognized market research as of little use for 24.3%, and 6% had no opinion on this subject (Fig. 8).

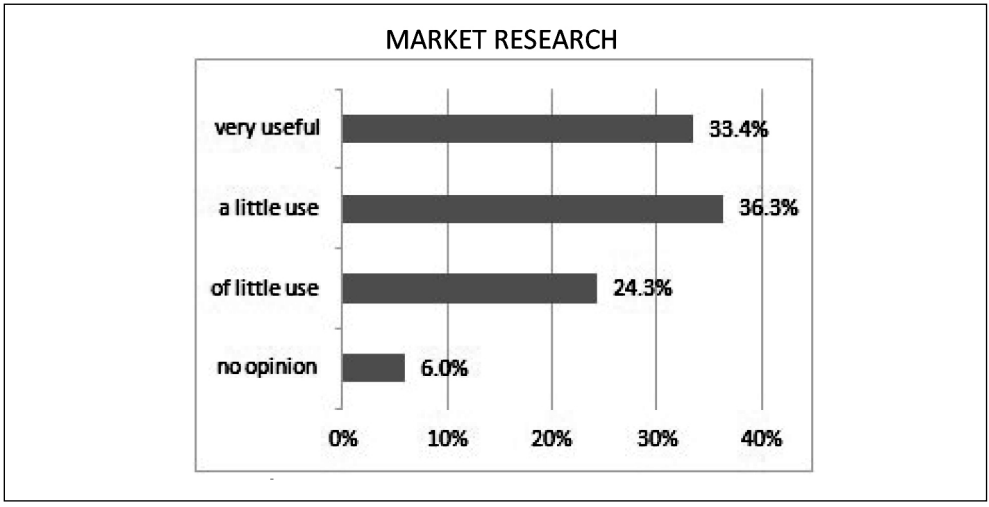
Respondents were also asked to express their opinion on their own research and development department. Many of them

Fig. 7: Sources of knowledge derived from cooperation with universities or research institutes and consulting companies



Source: own study based on research

Fig. 8: **Sources of knowledge derived from cooperation with universities or research centres, consulting firms and market research**

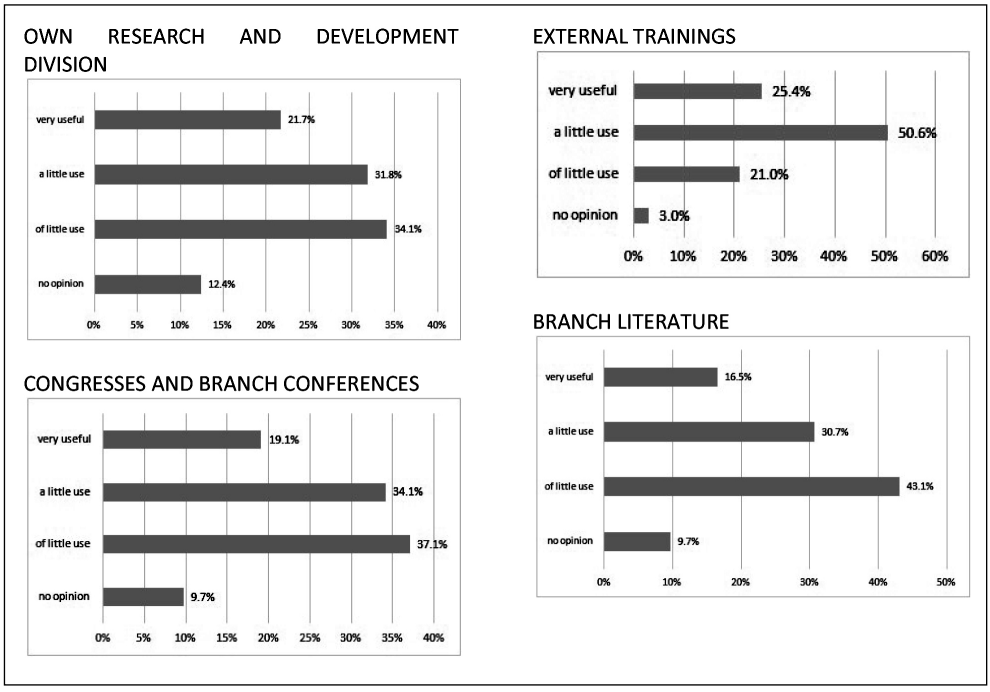


Source: own study based on research

commented in a very positive manner on ensuring their companies a competitive position in the market with the professionalization of planning and management, as well as control and monitoring of the current research and development policy.

The R&D departments create economically viable business plans or medium- and long-term development programs. Respondents evaluated their own research programs to support the improvement and modification of the existing range of food and developing all kinds of new technological, organisational aspects and production particularly well. More than half of them spoke favourably about the subject considering its function "very useful" (21.7%) and "useful" (31.8%). It was evaluated as being of little use by 34.1%, and 12.4% had no opinion on this subject. External trainings were also very highly rated. More than three-quarters considered them to be "very useful" (25.4%) and "useful" 50.6%). It was rated as being of little help by 21%, and 3% had no opinion on this subject. Employees of food companies consider external training to be supporting and expanding the existing skills and competencies, enabling the acquisition of new knowledge and sharing experiences with others in the food industry, which in the future will result in maximum orientation on the subject. They also made a charge of the lack of possibilities of immediate verifications of elements of knowledge gained during the trainings as well as their usability as specific job positions. Opinions were divided on congresses and industry meetings, because only 19.1% respondents recognized them as "very useful", and "useful" in 34.1% of the cases, which accounted for more than half of the respondents. Unfortunately, very few found them useful – 37.1%, and 9.7% had no opinion on this subject. Respondents frequently pointed to the uselessness of repeated congress meeting topics and their cost. Industry meetings, which helped to understand the activities of competitive enterprises, and often establish cooperation, were assessed much higher. The usefulness of professional literature in the surveyed companies was evaluated similarly, and was rated as "very useful" by 16.5%, and helpful in 30.7% of the cases, which is less than half of the surveyed companies. Unfortunately, the majority of the respondents did not find it useful enough – 43.1%, and 9.7% had no opinion on this subject. Respondents indicated that the professional literature helps in keeping up with scientific and technological innovations, which, despite the wide availability, cannot be accessed through the Internet, and is often regarded as a less reliable source of information by serious enterprise (Fig. 9).

Fig. 9: **Sources of knowledge derived from their own research and development department, external training, conferences and business meetings and professional literature**



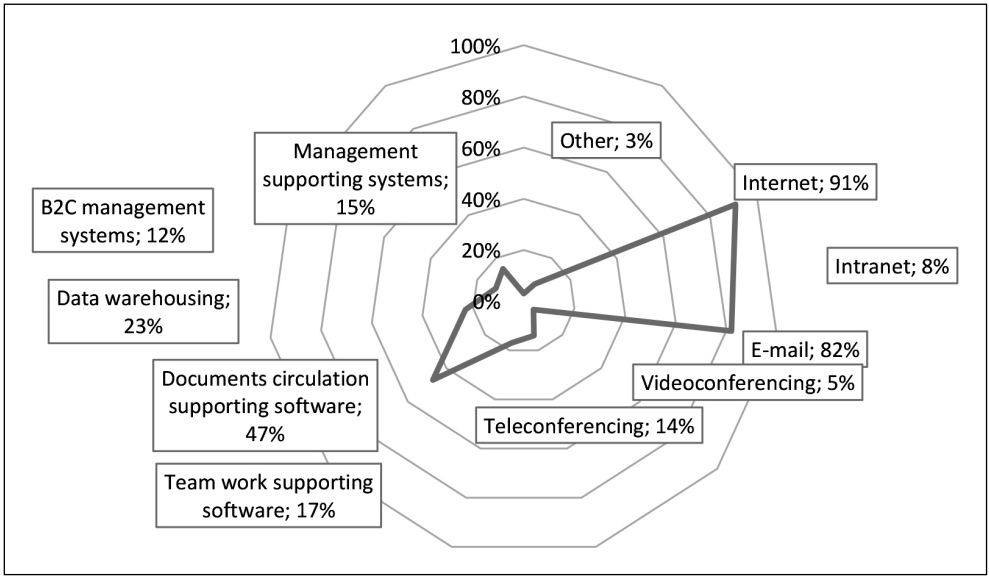
Source: own study based on research

In the present study, respondents were also asked to assess the use of systems and tools for storing information and internal communication within companies (Fig. 10). With a wide range, which was presented to respondents to choose from, they divided it into the most useful (answers in the range of 10-39%), existing for the protection of the functioning of the enterprise (answers in the range 0-9%) and support (answers in the range of 40-100%). The Internet (91%), e-mail (82%) and workflow systems (47%), with the highest scores of the proposed communication tools were among the most useful groups. The group of tools to protect the current functioning of the company included: data warehousing (23%), software for group work (17%), management support systems (15%), teleconferencing (14%) and systems, customer relationship management (12%). Respondents considered Intranet (8%), video conferencing (5%) and other (3%) as assisting tools.

In order to determine the average level of funding, we requested they be specified in each test year by the companies that spent them. The analysis found that throughout the period considered, with the exception of 2010, their amount increased which may indicate a growing interest in them and understanding the benefits of this type of activity (Fig. 11).

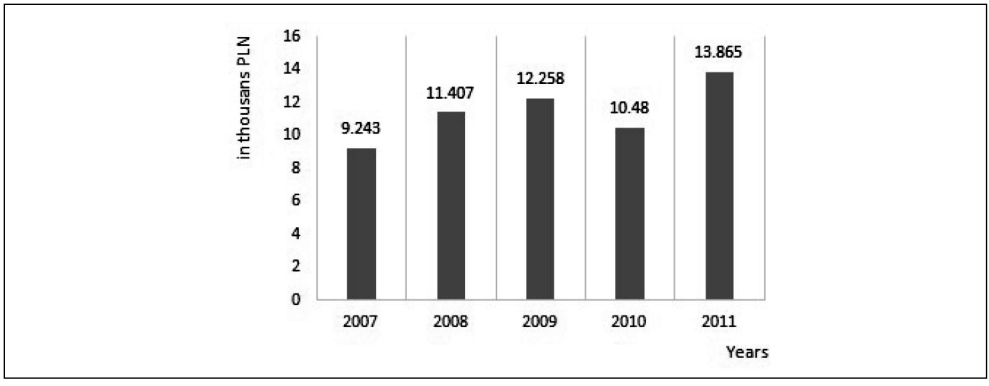
On the other hand, Fig. 12 presents the percentage of respondents declaring that the food industry will benefit from funding for knowledge management. It can generally be said that the company applying these investments generally achieved better economic results in relation to the earlier ones (64.4%), increased turnover (by 63.3%), the value of sales (59.2%) and expanded markets (49.8%). In addition, respondents pointed to many other benefits derived from the application of knowledge management components, which was reflected by an increase in the total economic value of the company and their position on the market.

Fig. 10: **Use of systems and tools for storing information and internal communication by food business operators**



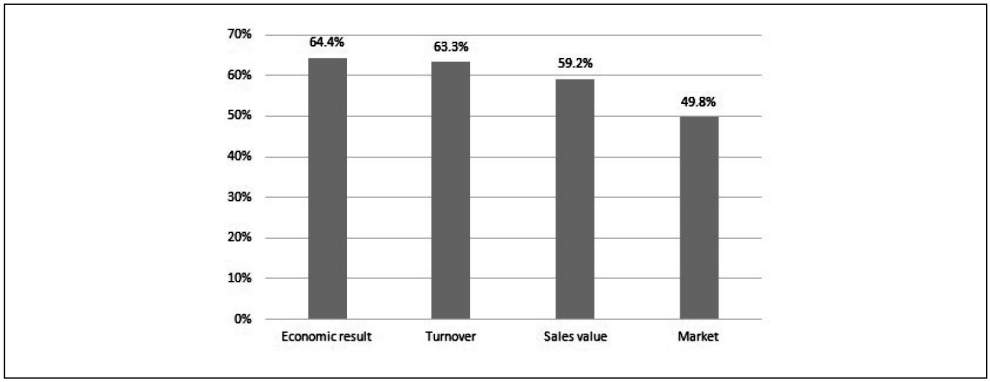
Source: own study based on research

Fig. 11: **The average level of funding allocated by the food business for knowledge management**



Source: own study based on research

Fig. 12: **Percentage of respondents who declared the food industry will benefit from funding for knowledge management**



Source: own study based on research

Conclusions

The analysis of the issue of knowledge management in the food industry in Poland was conducted on the basis on the results of studies, which were to verify the thesis as to whether the food industry could be considered as sector implementing knowledge management components in 2007-2013. The evolution of the food industry in Poland was presented, its factual material as agribusiness made with the conducted economic analysis, organisational and financial analysis (research described in a separate paper) have shown that entrepreneurs running businesses in the food industry are actively engaged in exploring the full instrumentation including elements of knowledge management, tools and all kinds of sources of cooperation. The results of this study demonstrated that food business operators use various sources of knowledge. The collaboration that takes place between customers and suppliers, as well as external training was deemed as most significant. The lack of interest in the surveyed enterprises in using the knowledge of the acquired business is interesting, and very minimal cooperation with universities or research centres is surprising. This follows from the fact that companies frequently acquire knowledge in trade relations, but also from specialist companies equipped with a suitable base, which also were considered as the most useful. The lack of cooperation with universities and research centres can attest to the impossibility of its use in practical applications in enterprises, or a lack of understanding of the benefits of this kind of cooperation. The study and the results led to the following conclusions:

1. Unfortunately, only less than 2/3 of the surveyed enterprises of the food industry carried out activities related to the implementation of elements of knowledge management in the company in the years 2007-2012. This underlines the small interest in this type of action resulting from the lack of profitability or having to incur high costs in relation to the obtained results. The lack of a conscious approach to strategic planning and treating it as a long-term and formal process aimed at achieving these goals could also have been an obstacle. Companies that implement elements of knowledge management, most often pursue training, showed knowledge management as a system of motivation, as well as make use of all kinds of forms of guidance.
2. Internal training proved to be one of the most supportive measures of implemented acquisition and knowledge transfer. Mentoring also relies on the care of experienced staff on junior staff as well as a staff rotation system was used for the positions. Businesses were most interested in the use of practical knowledge, but also the Internet, electronic mail (e-mail), document circulation systems and data warehouses.

3. The results of the study indicated that in 2007, more than half of the surveyed enterprises of the food industry spent funds for knowledge management, increasing them annually. In 2011, the percentage of companies disbursing them was less than 2/3. The disbursement of funds contributed to the improvement of the economic performance of enterprises, increase in the turnover of the company, as well as the expansion of markets.
4. In the surveyed enterprises the average level of financial resources incurred for knowledge management in the years 2007-2011 increased annually (except for 2010). These measures increased from PLN 9,243.37 in 2007 to PLN 13,865.01 in 2011. There has also been a growing proportion of the surveyed companies, which declared the increase in value as well as the size of the selected characteristics of their business, which has risen as a result of incurring financial outlays for knowledge management.

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Abstract

THE SPECIFICITY OF KNOWLEDGE MANAGEMENT IN THE FOOD INDUSTRY IN POLAND

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The article presents an analysis of the problems of knowledge management in the food industry in Poland, which was carried out on the basis of the results of the author's own study. The study was conducted in the years 2007-2013. The research shows that businesses established in the food industry are actively involved in the use of knowledge management instruments including: elements, tools and all kinds of sources of cooperation. The company's production processes use various sources of knowledge. It should be noted that outstanding cooperation takes place between customers and suppliers, as well as in external training. A weak interest of the surveyed enterprises in using the knowledge of the acquired business, and very insignificant cooperation with universities or research centres was discovered. Companies frequently acquire knowledge in trade relations, but also from specialist companies with an appropriate base which was also recognized as the most useful sources. The lack of cooperation with universities and research centres can attest to the impossibility of its use in practical applications in enterprises, or a lack of understanding of the benefits of this kind of cooperation. It is stated that, in the years 2007-2012, less than 2/3 of the surveyed enterprises of the food industry carried out activities related to the implementation of elements of knowledge management in the enterprise; internal training proved to be the most supportive in implementing acquisition and transfer of knowledge; more than half of the surveyed enterprises of the food industry spend funds on knowledge management, increasing them annually; surveyed companies noted the annual increase in the average level of financial resources incurred for the management of knowledge in the years 2007-2011(except 2010).

Key Words: *Knowledge management, food industry, intellectual capital.*

JEL Classification: *D2, L2, L6.*

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GENDER EQUALITY AND CORPORATE GOVERNANCE IN SLOVAKIA

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Introduction

In the European environment, a major initiative for responsible business practice was introduced in the Lisbon summit in March 2000, which EU leaders agreed to make the European Union the most competitive and dynamic knowledge-based economy in the world, capable of sustained economic growth with more jobs and grater social cohesion by 2010 (Musová & Poliačiková, 2008). Consequently, the European Commission issued several documents on social responsibility of businesses in order to help integrate the concept of corporate social responsibility (CSR) into everyday business life. In the year 2001 the European Commission in its Green Paper published the first official definition of CSR as the "voluntary integration of social and environmental concerns of company's commercial operations and its relationship with its stakeholders" (Horehájová & Marasová, 2008; Sopková & Raškovská, 2012; Martinčík & Polívka, 2012).

The global economic and financial crisis has considerably slowed down the implementation of the objectives of the Green Paper and significantly deepened mistrust from customers, shareholders, investors, employees and the public. The crisis has exposed fundamental issues and unsustainable trends in Europe, which can't be ignored. The European Commission created a strategy for Europe, in 2020, to emerge from the crisis and prepare the EU economy for the next period. This strategy has identified three key drivers for growth, which are to be implemented through concrete actions at both the EU and national level (European Commission [EC], 2010):

- smart growth (through more effective investments in education, research and innovation),
- sustainable growth (support for a competitive low-carbon economy with effective use of resources),
- and inclusive growth (support for the economy with high employment, social and territorial cohesion, and poverty reduction).

The present century is one where the nature of business is changing. Markets, customers, competitors and technology are all in flux, thus if companies want to be successful, they must also change their practices (Adamska & Minárová, 2014). Responsibility in business again comes to the fore and in the current post-crisis period is one of the factors that can significantly contribute to the achievement of stability and sustainable growth on a global level. Business should build its position on the principles of transparency and an integrated approach to sustainable products and services, and the active cooperation of all stakeholders to contribute to the overall well-being of society as well as the entire planet.

This paper will firstly focus on the economic area of corporate social responsibility. In this economic area, corporate governance plays an important role, particularly in relation to shareholders and employees. The next part is related to gender equality and presents a systematic procedure to integrate the needs and priorities of women and men in all policies and measures promoting equality while taking into account their mutual differences and interests. From this theoretical background, we present our research results, which test whether there is a relation between the level of corporate governance and the representation of women on company boards.

1. Corporate Governance as a Tool of Corporate Social Responsibility

Corporate Social Responsibility was described by Carroll (1999) as follows: the social responsibility of business encompassing the economic, legal, ethical and discretionary expectations that society has of organizations at

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a given point in time. Liebman (in Mallin (2013)) noted, at present, the notion of Corporate Social Responsibility has narrowed down to a mere issue of corporate governance. In the context of the current issues, corporate governance is one of the key elements in building well-governed companies into the single European market. Well-functioning and sustainable companies can contribute to sustainable growth, which is one of the three priorities set out in the Europe 2020 Strategy.

The development of corporate governance has been articulated by theories from a number of disciplines, including finance, economics, accounting, law, management, and organizational behavior. The main theory is the agency theory that identifies the relationship between one party (the principal) who delegates work to another party (the agent). In context of a corporation, the owners are the principal and the directors are the agents. Sir Adrian Cadbury (1992) first defined the concept of corporate governance as "the system by which companies are directed and controlled". Corporate governance ensures a balance between economic, social, individual and municipal goals of the company with respect to all stakeholders. A definition from the OECD clearly captures the essence of corporate governance as "the system by which business corporations are directed and controlled. The corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporation, such as the board, managers, shareholders and other stakeholders and spells out the rules and procedures for making decisions in corporate affairs" (OECD, 2004). The OECD Principles of Corporate Governance are divided into the following areas: ensuring the basic for effective corporate governance framework, the rights of shareholders and key ownership functions, the equitable treatment of shareholders, the role of stakeholders in corporate governance, disclosure and transparency, and the responsibilities of the board. OECD Principles became the basis for the creation of national codes of corporate governance in most countries of the world, including Slovakia. The OECD has started a review process of principles and will issue new ones in 2015, which confirms the growing importance of corporate governance. Subsequently Central European Corporate Governance Association – CECGA will also revise the Slovak Code.

2. Gender Diversity in the Context of Corporate Governance

One of the principles of corporate governance, the responsibilities of the board, is closely related to the issue of gender equality. According to this principle the board should ensure the strategic management of the company, the effective monitoring of management and should act responsibly towards both society and shareholders. These activities may be determined by many factors and one of them is gender equality.

Discussions on gender equality are conducted within the issues of diversity management. The basis of the diversity management concept can be seen in the natural societal mix with people of different age, gender, race, ethnicity, mental and physical abilities, sexual orientation and other characteristics (Eger & Indruchová, 2014). Hubbard (2004) defines diversity management as "a process of planning for, organizing, directing and supporting these collective mixtures in a way that adds measurable difference to organizational performance".

In the Slovak environment, women are seen as part of the company, but unfortunately, with fewer opportunities for self-realization in comparison with men, a reflection found in gender statistics. Institutions that should take care of most balanced gender representation are also seen as less inclined equalization of both sexes. Thus, there is a situation where the company maintains gender inequality, first by the public authorities, but also the company itself (Bútorová, 2009).

Gender equality is a fundamental right guaranteed by Article 23 of the Charter of Fundamental Rights of the European Union. Similarly, Article 3 of the Treaty on the Functioning of the European Union proclaims that, the European Union focuses on the elimination of inequalities and supports a balance between men and women in all its activities. The European Commission reaffirmed its commitment to gender equality by the creation of the Women's Charter and the Strategy of equality between women and men (2010-2015). Achieving gender equality is also important for the EU's growth, employment and social cohesion. The already noted Strategy 2020 contains the main objective of increasing the employment rate of women and men (20-64 years old) to 75% in 2020. Women's

employment should increase both quantitatively and qualitatively. Female employment rate in the EU-28 was 63.5% for 2014.

Given the greater participation of women in the labor market and education, we would expect a corresponding improvement in terms of the effective use of women's talents. Statistics of the European Commission show that the proportion of women on the boards of the largest listed companies in the EU was 17.8% in October 2013. Moreover, there are very few women in the most influential positions: just 4.8% of the chairpersons of these companies and only 2.8% of CEOs are women (EC, 2014a). There are also significant differences in the representation of women on the boards of large publicly-listed companies in the EU. For example, in Finland, boards were 30% female, but in Malta the figure was just over 2%. The best five performing countries were: Finland (30%), France (30%), Latvia (29%), Sweden (26%) and the Netherlands (25%). A positive point was that Slovakia was ranked in the 6th place just behind the Netherlands with 24%. But there are still Member States where men still hold more than 90% of board positions (Malta, Cyprus, Estonia, Greece, Romania and Portugal). Nevertheless, there has been significant progress over the last decade thanks to the intense debate and regulatory pressure (EC, 2014b).

Effective use of human capital is one of the ways to improve European competitiveness. The European Commission argues that a more balanced representation of women and men in economic decision-making positions can contribute to a more productive and innovative working environment and improved company performance. The European Commission claims that the progress in gender equality can have the following positive impacts (EC, 2012):

- improved company performance: companies with a higher share of women at top levels can deliver strong organizational and financial performance,
- better quality of decision-making: a more diverse board of directors can contribute to better performance because decisions are based on evaluating more alternatives,
- improved corporate governance and ethics: the quality of corporate governance and ethical behavior can be higher in companies with a high share of women on boards,
- better use of the talent pool: 60% of university graduates in Europe are women. Systematically including suitable candidates of both sexes ensures that new board members are selected from the very best candidates, both male and female.

For a thorough understanding of the issue, we have reviewed related studies to see if they confirm that gender diversity has a positive effect on a firm's value, and the greater gender diversity affects the larger economic gains. These findings were confirmed by the Cai et al. (2006) on a sample of 114 companies listed on the London Stock Exchange. Adams and Ferreira (2009) found evidence for an argument about corporate board diversity, namely that women pay greater attention to monitoring firms; women board members have better attendance records; their presence improves the attendance of men; and women were more involved in monitoring committees in U.S. firms during the period 1996-2003. The authors also examined whether gender diversity impacts corporate performance (Tobin's g and ROA). They found that diversity has a positive impact on performance in firms that, otherwise, have weak governance, as measured by their abilities to resist takeovers. But enforcing gender quotas in the boards could ultimately decrease shareholder value in firms with strong governance. Their explanation is that greater gender diversity could lead to over monitoring in those firms. Other authors, Srinidhi, Gul and Tsui (2011) confirmed the hypothesis that the U.S. corporations with gender diverse boards exhibit higher-quality earning. Their sample period was 2001-2007. They also claimed that firms with female directors, specifically in the audit committee, exhibit better reporting discipline by managers.

But other studies did not confirm the positive impact of women on corporate boards. For example Álvarez et al. (2010), show that companies with higher levels of gender diversity do not obviously outperform companies with lower levels of diversity. The proportion of female directors on the board is associated with a positive and significant impact on Tobin's Q, but no significant effects on the other variables were detected (ROA, ROE, ROS, ROA – net). The presence of female directors on boards has a mainly non-significant effect on corporate performance. The sample was with Spanish

companies that were listed on the Madrid Stock Exchange over the period 2004-2006.

In another study, Elbadry (2010) examined the hypothesis of a positive impact of women on the board of directors to mitigate information asymmetry in non-financial UK companies listed in the London Stock Exchange from 2003 to 2006. The study showed that the existence of women on the board had no effect on the degree of asymmetric information. Moreover, only 102 companies out of 392 companies in the sample had women on their boards. Furthermore the study showed that the higher the quality of corporate governance, the lower the degree of asymmetric information, and vice versa. So given this relationship between the corporate governance and information asymmetry, the implication was that there was no relationship between representation of women on the board and the quality of corporate governance.

Some studies have researched this issue in terms of psychology. On the positive side, gender and racial diversity may operate as occupational diversity does in small groups, enabling them to come to better decisions and to come to them more quickly. On the negative side, gender and racial diversity have been found to increase conflict in small groups, and this may inhibit their decision-making capacity (Dobbin & Jung, 2011).

The results of these studies indicate that women on the boards may affect the level of corporate performance, firm value, monitoring committee activities, decision making, risk taking and information asymmetry. In the next section, we will examine whether there is a relationship between the gender equality and the level of corporate governance in Slovakia.

3. Main Characteristics of the Research and the Results of Correlation Analysis

To the best of our knowledge, this is the first paper to investigate the link between corporate governance and gender equality in companies on the Bratislava Stock Exchange. Studies in this area are not available even in neighboring countries such as Czech Republic, Hungary and Poland. Our main motivation was the highly topical issue of gender equality and corporate governance in the European Union.

In the first part of our analysis we conducted an extensive survey of disclosure in corporate governance by companies whose securities are listed on the Bratislava Stock Exchange. The second part was to create our corporate governance index for each monitored company. In the final stage, we identified the existence of dependence between the representation of women on boards and the level of corporate governance based on correlation analysis.

The subject of our research was all companies whose securities are listed on the Bratislava Stock Exchange between the period 2011-2013. The aim of our research is to determine whether a relationship exists between the representation of women on the boards and the level of corporate governance in companies listed on the Bratislava Stock Exchange. There were 104 companies in 2011, 109 in 2012 and 102 companies in 2013. The number of companies which quotes their shares and bonds is in the following table (Tab. 1).

We obtained the information from the companies' annual financial reports which are available in the Central Register of Regulated Information, the Register of Financial Statements and on the companies' websites for period 2011-2013.

Tab. 1: The number of shares issuers and bonds issuers for the period 2011-2013

	2011	2012	2013
The number of shares issuers	87	92	84
The number of bonds issuers	11	11	11
The number of issuers of shares and also bonds	6	6	7
TOTAL number of issuers	104	109	102

Source: authors processed according to data from the Bratislava Stock Exchange

We measured the level of corporate governance using our corporate governance index. This index uses ordinal measures of various evaluative criteria (see Annex). The criteria were as follows:

a) disclosure of the current annual report in the Central Register of regulated Information CERI,
b) disclosure of the current annual report in the Register of Financial Statements RUZ,
c) disclosure of the current annual report on the companies' websites,
d) the scope and clarity of the information about corporate governance in annual report according to § 20 of the Accounting Act,
e) the scope, clarity and quality of information in corporate governance statement,
f) information about board members, such as names, experience, responsibility and functions,
g) information about the structure and amount of remuneration for individual members of the board,
h) information about risk management, defined predictable risks and risk quantification,
i) information about the establishment and activities of an Audit Committee, or the failure to establish one,
j) information about the establishment and activities of a Remuneration Committee, or the failure to establish one,
k) information about the establishment and activities of a Nomination Committee, or the failure to establish one.

Assessment methods together with the results are in the annex of this paper. Selection criteria evaluation was conducted based on the results of a survey concerning disclosure of corporate governance and based on the inspiration mentioned in foreign studies. We assign weights to each assessment criterion in corporate governance index with the aim to objectively assess the importance of each criterion. Our corporate governance index was as follows:

$$CG\ index = 0.095*(a + b + c) + 0.079*d + 0.159*e + 0.079*f + 0.079*g + 0.079*h + 0.079*i + 0.079*j + 0.079*k \quad (1)$$

Individual assessment criteria were given a score and assigned a weight according to their degree of importance. We set the value of coefficients based on expert estimation and supported by Saaty's method of determining the weights. The expert group consisted of people on boards from Central European Corporate Governance Association that has dealt with issues of corporate governance in Slovakia since 2004. We identified through expert estimation that the criterion ("the scope, clarity and quality of information in corporate governance statement") to be the most important one in the index. Other important criteria with the lower value of the coefficient were: "disclosure of the current annual report in CERI", "disclosure of the current annual report in RUZ" and "disclosure of the current annual report on the companies' websites". Other criteria were the same coefficients with respect to their significance in comparison with the aforementioned higher ranked criteria in the index. Subsequently, we compiled an order of the companies based on corporate governance index with expert estimation of weights with Saaty's weights method. The order of the companies was the same in both causes for the whole period. For purposes of analysis, we decided to use the corporate governance index, which weights were based on expert estimation. Each monitored company was scored using a weighted sum of the evaluated criteria. This allowed corporate governance comparisons across companies.

After intensive data collection for each monitored company we evaluated the data in the statistical program SPSS 18 through the Spearman's rank correlation coefficient. The Spearman's rank correlation coefficient was used because normal distribution of statistical values was not confirmed.

Spearman's rank correlation coefficient

$$RS = \frac{1-(6\sum_{i=1}^{n} d_i^2)}{n\times(n^2-1)} \quad (2)$$

where: d_i is the difference between the rank character x, y and n is the range of random selection. The coefficient can have values in the range <-1;1>. If the value is closer to the -1 or to the 1, the dependence is tighter. The positive coefficient confirms direct dependence and negative indirect relationship between the monitored characteristics.

From the available annual reports and Business Register of the Slovak Republic, we collected data about female representation on the boards of companies. The gender equality was measured by the percentage of women on the board of directors and supervisory board 2011-2013.

Based on results of the studies reviewed above and our assumptions, we set the following hypothesis.

H: There is a correlation between the representation of women on the boards and the level of corporate governance in companies listed on the Bratislava Stock Exchange.

We evaluated the level of corporate governance using the corporate governance index. Table 2 gives the basic characteristics of this index for the period 2011-2013. The Corporate governance index reached a minimum value at 0 and a maximum of 1.38 for the whole reporting period. Companies achieved an average value of the index of around 0.5 point. Standard deviation of the mean had a growing tendency, from 0.38 to 0.42 points. Distribution asymmetry is evident from the value of skewness and kurtosis parameters. A positive value of skewness indicates to us that the mean is greater than the median – most of the values of the index are lower than the mean. We found out that there were higher proportions of companies with below-average value of corporate governance index. Approximately 20% of companies in each reference year did not disclose information in the right form or information was not disclosed at all. Therefore, we could not prepare the corporate governance index for these companies. Based on the negative values of the kurtosis a platykurtic distribution was confirmed a. We can conclude that the incidence of extreme value is less frequent compared to the normal distribution for the period 2011-2013.

Tab. 2: Descriptive statistics of corporate governance index for period 2011-2013

	N	Min	Max	Median	Modus	Mean	Std. Deviation	Skewness		Kurtosis	
								Stat.	Std. Error	Stat.	Std. Error
CG Index 2011	104	.00	1.38	0.4275	0.00	0.4847	0.38007	0.405	0.237	-.738	.469
CG Index 2012	109	.00	1.38	0.4270	0.00	0.5094	0.39455	0.332	0.231	-.838	.459
CG Index 2013	102	.00	1.38	0.4270	0.00	0.5072	0.42421	0.420	0.239	-1.01	.474

Source: own

The following table (Tab. 3) presents the descriptive statistics representation of women in the total number of directors and the supervisory board for the 2011-2013 timeframe. We found significance in the rising median value, which was in 17% in 2011 and 22% in 2013. The average representation of women increased year on year 2012/2013 from 23% to 24%, while the average in the EU-28 was lower at 18%. Some companies did not have any woman on the board or the supervisory board. The number of these companies increased from 24 in 2011 to 29 in 2012 and subsequently decreased to 26 companies in 2013. Women on the board of directors were not represented in 65 companies in 2011 and 2013 and in 70 companies in 2012. The number of these companies was twice more compared with companies without the representation of women on the supervisory boards. The number of companies which did not have representation of women on the supervisory board was 36, 38 and 32 companies for the period 2011-2013. The average number of women on boards of directors was around 0.44 and average number of women on supervisory board oscillated by one. Women were represented on the supervisory boards more frequently than on boards of directors.

Tab. 3: Descriptive statistics of women on board for period 2011-2013

	N	Min	Max	Median	Modus	Mean	Std. Deviation	Skewness		Kurtosis	
								Stat.	Std. Error	Stat.	Std. Error
Women Board 2011	104	.00	0.83	0.1667	0.00	0.2295	0.20006	0.782	0.237	.064	.469
Women Board 2012	109	.00	1.00	0.2000	0.00	0.2328	0.20992	0.857	0.231	.714	.459
Women Board 2013	102	.00	1.00	0.2222	0.00	0.2390	0.21034	0.862	0.239	.822	.474

Source: own

Tab. 4: Correlation analysis for period 2011-2013

Spearman's rho		CG index	Sig.
Female Board	2011	-0.175	0.075**
	2012	-0.303	0.001*
	2013	-0.236	0.017*

Source: own

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.1 level (2-tailed)

We examined a relationship between the representation of women on the board and the level of corporate governance by Spearman correlation coefficients. However the results differ significantly from those stated in the previous section of this paper. Values of Spearman's correlation coefficient are found in the following table (Tab. 4).

At the 5% significance level, we accepted the hypothesis about the existence of correlation between the representation of women on the boards and the level of corporate governance in companies listed on the Bratislava Stock Exchange for 2012 and 2013. We can also confirm the hypothesis for the 2011 period, but due to a higher p-value, the correlation is significant at the 0.1 level. The Spearman correlation coefficients were negative values. In this case, the higher proportion of women on the board of companies related to lower level of corporate governance. The values of correlation coefficients confirmed weak indirect dependence.

Conclusions

Gender equality is becoming increasingly important, especially because of European Union pressure. The European Commission has decided to take legislative action with the strong support of a number of member states. On 14 November 2012, it put forward a proposal for a Directive on improving the gender balance among non-executive directors of companies listed on the stock exchange. The European Parliament has repeatedly called upon companies and member states to increase female representation on company boards, and has invited the Commission to propose legislative quotas to achieve 30% female membership of management bodies by 2015 and 40% by 2020. Some member states have developed national legislation and other member states have self-regulatory initiatives.

By reviewing the literature, we find that there is a clear gap in examining the relationship between the representation of women on the

board and the level of corporate governance. To the best of our knowledge, this is the first paper that examines the relationship between corporate governance and female on boards using data of companies on the Bratislava Stock Exchange. Similarly, we did not find comparable studies examining the relationship between the representation of women on boards and the level of corporate governance in comparable countries. We examined the existence of a relationship in two stages. In the first stage, we compiled a corporate governance index for each monitored company that allows us to determine the level of corporate governance. The data for the corporate governance index have been collected from the companies' annual reports and from their websites. In the second stage, we obtained information about the proportion of women on boards from the companies' annual reports and examined its effect on corporate governance. The main contribution of this paper is confirmation of the correlation between the representation of women on the board and the level of corporate governance for period 2011-2013. We confirmed the hypothesis of a correlation between the representation of women on the boards and the level of corporate governance in companies listed on the Bratislava Stock Exchange. The findings of the negative correlation were unexpected. On the negative correlation may affect a relatively short history of the capital market in Slovakia, a small number of active companies on the Stock Exchange in Bratislava and other factors that could be the subject of further research.

Hence, the outcome of this study could be used as the basis for future research. The main limitation of this paper is that the paper focused on the companies on the Bratislava Stock Exchange. Future work could extend the research by using the companies on over the counter market or the companies in other countries such as the Czech Republic. Next, we recommend the assembly of a regression model to examine the relationship between corporate governance and representation of women on boards with respect also other variables such as board size.

Finally, we believe that the findings of this research provide useful evidence of the level of corporate governance in Slovakia, a subject matter that has been covered in the previous research in corporate governance. This adds a new dimension to the studies in the corporate governance area and gender equality.

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Appendix A: Evaluation 1st, 2nd and 3rd criterion

Criteria	Description	Ordinal scale	Results – numbers of companies 2011/2012/2013
1. Disclosure of information	Availability of information to shareholders and potential investors. The annual financial report or annual report is available in CERI, in RUZ or on the company's website. Availability of information according to the Act on Stock Exchange §45 in paragraph 1 and the Accounting Act §23 in paragraph 2.	„0" = annual report for the researched period is not published in CERI, in RUZ, and on the company's website either	25/25/24
		„1" = annual report is published in one of the three options (CERI, RUZ, company's website)	23/8/8
		„2" = annual report is published in two of the three options (CERI, RUZ, on company' s website)	56/76/69
		„3" = annual report is published in CERI, in RUZ and also on company's website	1*
2. Annual Report	The scope and clarity of the information about corporate governance in an annual report.	„0" = annual report does not contain information on corporate governance	47/39/53
		„1" = annual report contains partial information on corporate governance	43/64/27
		„2" = annual report contains partial information on corporate governance and deviations from compliance with the Code	14/6/22
3. Statement on Corporate Governance	The scope, clarity and quality of information about corporate governance according to the Accounting Act §20 in paragraph 6 a,-g,	„0" = the statement is not available or does not contain any specific information on CG	57/61/68
		„1" = the statement contains a brief explanation of each item	40/28/12
		„2" = the statement contains an explanation of each item and the reason for deviation from compliance with the Code	7/20/22

Source: own

Note: *Disclosure of information in the Register of Financial Statements was observed only in 2013 due to new legislation.

Appendix B: Evaluation 4th, 5th and 6th criterion

Criteria	Description	Ordinal scale	Results – numbers of companies 2011/2012/2013
4. Composition of the boards	The scope of information about board members, such as names, experience, responsibilities and management posts.	„0“ – no information	27/31/33
		„1“ – only the names of board members	64/64/57
		„2“ - published the names of board members, together with the qualifications, roles and responsibilities and managerial posts	13/14/12
5. Remuneration of boards members	Information about the structure and amount of remuneration for individual members of the board.	„0“ = no information	61/63/65
		„1“ = cumulative data about remuneration for all company’s boards that are established	34/39/32
		„2“ = disclosed the amount of remuneration of board members and managers of the company or remuneration disclosed for individual boards of the company	9/7/5
6. Information on risk management	Information on risk management, defined predictable risks, monitoring and quantification of risks.	„0“ = no specific information	72/82/69
		„1“ = basic information about risk management and defined predictable risks	16/10/11
		„2“ = comprehensive information about risk management and risk quantification	16/17/22

Source: own

Appendix C: Evaluation 7th, 8th and 9th criterion

Criteria	Description	Ordinal scale	Results – numbers of companies 2011/2012/2013
7. Audit Committee	Information on whether the committee was or was not established, including its activities.	„0“ = no information	51/55/50
		„1“ = information on whether the committee was or was not established (reasons why it was not established)	34/41/35
		„2“ = is established, a description of the committee's and the results of its activities	19/13/17
8. Remuneration Committee	Information on whether the committee was or was not established, including its activities.	„0“ = no information	88/87/80
		„1“ = information on whether the committee was or was not established (reasons why it was not established)	12/18/17
		„2“ = is established, a description of the committee's and the results of its activities	4/4/5
9. Nomination Committee	Information on whether the committee was or was not established, including its activities.	„0“ = no information	91/92/85
		„1“ = information on whether the committee was or was not established (reasons why it was not established)	12/16/16
		„2“ = is established, a description of the committee's and the results of its activities	1/1/1

Source: own

Abstract

GENDER EQUALITY AND CORPORATE GOVERNANCE IN SLOVAKIA

Hussam Musa, Lenka Debnárová, Zdenka Musová, Peter Krištofík

Gender representation on company boards is controversial and currently a highly debated issue in corporate governance. It is also considered to be an important tool of corporate responsibility in economic areas. Of all the progressive actions that the EU and Member States have implemented to revive the European economy, the issue of women's participation in the labor market, particularly in corporate governance, merits more attention. Equality between women and men is one of the European Union's founding values yet clearly there are significant differences in pay by gender and representation of women on boards. One of the principles of corporate governance, the responsibilities of the board, is closely related to the issue of gender equality. According to this principle the board should ensure the strategic management of the company, the effective monitoring of management and should act responsibly towards both society and shareholders. These activities may be determined by many factors and one of them is gender equality. Advancing gender equality in the labor market continues to be a policy objective in many European Union countries. Wide national variations are evident in strategies and accomplishments towards improving gender equality at all levels of the labor market, including corporate governance roles. This paper focuses on the effect of gender diversity on corporate governance in companies listed on the Bratislava Stock Exchange. We measured the level of corporate governance by using a corporate governance index, compiled separately by company, and based on information from companies` annual reports. The paper uses a correlation analysis to examine the association between the representation of women on boards and the level of corporate governance. To the best of our knowledge, this is the first paper to investigate the link between corporate governance and gender equality in companies on the Bratislava Stock Exchange.

Key Words: *Gender policy, gender equality, corporate social responsibility, corporate governance, corporate governance index, Slovakia.*

JEL Classification: *G34, J16, M14.*

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INFLUENCE OF BUSINESS PERFORMANCE MEASUREMENT SYSTEMS AND CORPORATE SUSTAINABILITY CONCEPT TO OVERAL BUSINESS PERFORMANCE: "SAVE THE PLANET AND KEEP YOUR PERFORMANCE"

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Introduction

The examination of the measuring corporate performance issues is dedicated to many authors from different points of view: the relationship of the strategy and strategic orientation to the business performance (Morgan & Strong, 2003); the view of a strategic measurement performance system through strategic agenda and decision-making as a result of the process of (re)formulating strategy (Bisbe & Malagueño, 2012); the effect of strategic measurement performance system on the important attributes of the strategy formulating process (Gimbert et al., 2010); the effect of strategic performance measurement system of human resources and corporate results (Bento & White, 2014); the use of the process performance measurement (Tuček et al., 2013); the relations among customer satisfaction, customer loyalty and financial performance of a commercial bank (Belás & Gabčová, 2016); the methodology for prediction and detection of the ways of solving demanding situations in managerial work, with obvious implications in performance of managers and in efficiency of business performance management (Lajčin, Frankovský, & Štefko, 2012); the model of acquisition activity in financial sector (Korauš et al., 2015); performance management and public corporate governance with regard to relationships with both external (stakeholders) and internal (politicians and management) actors (Romolini et al., 2015). Many other empirical studies realized around the world in recent years have also confirmed the relationship between strategic planning and business performance (Rudd et al., 2008).

If we are talking about the need and ability of the system to adapt and operate in the long term period with the orientation of economic, environmental and social performance of enterprise, we refer to a corporate sustainability performance measurement system (Searcy, 2012). According to Maletic et al. (2015) it seems that it exists some support for existence of a business case for corporate sustainability. Using Tobin´s q was founded that corporate sustainability is strongly associated with market value (Lo & Sheu, 2007, p. 355); the greater engagement in sustainability activities can lead to a greater innovation, which in turn leads to greater financial and market performance (Maletic et al., 2015). On the other hand, the analysis of link between corporate social responsibility (in our view a narrower concept as corporate sustainability) and the performance indicators showed that the link between these variables is negative. These results cover this effect only during the first years in which sustainability actions are applied. It will be necessary to examine a longer time period (López et al., 2007). All of these authors state that in the research it is still necessary to provide a clearer understanding. The aim of this paper is to identify the relationship between selected management tools and concepts of various development phases of strategic performance measurement systems to overall business performance measured by indicator ROE. Similarly the aim is to identify the relationship between the sustainability index and indicator ROE as a key aspect in terms of the current extremely advancing climate crisis.

1. A Brief Overview of the Performance Measurement Systems

As the report of RSA Tomorrow's Company shows (Neely et al., 2000), the achievement of sustainable corporate success in the demanding world market depends on the relevant enterprises indicators for the measurement of business performance. Currently, strategic performance management and measuring system can significantly contribute to achieving and solving this gap. From our point of view and after extensive literature resources search, we state that the issue of business performance measurement system was passed the following phases: measurement systems based on purely financial indicators, non-financial performance measurement indicators (impact of technological innovations, environment, etc.), KPI, BSC, Business Intelligence knowledge information support and finally the sustainability performance measurement system.

1.1 Financial Business Performance Measurement System

In the past, the majority of corporate practice methods were concentrated to measure corporate performance refers to mainly the financial performance. Within these measurement systems is based on traditional accounting system (Ahmed et al., 1999). The early performance measures were appropriate to evaluate divisional and managerial performance or the use of standard costing and variance analysis to control production activities (Chenhall & Langfield-Smith, 2007, p. 266). Cost management is one of the most important issue of company performance and company financial management (Novák & Popesko, 2014).

Traditional business performance measures have mostly financial character which measures the rate of return on investment, cash flow and profit margins (Gunasekaran & Kobu, 2007). These measures have been criticized due to their reduced ability of using for comprehensive performance measurement. Value based management system came up with an innovation in the form of indicator EVA (Sharma & Kumar, 2010).

From 80s the traditional accounting measures have been criticized in terms of heavily oriented nature toward internal comparisons of costs and revenues, also a little attention to the external environment; of misleading signals for continuous improvement and innovation, worked well for industrial era (Kaplan & Norton, 2005); of historical and backward character (Ittner & Larcker, 1998); furthermore they are focused the outcome instead of being process oriented (Yeniyrt, 2003). Shortcomings of traditional measurement systems triggered a revolution in the business performance measurement (Kennerley & Neely, 2002). The revolution is a radical decision and changes from the processing of financial measures as a basis for measuring performance for their processing as one of a wider set of measurements. The inadequacy of traditional measurement systems pointed also Research Institute of Management Accountants (1996), when only 15% of respondents considered their measurement system as supporting the objectives, while 43% of respondents considered it to be inadequate (Burgess et al., 2007). This showed that enterprises can replace existing traditional measurement systems to those that reflect their current objectives and business surroundings (Kennerley & Neely, 2002). The results from the data of manufacturing enterprises show that enterprises with more extensive performance measures mainly objective and subjective nonfinancial measures have higher performance (Van der Stede et al., 2006).

1.2 Strategic Business Performance Measurement System

Performance measurement system define Gimbert, Bisbe and Mendoza (2010) as a set of financial and non-financial measures to support enterprise decision-making by collecting, processing and analyzing quantified information regarding its performance and presented in a brief review. A subset is a Strategic Performance Measurement System (SPMS), whose typical feature is the design of these systems to support decision making by managers through financial and also non-financial indicators covering different perspectives and which in combination enables to transform strategy into a comprehensive set of performance measures (Chenhall, 2005). SPMS contributes to the achievement of strategic goals through three mechanisms: a better understanding of the links between different policy priorities, effective communication between the objectives and activities and the efficient allocation of resources and tasks (Dossi & Pateli, 2010).

The most typical example of such systems is a BSC. BSC methodology has become popular since their introduction by Kaplan and Norton in 1992. The system itself has undergone development in terms of the change from a traditional point of view to measure performance towards a process where the business is able to measure what it wants, while involving and intangible assets (Perkins et al., 2014). Non-financial indicators are considered as the drivers the future financial performance of the company (Tangen, 2004). This is indicated by the results of research the global consulting firm Bain & Company in 2015, where the tool BSC was one of the six most widely used management tools among enterprises all over the world (Rigby & Bilodeau, 2015). This fact confirms the assumption that enterprises consider this tool to be a necessary and effective in strategy implementing and measuring business performance. On the other hand, it is important to misunderstand the BSC as a miraculous tool which somehow improve business performance (Perkins et al., 2014).

In Slovakia or Czech Republic have been also addressed several research of this issue in the recent past, there may be mentioned e.g. research of the SPSM and BSC methodology application in business practice. Gavurová presents the results of the first exhaustive survey in Slovak enterprises implementing BSC (Gavurová, 2011). Other similar research based on a questionnaire survey obtained from the 91 companies from Czech Republic. The study indicates that there is a positive significant relationship between management tools and techniques utilization and organizational performance (Afonina, 2015). The next survey realized in Czech Republic was focusing on the evaluation the impact of the use of BSC in order to achieve greater financial performance of businesses, depending on the size and business sector on a sample of micro, small, medium and large enterprises. This survey showed that out of a total sample of 350 enterprises, only 13% of them use BSC concept. For companies using the BSC were considered only those businesses that actively use this tool at least two years. The effect of the BSC use and its impact on financial performance was tested using financial indicators ROA and ROE. The research results also did not confirm that the BSC use contributes to improved financial performance of the company. In the research was used a sample of 167 enterprises (Knápková et al., 2014). Important will be also its implementation, as evidenced by the results of such research in Slovakia, implementation of the BSC system only through the software solutions can lead to a false understanding of the meaning of BSC by managers, which is also a common reason for failure to implementation of this system (Šoltés & Gavurová, 2015). Similar results have also brought other foreign research, which states, that the BSC are associated with higher measurement system satisfaction, but exhibit almost no association with economic performance (Ittner et al., 2003). Another important foreign research, however, says that if the BSC is used primarily for strategic management, then it will also bring higher financial performance (Braam & Nijssen, 2004).

1.3 Business Intelligence as a Key Knowledge Information Support for Business Performance Measurement System

The business impact of SPMS is affected by information technology variables (Internet usage, ERPs, informational technology tools) (Bento et al., 2014). Especially ERP II – BI (Business Intelligence) represents the system that provides the ability to analyze business information in order to support and improve management decision making (Elbashir et al., 2008). Together with the facilitating the decisions communication is in this way supported the corporate performance management (Melchert et al., 2004). For BI success are necessary the technological capabilities such as data quality, user access and the right and whole integration of BI with other existing systems (Işik et al., 2013).

Several studies are devoted to the influence of information technology on business performance. According to the Bento et al. (2014) is evident that information technology variables contribute significantly to the business impact of SPMS. Except of above mentioned benefits, the using of BI improves the overall enterprise performance (Ranjan, 2009). If the performance measurement systems are supported by appropriate IT platforms it will improve identification of strengths and weaknesses of enterprise, continuous improvement etc. (Nudurupati & Bititci, 2005) which ultimately can lead to the improvement

of business performance. Petrini and Pozzebon (2009) suggest that BI system takes an important role in improving of implementation and monitor sustainable practices. The lack of information support decreases the reliability of information and also inhibits their integration with another indicator for complex decision making. Higher-quality, lower-cost information is a key to unlocking more sources of finance for SMEs (Belás et al., 2016).

The survey carried out on the sample of 164 enterprises operating in Slovakia investigated the implementation, respectively using of BI in relation to company ROE value. The results show that only 7% of enterprises have implemented and use a system of BI, whereby these companies belong to the group with the ROE more than 4%. On this basis is displayed the hypothesis that the use of the BI system will affect the higher business performance. Even 71% of enterprises not consider an implementing this system into the practice. The research results showed that in the case that companies do not have the BI information system as a complex system and not take into account its implementation they tend to have a lower level of performance. On the other hand, businesses that currently use BI system they achieve a better performance with a ROE of more than 4%. It follows that the BI system has a major impact on business performance (Rajnoha et al., 2016).

1.4 Sustainable Performance Measurement System

A comprehensive view of the business is not possible without neglecting the social and environmental aspects, while highlighting only the economic aspect would not reflect the diversity of processes occurring in the enterprise in relation to the various entities that are perform in the business (Marková, 2012). For these reasons has discovered a new tool for measuring performance – Triple Bottom Line (TBL). The responsibility of a business is not just about generating economic profit (profit), but also about caring for society as a whole (people) and the environment (planet). These three elements are the basis of TBL (Fauzi et al., 2010). This framework for measuring performance created by J. Elkington went beyond the traditional measure of profit and return on owner value with regards to environmental and social dimensions.

The corporate sustainable concept is based on the globally-oriented concept of sustainable development. In general, the most acceptable definitions are those that come from the report of the World Commission of the United Nations Environment and Development. The environmental indicators being assessed can be organized into 3 major groups of environmental indicators: environmental quality, environmentally responsible behaviour, and consumption of environmental services (Streimikiene, 2014). The measurement of sustainability is required due to several reasons (Jurigová & Lencsésová, 2015). Corporate sustainability strategy is essential for sustainable development, but also for the successful management of the company through the related social, legal, political and economic requirements in terms of market competition (Schaltegger et al., 2012). The social, legal and political environment, which are created by state, play an important role (Virglerová et al., 2016).

In the sustainability issue are used the sustainably oriented key performance indicators. This indicators measure progress toward sustainability and demonstrate the environmental, social and economic impacts. According to Keeble et al. (2003) difficulties in performance measuring accrue mainly from the enterprise complex organizational structure with different trade flows, functions and projects. In order to be able to measure corporate sustainability was developed several methods and models. Global Reporting Initiative created reporting guidelines which provide a framework for the content of the information included in the corporate social responsibility report (Searcy, 2012). The aim of composite index of sustainable development created by Glavic and Krajnc is to provide a simplified and quantified view of the integrated information on sustainable development in case of a more comprehensive number of indicators. Index can be used to inform and support decision-making about development trends and referring to the potential opportunities for improvement in the sustainability areas (Glavic & Krajnc, 2005).

As we have already mentioned the relationship between corporate sustainability and business performance has carried on many research debates. Some researches declare a positive relationship between corporate sustainability/corporate social responsibility

Tab. 1: Overview of relationship between corporate sustainability and business performance

Author	Description
Eccless, Perkins and Serafeim	„High sustainability" enterprises outperformed their counterparts in term of stock market performance and accounting criteria (ROA, ROE). The environmental, social and governance performance can contribute to financial performance.
Lo and Sheu	Using Tobin´s q was founded that corporate sustainability is strongly associated with market value.
Servaes and Tamayo	CSR has a positive impact on financial performance in relation to high advertising intensity.
Cochran and Wood	Within industry groups the financial variable most strongly correlated with CSR is asset age. After controlling for asset age, using a large sample, and industry-specific control groups, there still is weak support for a link between CSR and financial performance.
Pava and Krausz	Enterprises which have been met criteria of CSR/sustainability have generally been shown to have financial performance at least on a par, if not better, than other enterprises.
Koh, Qian and Wang	It exists the positive relationship between sustainability performance and financial performance. This relationship is moderated by a firm's financial distress risk.
Waddock and Graves	Better corporate social performance seems to be positively related to better financial performance. It can be interpreted in both directions (better financial performance may lead to improved sustainability performance and vice versa, ceteris paribus).
Maletic et al.	Greater engagement in sustainability activities can lead to a greater innovation, which in turn leads to greater financial and market performance.
Ayvazyan and Afanasyev	The role of the state and regional governments in the development of innovation space to support sustainable innovative performance is emphasized.
López et al.	The analysis of link between CSR (in our view a narrower concept as corporate sustainability) and the performance indicators showed that the link between these variables is negative. It will be necessary to examine a longer time period.
Garcia Castro et al.	The positive relationship between social performance and financial performance which was found in most of the previous research becomes a non-significant or even a negative while the endogeneity is taken into account.
Hawn and Ioannou	Symbolic actions of environmental, social and governance have a higher impact on market value in the presence of higher intangible assets, and that a larger gap between symbolic and substantive actions has a higher positive effect on firm performance. Substantive actions have a lower or no significant impact on market value (even though they have a significant positive effect on ROA in the presence of higher intangibles).
Baron, Harjoto and Jo	For the full dataset CFP and CSP are found to be largely unrelated, which is consistent with the theories in which CSP provides product differentiation or the social market line is horizontal. This, however, is an equilibrium relationship and does not imply the absence of a causal relation between CSP and CFP for individual firms. The absence of an empirical relation between financial performance and social performance or the presence of a positive relation for consumer industries and a negative relation for industrial industries does not mean that there is no causal relation for an individual firm.

Source: Eccless et al. (2012); Servaes and Tamayo (2013); Cochran and Wood (1984); Pava and Krausz (1996); Koh et al. (2014); Waddock and Graves (1997); Lo and Sheu (2007); Maletic et al. (2015); Ayvazyan and Afanasyev (2016); López et al. (2007); Garcia Castro et al. (2010); Hawn and Ioannou (2012); Baron, Harjoto and Jo (2012)

(CSR), some argue that there is no correlation. In Table 1 we presented some findings in field of business performance.

Based on results of our research we inclined to authors, who state that it exist a positive correlation between corporate sustainability and financial performance. Strategic management tool BSC can also refer to the corporate sustainability concept. In this sense the '**sustainable BSC**' extends the traditional perspectives with perspective on the environment and society. Earlier studies identified the existence of the relationship between the characteristics of entrepreneurs and business performance, but the results were still inconclusive (Kozubíková et al., 2015). This may cover the central requirement of the corporate sustainability concept in continuous improvement of business performance in economic, environmental and social terms (Figge et al., 2002). Based on this, it is evident link between performance measurement systems in reaction business sector to the present trends and opportunities.

Due to the aim of paper and from our analytical view defined phases of performance measurement systems, we focused on identifying the impact of the selected tools used in the individual phases to overall business performance measured by indicator ROE. This aim we have transformed into the research hypotheses.

2. Objectives, Data Collection and Methodology

2.1 Objectives and Research Hypothesis

The aim of this paper is to identify the relationship between selected management tools and concepts of various development phases of strategic performance measurement systems to overall business performance measured by indicator ROE. Similarly the aim is to identify the relationship between the sustainability index and indicator ROE as a key aspect in terms of the current climate crisis.

To identify the relationship between selected management tools and overall corporate performance, we formatted the following research hypothesis:

H1: We assume that businesses applying the BSC methodology will achieve significantly higher performance.

H2: We assume that if businesses use a system of key performance indicators (KPI) will achieve higher level of performance.

H3: We assume that businesses applying in addition to financial indicators and also non-financial indicator in the form of more orientation on the environment will achieve better performance.

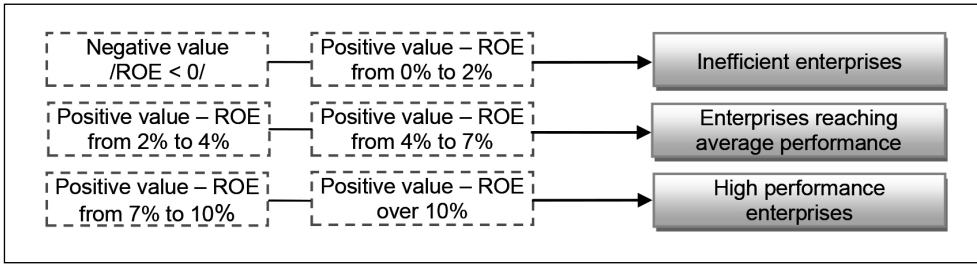
H4: We assume that a stronger emphasis on non-financial, strategic indicators and environment has no significantly negative impact on the financial performance of the company, and they create a Sustainable Performance Measurement System.

2.2 Data Collection

The first stage of primary research presented querying selected sample of Slovak enterprises in the form of an online questionnaire focused on the use of selected parameters of performance measurement system. The emphasis was on the investigation of impact these parameters on the overall business performance measured by ROE. In the second phase of research, we focused on exploring issues of measuring corporate sustainability through a sustainable development composite index in a particular manufacturing enterprise and its impact on performance. The conclusion contained assessment of achievements and identification of mutual relationship and strategic performance measurement system and measuring corporate sustainability. Data about the primary database of 1,457 enterprises from selected industries of the Slovak Republic (the greatest extent was enterprises represented by engineering, wood and automotive industries) we received from information of various industrial associations and those we have subsequently supplemented by other companies on the basis of extensive online survey. The questionnaire was distributed in two consecutive rounds. First via e-mail (time for completion was two months, low latency – there were completed only 45 research questionnaires), subsequently we are therefore used in the second round the form of telephone and the most common form of face-to-face interview (time for completion was next two months, there were filled other 119 research questionnaires). After these two consecutive rounds the questionnaires were correctly completed by 164 enterprises in the end. We consider the size of the research sample as being sufficiently representative

and this is 11.26% share of the total number of companies surveyed. For this, we could identify and analyze parameters for measuring and managing corporate performance, a key finding was the size of ROE. Based on this, we have incorporated the companies to the performance categories (6 intervals of scale), which are influenced by the lower frequency reduced to 3 respectively 2 performance enterprise categories. We realized that more appropriate indicator would be the indicator EVA, but for its determination it is necessary to know the costs of the own capital, which is in our conditions rather unrealistic. Therefore, we have used more accessible indicator ROE. In view of the sensitivity of the data we have scale a value of 0% to over 10%. Moreover we considered 6% of ROE as the moderate value reached in surveyed enterprises. Specification of enterprises is shown in Fig. 1.

Fig. 1: The segmentation of enterprises surveyed into the performance groups



Source: own

2.3 Methodology

In the quantitative part of the research, we did not focus only on traditional financial tools; greater emphasis was therefore put to the BSC and KPI. In the area of non-financial indicators, we focused on companies and their orientation to the environment. The results obtained by questionnaire survey were processed by statistical methods, whereby we except of selected variables of descriptive statistics for one variable (frequency, relative proportions) used mainly Chi-square test of independence. It is used to test the categorical variable weather there is a relationship between these variables or not. In the analyzing this relationship we started from Pivot Tables and Pivot coefficients. The analysis of the difference between observed (empirical) and expected (theoretical) frequency we used Pearson chi-square test. Besides this, we have also used a similar M-V chi-square test, which is based on the theory of maximum likelihood and is used in case there is a real between variables dependent. The hypothesis was verified at the 5% significance level (α = 0.05).

In the qualitative part of the research we have created in the condition of particular enterprise a composite index of sustainability which we constructed based on the work of Krajnc and Glavič (2005). For the analysis of industrial enterprise in the automotive industry, we aimed to extract the necessary data from relevant areas and to complete them by sub-indices into a single composite index. In the analysis, we can point out that the company is primarily focused on achieving economic performance, and belongs to the middle of the pollutant, which means that the environmental focus lies primarily on the issue of waste. In terms of social areas it is an enterprise that provides to its employees many advantages. The data we have obtained for a given enterprise, we compared the time period of six years (2009-2014). The following Table 2 contains indicators for the area in the specified units for the period, and its distribution corresponds classified based on the GRI guidelines.

In the economic field we included the traditional indicators (x_{1i}) used in accounting as well as intangible assets. Direct impact on the performance of the enterprise is mainly the quality of production, which is expressed through error rate (PPM – Parts per million) and the cost of the claims. Indicators of socio-social

Tab. 2: Indicators from different areas of corporate sustainability

Economic indicators	Social indicators	Environmental indicators
Sales (€)	Donations (€)	Electricity consumption (MWh)
Profit (€)	Training costs (€)	Natural gas consumption (m^3)
Capital expenditure (€)	13th and 14th salary (% from gross wage)	Consumption of LPG, propane butane (t)
R&D costs (€)	Zero absence (%)	Fuel consumption (t)
Other fines and penalties (€)	No. of workers accidents (number)	Water consumption (m^3)
Average value of PPM (number)	The number of days due to work accidents	Waste (t)
The cost of claims (€)	Gender inequality (%)	Investments in the environment (€)
		Fines and penalties (€)

Source: own

area (x_{2i}) reflect the attitude of enterprises to internal groups (employees) and external groups (public). Environmental indicators (x_{3i}) involve mainly the areas of consequences on the environment within the individual types of materials in the production. These include a balanced view of the environmental consequences of the inputs and outputs of the company. Subsequently, we assigned to these indicators a character; the positive impact on the sustainable development of enterprise (x_{ji}^{+}) and the negative impact (x_{ji}^{-}) . Because of the indicators were expressed in different units of measurement, the normalization of their value was needed. One method that can be used is the calculation of standard indicators using the relationships (1) and (2). Normalization of indicators of positive impact is carried out according to equation (1) and normalization of indicators of negative effects is carried out according to equation (2):

$$x_{ji\,t}^{N} = \frac{x_{ji\,t}^{+} - x_{ji\,\min}^{+}}{x_{ji\,\max}^{+} - x_{ji\,\min}^{+}} \tag{1}$$

$$x_{ji\,t}^{N} = 1 - \frac{x_{ji\,t}^{-} - x_{ji\,\min}^{-}}{x_{ji\,\max}^{-} - x_{ji\,\min}^{-}} \tag{2}$$

For the purposes of assessment the importance of individual indicators in the groups in relation to the sustainable development of enterprise, it is necessary establish the weights of relevant indicators (w_{ji}). In our work, we apply AHP (Analytical Hierarchy Process) method to determine weights. Detailed description of this methodology is stated by Saaty (2008). After these procedures we proceed to the construction the sub-indices of sustainability ($I_{S,j}$) of each group of indicators. These sub-indices are calculated as a weighted average of the individual standardized indicators at the time of the relevant set of indicators as follows:

$$I_{S,j\,t} = \frac{\sum_{i=1}^{n_j} w_{ji} . x_{ji\,t}^{N}}{\sum_{i=1}^{n_j} w_{ji}} \tag{3}$$

Finally, the individual sub-indices of sustainability are aggregated into a single composite index of sustainable development at the time as the weighted average of the individual sub-indices of sustainability as follows:

$$I_{CSD\,t} = \frac{\sum_{j=1}^{3} u_j . I_{S,j\,t}}{\sum_{j=1}^{3} u_j} \tag{4}$$

Composite index has helped us to develop an overall picture of the areas of corporate sustainability with the unveiling of visible reserves and potential opportunities

for improvement. Finally, we investigated the impact rate of index on performance indicator ROE through Spearmen´s coefficient.

3. Research Results

3.1 Non-Traditional Measures and their Impact on Business Performance

Within the frame of using tools, respectively concepts conducive to improving the performance, we focused on the less frequently used tools in the form of BSC methodology. We were interested in a sub-analysis, whether this concept has a major impact on the overall performance of enterprises. The following Tables 3 and 4 indicated achievements through selected statistical tests.

From the Tables 3, 4 we can see that the BSC methodology has a demonstrable impact on the business performance and the value

Tab. 3: Pivot: BSC methodology x Performance – statistics

Statistics	Chi-square	df	p
Pearson´s chi-square	12.78406	df = 2	p = .00167
M-V chi-square	10.11521	df = 2	p = .00636
Contingency coefficient	.2689137		
Cramer´s V	.2791981		

Source: own

Tab. 4: Pivot: BSC methodology x Performance – frequency

	The observed frequency			Expected frequency			Observed minus the expected frequencies (residue)		
	BSC is not used	BSC is used	Total	BSC is not used	BSC is used	Total	BSC is not used	BSC is used	Total
Group 1	68	4	72	65.41463	6.58537	72.0000	2.58537	-2.58537	0.0000
Group 2	58	3	61	55.42073	5.57927	61.0000	2.57927	-2.57927	0.0000
Group 3	23	8	31	28.16463	2.83537	31.0000	-5.16463	5.16463	0.0000
Row total	149	15	164	149.0000	15.0000	164.0000	0.00	0.00	0.00

Source: own

Note: Group 1 (ROE < 0, 0-2%); **Group 2** (ROE 2-4%, 4-7%); **Group 3** (ROE 7-10%, over 10%).

in terms of residues, it is clear that the use of the methodology can be achieved above-average performance (ROE value of 7%). If the enterprises do not use the BSC methodology, they will achieve an average or even below-average performance (ROE of 7% or less), which also reflects the hypothesis H1.

From previous data – Tables 5, 6, we can conclude that the KPI system affects the performance of enterprises, while from the residue data is evident that businesses using KPI they achieve a better performance with ROE of 4%. It follows that the hypothesis H2 is also confirmed.

In terms of non-financial indicators we paid attention to especially orientations on the environment and analysis results (Tabs. 7, 8) revealed statistically significant dependence of business performance and the orientation of the environment, and similarly as in the previous case, enterprises typically achieve better business performance with ROE of 4%.

The sample analysis of all relevant sectors (164 enterprises) showed that on the overall performance have impacts except to traditional indicators such as output of financial accounting also other factors. While the use of BSC methodology and KPI was foreseen

Tab. 5: Pivot: KPI x Performance – statistics

Statistics	Chi-square	df	p
Pearson´s chi-square	4.844668	df = 1	p = .02773
The M-V chi-square	4.588895	df = 1	p = .03218
Phi coefficient for 2x2 tables	.1718740		
The contingency coefficient	.1693902		

Source: own

Tab. 6: Pivot: KPI x Performance – frequency

	The observed frequency			Expected frequency			Observed minus the expected frequencies (residue)		
	KPI is not used	KPI is used	Total	KPI is not used	KPI is used	Total	KPI is not used	KPI is used	Total
Group 1	100	7	107	95.9085	11.0915	107.0000	4.09146	-4.09146	0.0000
Group 2	47	10	57	51.09146	5.90854	57.0000	4.09146	-4.09146	0.0000
Row total	147	17	164	147.0000	17.0000	164.0000	0.00	0.00	0.00

Source: own

Note: Group 1 (ROE<0, 0-2%, 2-4%); **Group 2** (ROE 4-7%, 7-10%, over 10%).

Tab. 7: Pivot: Non-financial indicator Orientation of environment x Performance – statistics

Statistics	Chi-square	df	p
Pearson´s chi-square	5.073809	df = 1	p = .02429
The M-V chi-square	4.815006	df = 1	p = .02821
Phi coefficient for 2x2 tables	.1758916		
The contingency coefficient	.1732323		

Source: own

Tab. 8: Pivot: Non-financial indicator Orientation of environment x Performance – frequency

	The observed frequency			Expected frequency			Observed minus the expected frequencies (residue)		
	Do not focused	Focused	Total	Do not focused	Focused	Total	Do not focused	Focused	Total
Group 1	99	8	107	94.637	12.3963	107.0000	4.39634	-4.39634	0.0000
Group 2	46	11	57	50.39634	6.60366	57.0000	4.39634	-4.39634	0.0000
Row total	145	19	164	145.0000	19.0000	164.0000	0.00	0.00	0.00

Source: own

Note: Group 1 (ROE<0, 0-2%, 2-4%); **Group 2** (ROE 4-7%, 7-10%, over 10%).

higher, this fact is confirmed also in the area of non-financial corporate orientation to the environment. Hypothesis H3 is also accepted. All of the above findings and conclusions may have great importance on the business practices due to the fact that at present Slovak enterprises use these tools in a relatively lesser extent compared to the research carried out abroad.

As we mentioned in chapter 1.3 in connection with information systems is clear that effective SPMS should be supported by application of knowledge BI information system in a stronger extent. It seems that it is just the set of information tools from ERP to knowledge information systems like BI, which gives to methods and tools included in the SPMS a particular "spirit" and encouraging them dynamically towards achieving a higher economic performance of the company. From this our research is evident that the key tool in increasing the overall business performance of the enterprise in the selected Slovak industries seems to be employing a system of strategic performance management of the company, supported by a knowledge-based BI Information System (enterprises using BI system achieve better performance with ROE over 4%) (Rajnoha et al., 2016).

3.2 Estimation of Corporate Sustainability through Composite Index and its Impact on Business Performance

Within the qualitative research, as we declared in the Methodology section we at first collected the necessary data for indexes to be created in each sustainability area and then summarize in a composite index of sustainable development. The results of the sub-index and also the composite index (I_{CSD}) are shown in Tab. 9.

Tab. 9: Results of individual sub-indexes and the composite index of sustainable development

Shortcut	Title	2009	2010	2011	2012	2013	2014
Is,1	Economic sub-index	0.345	0.545	0.510	0.430	0.751	0.592
Is,2	Social sub-index	0.244	0.151	0.689	0.746	0.619	0.527
Is,3	Environmental sub-index	0.681	0.241	0.181	0.331	0.459	0.186
I_{CSD}	Composite index of SD	0.424	0.312	0.460	0.503	0.610	0.435

Source: own

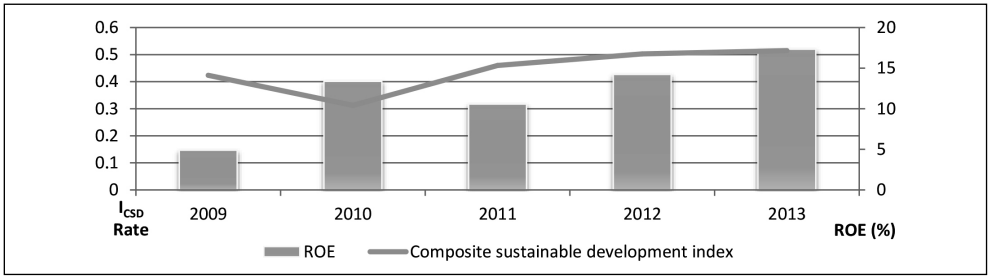
Tab. 10: Testing correlation through Spearman correlation coefficient

			Is,1	Is,2	Is,3	I_{CSD}	ROE
Spearman's rho	$Is_{,1}$	Correlation Coefficient	1.000	-.200	-.900*	.300	.700
	$Is_{,2}$	Correlation Coefficient	-.200	1.000	-.100	.700	.300
	$Is_{,3}$	Correlation Coefficient	-.900*	-.100	1.000	-.500	-.600
	I_{CSD}	Correlation Coefficient	.300	.700	-.500	1.000	.700
	ROE	Correlation Coefficient	.700	.300	-.600	.700	1.000

Source: own

Tab. 9 shows that the composite index of sustainable development ranges from 0.31 (2010) to a value of 0.435 (2014). These values can be considered as an average. In principle: the higher value of the composite index, the higher is also improvement of the enterprise towards sustainability. The same we can say about the evaluation of sub-indexes. In 2009 and 2010 were the lowest reported values, while drop was mainly due to the significant decrease of the environmental and moderate decrease of social sub-index. The total average value of the composite index is 0.46, which means that in the enterprise are substantial reserves

Fig. 2: Relationship between I_{CSD} and indicator ROE



Source: own

for the improvement, whereby the individual sub-indices (Is,1; Is,2; Is,3) should point out the potential hazards that cause this status.

Our aim was also to find out whether there is a relationship between the composite index of sustainable development and individual sub-indices and indicator of ROE. For this purpose we used Spearman's rank correlation coefficient (Tab. 10). Direct moderate correlation is apparent between economic sub-index and also composite index of sustainable development and indicator of ROE. The connection of environmental and social sub-index separately to ROE had not been shown sufficiently.

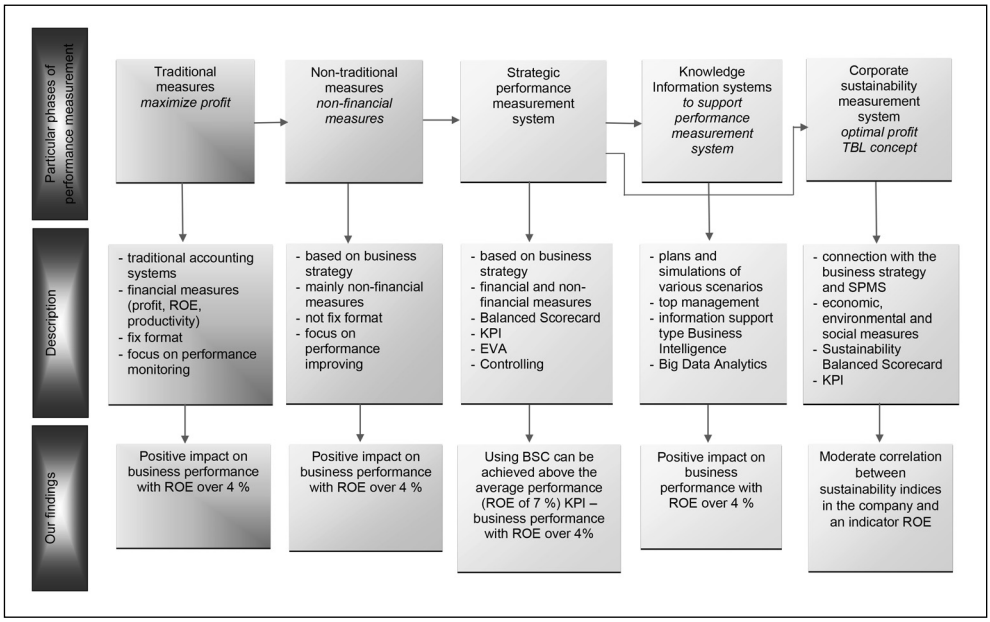
For the once, we assume that the measures it has taken place in the context of sustainable development (which are captured in various sustainability indices) may have a delayed effect, respectively there is a time lag between the adoption of certain measures and economic (financial) consequences. We have analyzed the delay for a one year. This assumption is supported by the following chart and from which it can be clearly seen late changes in ROE indicator in connection to the development of a composite index of sustainability (Fig. 2). In this case it exists the observed strong, respectively moderately strong direct link between I_{CSD} and indicator ROE.

4. Discussion, Limitations and Conclusion

Performance measurement system has undergone for several phases into its present form. At the beginning the system was focused solely on financial indicators based on accounting data from the past previous years. Whereas the businesses do not operate in a closed system of relations, but rather in a dynamically evolving environment, it was necessary to look at the business performance in other way and take account of its nature. The attention has given to the non-financial indicators and more complex systems to support business performance, with an emphasis on strategy and business objectives (in terms of technological innovations, the environment, social aspects, IT).

With a growing awareness of natural limits and social issues it comes to the fore the corporate sustainability concept and its measurement. In this area are still some limitations, especially in the linking of economic, environmental and social performance. We can conclude that SPMS and corporate sustainability measurement system are in the some relation. More and more businesses are willing to invest time and energy on building SPMS focused on non-financial objectives and indicators, as well as sustainable development of enterprises. These endeavors, however, definitely not be inconsistent with the achievement of the overall economic performance of the company measured by ROE, which confirmed the partial results of our empirical research. The development of individual periods of performance measurement system we further characterize in the following Fig. 3. Apart from the brief description of these periods it is mention also the connection with the specific results of our research. We identified and analyzed parameters for measuring and managing corporate performance, whereby a key finding was the size of ROE. We examined selected tools and concepts from the perspective of the different phases of performance measurement

Fig. 3: **The overview of particular phases of performance measurement systems with our research findings**



Source: own

systems stated in Part 1. Firstly, we analyzed the influence of BSC methodology to the business performance. In conclusion BSC methodology has a demonstrable impact on the business performance which means that through its use can be achieved an above-average performance (ROE value of 7%). Secondly, also KPI system affects the performance of enterprises; businesses using KPI achieved a better performance with ROE of 4%. Thirdly, in terms of non-financial indicators especially orientation on the environment the analyses demonstrated statistically significant dependence between examined parameters (better business performance with ROE of 4%). Fourthly, in the case that companies do not have the knowledge information system as a complex system and do not take into account its implementation they tended to have a lower level of performance. This means that the BI knowledge information system has a major impact on business performance.

Further, we supported the fact that direct moderate correlation is apparent between economic sub-index and also composite index of sustainable development and indicator of ROE. The connection of environmental and social sub-index separately to ROE had not been shown sufficiently. The assumption of a delayed effect was shown in sustainability indices. In this case it exists the observed strong, respectively moderately strong direct link between sustainability indices and indicator ROE. In the sustainable development issue, we can say that the environmental sub-index has the effect of reducing the total value of composite index; on the contrary the social sub-index maintained this value. Due to the changes that occur in environmental (existential), we think that the linking between sustainable development and business performance is the way according the motto “save the planet and keep your performance”. However, we can conclude that the index of sustainable development is a challenge for enterprises reflecting a growing need for change purely short-term oriented, consumerist patterns of production and consumption.

Finally, we conclude that SPMS in its current form has gone through a certain phases

of development which are characterized by particular features. We presented the brief view of these phases with support of our research results. Between SPMS and corporate sustainability we see the certain connection (a complex support of decision making, improving performance, mainly intended for larger companies, ability to manage the business in a predetermined direction of the longer term, respecting the change in global thinking with regard to sustainable development).

Our research has been processed with the following limitations:

- **Sample size**. Due to the lower return it was not possible to reach a larger number of enterprises, so research sample was 164 enterprises.
- **ROE indicator**. This limitation would be to use only one parameter to measure performance in the form of ROE. The most appropriate indicator should be indicator EVA, but because of the problems of availability of data, we focused on the ROE indicator. In further research would be applicable to extend the parameter of another (ROA, ROI, NOPAT).
- **Examination of corporate sustainability in the questionnaire survey**. We examined the corporate sustainability concept in the example of a particular enterprise. Thereby it is absent a preview to the concept and processing a large number of enterprises.
- **Performance of the enterprise surveyed**. Despite the fact that the results revealed moderate interdependence between sustainability indices and indicator ROE, it is questionable to what extent the particular index contributes to business performance.

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Abstract

INFLUENCE OF BUSINESS PERFORMANCE MEASUREMENT SYSTEMS AND CORPORATE SUSTAINABILITY CONCEPT TO OVERAL BUSINESS PERFORMANCE: "SAVE THE PLANET AND KEEP YOUR PERFORMANCE"

Rastislav Rajnoha, Petra Lesníková, Vladimír Krajčík

Nowadays the dissatisfaction with only financial indicators has led to a focus on non-traditional areas of performance measurement as Balanced Scorecard, environment indicators and others. Moreover many recent studies has focused on the corporate sustainability concept and performance measurement interconnection. The aim of this paper is to identify the relationship between selected management tools and concepts of various development phases of strategic performance measurement systems to overall business performance measured by indicator ROE. Similarly the aim is to identify the relationship between the sustainability index and indicator ROE as a key aspect in terms of the current climate crisis. Our most important findings bring new information and knowledge for the strategic transformation from traditional business performance measurement system to strategic and sustainable performance measurement system. Specifically we found out that the BSC methodology has a demonstrable impact on the business performance. Also KPI system and orientation on the environment affect the performance of enterprises. In the case that companies do not have the knowledge information system as a complex system and do not take into account its implementation they tended to have a lower level of performance. This means that the BI knowledge information system has a major impact on business performance. Regarding to the corporate sustainability concept we can confirm that the direct moderate correlation is apparent between economic sub-index and also composite index of sustainable development and indicator of ROE. The connection of environmental and social sub-index separately to ROE had not been shown sufficiently. Based on results we can conclude that the index of sustainable development is a challenge for enterprises reflecting a growing need for change purely short-term oriented, consumerist patterns of production and consumption.

Key Words: *Business performance, financial measures, non-financial measures, strategic performance measurement system, knowledge information system, sustainability measurement system.*

JEL Classification: *M21, M14.*

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ACCESS TO FINANCE: INNOVATIVE FIRMS' PERCEPTIONS IN POST-TRANSITION EU MEMBERS

Valerija Botrić, Ljiljana Božić

Introduction

It is widely documented in the literature that innovators perceive business obstacles differently from non-innovators (Mohnen et al., 2008; Galia & Legros, 2004). Extant findings indicate that firms are able to surmount obstacles (Baldwin & Lin, 2002; Tourigny & Le, 2004) and efforts to understand how firms manage to innovate despite obstacles have been made (Radas & Božić, 2012). It has also been emphasized in the literature that we need to distinguish between obstacles that cause absence of innovation and those that make innovation difficult (D'Este et al., 2012; D'Este, Rentocchini, & Vega-Jurado, 2015). Access to finance has been recognized as important issue not only in the academic literature, but also in public discussions. In terms of policy actions, access to finance has been frequently discussed as one of the obstacles for growth within the European Union, especially in case of SMEs. In 2012 EC adopted an action plan to improve access to finance for SMEs (European Commission, 2011). Programme Competitiveness and Innovation Framework Programme (CIP) and its successor Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME) are designed to alleviate financing constraint for important segments of the EU economy. Despite this, Survey on the Access to Finance of Small and Medium-sized Enterprises (SAFE) reveals variations across EU countries in various aspects of access to finance but it is still an issue for many firms in EU countries.

Although problems regarding the access to finance are present across Europe, especially related to SMEs, we focus the analysis on post-transition EU member countries, due to well-known reasons. These countries generally have to catch up with EU most developed economies in many aspects. Problems with access to finance in these countries are potentially harmful to development of entrepreneurship, innovation performance and overall growth, leading to further lagging behind more advanced market economies. Perceived access to finance can determine business decisions and constrain potential business expansion, including introduction of innovation. In this paper we seek to identify if a gap in perceptions on access to finance between innovating and non-innovating firms in post-transition economies exists. The presence of this gap can help us to understand why firms don't initiate innovation activities. Faced with lack of internal finances, firms that perceive access to external finances as major and unsurmountable problems are expected to give up their ideas without even attempting. Innovation activities in post-transition EU member states are even more financially constrained because insufficient financial support by public institutions (Šipikal, Pisár, & Uramová, 2010). Specifically, previous research has shown that majority of entrepreneurs in Slovakia and the Czech Republic do not receive sufficient help and support from banks as bank criterions for loan approval are too strict (Belás et al., 2015).

In addition to identifying access to finance gap between innovative and non-innovative firms, we explore whether we could identify the characteristics of the firms that contribute to the gap formation. In other words, we explore whether factors such as size of the firm or educational attainment of the employees could explain the differences in access to finance perceptions between innovative and non-innovative firms. Since we are analysing the data pooled over a set of countries, identifying common factors would imply that similar policy recommendations could be provided for a group of countries. Identifying country-specific factors to prevail would call for distinctive solutions.

The remainder of this paper is organized as follows. Section 1 provides basic information on theoretical framework and empirical strategy used in the analytical segment. Section 2 gives overview of the problem analysed. Section 3 presents results of the empirical estimation and provides discussion. Last section summarizes conclusions.

1. Theoretical Background and Empirical Strategy

The main focus of the paper is related to the factors influencing the access to finance perceptions. In particular, we want to address the issue whether access to finance is different for innovators than for non-innovators, based on their revealed perceptions. Lack of appropriate financing is important issue from the perspective of innovators but also relevant for all enterprises (Savignac, 2008; Tiwari et al., 2007), regardless of their current innovation effort. The growth of firms, especially small ones, is frequently seriously limited by internal finances (Carpenter & Petersen, 2002). The literature usually finds that small enterprises and in particular micro enterprises have more difficulties in financing their projects (Beck & Demirgüç-Kunt, 2006). Freel (2007) provides evidence that small and innovative firms are less successful in obtaining loans in comparison to large firms, and the background for this is found in bank concentration (Beck, Demirgüç-Kunt, & Maksimovic, 2004). Financing related problems negatively affect profitability of start-ups (Banerjee, 2014). Nevertheless, literature argues that financial constrains to SMEs in developing countries can be alleviated by financial liberalisation (Laeven, 2003). Since financial sector has been underdeveloped at the beginning of transition and recently severely affected by global economic crisis, the legitimate question is how the firms in these economies have weathered these unfavourable conditions.

Special characteristics of firms have also been analysed in the literature with respect to relative access to finance difficulties. Extant literature suggests that gender of firm owner or manager determines relative access to finance. Female led firms experience more problems in obtaining necessary financing (Lee, Sameen, & Cowling, 2015). However, Haines, Orser and Riding (1999) argue that there is no a priori discrimination against female entrepreneurs, but rather that female entrepreneurs are likely to run smaller businesses in risky industries. Furthermore, low proportion of venture capital investment in female owned enterprises can be explained by the dissimilarity in the industry preferences by female entrepreneurs and venture capitalists (Green et al., 2001). However, although it is still at the low level, these authors identified positive trends regarding venture capital investments of female owned enterprises. Also, over time, access of female entrepreneurs to bank loans has improved (Haynes & Haynes, 1999).

Another factor influencing the relative access to finance is education of the entrepreneurs and/ or employees. It has even been found that education is related to the use of equity capital for financing businesses owned by female entrepreneurs (Carter et al., 2003). Vos et al. (2007) find that younger and less educated entrepreneurs are more likely to get loan approval. According to the same source, fear of loan denial is lower for entrepreneurs with higher levels of education while older and more educated entrepreneurs seek financing from external sources less.

Girma, Gong and Görg (2008) find that access to finance affects firms differently depending on their ownership structure. Their result show that state owned firms experience fewer problems with financing in comparison to other firms. Foreign ownership, frequently associated with foreign direct investment, can provide additional source of financing and consequently alleviate financing constraints (Harrison, Love, & McMillan, 2004). Foreign owned firms have been found to face less financing constraints (Beck et al., 2006), due to ability to raise necessary funding not only domestically, but also from abroad.

Except ownership, other firm characteristics are related to access to finance difficulties. Beck et al. (2006) find relationship between firm age and financial constraints. Namely, older firms are less constrained by financial problems, since they are present on the market for a longer period and had the opportunity to build relationships with investors. Access to finance is significantly more constraining for young innovative firms than it is for older innovative firms (Schneider & Veugelers, 2010), since investors frequently do not have previous experience with young firms and mind find their business (innovative) ideas too radical.

There are two possible reasons why in the literature established relationships might not hold for post-transition economies. The first is that the structure of economy might be under different influences than in the case of advanced market economies. This might be in particular related to the development of the financial system in post-transition economies (Epstein, 2014). Another factor impeding access to finance that we want to emphasize in this paper is related to the effects of global economic crisis. Specifically, credit crunch effect might have been more severe in post-transition than in more advanced economies, partially also as a consequence of cross-border lending (Haas, 2014). Svetličič and Kunčič (2013) emphasize that foreign capital, which has been very important source of financing in transition economies, has severely decreased as a consequence of crisis. Thus, although the factors that have been previously found in the literature to affect access to finance might also be important for post-transition economies, there are some special features which combined with the effects of the latest crisis, might exert unexpected results.

In order to analyse perceptions of access to finance empirically, we rely on the latest available Business Environment Survey (BEEPS V), covering the 2012-2013 period. This survey is conducted by the European Bank for Reconstruction and Development (EBRD) and the World Bank. The data for 15,600 manufacturing and services firms in 30 EBRD countries are gathered employing face-to-face interviews. More information on BEEPS V is available on http://ebrd-beeps.com/.

The sample in this study consists of 3,393 firms from eleven central and eastern European countries (CEEC) – EU members. The sample includes countries that joined EU during the eastern enlargement in 2004 (Czech Republic, Estonia, Hungary, Latvia and Lithuania, Poland, Slovak Republic, Slovenia), 2007 (Bulgaria, Romania) and finally in 2013 (Croatia). Since we analyse period 2012-2013, we do not need to provide additional argument that the effects of global economic crisis are still present in the sampled economies. This fact has important consequences for decisions to innovate and ongoing innovation activity of the enterprises. In this analysis we distinguish between innovative and non-innovative firms. Innovative are those that during the last 3 years (1) have successfully developed new or significantly improved product, production/supply practice, organisational/management practices or structures, marketing methods and logistical or business process, and/or (2) have invested in (intermural or extramural) R&D and and/or gave employees time to develop or try out a new approach or new idea about products or services, business process, firm management or marketing.

Firms without innovation output or any documented attempt to innovate are classified as non-innovative. All cases where the answer to one of the questions related to innovation activity was “I do not know” are excluded from the analysis as their answers are not reliable. In order to analyse factors contributing to the perceptions of access to finance, we rely on the factors previously established in the literature. To that end, we consider following list of variables (the explanation of the variable coding is in the Appendix A1).

Size of the firm. In order to capture this effect, we consider dummy variables for micro, small, medium and large enterprises. The definition of the size boundaries is taken from the Survey itself. The rationale for inclusion of this variable is that it seems that larger enterprises are expected to have easier access to finance than SMEs.

Type of the enterprise. Since our main focus is on the countries in various stages of post-transition, one of the hypotheses is that origin of establishment itself might be important for difficulties in obtaining finance. For example, we could foresee that firms that start as originally private might perceive larger difficulties in access to finance than joint ventures with foreign partners who could provide financing from their home countries. Dummy variables that reflect whether the firm was established by privatization of a state-firm; as originally private; as private subsidiary of a formerly state-owned firm; joint venture with foreign partners or state-owned firms are considered. Additionally, we include dummy variable if the establishment is part of a larger enterprise. Since we generally assume that larger firms can more easily gain access to finance, we believe that this additionally captures the network effect, in particular if this case is related to domestic subsidiary of a multinational enterprise.

Type of activity. In this paper we cover the period during which effects of the global crisis

have affected most of the analysed countries. Since the crisis can have different impacts on different segments of the economy, we include dummy variables for the most general type of activities – manufacturing, retail and services. This effect could be probably more important for transition economies, which had gone through a deindustrialisation period (see Kudina and Pitelis (2014) for a wider explanation related to FDI and overall economic performance) and consequently we assume that firms in manufacturing perceive larger difficulties in financing their projects. Additional factor is that projects in manufacturing might be financially more demanding than projects in services. Since we cannot control for the amount of financing required for each project, this approach seems plausible.

Gender of employees. Two aspects are considered here. First relates to the dummy variable if the manager is female and the second relates to the share of female employees in the firm. The gender issues have been previously found significant in relation to the access to finance and we also believe that this might be important for post-transition economies.

Age of the firm and education of employees. Including age of the firm relates to the knowledge accumulation through time. Young firms frequently have difficulties in getting finance, both due to the fact that they are relatively unfamiliar to financing agents and their lack of experience in preparing project documentation. Along the same lines, we assume that firms with highly educated employees are more likely to prepare the financing documentation according to the requirements and consequently do not perceive the financing constraints as important as firms with less educated employees.

Growth of the firm. We assume that firms that have experienced growth (measured by the increase of employment during the last three years) and firms that expect growth of their sales in the forthcoming period at the same time less likely to identify access to finance as a major obstacle for development. Thus, we also include these variables in our specification.

The contribution of these factors to the access to finance perception gap are empirically assessed in Section 3. However, prior to that, we devote some space to the presentation of the sample characteristics and illustration of the analysed issue.

2. Preliminary Findings and Empirical Strategy

Table 1 shows the structure of the sample by country, innovation activity and applications for credits or bank loans in the three-year period. Total sample is dominated by innovators (i.e. 55 percent), which is fortunate for the analysis since the countries in the sample are not belonging to the innovation leaders in the European Union. Analysed by country, Estonia, Hungary, Latvia, Lithuania and Slovak Republic have less than 50 percent of innovative firms in the sample. Our analysis focuses on all types of innovative activity. However, it might be interesting to reveal that among the innovative enterprises, large share of them revealed that they had introduced new product or service over the reference period (from 48 percent in Bulgaria to 78 percent in Czech Republic). New production methods has been relatively less frequent (from 22 percent in Slovenia to 56 percent in Hungary), as well as new organisational/management practices (from 35 percent in Latvia to 58 percent in Bulgaria) and new marketing methods (from 35 percent in Latvia to 65 percent in Romania). Since respondents could have reported multiple innovative activities, we classify them as innovators if they had reported any of the possibility during the reference period.

26 percent of firm in the overall sample have had applied for bank loans, showing that there is a large percentage of firms that had direct experience with the access to finance. Countries with highest rate of firms that have applied for credits and loans are Romania (37.5 percent), Slovenia (36 percent) and Estonia (29.6 percent). Data reveal that innovators apply more for bank loans and credits (30.5 percent of innovators vs. 25.5 non-innovators). However, data vary significantly by country. In Bulgaria, Croatia, Czech Republic, Estonia and Slovenia non-innovative firms apply more for loans and credits.

In order to assess whether the innovative firms or non-innovative firms perceive access to finance more, we have contrasted the responses of each sub-populations regarding their answers. Results presented in Figure 1 reveal that access to finance is perceived as major obstacles more in innovative firms. Share of firms perceiving access to finance as major issue is generally higher in the group of innovative firms than among non-innovative

Tab. 1: Innovative and non-innovative firms and their applications for credits or loans

Countries	Innovators			Non-innovators		
	Applied	Not applied	Total	Applied	Not applied	Total
Bulgaria	29	124	153	23	105	128
Croatia	56	161	217	35	72	107
Czech Republic	46	119	165	16	50	66
Estonia	37	72	109	35	99	134
Hungary	38	72	110	32	150	182
Latvia	16	96	112	17	185	202
Lithuania	34	71	105	24	120	144
Poland	79	202	281	38	181	219
Romania	157	227	384	34	92	126
Slovak Republic	27	65	92	26	103	129
Slovenia	52	87	139	30	59	89
Total	571	1,296	1,867	310	1,216	1,526

Source: own based on BEEPS

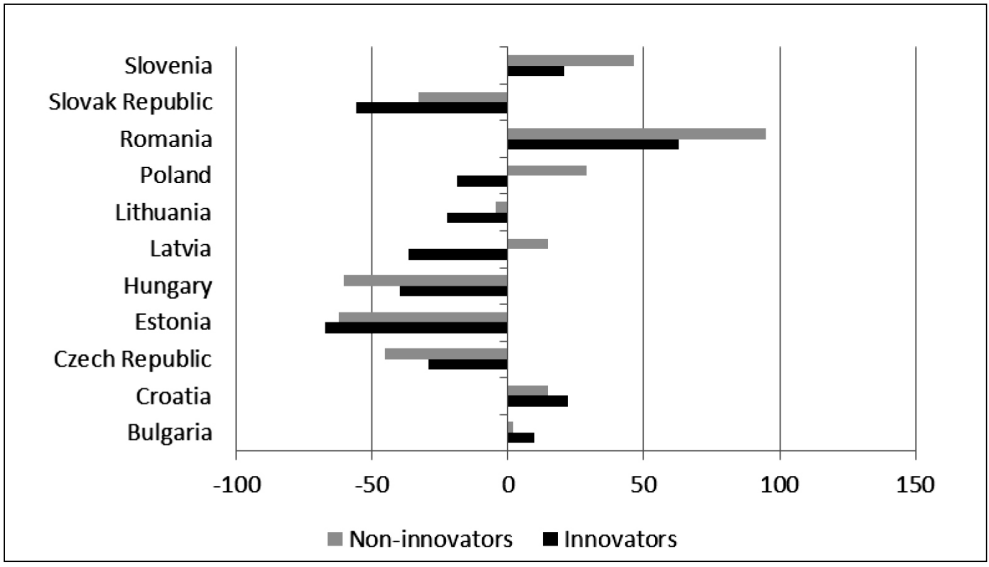
firms. This is not the case in Latvia, Poland and Slovak Republic where there is higher share of non-innovative films struggling with this obstacle. In order to emphasize the cross-country differences, we present the perceptions of each subgroup (innovator or non-innovator) in specific country to the overall sample. This reveals that the access to finance is considered to be more important in Romania, Slovenia, Croatia and Bulgaria. In Poland and Latvia, non-innovators seem to express larger concern regarding access to finance than non-innovators in other countries.

As indicated, innovative firms perceive access to finance to be major obstacle more frequently than non-innovative firms. The overall sample data indicates that the share of innovators who perceive access to finance to be major or very severe obstacle is 19.6 percent. In case of non-innovators this percentage is 13.8. Furthermore, preliminary probit estimates (results available upon request) have revealed that when access to finance is regressed to possible predictors including dummy variable for innovative firms in a pooled sample, the innovative dummy is positive and statistically significant. This additionally confirms the fact that innovative firms perceive access to finance more problematic than other firms. Amongst other variables, only two more were found significant, both with negative coefficient – a dummy variable for a firm being a part of a larger enterprise and a dummy for an enterprise which has been established as joint venture. Both seem highly logical, since in both cases we can assume that partners are responsible for providing additional financing.

Preliminary analysis points to the existence of perception gap between innovative and non-innovative firms in sampled countries. The question that we want to analyse is whether we can identify the firm characteristics that contribute to the gap in perceptions. Since part of the explanation behind the gap might be related to the differences in firms' characteristics (as previously established in the literature), we restrict the analysis to the matched sample.

Our variable of interest is whether firms consider access to finance to be major or very severe obstacle to their business. To identify the gap in the outcome variables we have used Fairlie (1999) decomposition, which is an extension of the widely used Blinder-Oaxaca decompositions for the cases when the outcome variable is binary. Fairlie (1999) describes the method to identify and decompose the overall gap between the two subgroups into the contribution of each specific factor considered

Fig. 1: **Share of firms perceiving access to finance as major obstacle, innovative vs. non-innovative sub-sample**



Source: own based on BEEPS

to be relevant for the existing gap. The methodology relies on defining characteristics which are important for the specific outcome. The significance of specific factors for the outcome can be estimated by the logit or probit model. Theoretically, decomposition method proposed by Fairlie holds exactly in case of logit model, but empirically very closely also for the probit model (Fairlie, 2005). In the specifications presented below, we follow the logit approach, which has initially considered all previously discussed variables. The final choice of variable, however, ensured favourable statistical properties of the estimation output.

In all presented cases, prior to estimation, variables were checked for multicolinearity. This is particularly important in case of dummy variables capturing the whole population. Since we do not assume a priori that the correlations are the same across analysed countries, data properties dictate omission of the specific category covered by reference dummy variable. The results of the estimation are presented in following section.

3. Empirical Results and Discussion

We have estimated the gap in perceptions on relative difficulties in access to finance between innovators and non-innovators with two separate definitions of innovative firms, in order to provide some robustness check. In „output innovation" the innovative firms are only those that were successful in innovation activity during the analysed period. In „R&D innovation" innovative firms are defined as those that were successful in innovation output but also as those that had innovation input during the analysed period but were not yet successful in output innovation.

The gap has been estimated by following the Fairlie procedure. The procedure has been applied with standard 100 replications, randomising the ordering of independent variables. The sample has been restricted to the firms in the countries analysed in the paper. The reference group has been set to innovators. The results of the gap estimation are presented in Table 2.

The data in previous table reveals that the innovative firms perceive access to finance as generally more important problem than non-innovative firms. The fact that the gap slightly differs from the one based on sample averages is due to matching procedure. Without matching, the sample gap amounted

Tab. 2: Estimated gap results in two alternative specifications

	Output innovation	R&D innovation
Innovators (percent)	19.66	19.25
Non-innovators (percent)	14.28	13.72
Gap	-5.38	-5.52
Total explained	-3.09	-2.52
- Percentage of gap	57.43	45.65

Source: own

to -5.8. This shows that matching reduced the gap to a certain extent, although the effect seems small. Both estimations have yielded similar results, showing that the definition of the innovative firm (the one with innovation output, or just innovation input in the analysed period) does not affect the final results. When overall sample is considered, innovative firms perceive greater difficulties in access to finance than non-innovative firms.

The variables used in the decomposition seem to contribute to the explanation of the overall gap. The results imply that, if the non-innovative firms were more similar to innovative firms, this would actually reduce the estimated gap in perceptions. So, part of the explanation of the perceptions gap could be attributed to the different characteristics of the innovative in comparison to non-innovative firms.

When exploring the perceptions on the access to finance, the benefits of utilizing the Fairlie procedure can be found in the fact that it uses logit model to perform one to one matching. The estimated logit model has the dummy dependent variable related to the access to finance. Thus, from the data presented in Appendix A2, we can see that country dummy variables are important predictors for the access to finance difficulty perceived by innovative firms. Additionally, we can only find female top management to be important predictor, and from the estimation results it seems that female managers are less likely to perceive this issue as the problem. If we include the firms that had innovation input but were not successful in the sample, than we can also see that micro enterprises dummy variable becomes significant. This finding might be related to the most current period, since micro firms might be having adverse experienced on the financial markets due to the crisis. This specification precisely includes micro firms that have attempted innovation, but were not yet successful and it seems that for them the financing constraint is relatively more important than if we count as innovators only those that already had innovation output.

Decomposition of gap reveals that relatively few variables can be accounted for its existence, due to the fact that most of the contributions seem to be insignificant. In case when we have defined innovators as those that actually had innovation, dummy variable covering female top management was the only one (besides country dummies) that was significant contributor to the explanation of the gap. It explained approximately 3.9 percent of the gap. In case of definition of firms that have both attempted innovation and succeeded, 3.9 percent of the gap and 8.6 percent of the total explanation of the gap can be attributed to the firms with female top management. This means that female top management perceives that the access to finance is more important for innovative firms.

The fact that we have found country variables to be important contributors to the gap reflects different financing conditions in the countries.

The important finding of empirical exercise performed in this paper is that, although differences in perceptions of the access to finance difficulties between innovative and non-innovative firms exists in most post-transitional economies, they are in general not related to the characteristics of the firms, but actually immanent to the countries themselves. Thus, although general claim persists that smaller firms, or relatively younger firms or even the firms in manufacturing sector experience greater difficulties in finding adequate financial resources for their projects, our results point to

Tab. 3: Contributions to the gap: estimated coefficients and percentage of total gap

	Estimated coefficients*100 (standard errors*100)	
	Output innovation	**R&D innovation**
Type of activity		
-Manufacture	-0.103 (0.202)	-0.068 (0.199)
-Services	0.002 (0.036)	0.003 (0.059)
Size of enterprise		
-Micro	0.234 (0.224)	0.394 (0.254)
-Small	0.022 (0.159)	0.109 (0.229)
-Large	-0.149 (0.349)	-0.499 (0.449)
Segment	0.050 (0.059)	0.052 (0.081)
Establishment origin		
-Privatization	0.029 (0.080)	-0.015 (0.089)
-Subsidiary	-0.008 (0.021)	-0.006 (0.042)
-Joint	0.029 (0.049)	0.58 (0.081)
-State	0.030 (0.036)	0.010 (0.030)
Age of firm	-0.030 (0.105)	0.077 (0.124)
Employees		
-Female management	-0.212* (0.115)	-0.217* (0.120)
-Employment delta	-0.053 (0.077)	-0.017 (0.047)
-University share	-0.007 (0.045)	0.002 (0.039)
Positive expectations	-0.255 (0.288)	-0.087 (0.318)
Country dummies		
-Bulgaria	0.065 (0.171)	0.161 (0.240)
-Croatia	-0.310 (0.304)	-0.410 (0.379)
-Czech Republic	-0.172 (0.200)	-0.042 (0.171)
-Estonia	-0.083 (0.092)	-0.060 (0.105)
-Hungary	-0,084 (0,155)	-0.119 (0.171)
-Latvia	0.763* (0.450)	0.899 (0.585)
-Lithuania	0.393 (0.278)	0.334 (0.308)
-Poland	0.149 (0.357)	0.288 (0.493)
-Romania	-3.340*** (0.795)	-2.854*** (0.812)
-Slovenia	0.003 (0.259)	-0.498 (0.390)

Source: own

Notes: *** denotes significance at 1%, ** denotes significance at 5%, * denotes significance at 10%. The percentages of total contribution of all covariates to the gap calculated based on unrounded data.

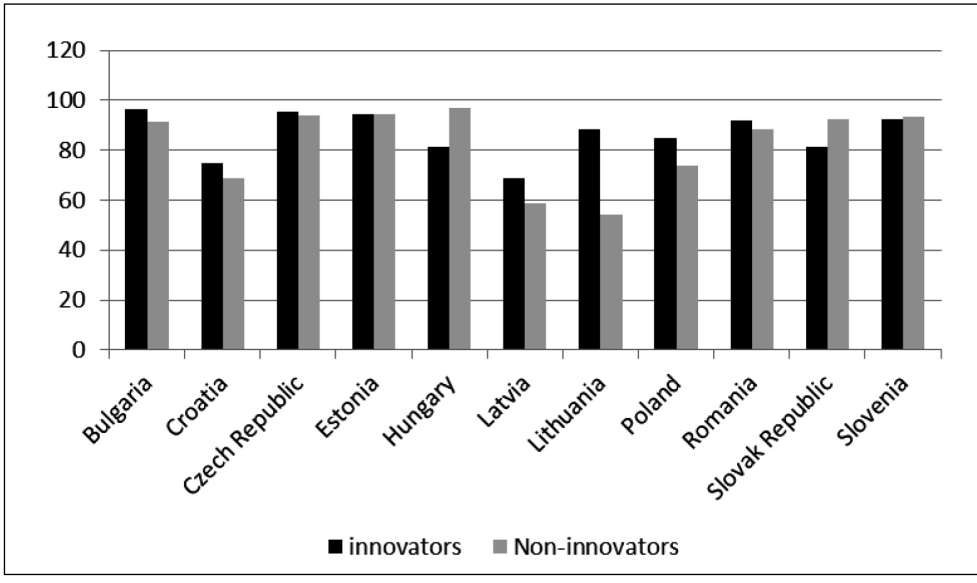
the fact that most important factor relates to the country the firms actually stage their business activity in. Thus, in countries with generally better business environment, innovative firms might form different expectations regarding the financing difficulties.

The expectations are frequently formed based on previous experience, as adaptive expectations. If the firms expect that their project will not be funded, they might not even decide to apply for credit. Thus we explore whether there are differences when it comes to approval rate of prior loan requesting attempts in innovative and non-innovative firms across country. In most of the countries (with the exception of Hungary, Slovak Republic and Slovenia), innovative firms have higher approval rate. Thus, previous experience of those that have asked for a credit or a loan does not indicate that based on their negative experience they would restrain from continuing their projects (Fig. 2).

Previous analysis refers only to the firms that have applied for finance and their experience, which seems to be in general positive. However, it might be the case that across the countries there are differences in factors influencing decisions not to seek finance. Consequently, we explore the main reasons innovative firms decide not to apply for finance and the answers are presented in Table 4.

The main reason why innovative firms don't apply for bank loans in all analysed countries is because they have enough capital to finance their operations and thus there was no need for additional external financing. The second most important reason why innovative firms in CEEC don't apply for loans is attributed to unfavourable interest rates. In countries such as Bulgaria, Croatia and Romania this is rather pronounced reason for not applying for bank loans. In several countries (namely in Latvia and Slovak Republic) there is equal percentage of innovative firms discouraged from applying for loans due to complicated procedure as it is due to unfavourable interest rates. Other reasons include too high collateral requirement that appears the most present among innovative firms in Bulgaria, Croatia, Hungary, Lithuania and Romania. Certain percentages of innovative firms, mainly from Hungary, indicate the size and maturity of offered loans were insufficient as one of the reasons for not applying. Interestingly, there are innovators

Fig. 2: Approval of finance rate to innovators vs non-innovators (in percent)



Source: own based on BEEPS

Tab. 4: Main reasons for not applying for finance, innovative firms (in %)

Country	Reasons					
	No need	Procedure	Interest	Collateral	Size	Pessimist
Bulgaria	55.64	5.64	25.00	6.45		
Croatia	67.70	6.21	13.04	7.45	1.24	0.62
Czech Republic	83.19		3.36		0.84	0.84
Estonia	76.38	2.77	5.55			2.77
Hungary	56.94	2.77	8.33	6.94	4.16	1.38
Latvia	77.08	3.12	3.12	2.08		5.21
Lithuania	61.97	5.63	8.45	7.04	1.41	2.82
Poland	78.22	1.48	3.46	1.48		1.98
Romania	56.82	9.69	17.18	7.92	0.44	0.88
Slovak Republic	75.38	7.69	7.69	3.07		
Slovenia	79.31	2.29	3.44	2.29		

Source: own based on BEEPS

Notes: No need: No need for a loan - establishment had sufficient capital; Procedure: Application procedures were complex; Interest: Interest rates were not favourable; Collateral: Collateral requirements were too high; Size: Size of loan and maturity were insufficient; Pessimist: Did not think it would be approved

that anticipate their approval would be rejected and hence don't apply. These pessimistic expectations are especially pronounced in Latvia.

The fact that the firms have declared that they have sufficient funding available is rather puzzling. If we were analysing economies and periods with abundant capital and pronounced economic growth, the large proportion of answers implying that there are enough internal funding available could be associated with encouraging business prospects for these firms. However, in circumstances this paper is referring to, a large proportion of "no need for financing" answers could be translated in "not enough viable business ideas", which is a notion frequently emphasized in public debates related to financing conditions in post-transition economies.

Conclusions

The main focus in this paper was exploring the gap in perceptions on access to finance difficulties in post-transition economies. The main findings is that, in general, innovative firms perceive access to finance (regardless whether they have already been successful in innovation or have just devoted some resources to innovative activity) to be a larger problem than non-innovative firms. However, this problem is not evenly distributed among the countries and there are even countries in which non-innovators have expressed greater concern regarding the financing constraint.

In exploring the factors contributing to the gap we have identified that precisely country differences play important role. Only one additional factor can be found to be significant contributor to explaining the gap – female top management. It seems that when innovative firms are considered, female top managements are more likely to express their worries regarding the difficulties in obtaining required financing. However, when gap in perceptions between innovators and non-innovators are considered, having female top management actually acts in reducing the existing gap.

The fact that other factors considered – size and age of the firm, type of establishment, growth prospects, structure of employees –

were not found to be significant contributors implies that firms with these characteristics perceive access to finance equally important impediment to their business, whether they are innovative or not. It seems that the major factor behind the gap in access to finance perceptions is related to the successfulness of the national policy in promoting available financing sources. This fact points to the need to redesign national policies where the gap seems to be most articulated in a way that it supports financing of innovation projects more vigorously than the previous experiences show to be the case.

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Appendix A1: Data description

Variable	Definition
Finance obstacle	= 1, if a firm perceives access to finance as major or severe obstacle
Manufacture	= 1, if a firm's main activity is within manufacturing sector
Services	= 1, if a firm is operating within wholesale; Hotel and restaurants; Services of motor vehicles; Construction Section; Transport ; Supporting transport activities or Post and telecommunications
Retail	= 1, if a firm's main activity is retail
Micro	= 1, if this is a micro firm (less than 5 employees)
Small	= 1, if this is a small firm (more than 5, less than 19 employees)
Medium	= 1, if this is a medium firm (more than 20, less than 99 employees)
Large	= 1, if this is a large firm (more than 100 employees)
Segment	= 1, if establishment is part of a larger firm
Privatization	= 1, if the firm was established by privatization
Subsidiary	= 1, if the firm was established as subsidiary of formerly state-owned firm
Joint	= 1, if firm was established as a joint venture with foreign partners
State	= 1, if firm was established as state-owned
Private	= 1, if firm was established from time of start-up as private
Age of firm	= years since establishment (until the time of interview)
Female share	= number of female employees/total employees
Female management	= 1, if top manager is female
Employment delta	= number of workers last fiscal year/number of workers 3 years ago
University share	= share of employees with university degree in total
Positive expectations	= 1, if a firm expects its sales to increase next fiscal year
Country dummies	= 1, if a firm is located in specific country

Source: own

Appendix A2: Logit estimates for Fairlie procedure, innovative firms sample

	Estimated coefficients (standard errors)	
	Output innovation	**R&D innovation**
Constant	-2.575*** (0.368)	-2.556*** (0.432)
Type of activity		
Manufacture	0.091 (0.175)	0.069 (0.198)
Services	0.012 (0.173)	-0.009 (0.193)
Size of enterprise		
Micro	0.371 (0.328)	0.675* (0.362)
Small	0.023 (0.166)	0.095 (0.192)
Large	0.127 (0.290)	0.400 (0.329)
Segment	-0.414 (0.340)	-0.258 (0.381)
Establishment origin		
Privatization	-0.103 (0.278)	0.054 (0.307)
Subsidiary	-0.471 (0.770)	0.145 (0.803)
Joint	-0.593 (0.758)	-0.734 (1.059)
State	0.681 (0.719)	0.661 (0.854)
Age of firm	0.002 (0.006)	-0.005 (0.008)
Employees		
– Female management	-0.419** (0.178)	-0.440** (0.196)
– Employment delta	0.023 (0.029)	0.140 (0.024)
– University share	-0.002 (0.012)	0.002 (0.014)
Positive expectations	0.132 (0.146)	0.046 (0.167)
Country dummies		
– Bulgaria	0.673* (0.394)	0.734* (0.441)
– Croatia	0.900** (0.384)	0.924** (0.449)
– Czech Republic	0.519 (0.459)	0.154 (0.594)
– Estonia	-0.424 (0.473)	-0.315 (0.528)
– Hungary	-0.234 (0.436)	-0.344 (0.497)
– Latvia	0.783** (0.363)	0.846** (0.420)
– Lithuania	0.792** (0.381)	0.714 (0.438)
– Poland	0.881** (0.351)	0.999** (0.402)
– Romania	1.620*** (0.354)	1.601*** (0.414)
– Slovenia	1.415*** (0.372)	1.245*** (0.451)
Diagnostics		
N	1,821	1,501
logL	-706.79	-569.48
LR Chi^2	79.55***	61.61***
Pseudo R^2	0.05	0.05

Source: authors' estimates

Notes: *** denotes significance at 1%, ** denotes significance at 5%, * denotes significance at 10%.

Abstract

ACCESS TO FINANCE: INNOVATIVE FIRMS' PERCEPTIONS IN POST-TRANSITION EU MEMBERS

Valerija Botrić, Ljiljana Božić

The post-transition EU member countries generally have to catch up with EU most developed economies in many aspects. Access to finance problems in these countries are potentially harmful to development of entrepreneurship, innovation performance and overall growth, leading to further lagging behind more advanced market economies.

In this paper we analyse perceptions on access to finance in post-transition EU member countries. Special focus in the paper has been put on the differences between innovative and non-innovative firms. Furthermore, we seek to identify the characteristics of the firms that contribute to the gap formation. Empirical analysis in this paper relies on the latest available Business Environment Survey (BEEPS V), covering the 2012-2013 period. The sample in this study consists of 3,393 firms from eleven central and eastern European countries – EU members (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia).

The analysis expectedly revealed that innovative firms perceive financing constraints to be more important for their business, but somewhat unexpectedly the differences across countries are present. Although access to finance is more likely to be perceived as a problem by innovative firms, the firms that are either a segment of larger enterprise or established as joint venture, in general have less problems in financing their activities. When exploring the contributors to the perceptions in access to finance gap, only one variable proved to be important – female top management. It seems that if female top managers were more equally distributed between innovative and non-innovative firms, the perceptions on access to finance gap would be smaller.

Key Words: *Access to finance, innovation, post-transition.*

JEL Classification: *O31, P33.*

DOI: *10.15240/tul/001/2017-1-009*

TWIN DEFICITS THREAT IN THE EUROPEAN UNION

Marianna Sinicakova, Veronika Sulikova, Beata Gavurova

Introduction

In the 1980´s the US economy was marked by until then rather unusual external and internal deficits. Similar situation gradually appeared in other countries. During last decade it was analysed in the case of so called PIIGS countries (Portugal, Ireland, Italy, Greece, and Spain) in the European Union. This co-movement draws interest of many researchers. Generally it is believed that internal deficit (fiscal budget deficit) causes external one (external balance deficit). External balance deficit is usually measured via trade or current account deficit. This phenomenon is called „twin deficit". Twin deficit problem can be perceived as a vicious circle. High budget deficit generates important current account deficit and this in turn leads to higher budget deficit. Therefore twin deficit threat should be in the centre of attention of policy makers.

While from 2000 to 2007 there were no significant changes in public debt level in the EU countries on average (including new member states that became the EU members since 2004, 2007, and 2013), during next seven years from 2008 to 2014 public debt has risen by 22% on average. During the first observed period even PIIGS countries managed to maintain their public debt level. In addition Bulgaria succeeded to reduce its public debt by 55%. During the next period public debt has risen significantly mainly in the PIIGS countries (by 56% on average) but also in Slovenia and Croatia by 61% and 45% respectively. Recommended value of public debt stemming from Maastricht criteria was overstepped by 9 or 15 out of 28 EU countries on average (including later EU members) during the first or second period respectively. In terms of average budget deficit during the first period 9 countries exceeded value of 3% to GDP recommended by Maastricht criteria. Throughout next period, 3% level of budget deficit was violated in 20 countries.

Several authors, e.g. Clarida et al. (2007), recommended 5% as a maximum threshold for current account deficit to GDP. Higher deficit represents according to them a danger zone for a country. Lower deficit can be quite easily in medium and long term compensate by current account surplus or by investments and other items of capital account. However, a deficit over 5% leads to external instability and other negative impacts in a country. When calculating average value of current account deficit to GDP during period from 2000 to 2014, 7 countries out of 28 exceeded dangerous point of 5%. It was as expected mainly the case of new EU members (Bulgaria, Cyprus, Estonia, Latvia, and Romania) and PIIGS countries (Greece, Portugal). While in the case of public debt we could observe worsening of situation during last years, the opposite was true as for current account deficit. All countries experienced improvement apart from Cyprus with slightly deepening deficit. This can be explained by recent financial and economic crisis accompanied by general decrease of domestic consumption. So how it is with internal and external indebtedness or imbalances in the European Union?

Results differ among countries (Kalou & Paleologou, 2011; Sipko, 2014). Neither hypothesis of twin deficit phenomenon, nor hypothesis on causality that internal deficit implies external one was confirmed in all countries. Consequently, if a country manages to reduce its internal deficit it does not have to lead automatically to drop of external deficit. Additionally there is a need to remember about country and economy environments (Michalski, 2010). Environment of local specific economics is not a simple sum of microeconomic influences (Bem et al., 2015) but should be considered with

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expected influences on the results (Szczygiel et al., 2015). Evolution of exchange rates (Sipko, 2000), business environment for small and medium enterprises (Belás & Sopková, 2016; Virglerová et al., 2016; Dubravská et al., 2015; Ključnikov et al., 2016; Belás et al., 2015) and other factors can significantly influence the results.

Nevertheless, ambition of the paper is to find out if twin deficits exist within the European Union consisting of various rather heterogeneous economies. We assume that the fewer countries suffer from the phenomenon the better situation for the EU policy makers is. Less problems with twin deficits across Europe lead to lower probability of contagion effect in other European countries. Though the aspect of twin deficits is much broader. Our paper extends existent literature from various points of view.

Via several steps we would like to identify i) presence of twin deficits in particular countries ii) direction of their causality, iii) and a break point (threshold) from which relationship between deficits may change. In addition, our paper considers diversity of studied groups of countries. We compare situation in i) new versus old member states, ii) advanced and emerging or developing European countries (according to the International Monetary Fund classification), iii) PIIGS and other countries, iv) euro area members and non-members.

Our approach enables us to specify external and fiscal position of researched countries. We will determine interactions or absence of interactions between variables.

The paper is organised as it follows. Section 1 presents a theoretical background and overview of relevant literature in the field of twin deficits, internal and external imbalances, etc. Section 2 reviews data applied in our analysis. Section 3 depicts employed methods. Section 4 provides empirical results and discussion based on our findings. The last section brings the conclusions.

1. Theoretical Background and Literature

Literature in the field of relationship between current account deficit and budget deficit can be divided into four groups. Research on: i) the twin deficit hypothesis, ii) the current account targeting hypothesis, iii) the feedback linkage, iv) and the inter-temporal Ricardian view (see Tab. 1).

The twin deficit hypothesis claims that budget deficit causes current account deficit. In other words, rising public expenditures cannot be fully and immediately satisfied by domestic production. Significant importations to a country are required and this will, ceteris paribus, lead to current account deficit. This phenomenon has been clarified via two possible approaches: a) the Mundell-Fleming theory b) and the Keynesian absorption theory.

The Mundell-Fleming approach stems from the fact that a rise of budget deficit implies a growth in real domestic interest rates. Consequently, this leads to capital inflows and exchange rates will appreciate. Therefore, importations will be relatively cheaper and exportations will be less competitive. This situation will trigger current account deficit.

The Keynesian absorption theory is based on the principle that a rise of the budget deficit generates a pressure on domestic consumption and absorption. This contributes to current account deficit.

Tab. 1: Relationship between current account deficit and budget deficit

i) twin deficit hypothesis	budget deficit → current account deficit	▪ Mundell-Fleming theory ▪ Keynesian absorption theory
ii) current account targeting	budget deficit ← current account deficit	
iii) feedback linkage	budget deficit ← → current account deficit	▪ bidirectional causality
iv) no linkage	budget deficit X current account deficit	▪ inter-temporal Ricardian view

Source: own

Some authors (Islam, 1998; Salvatore, 2006; Rault & Afonso, 2009) have proved important nexus between the two deficits and their causality from internal deficit to external one. They verified assumptions of the Mundell-Fleming and Keynesian theories.

On the other hand several authors, e.g. Anoruo and Ramchander (1998), Marinheiro (2008), and Stiglitz (2010), observed and confirmed reversal relationship between external and internal deficit. This opposite relationship was named as ''current account targeting'' by Summers (1988). Deterioration in the current account will probably curb economic growth, tax revenues will drop down and this will raise budget deficit, ceteris paribus.

Other researchers confirmed a bidirectional causality between internal and external deficits. Feldstein and Horioka (1980) observed that investments and savings are significantly correlated and this leads to bi-causality between the two variables. Similar empirical findings are in the contribution by Kalyoncu (2007).

However, some authors did not find any relation between the two deficits. These results are in line with the Ricardian equivalence hypothesis. This hypothesis postulates that budget and current account deficits are not interdependent. If economic growth drops, government will probably realise fiscal measurements to influence savings and investments, therefore real interest rates, exchange rates and current account does not have to be changed (Garcia & Ramajo, 2004; Michalski, 2009).

Within twin deficits, some authors (Algieri, 2013) have been recently focusing on so called PIIGS countries due to their significant indebtedness and problems in financial sector.

Complex studies comprising twin deficit analyses in larger groups of countries are rather scarce. Many authors focus on particular economies or smaller groups of countries. Therefore we would like to fulfil the gap and to analyse the European Union countries. Most of the authors apply Granger-causality testing, panel data, error correction model and generalized least squares estimators. However, we believe that it is useful to identify a break point after which nexus between deficits can be changed. Thus we will employ the threshold model to find this critical value.

2. Data

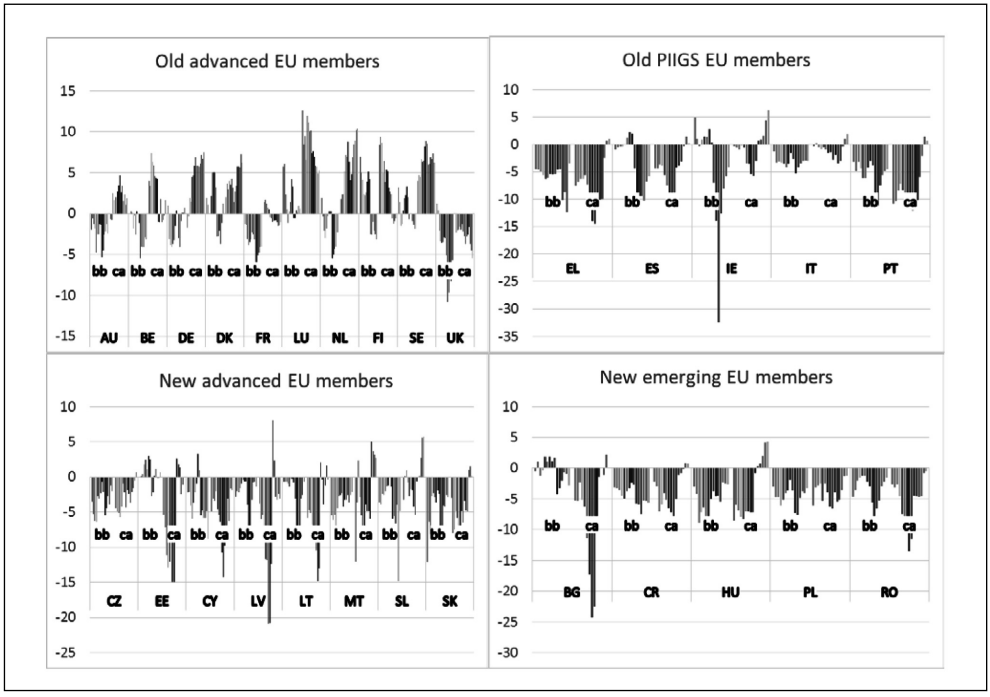
Our analysis comprehends 28 European countries. The sample includes annual data from 2000 to 2014. We employed either Eurostat or International Monetary Fund databases released in 2015.

Similarly to other panel data models for twin deficits (Chinn & Prasad, 2003; Forte & Magazzino, 2013), current account balance (ca) is a dependent variable and budget balance (bb) (budget deficit) is an independent variable. The public debt is defined as a threshold variable in our model, which enables us to determine the relation between budget balance and current account separately in several debt-to-GDP intervals.

We include also control variables which explain the current account balance. Firstly, we add an output gap. Output gap was calculated as a difference between actual and potential gross domestic product (GDP). Potential GDP was calculated using usual Hodrick-Prescott filter. We expect that an increase in output gap will deteriorate the current account. Then, we add a real effective exchange rate, as an important determinant of current account balance. Further, we take into account a trade openness; if a trade openness increases, the current account surplus is about to grow (as it is shown by Nickel and Vansteenkiste (2008)). Further, we add domestic investments as an increase in domestic investment leads to the current account deficit. Another control variable is inflation measured as annual rate of change or using GDP deflator. Rise of inflation should contribute to increase of current account deficit and this in turn should lead to rising budget deficit if we assume current account targeting hypothesis (i.e. assumption that external imbalance implies internal one).

Figure 1 provides us with a rough overview of two main time series; current account deficits and budged deficit. It approximately captures situation in four groups of countries from 2000 to 2014: i) old advanced EU members, ii) the PIIGS EU members, iii) new advanced EU members, iv) and new emerging members. It seems that both deficits did not appear in the group of old advanced EU members with the exception of the United Kingdom. However simultaneous presence of both imbalances is more obvious in three remaining groups. Nevertheless we will apply several methods to verify our twin deficit hypothesis apparent

Fig. 1: Budget balance and current account (% of GDP) from 2000 to 2014



Source: own representation according to the Eurostat (2015), International Monetary Fund (2015)

Note: BE – Belgium, BG – Bulgaria, CZ – Czech Republic, DK – Denmark, DE – Germany, EE – Estonia, IE – Ireland, EL – Greece, ES – Spain, FR – France, CR – Croatia, IT – Italy, CY – Cyprus, LV – Latvia, LT – Lithuania, LU – Luxembourg, HU – Hungary, MT – Malta, NL – Netherlands, AU – Austria, PL – Poland, PT – Portugal, RO – Romania, SL – Slovenia, SK – Slovakia, FI – Finland, SE – Sweden, UK – United Kingdom, PIIGS – Portugal, Italy, Ireland, Greece, Spain. Classification of countries as advanced or emerging ones is according to the International Monetary Fund.

but not certain from Figure 1. The employed methodology is described in chapter 3.

3. Methodology

Presence of twin deficit phenomenon in the EU countries is verified using standard Pearson´s correlations between two principle variables, budget balance and current account. However, we will consider time lag, too, as it is possible that budget balance deficit or surplus can imply current account deficit or surplus and vice versa with a certain delay (Lascsáková, 2016). We choose a delay of one year and thus we perform cross-correlations.

Gradually we complete our research using Granger causality testing and panel data threshold model.

3.1 Granger Causality Testing

Granger causality testing will enable us to determine direction of causality between observed variables. We will focus on relationship between budget balance (bb) and current account balance (ca).

Null hypothesis will suppose that budget balance does not Granger cause current account balance. On the contrary, alternative hypothesis will be based on assumption that budget balance does not Granger cause current account. And we will test opposite direction, too, considering budget balance as dependent and current account as independent variable (Lascsáková, 2010).

Granger causality testing typically deals with lagged values of variables to take into

account delayed impact of independent variable on dependent one. Number of lags is usually chosen according to Schwarz or Akaike information criterion.

However, Granger causality testing has its limitations. Granger causality is not always true causality. Granger test is designed to measure a nexus between two variables. Nevertheless, in reality a relationship can be implied by three or more variables (Toda & Yamamoto, 1995). Therefore it seems appropriate to verify these causalities using vector autoregression or panel data model. Further, we will apply panel data threshold model.

3.2 Panel Data Threshold

Hansen (1999) proposed a panel data threshold model with fixed effects. The model is defined in the following way:

$$y_{it} = \mu_i + \beta_1' x_{it} I(q_{it} \le \gamma) + \\ + \beta_2' x_{it} I(q_{it} > \gamma) + e_{it} \quad (1)$$

Here, the panel data set is divided into two regimes, depending on the fact whether the real value of the threshold variable q_{it} is higher or smaller than the estimated threshold (i.e. the estimated value of the threshold variable γ). These two regimes are distinguished by different estimated regression coefficients β_1 and β_2. Econometric modelling gives the estimation of the regression coefficients β_1, β_2 and the estimation of the threshold γ.

Double threshold model (i.e. the model with two estimated threshold values of the threshold variable) can be defined in the following way:

$$y_{it} = \mu_i + \beta_1' x_{it} I(q_{it} \le \gamma_1) + \beta_2' x_{it} I(\gamma_1 < \\ < q_{it} \le \gamma_2) + \beta_3' x_{it} I(q_{it} > \gamma_2) + e_{it} \quad (2)$$

where the estimated thresholds $\gamma_1 < \gamma_2$ (Hansen, 1999).

3.3 Threshold Model for Twin Imbalances

We suppose that the relation between current account and budget balance depends on the public debt-to-GDP ratio. Therefore, we define a panel data threshold model for twin imbalances. We write directly a double-threshold model, as further estimation shows that one-threshold model is not well specified:

$$CA_{it} = \mu_i + \beta_1 BB_{i,t-1} I(DEBT_{i,t-1} \le \gamma_1) + \\ + \beta_2 BB_{i,t-1} I(\gamma_1 < DEBT_{i,t-1} \le \gamma_2) + \\ + \beta_3 BB_{i,t-1} I(DEBT_{i,t-1} > \gamma_2) + \\ + \theta_1 GAP_{i,t-1} + \theta_2 REER_{i,t-1} + \\ + \theta_3 OPEN_{i,t-1} + \theta_4 INV_{i,t-1} + e_{it} \quad (3)$$

Where:

CA_{it} is a current account balance (in % of GDP).
$BB_{i,t-1}$ is a budget balance (in % of GDP).
$DEBT_{i,t-1}$ is a public debt (in % of GDP) – a threshold variable.
$GAP_{i,t-1}$ is an output gap (in % of potential GDP).
$REER_{i,t-1}$ is a real effective exchange rate (index).
$OPEN_{i,t-1}$ is a trade openness (in % of GDP).
$INV_{i,t-1}$ are private investment (in % of GDP).

In order to avoid an endogeneity, each independent variable is lagged by one year, as it is recommended by Baum et al. (2013).

4. Results and Discussion

At first we perform correlations between two key variables, i.e. current account and budget balance to reveal a basic relation between them. Standard correlations are completed by cross-correlations taking into account delayed impact of studied variables. As stated previously, countries are divided into four groups: i) old advanced EU members, ii) PIIGS countries, iii) new advanced EU members, iv) new emerging EU members.

Table 2 displays that relation between internal and external (im)balances occurs in all four groups of countries regardless their euro area membership. However it is present in all PIIGS countries.

Prior to Granger causality testing we verified stationarity of our data by Augmented Dickey-Fuller test and Kwiatkowski-Phillips-Schmidt-Shin. As stationarity was confirmed, we used data in their level values.

Table 3 captures results of Granger causality testing. More or less evident twin deficits are in 15 out of 28 countries. The twin deficit phenomenon appears in all four groups regardless their euro area membership. However, this problem occurs in all so called PIIGS countries. We confirmed traditional twin deficit hypothesis based on assumption that budged deficit implies current account deficit in the case of the Netherlands, Greece, Italy,

Portugal, Cyprus, Czech Republic, and Croatia. We identified opposite causality (so called current account targeting) in six countries (Belgium, Finland, France, Ireland, Malta, and Romania). As for Finland relation between its internal and external balance is implied rather by their mutual surpluses than deficits. Bi-causality can be observed in Spain and Hungary. We consider existence of bi-causality as the most complicated situation. Then it is a real vicious cycle. To solve this problem, policy makers must target both imbalances at the same time which can be very difficult. Persistent macroeconomic problems in these two countries confirm our assumption.

Consequently we estimated a model with one threshold; however the estimated regression was not well specified and the estimated coefficients were not statistically significant. Finally we decided to estimate a model with two thresholds (with three debt-to-GDP intervals). Results are captured in Table 4.

The threshold model estimated two debt-to-GDP thresholds: 30.688% and 98.126%. Public debt therefore divided the relation between current account and budget balance into three intervals: debt-to-GDP i) smaller than 30.688%; ii) in the interval from 30.688% to 98.126%, iii) higher than 98.126%.

If public debt is inferior to 30.688%, there is a negative relation between budget balance and current account – twin deficits are not confirmed. However this finding fits only to five countries out of 28 analysed economies. It is the case of Bulgaria, Estonia, Latvia, Lithuania, and Luxembourg. While their average general gross government debt measured to gross domestic product was only 15.76%, it was 76.94% on average in 23 other European countries throughout all observed period. While Baltic countries and Luxembourg maintained stabilised and low public debt during whole time series, Bulgaria decreased its indebtedness significantly. Initial level of its public debt was 72.75% in 2000. In 2014 it was less than 27%. In addition absence of twin deficits in those countries is important advantage for their further economic development. During the first period Bulgaria had budget surpluses and current account deficits at the same time. Nevertheless in the following period, budget deficits were accompanied by rather balanced or even positive current account.

As for other EU countries, their public debt has been almost always over 30.688%. Yet our outcome indicates that public debt at about 30% and less could significantly help to avoid problems of twin deficits in the EU countries. This fact decidedly discredits Maastricht criterion on public debt set on the too "generous" level of 60% to GDP. A limit around 30% for EU countries would be more rational.

If public debt is in the interval from 30.688% to 98.126%, there is a positive relation between budget balance and current account – risk of twin deficits or lower values of twin deficits were confirmed. This is the case of most of researched EU countries with the exception of Bulgaria, Luxembourg, and the Baltic countries belonging to the first and Greece, Italy, and Portugal belonging to the last interval. Though Belgium, Ireland, Spain, and partially also the United Kingdom has been recently approaching to the last interval. Approximately, half of the countries from the second interval manifests more or less serious marks of the twin deficit problem regardless its economic status and single currency application, i.e. old advanced members (Belgium, Finland, France, United Kingdom); PIIGS members (Italy, Portugal); new advanced members (Czech Republic, Cyprus, Slovakia); and new emerging members (Croatia, Hungary, Romania). Finland appears here also due to its twin surpluses during last years. Other countries face high risk of twin deficit problems in the near future as their public debt has risen significantly during last years (e.g. Slovenia).

If public debt is superior to 98.126%, there is a positive relation between budget balance and current account – high twin deficits are confirmed. In conclusion, we do not confirm the validity of Ricardian equivalence under high public debt (more than 30%). Twin deficit hypothesis has not been justified in the case of low public debt (less than 30%). This hypothesis postulates independence between budget and current account deficits. If economic growth drops, EU governments usually do not realise sufficient fiscal measurements to influence savings and investments to counterbalance deficits. Twin deficits are confirmed also if debt-to-GDP is important (i.e. higher than 98.126%).

Such a high value of public debt does not trigger economic policy measurements in those countries sufficiently to prevent the problem of twin deficits.

Tab. 2: **Correlations and cross-correlations between current account and budget balance from 2000 to 2014**

Country		Euro area member	Correlations and cross-correlations		
			$CA_t \sim BB_t$	$CA_t \sim BB_{t-1}$	$BB_t \sim CA_{t-1}$
			Old advanced EU member states		
Austria	**AU**	€	-0.253	-0.021	-0.485
Belgium	**BE**	€	0.705	0.514	0.719
Germany	**DE**	€	0.287	0.125	0.178
Denmark	**DK**		-0.580	-0.888	-0.282
Finland	**FI**	€	0.845	0.835	0.812
France	**FR**	€	0.568	0.601	0.480
Luxemburg	**LU**	€	-0.333	-0.075	-0.387
Netherlands	**NL**	€	-0.350	-0.657	0.129
Sweden	**SE**		0.219	0.149	0.268
United Kingdom	**UK**		0.409	0.322	0.630
			Old so called "PIIGS" EU member states		
Greece	**EL**	€	0.318	0.727	0.119
Spain	**ES**	€	0.601	0.804	0.215
Ireland	**IE**	€	0.180	0.419	0.210
Italy	**IT**	€	0.287	0.569	0.233
Portugal	**PT**	€	0.686	0.183	0.244
			New advanced EU member states[1]		
Cyprus	**CY**	€	0.615	0.707	0.186
Czech Republic	**CZ**		0.562	0.642	0.441
Estonia	**EE**	€	-0.563	-0.707	-0.118
Latvia	**LV**	€	-0.675	-0.597	-0.207
Lithuania	**LT**	€	-0.481	-0.586	-0.081
Malta	**MT**	€	0.153	0.142	-0.081
Slovenia	**SL**	€	-0.705	-0.764	-0.402
Slovakia	**SK**	€	0.714	0.263	0.179
			New emerging and developing EU member states[1]		
Bulgaria	**BG**		-0.590	-0.675	-0.130
Croatia	**CR**		0.683	0.808	0.362
Hungary	**HU**		0.585	0.674	0.608
Poland	**PL**		-0.064	0.118	0.183
Romania	**RO**		0.004	0.342	0.493

Source: own

Note: Pearson´s correlations between current account and budget deficit in time *t*. $CA_t \sim BB_{t-1}$ = cross-correlations between current account in time t and lagged budget deficit in time *t-1*. $BB_t \sim CA_{t-1}$ = Cross-correlations between budget deficit in time *t* and lagged current account in time *t-1*. If Pearson´s coefficient is from 0.6 to 1, it is high correlation marked as ; if Pearson´s coefficient is from 0.4 to 0.59, it is medium correlation marked as .

[1] classification according to International Monetary Fund

Tab. 3: Granger causality testing between current account deficit and budget deficit

Country		Euro area member	Causality			
			CA ~ BB		BB ~ CA	
			order 1	order 2	order 1	order 2
			Old advanced EU member states			
Austria	AU	€	0.699	0.717	0.123	0.104
Belgium	BE	€	0.945	0.802	0.054 ·	0.205
Germany	DE	€	0.537	0.349	0.111	0.523
Denmark	DK		0.302	0.113	0.293	0.582
Finland	FI	€	0.184	0.381	0.133	0.013 *
France	FR	€	0.454	0.256	0.617	0.015 *
Luxemburg	LU	€	0.675	0.376	0.148	0.229
Netherlands	NL	€	0.008 **	0.152	0.112	0.238
Sweden	SE		0.972	0.432	0.576	0.896
United Kingdom	UK		0.673	0.283	0.348	0.350
			Old so called "PIIGS" EU member states			
Greece	EL	€	0.051 ·	0.006 **	0.921	0.455
Spain	ES	€	0.008 **	0.114	0.014 *	0.277
Ireland	IE	€	0.142	0.708	0.097 ·	0.019 *
Italy	IT	€	0.431	0.011 ·	0.522	0.334
Portugal	PT	€	0.136	0.052 ·	0.370	0.948
			New advanced EU member states[1]			
Cyprus	CY	€	0.054 ·	0.082 ·	0.474	0.809
Czech Republic	CZ		0.109	0.067 ·	0.376	0.126
Estonia	EE	€	0.185	0.381	0.673	0.772
Latvia	LV	€	0.315	0.757	0.114	0.147
Lithuania	LT	€	0.179	0.270	0.123	0.147
Malta	MT	€	0.693	0.491	0.649	0.078 ·
Slovenia	SL	€	0.165	0.132	0.333	0.575
Slovakia	SK	€	0.257	0.965	0.514	0.314
			New emerging and developing EU member states[1]			
Bulgaria	BG		0.111	0.456	0.642	0.211
Croatia	CR		0.021 *	0.149	0.733	0.793
Hungary	HU		0.041 *	0.230	0.118	0.051 ·
Poland	PL		0.507	0.653	0.319	0.221
Romania	RO		0.165	0.239	0.000 ***	0.007 **

Source: own

Note: BB = budget balance, CA = current account. Order 1 or 2 corresponds to one or two lags respectively in time series. ***=0.001, **=0.01, *=0.05, · =0.1 indicate 0.1%, 1%, 5%, 10% significance level. Significance level ***, ** and * is marked as ; significance level · is marked as .

[1] classification according to International Monetary Fund

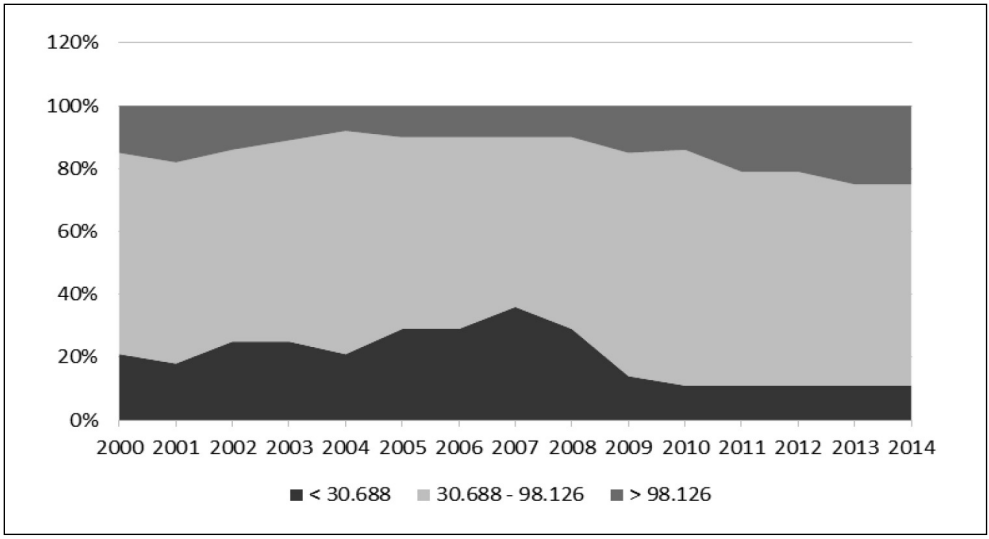
Tab. 4: Threshold model estimation; explained variable: current account (in % of GDP)

Variables		Coefficients		Standard Error
$BB_{i,t-1}$ ($DEBT_{i,t-1} \leq 30.688\%$)	β_1	**-0.652**	***	**0.271**
$BB_{i,t-1}$ ($30.688\% < DEBT_{i,t-1} \leq 98.126\%$)	β_2	**0.145**	***	**0.049**
$BB_{i,t-1}$ ($DEBT_{i,t-1} > 98.126\%$)	β_3	**0.443**	***	**0.106**
$GAP_{i,t-1}$	θ_1	-0.185	***	0.070
$REER_{i,t-1}$	θ_2	0.056	***	0.022
$OPEN_{i,t-1}$	θ_3	0.055	***	0.013
$INV_{i,t-1}$	θ_4	-0.605	***	0.093
The estimated thresholds: **30.688** and **98.126**				

Source: own

Note: Double-threshold model; ***=0.001, **=0.01, *=0.05, · =0.1 indicate 0.1%, 1%, 5%, 10% significance level. BB is budget balance, DEBT is public debt, GAP is output gap, REER is real effective exchange rate, OPEN is openness, INV – investment.

Fig. 2: The percentage of countries corresponding to the particular public debt-to-GDP regime



Source: own

Note: percentage of countries with lower public debt-to-GDP than 30.688%, with public debt-to-GDP between 30.688% and 98.126% and with public debt-to GDP higher than 98.126% in a particular year.

Tab. 5: The percentage of countries corresponding to the particular public debt-to-GDP regime

Year	Public debt-to-GDP ratio		
	Inferior to 30.688% Negative relation between BB and CA	30.688% – 98.126% Positive relation between BB and CA	Superior to 98.126% Positive relation between BB and CA
2000	21%	64%	15%
2001	18%	64%	18%
2002	25%	61%	14%
2003	25%	64%	11%
2004	21%	71%	8%
2005	29%	61%	10%
2006	29%	61%	10%
2007	36%	54%	10%
2008	29%	61%	10%
2009	14%	71%	15%
2010	11%	75%	14%
2011	11%	68%	21%
2012	11%	68%	21%
2013	11%	64%	25%
2014	11%	64%	25%

Source: own calculation

Note: BB = budget balance, CA = current account

The third interval concerns Greece, Italy, and Portugal. In these countries we find full-fledged and persistent twin deficits proved also by above-mentioned Granger causality testing and cross-correlations.

Control variables i.e. output gap, openness, and investment have expected impact on current account deficit. Output gap and investment have negative relation with current account. Increase in output gap and investment leads to current account deficit in the researched EU countries. As expected, openness has positive relation with current account.

Evidently the majority of countries are found in the public debt-to-GDP regime in the interval from 30.688% to 98.126% (see Fig. 2 and Tab. 5). In addition situation is deteriorating in time. Gradually throughout analysed period less countries belong to the first interval and more economies to the last one.

Conclusions

We identified presence of more or less serious twin deficits problems in at least half of European Union countries. Using Granger causality testing we confirmed traditional twin deficit hypothesis based on assumption that budget deficit implies current account deficit in the case of the Netherlands, Greece, Italy, Portugal, Cyprus, Czech Republic, and Croatia. We found opposite causality (so called current account targeting) in six countries (Belgium, Finland, France, Ireland, Malta, and Romania). Bi-causality can be observed in Spain and Hungary. We consider existence of bi-causality as the most complicated situation in practice. Then it is a real vicious cycle. Policy makers must target both imbalances at the same time, to solve this problem, which can be very difficult. Persistent macroeconomic problems in these two countries confirm our assumption.

The twin deficits phenomenon appears in all groups of countries regardless their economic performance and the euro area membership.

Consequently we cannot conclude that the single currency is responsible for such problems as twin deficits. However, it can indirectly have this effect due to irrationally high Maastricht criterion on public debt. Generally popularised Maastricht criteria have become referential values also for non-euro area members, world markets, international financial institutions, etc.

Using threshold panel data model we calculated two crucial thresholds which change situation in researched countries as for their potential twin deficits. Countries with public debt-to-GDP lower than 30.688% do not record twin deficits (Bulgaria, Estonia, Latvia, Lithuania, and Luxembourg). It seems that Ricardian equivalence is valid mainly in these countries. Countries with public debt-to-GDP between 30.688 and 98.126% experience certain occurrence or risk of twin deficits. Countries with public debt-to-GDP in long run over 98.126% (Greece, Italy, and Portugal and some other approaching to this level) suffer from high and persistent twin imbalances. Therefore we assume that too liberal Maastricht criteria lead EU countries to twin deficits and trigger a contagion effect evident not only during crisis period. Thus we recommend to reconsider convergence criteria and to decrease at least criterion on public debt to 30%.

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Abstract

TWIN DEFICITS THREAT IN THE EUROPEAN UNION

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The aim of the contribution was to identify presence and contagion threat of twin deficits, i.e. simultaneous budget and current account deficit in the EU countries. Using correlations and Granger causality testing we recorded existence of twin deficits in most of EU countries. In several countries we confirmed traditional causality that budget deficit implies current account deficit. In several other countries the opposite, known as current account targeting, was true. In two counties (Spain and Hungary) bi-causality was detected. We consider existence of bi-causality as the most complicated situation in practice. Then it is a real vicious cycle. Policy makers must target both imbalances at the same time, to solve this problem, which can be very difficult. Persistent macroeconomic problems in these two countries confirm our assumption.Our paper extends existing literature by determination of two thresholds for public debt-to-GDP which modify occurrence and risk of twin deficits in the EU countries. These break points were identified via threshold panel data model. Twin deficits problems are not probable for countries with public debt-to-GDP lower than 30.668%. However, risk of this phenomenon is much higher if public debt is from 30.688% to 98.126%. Countries with public debt over 98.126% suffer from high and persistent twin imbalances. Therefore we suggest reconsideration of Maastricht criterion on public debt and its reduction to 30%. Finally we observe contagion effect of twin deficits throughout EU countries regardless their economic performance or the euro area membership which is indirectly triggered also in the case of non-euro area members.

Key Words: *Imbalances, twin deficits, current account, budget balance, threshold.*

JEL Classification: *G34, M12.*

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A RESTAURANT QUALITY MODEL BASED ON MARKETING FACTORS

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Introduction

In the highly competitive restaurant industry, satisfying guests should be the critical objective of all businesses that wish to prosper and encourage repeat purchases. However, ensuring proper quality in restaurants is limited by a number of industry-specific factors, including volatile demand, small businesses, intense competition, the wide range of food and beverage products offered, the inseparability of production and consumption, intangibility of services, labour-intensive production, the importance of employees' attitude towards guests and many other factors that significantly affect the level of overall service quality. A crucial challenge to all restaurateurs today is how to provide a quality offering that is not only compelling for guests but also superior to that of business competitors. In order to gain an advantageous edge in this highly competitive environment, the marketing literature has consistently emphasized the importance of marketing orientation as a strategic tool. The growing recognition of the customer-based marketing approach (i.e., business to consumer) has suggested that implementing quality as a marketing tool is the essential element in fostering customer relationships and sustainable market share (Wang, Law, Hung, & Guillet, 2014). Understanding customers' needs is the first step in delivering quality services. The best way to manage customers' expectations is to find out what their needs and wants are, strategize how to meet them and implement these strategies in practice. In the scientific literature, there are several theoretical models to explore customers' expectations and assess service quality. After the introduction of the generic SERVQUAL instrument in 1988 by Parasuraman, Zeithaml and Berry, the issue of restaurant service quality has received considerable critical attention. Several attempts have been made (Kim, Ng, & Kim, 2009; Sulek & Hensley, 2004; Vanniarajan, 2009) to improve and develop specific quality measurement techniques suited to the needs of the restaurant industry (e.g., DINESERV, SERVPERF, CIERM, TANGSERV). All of these techniques focus on specific aspects of service delivery (techniques are presented in chapter 1.3). As food is the fundamental component of the dining experience, it undoubtedly has a significant impact on guests' satisfaction (Vanniarajan, 2009). Despite the importance of food quality, some scholars have focused on the service encounter aspect of service quality (Ayeh & Chen, 2013; Edvardsson, 2005; Han, Back, & Barrett, 2010). Further examination reveals that most studies (Andaleeb & Conway, 2006; Barber, Goodman, & Goh, 2011; Mosavi & Ghaedi, 2012; Raajpot, 2002; Voon, 2012) have empirically investigated the role of different and specific quality factors, such as environment, tangibles, cleanliness, price perception, and so forth. One interesting finding that emerges from the comparison of these studies is that research results are mutually inconsistent, as they emphasize the importance of different quality factors. Nonetheless, no study has determined which marketing factor (7P) is the most important in assessing the quality of the dining experience. Therefore, it would be of academic significance to summarize the results of different studies and to empirically investigate the importance of different marketing factors in assessing the quality of restaurant offerings.

To fill this research gap, the current study focuses on seven marketing factors (marketing mix) that, according to Kotler (2004), form the fundamental part of restaurant offerings. We assume that all marketing factors have a significant impact on guests' satisfaction as they form an inseparable part of the dining experience. The purpose of this article is to

describe the development of a marketing-oriented model for measuring restaurant quality and to discuss its properties and potential applications. More specifically, research construct clarification is mainly related to our main research question: How do different marketing quality factors influence the assessment of overall restaurant quality (7P) from the guests' perspective? We therefore hypothesize:

H1: All seven marketing quality dimensions (7P) have a statistically significant influence on guests' quality perception.

Based on Kotler's marketing mix strategic approach, Edwards (2013) and Sedmak (2011) highlighted the importance of the overall quality experience. According to these authors, all quality factors have to be considered together when evaluating the restaurant experience, as they all influence guests' quality expectations and perceptions. The restaurant offering must therefore be consistent, coherent and designed in accordance with guests' expectations (Sedmak, 2011). We hypothesize that:

H2: Guests perceive the quality of delivered restaurant offerings as coherent.

Testing these hypotheses calls for a literature review inquiry into recent research on restaurant quality. Based on a thorough literature review, a quality model was developed based on marketing factors for measuring customers' perceptions of restaurant quality. In the second part of the study, the model was empirically tested. The overall structure of the study consists of four chapters, including this introductory chapter. Chapter one begins by laying out the theoretical dimensions. Chapter two is concerned with methodology – it describes the generation of model items and provides an evaluation of the model's reliability and factor structure. Finally, the conclusion presented in the last chapter gives a brief summary and critique of the findings.

1. Theoretical Background

1.1 Service Quality

Defining service quality requires a specific approach to quality measurement, as it is not based on general objectivity and measurability. The approach from the standpoint of the customer is based on a highly subjective perspective. While a variety of definitions have been suggested (Grönroos, 1984, 1990; Langer, 1997; Parasuraman et al., 1988; Reeves & Bednar, 1995), this paper is based on the definition suggested by Parasuraman, Zeithaml, and Berry (1985), who defined service quality as the ability of a service to fulfil and exceed guests' expectations. The common characteristic of all service quality definitions (Parasuraman et al., 1988; Reeves & Bednar, 1995; Ryu & Jang, 2007; Van Vaerenbergh, Larivière, & Vermeir, 2012) is the consumer-based concept, which makes service quality a highly subjective and relative phenomenon that differs based on who is judging the service. In our study, specific marketing factors involved in the marketing mix (7P) are used as key quality dimensions.

1.2 Theoretical Models of Service Quality

A large and growing body of scientific literature has investigated the theoretical concept of service quality. Several attempts have been made to capture the essential characteristics of service quality in theoretical models. These models are especially important because they provide a theoretical basis for various techniques (instruments) for measuring service quality. The American school (Parasuraman, Berry, & Zeithaml, 1993; Parasuraman, Zeithaml, & Berry, 1994) is mainly focused on identifying the criteria that consumers use in evaluating the quality of services. Researchers have contributed a five-step model of service quality and an instrument for measuring service quality – the SERVQUAL instrument – in which they defined five dimensions of service quality: Reliability, Assurance, Tangibles, Empathy, and Responsiveness. Meanwhile, researchers from the Scandinavian school (Grönroos, 1990; Lehtinen & Lehtinen, 1991) have identified two major aspects of service quality: technical quality (the tangible aspect of the quality) and functional quality. Drawing on an extensive range of sources, the scholars (Candido & Morris, 2000; Lin, Chan, & Tsai, 2009) used various methods in an attempt to create valid and overall-service quality models. Candido and Morris (2000) defined a new model with 14 steps, but an in-depth analysis revealed that the model is mainly based on the five-step model. Overall, none of these modified models

received a significant scientific validation. Conversely, several authors highlighted the need to break the link between the traditional American and Scandinavian schools and proposed alternative quality models. Lin et al. (2009) upgraded the traditional IPA (Importance Performance Analysis) model and developed a new model called IPGA. The IPGA model is designed to optimize the use of production resources with the aim of improving the quality of services offered. Nevertheless, all these studies highlight the need for future development of service quality management.

1.3 Tools for Measuring Service Quality

In our study, we focus on tools (techniques) that collect quality information based on pre-determined standards, although the customers' feedback can also be obtained by a number of qualitative techniques. Despite the unquestionable significance of qualitative techniques, we decided to use quantitative techniques. Some of these techniques (often also referred to as models) measure service quality basing on the quality gaps that occur as a result of differences between guests' expectations and perceptions (SERVQUAL, DINESERV); some are one-dimensional and focus solely on service performance evaluation (SERVPERF, Dineserv.per); some combine quality and importance measurement of different service factors (SERVIMPERF); some focus on employees' responses to specific critical situations (Critical Incident Technique – the extended model); and, finally, some address external evaluators (AAA Diamond, Michelin Stars). The predominant quantitative measurement technique is the SERVQUAL instrument (Marković, Raspor, & Šegarić, 2012), which measures quality basing on the gap between guests' expectations and perceptions. According to Aigbedo and Parameswaran (2004), all five dimensions of the SERVQUAL instrument have not yet been fully validated. Therefore, the authors propose additional metrics that would better explain the gap between expectations and perceptions. Other authors (Dedeke, 2003; Jensen & Hansen, 2007; Juwaheer, 2004; Ryu, 2005) have highlighted the need for a tailored approach to service quality measurement. Despite these criticisms, however, SERVQUAL remains one of the most commonly used service quality measurement techniques (Marković et al., 2012). Inclusion of quality dimensions in different restaurant service quality models is presented in Table 1.

As can be seen from the table above, specific techniques, such as Tangserv and CIERM, have moved away from the traditional RATER dimensions of the SERVQUAL instrument. Our findings are consistent with

Tab. 1: Inclusion of quality dimensions in different service quality models

Dimension / Model	Tangibility	Reliability	Responsiveness	Assurance	Empathy	Nutritional value	Ingredients	Food preparation technique
SERVQUAL	x	x	x	x	x			
DINESERV	x	x	x	x	x			
Dineserv.per	x	x	x	x	x			
Tangserv	x							
CIERM						x	x	x

Source: own

those of other studies (Cronin & Taylor, 1994; Llosa, Chandon, & Orsingher, 1998; Tribe & Snaith, 1998) in suggesting the necessity of moving away from these traditional dimensions.

2. Methodology

2.1 Research Process and Sample Description

Following the conceptualization and operationalization of the service quality construct (see Fig. 1), a 35-item instrument for assessing customer perception of restaurant quality was formulated and empirically tested. Although in many questionnaires (Marković et al., 2012) individual quality factors are substantively combined to express characteristics of several factors in a single, uniform quality factor (e.g., attractiveness of car parks and surrounding areas), in our study we have exclusively used one quality characteristic for the description of each quality factor (see Tab. 2). The level of customers' perceptions was measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The model is based on the performance aspect of quality measurement. In doing so (focusing on performance assessment), we support the theoretical findings of several authors (Abdullah & Rozario, 2009; Keith & Simmers, 2011; Landrum, Prybutok, & Zhang, 2007) whose works emphasize the importance of a one-dimensional (performance-only) approach to measuring quality. The questionnaire was pretested on ten guests and five restaurant managers who were invited to participate in the formation of the research instrument. Based on their suggestions, some minor changes were made. Our study was conducted from January to June 2014. The research was performed by ten interviewers in different restaurant settings in Slovenia – according to the official (national) classification the following types of restaurants were included in the research – "restavracije" (formal – luxury restaurants); "gostilne" (a kind of national Inns), and "okrepčevalnice" (informal – fast food facilities, snack bars and similar). A total of 323 independently operated restaurants were included in the study, representing 10% of the population of Slovenia. The research was conducted by direct interviews with domestic customers after they dined in the selected restaurants. We obtained permission from the restaurant managers before interviewing guests. Interviewing often took place at the table or, in some cases, in the restaurant lobby before guests` departure, as some managers did not allow interviews in the dining room. Randomly chosen guests were kindly asked to fill in the questionnaire. Out of a total of 2003 collected questionnaires, the final analysis is based on 1998 valid questionnaires. In the first step, descriptive statistics analysis was used to analyse respondents' demographic characteristics. The majority of respondents were an average of slightly less than 40 years of age, and the sample was composed of almost equal numbers of male (49.4%) and female guests (50.6%). The highest number of guests had completed secondary (vocational) education (47.2%), while 41.5% of guests had acquired a high school education, 4.9% had only finished elementary school and 6.3% of the guests had obtained a Master's degree or PhD. A total of 14% of guests were visiting the restaurant for the first time, while 86% of guests had visited the restaurant three or more times. In addition to demographic data, the purpose of the visit (as a psychographic variable) was introduced into the study. Results show that more than half (53.9%) of guests visited the chosen facility with the aim of satisfying hunger and thirst (physiological needs). The need to eat was followed by the purpose of socializing (27.1%), celebrations (9.9%), business meals (5.2%) and other purposes (4.1%).

2.2 Questionnaire Development

Product (Food)

Numerous studies have reported that food is the most important quality dimension that affects both the restaurant selection process and guests' satisfaction (Gupta, McLaughlin, & Gomez, 2007; Sulek & Hensley, 2004; Vanniarajan, 2009). All these studies outline a critical role of food quality evaluation in correlation with other quality factors. Nevertheless, in several international studies (Kim et al., 2009; Sulek & Hensley, 2004; Vanniarajan, 2009), food was identified as the most important quality dimension. Sulek and Hensley (2004) proposed that the quality of food should be simply defined by three key characteristics: food safety, attractiveness and digestibility. Based on literature review, we used the following quality factors in our research model: offer volume (selection of dishes), size of portions, taste, appearance, and perception of food safety.

People

A large volume of published studies (Andaleeb & Conway, 2006; Jaafar, Lumbers, & Eves, 2008; Mosavi & Ghaedi, 2012; Voon, 2012) describe the role of people as the most important quality dimension in restaurant quality management. Researchers who have looked at psychological aspects of perceptions have confirmed the correlation between guests' quality evaluation process and demographic characteristics of service staff. For example, Luohe and Tsaur (2011) confirmed the link between guests' perceptions and age; Martínez-Tur, Tordera, Peiró, and Potocnik (2011) emphasized the importance of organizational climate; and Wall and Berry (2007) concluded that guests' quality perceptions heavily depend on the type of restaurant itself. The previously mentioned finding of Wall and Berry (2007) corroborates the idea of Kim and Kachersky (2006), and Meng and Elliott (2008) who suggested that guests of fine dining restaurants are more sensitive to the attitudes of service staff. In contrast, a study conducted by Waxman (2006) in Caffe shops not only stressed the importance of staff's attitude but also revealed a rich set of social quality factors associated with staff, including warmth, a sense of belonging, familiarity, respect, trust, and support. The design of our questionnaire has been based on the results of the presented studies, and some quality factors were logically introduced from the SERVQUAL instrument (employees' politeness), DINESERV (well-trained, competent and experienced staff; number of staff) and the Tangserv model (customers' interactions with other people). Specific factors that have been introduced to our model for assessing the quality of people are: hospitality of staff, competences of service staff, sufficient number of staff to ensure quality service, importance of the presence of the restaurant manager, and the distracting presence of other guests.

Price

Subjective assessment of quality is particularly problematic in terms of individual perception of price. Kim and Kachersky (2006) state that the perceived price level and its correlation to quality are exclusively a result of an individual psychological process. This view is supported by many authors (Bhattachnaya & Friedman, 2001; Meng & Elliott, 2008) who have argued for the importance of individualism in price perception (especially "Fair price" perception). According to these authors, a fair price has a significant impact on guests' satisfaction and their perception of quality. The restaurant industry tends to be highly price-elastic, as a small change in price is accompanied by a large change in quantity demanded (Sedmak, 2011). We have noted, that price was not identified as the most important quality dimension in any of the presented studies. Nevertheless, many studies stressed the importance of different individual price factors (e.g., an accurate bill is also a quality factor in the DINESERV model). Following the above discussion, we may suppose that price quality can be measured based on the following price factors: understandability of prices, accurate bill, value for money, price competitiveness, and expected price level vs. actual price level.

Process

The quality of this dimension is most often assessed according to different activities of service staff (Cousins, Foskett, & Gillespie, 2002). Ha and Jang (2010) have primarily treated the quality of the service encounter as a multidimensional construct that is most often the result of guests' subjective evaluation of several quality factors, such as the process of welcoming guests, acceptance of orders, guest attendance, and so forth. Heung, Wong, and Qu (2000) reported that the speed of service is the most important factor in determining guests' perception of quality. Nam, Ekinci, and Whyatt (2011) state that it still remains unknown how many quality factors there really are. Based on the literature review, the following quality factors were included in our model: staff responsiveness to questions, staff helpfulness in serving guests' needs, staff responsiveness, and restaurant working hours.

Physical Evidence

The importance of the physical, tangible environment has been stressed by several authors (Kim & Moon, 2009; Mattila & Wirtz, 2001; Namasivayam & Mattila, 2007; Ryu & Jang, 2007; Yunkyong, 2007), as it represents an important basis for evaluating the quality of services. A number of authors (Cheng et al., 2012; Mosavi & Ghaedi, 2012; Ryu & Han, 2011; Wall & Berry, 2007) have reported that physical evidences have a different impact on guests who are visiting the restaurant for the

first time (i.e., first-time buyers) than on guests who have already visited the restaurant in the past. In particular, factors associated with cleanliness and noise significantly influence guests' perception of quality (Barber et al., 2011; Barber & Scarcelli, 2010). According to findings presented in this section and based on several quality models (SERVQUAL, DINESERV, Tangserv, SERVPERF), we have included the following quality factors in our questionnaire: cleanliness of the premises, neat and presentable staff, comfort, design in accordance with food offering, and sense of security.

Promotion

According to Sedmak (2011), the most common forms of promotion in the restaurant industry are advertising, sales promotions, public relations, discounts and special offers, outdoor lighted signs and boards, menus and wine lists, direct sales, invitations and announcements and special events. Direct sales present the only form of marketing communication that provides instant feedback from guests. The success of direct (personal) sales heavily depends on the competence, professionalism and charisma of the service staff. Aside from the functional aspect of quality, which heavily depends on service staff sales activities (recommendations) and guests' promotional activities (i.e., word of mouth; Keller, 2007), the quality of promotional activities is also perceived through the quality of technical factors, such as menu design (Din, Zahari, Othman, & Abas, 2012; Sharma, Wagle, Sucher, & Bugwadia, 2011) and discounts (Taylor & Long-Tolbert, 2002). The evidence presented in this section suggests that there are no major differences between different forms of promotional activities in ensuring offer quality and guests' (re)purchase intention. In light of the above, we have decided to include the following promotional quality factors in our questionnaire: visible marketing signs, signs of special attention and compliments (small gifts, etc.), service staff recommendations, volume of sales campaigns and special offers, and advertising activities in social media.

Placement

In the restaurant industry, unlike the hotel industry, traditional channels of distribution have remained underdeveloped. In the restaurant industry, channels of distribution are most often direct The most important channels of distribution are: location, direct distribution and indirect distribution through travel agencies and other providers that include restaurant offerings in their offerings (Sedmak, 2011). The importance of geographical location was emphasized by Bowie and Buttle (2004) and Parsa, Self, Sydnor-Busso, and Yoon (2011). We have decided to include the following quality factors in our study (the tangible factors were logically introduced from the Tangserv model): entrance accessibility, accessible parking areas, neat and clean surroundings, perception of whether the restaurant is worth the distance travelled, and indirect distribution.

Different studies emphasize the importance of different quality factors, as researchers base their studies on different (specific) quality factors. Nevertheless, no study has empirically investigated and compared all seven marketing quality dimensions (7P).

2.3 Analysis and Findings

The next section of the survey was concerned with the evaluation of the perceived quality of the restaurant offering. The results presented in Table 2 show that all quality factors were evaluated relatively highly (the average mean value is 3.98). Among the seven quality dimensions, the highest-rated dimension was product & food quality (mean 4.32), with food safety its highest rated factor (mean value 4.47). The results indicate that the lowest perceptions are related to the dimension of marketing communication (mean 3.57), with the lowest scores related to the factor "the restaurant is properly advertised in the media (2.95)". The coefficients of variation show how homogeneous guests are in the evaluation of individual quality factors.

In the next section of the study, an exploratory factor analysis was performed to assess the factor structure of perceived restaurant quality. With this factor analysis, we have tried to answer our main research question and to test our first hypothesis (H1), which suggests that all seven marketing quality dimensions (7P) have a statistically significant influence on guests' quality perception. Evidence of the scale's reliability, factor structure and validity on the basis of the analysed data is presented next. First, we checked whether the answers to the above 35 variables (quality factors) were normally distributed. Because we

Tab. 2: Analysis of the assessments of quality (descriptive statistics) – Part 1

Quality dimensions (7P)	Mean	Coefficient of variation (%)
Product (food)		
Selection of dishes	4.26	18.64
Extent of portions	4.27	19.11
Taste	4.35	17.70
Appearance	4.28	18.88
Food safety perception	4.47	16.82
Physical evidences		
Cleanliness of the premises	4.34	18.04
Neat (presentable) staff	4.28	19.30
Comfort	4.22	20.14
Sense of security	4.49	16.35
Design in accordance with food offered	4.26	20.16
People		
Sufficient number of staff for ensuring quality service	4.13	21.40
Importance of the presence of restaurant manager for ensuring quality offering	3.68	32.80
Distracting presence of other guests	2.51	54.26
Hospitable staff	4.26	20.52
Competences of service staff	4.13	21.84
Promotion		
Visible marketing signs	3.97	25.69
Signs of special attention and compliments	3.41	36.86
Recommendations from service staff	4.00	23.68
Volume of sales campaigns and special offers	3.53	34.31
Advertising activities in the social media	2.95	43.90
Price		
Understandability of price items	4.52	16.17
Accurate bill	4.67	13.88
Value for money	4.26	19.95
Price competitiveness	4.11	22.21
Expected price level vs. actual price level	2.12	57.50
Placement		
Accessible entrance	4.01	26.38
Accessible parking area	3.78	33.99
Neat (clean) surroundings	3.99	24.51
The restaurant is worth the distance travelled	3.99	24.71
The restaurant enhances indirect distribution	3.37	38.43

Tab. 2: Analysis of the assessments of quality (descriptive statistics) – Part 2

Quality dimensions (7P)	Mean	Coefficient of variation (%)
Processes		
Prompt responsiveness of staff to questions	4.24	21.84
Helpfulness of staff in satisfying clients' needs	4.04	24.80
Responsiveness of service staff	4.18	21.10
Restaurant opening hours	4.29	19.81
Waiting time	4.10	22.00

Source: own

Tab. 3: Rotated factor solution

Quality factors (QF)	Quality dimensions		
	People	Placement	Product and Physical evidences
Helpfulness of staff in satisfying guests' needs	**0.879**	–0.096	0.047
Immediate responsiveness of staff to guests' questions	**0.751**	–0.045	–0.049
Signs of special attention and compliments	**0.740**	0.024	0.144
Responsiveness of service staff	**0.709**	–0.006	–0.096
Recommendations from service staff	**0.649**	0.094	–0.034
Competences of service staff	**0.646**	0.038	–0.137
Hospitable staff	**0.551**	0.054	–0.158
Sufficient number of staff for ensuring quality service	**0.473**	0.019	–0.187
Value for money	**0.450**	0.084	–0.178
The restaurant is worth the distance travelled	0.259	**0.448**	–0.074
Accessible parking area	–0.104	**0.759**	0.038
Accessible entrance	0.082	**0.733**	0.020
Neat (clean) surroundings	0.094	**0.602**	–0.104
Taste	0.027	–0.041	**–0.747**
Appearance	0.002	–0.016	**–0.743**
Food safety perception	–0.072	0.022	**–0.729**
Sense of security	–0.041	0.097	**–0.676**
Extent of portions	–0.026	–0.008	**–0.667**
Selection of dishes	0.108	–0.060	**–0.649**
Comfort	0.138	0.088	**–0.502**
Cleanliness of the premises	0.211	0.094	**–0.495**
Neat (presentable) staff	0.328	0.054	**–0.416**
Design in accordance with food offer	0.320	0.044	**–0.395**
Explained variance %	**40.973**	**5.058**	**4.221**

Source: own

could not confirm a normal distribution for any of the selected quality factors of the first set (Kolmogorov Smirnov Test (KMO) was used), it was necessary for us to use the Principal Axis Factoring method for the exploratory factor analysis. The first test was performed in order to evaluate the suitability of information for inclusion in the factor model. Thus, on the basis of the value of the KMO measure of sampling adequacy (0.958), as well as the outcome of the Bartlett test of sphericity (χ^2 = 31,071.468; degrees of freedom = 595), we estimated that all included variables are suitable for factor analysis. The majority of factors had satisfactory communalities (> = 0.50), suggesting that the greater part of their variability can be explained by the influence of common factors, the three variables with too low communalities ("presence of Manager (0.132)", "distracting presence of other guests (0.190)" and "advertising activities in the social media (0.251)" – were excluded from the evaluation process of the factor model. After a few successive iterations of the factor model evaluation, we finally selected as most appropriate the factor model with 23 factors (presented in Tab. 3); while 12 factors had to be removed from further analysis. The suitability of information for inclusion in the final factor model is also supported by the values of the KMO indicator (0.957) and the outcome of the Bartlett test (χ^2 = 223,289.398; degrees of freedom = 253). Based on a rotated factor solution, we have chosen a final model with three factor groups (quality dimensions), as it allows for a more meaningful interpretation of the factor model. The final model with three quality dimensions is presented in Table 3. Factor weights with factor loadings above 0.3 and factors that contain more than three items were retained.

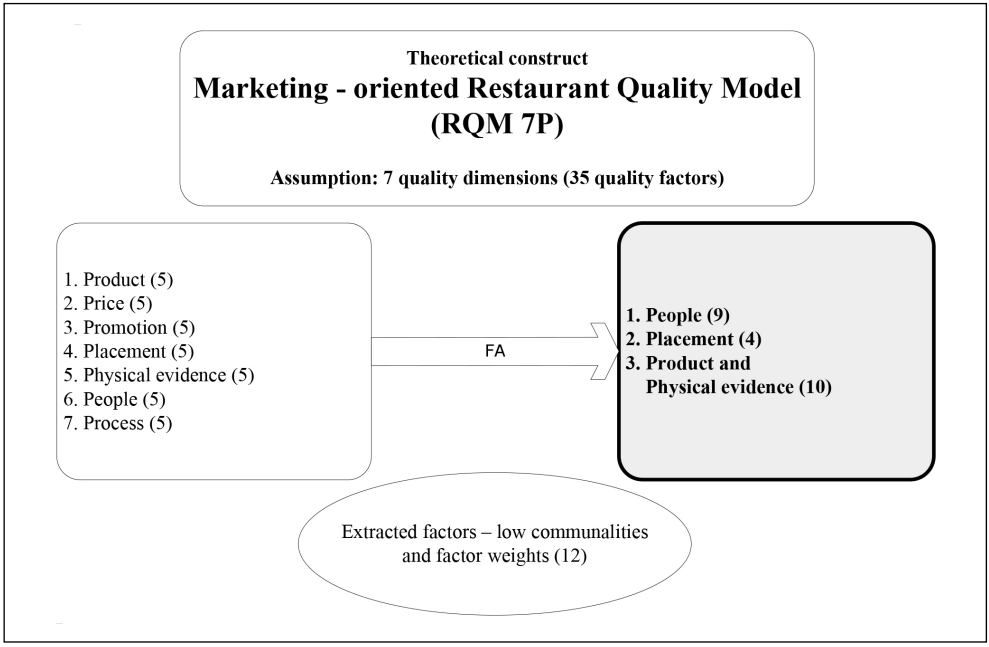
We started our factor analysis with seven quality dimensions, as, following Kotler's marketing theory, we have hypothesized that all seven quality dimensions have a significant influence on guests' overall quality perception. Based on the rotated matrix of factor weights shown in the table above, it is evident that guests' perception of the quality of restaurant offerings is mainly based on the quality of the following marketing factors: people (40.97%), placement (5.05%), product (food) and physical evidences (4.22%). Based on these three quality dimensions (see explanation below) and the values of their total explained variances, it is clearly evident that the quality of people (staff) has the greatest importance (40.97%) in assuring restaurant quality, followed by the quality of placement (5.05%) and the quality of food and physical evidences (4.22%). Other marketing quality dimensions are, in relation to guests' assessment of quality, not statistically significant. Special attention should be paid to the third factor, which is formed by merging the two dimensions of food and physical evidences. As further dissection of the results does not contribute to the improvement of the quality of the research, we have decided to keep the model with three main factors. These results clearly do not support H1, as only three marketing quality dimensions have a statistically significant influence on guests' quality perception. The relation between the theoretical construct and the research results is presented in Figure 1. On the left side, the 7P marketing quality dimensions are presented with initial 35 quality factors, while on the right side the research results, with the final 3 dimensions and 23 factors are presented. Twelve factors had to be removed from the factor analysis, as they had low communalities (< 0.5) and low factor weights (< 0.3). Thus, the results of this study indicate that guests perceive restaurant quality based on only three marketing quality dimensions and 23 quality factors (see also Tab. 3).

Although the findings presented above clearly indicate non–coherency of perceived quality, we have decided to further empirically investigate the differences between different quality dimensions. Based on the comparison of mean values presented in Table 2, we statistically analysed the perceived differences between all quality dimensions. Paired *t* statistics and two-sided tests were used for all possible pairs. Statistically significant differences were found between all quality dimensions (the only exception is the comparison between the mean value of the dimensions of product and physical evidences, for which the degree of significance is 0.510). This indicates that the offered quality is perceived as highly incoherent; thus, H2 cannot be confirmed. Contrary to expectations, this study did not confirm the coherency of perceived quality in restaurants' offerings.

Conclusion and Implications

The purpose of this study was to determine how different marketing factors influence restaurant guests' overall quality perception.

Fig. 1: Theoretical model and research results



Source: own

Based on the qualitative research, we were unable to determine the significance of different marketing factors, as the results of several presented studies are mutually inconsistent and contradictory. Another important finding that emerges from the literature review is that researchers base their studies on modified research models. This finding is in accordance with our earlier observations, which have shown that service quality dimensions cannot be generalised. Thus we have developed and tested a new marketing-oriented model based on universally comprehensive marketing methodology (7P) and includes the specifics of the restaurant industry terminology. As the model is based on a solid theoretical basis (literature overview) and marketing approach (7P), we consider the findings to be generally verifiable and applicable. This study has shown that only three (out of seven) main marketing dimensions have a statistically significant influence on guests' perception of restaurant quality – (1) people, (2) placement, and (3) product (food) and physical evidences, while other marketing factors are statistically insignificant. It was also shown that guests' perceived restaurant quality as highly incoherent. Returning to the research question posed at the beginning of this study, it appears that that the quality of staff has the greatest significance in ensuring restaurant quality. The present study also confirms previous findings (Andaleeb & Conway, 2006; Jaafar et al., 2008; Mosavi & Ghaedi 2012; Voon, 2012) and contributes additional evidence to suggest that people are definitely the most important marketing quality dimension in the restaurant industry. Another important finding was that the quality of food has little significance in determining the perception of restaurant quality, despite the fact that the vast majority of guests reported that they visited the restaurant with the intention of satisfying hunger and thirst. Therefore, regardless of the purpose of the visit, guests evaluate the quality of restaurant offerings according to the quality of the staff. Taken together, these results suggest that not all seven marketing factors are significant in ensuring restaurant quality.

This research extends our knowledge of restaurant management quality. The key strength of this study is its sample size. Moreover, this is the first time that all seven marketing factors have been used to explore restaurant quality. As the methodology is based on Kotler's (2004) marketing approach, we assume that it may be applied to other facilities elsewhere in the world.

A number of important limitations need to be considered. The current study only examined domestic guests' perceptions of restaurant quality in Slovenia; thus, additional caution must be applied, as the findings might not be transferable to full-board restaurant facilities that operate within hotels and other lodging facilities. Moreover, the importance of restaurant image was not included in the study. This research has generated many questions in need of further investigation. Future research should use different methodologies to replicate the findings of this study and to extend the current findings. What is now needed is a cross-national study involving different segments of guests in different types of food and beverage facilities. Large and randomised controlled trials combining both quantitative and qualitative research methods (Vila, Rovira, Costa, & Santoma, 2012) could provide more definitive evidence of the importance of the presented results in ensuring overall restaurant quality. More research is required to determine the significance of coherency to overall restaurant quality. Concerning the importance of people, further research focusing on the role of this dimension would provide a more detailed understanding of how to treat human aspects in restaurant quality management. A further study could assess the long-term effects of different marketing quality dimensions on guests' loyalty. Future trials should also examine the predictive ability of marketing factors on the overall service quality and financial performance of the restaurant industry with the help of Structural Equation Modelling (SEM).

For restaurant managers, the results indicate the value of investing substantial effort in understanding the complexity of human interactions. The essence of recruiting strategies, formal education and informal trainings must be recognised and encouraged. People (service staff) play a major role in guests' perception of overall restaurant quality. Their significance in ensuring overall restaurant quality is much more complex than simply seating guests, taking orders and serving the customers. Restaurant managers must therefore rethink the role their employees play in ensuring overall restaurant quality. Furthermore, as people (staff) present only one dimension of the restaurant marketing mix, managers must constantly measure the quality of their offering and adjust their marketing plans and strategies in order to ensure guests' satisfaction and the overall quality of the offering.

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Abstract

A RESTAURANT QUALITY MODEL BASED ON MARKETING FACTORS

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Previous studies have highlighted the importance of several quality factors in guests' assessment of restaurant quality. As there is no general consensus on which marketing quality factors really matter in assessing the quality of the dining experience in the previous literature, this paper describes and tests the development of a marketing-oriented Restaurant Quality Model (RQM 7P). In addition, this study tests whether guests' perceive overall restaurant quality offerings as coherent. Special attention was devoted to a marketing perspective (7P). Following the discussion of the conceptualization and operationalization of the restaurant quality construct, the procedures used in constructing and refining a multiple-item scale to measure restaurant quality are described. Evidence of the scale's reliability, factor structure and validity on the basis of analysing data is presented next. A sample of 1,998 valid questionnaires obtained by domestic guests in different restaurant facilities in Slovenia is analysed. Results show that guests perceive restaurant quality according to three marketing quality dimensions – (1) people, (2) placement, and (3) product (food) and physical evidences, while other marketing factors are not statistically significant in determining restaurant quality. In addition, the results indicate that guests perceive restaurant quality offerings as highly incoherent. From a theoretical point of view, this study contributes by developing a restaurant quality model based on marketing factors. In addition, it is the first study to test the perception of all seven marketing dimensions in the restaurant industry, and it provides insights regarding how guests perceive restaurant offering coherency. This research has thrown up many questions in need of further investigation. Future research should include a cross-national study involving different segments of guests in different types of food and beverage facilities.

Key Words: *Restaurant quality, service quality management, F&B management, marketing mix, Slovenia.*

JEL Classification: *L83, L15.*

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PRICING OF THE TOURISM PRODUCT: A TOOL FOR ENTREPRENEURS TO ADAPT TO A FLEXIBLE MARKET

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Introduction

During the last decades, the tourism industry from Central and Eastern European countries has gained an increasing importance. Because of the diversity of businesses and activities inside this sector, the tourism can be considered an effective engine for emerging sectors and for economy. Furthermore, due to its diverse, beautiful nature and valuable historical and cultural inheritance we consider that the tourism sector has growth potential, high efficiency and thus, opportunities for significant contributions both to national GDP and added value. Focusing on Romania, the favourable geographical position and landscape structure support the practice of various forms of mass and alternative tourism. According to the WTTC methodology (World Travel & Tourism Council, 2014), the total contribution of travel and tourism to GDP has been of 5.1% in 2013, and is predicted a growth potential of 3.8% per annum over the next ten years, while for European Union the total contribution of travel and tourism to GDP is forecasted to rise by 2.6% per annum.

Within the context of tourism development, more small and medium accommodation establishments have been lately developed in the country than big size ones. According to the National Institute of Statistics, the Romanian tourism sector included 6,009 tourist accommodation establishments in 2013. A percentage of about 90% belongs to the entirely private system, while more than 97% are small and medium establishments with less than 50 employees. The guest house category, including both urban and rural type, records the most significant increase.

The development trend of small and medium enterprises emphasizes the increasing importance of entrepreneurship within the tourism sector. Based on Schumpeter's early theory of economic development, more recent approaches view entrepreneurship as a promoter of economic development and named innovation the key element for sustaining it (Bull, Thomas, & Willard, 1995). When referring to innovation we don't consider only the component of developing new products and services, but also the stage of developing new strategies in the tourism establishments (Hamel, 2007). In order to reach the goals both approaches need entrepreneurial initiatives and ask for a high level of involvement of managers.

Due to the increase in the number of establishments being developed the competition has begun to be strengthened. Meanwhile, the market needs are more and more diverse which leads to new and various challenges for an effective and efficient management of the accommodation establishments in order to adapt them to a flexible and dynamic market. The effectiveness and efficiency of the accommodation establishments are influenced by continuous changes in consumer preferences. Thus, in order to be successful a tourism entrepreneur has to establish goals within the accommodation unit which could drive high levels of customer satisfaction. Some of the important issues are externally-oriented and refer to tourist profile identification – life style, actual and potential needs not included in the current offer, motivation for choosing different destinations. Meanwhile, the entrepreneur has to be internally-oriented and to focus on innovation, operations and other internal elements which ultimately determine the same increase in customer satisfaction.

Tourists get satisfaction from each of the components of a particular touristic product (Rigall-I-Torrent & Fluvia, 2011). Thus, hotel customers derive utility from all the available facilities, surroundings or other elements which can be considered for improving the delivered

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service – size of the room, quality of the goods and equipment, quality of food, communication with staff, other specific services included and made available by the accommodation establishment itself – healthcare, wellness, transportation. Meanwhile, it is very important to focus on the external availabilities which do not belong to the accommodation establishment, but to other organizations – private or state owned companies, local municipality. These attributes are referred as public characteristics (Rigall-I-Torrent & Fluvia, 2011), but they clearly state that ultimately, the consumer's choices depend on the specific combination of public and private attributes which give rise to the final product.

The link between entrepreneurs and market needs is sustained through marketing policies and strategies, respectively through the marketing mix components- product, price, placement and promotion. This paper focuses on the price as long as this is the element of the marketing mix which generates revenues, being at the same time more flexible than the other components (Kotler & Keller, 2011). Therefore, the price of touristic products has a high impact on the revenues and profit.

The management of tourism establishments should have competences and abilities to design a pricing policy which enables higher level of performance, determined by a price competitive advantage. Our study conducts an empirical analysis on the private and public attributes and their influence on the room rate. Price represents an instrument for adapting the strategy of entrepreneurs not only for the business start-up, but also for the entire life of the tourism entity. It is important for entrepreneurs to understand the role of pricing and its flexibility in tourism because of the specificities mentioned above. As point out in Kotler and Keller (2011), the price formation is more challenging in the current changing economic and technological environment.

The touristic product is complex and consists of goods and services gathered and offered to the client. Therefore, the price of a touristic product is defined through a group of observable attributes. The final satisfaction obtained by a tourist depends on the combination of these goods and private or public services; they are delivered by different entities, either public or private (Salo, Garriga, Rigall-I-Torrent, Vila, & Fluvià, 2014).

The hedonic pricing analysis is a valuable instrument for our endeavour as long as it allows to identify the set of observable attributes defining the product and ultimately, setting the price. Even more, the hedonic model allows the quantification of the marginal contribution for each attribute in the overall price, as it results from the balance between supply and demand. The interaction supply-demand determines the marginal implicit price of attributes, and the willingness of the customer to pay for it. As mentioned in Chen and Rothschild (2010), managers from accommodation and hospitality industry can use the information provided by hedonic model to price the products and develop marketing strategies.

This paper highlights the hedonic pricing model as a useful instrument for managers and entrepreneurs, when they establish the pricing policy for their touristic products. We conducted the empirical analysis on the significant factors explaining the variation in the prices, for the Romanian accommodation establishments market. The purpose of the research is to identify and quantify the marginal contribution of each attribute to price formation. The findings are helpful to sustain the overall strategy but also some particular ones, referring to promoting or developing some services based on the marginal contribution of the attributes. The results are valuable for all categories of accommodation, whether start-ups or well-established businesses.

Our empirical research focuses on the marginal contributions of private and public attributes of accommodation establishments from Romania, to the room rates. The accommodation units in the sample are mostly oriented towards leisure tourism and are located in the rural areas of the country. The data related to room rates and attributes were collected from a Romanian tourism website. The attributes considered, as explanatory variables, in hedonic pricing models differ from paper to paper, according to the main objective of the research and availability of data. Taking account of the standardized factors used in previous papers and of the data available on the website, we consider, as important in determining the room rate, two groups of factors:

a) attributes specific to the accommodation unit: number of rooms in the accommodation establishment, type of establishment (guest

house, villa and house, chalet, hotel), stars rating (4 stars, 3 stars, 2 stars), and dummy variables for providing breakfast, pets allowed, bicycle/ATV rent facility (1 indicates presence and 0 indicates absence);

b) attributes describing the location: nearby tourist attractions, close to the city, close to thermal baths, near lake, isolated place. These location characteristics are included in the hedonic models as dummy variables (1 indicates presence).

The impact of these factors on room rates is measured for the whole sample of accommodation units, for the sub-sample of units providing breakfast, and for the sub-sample of units not providing breakfast.

Section 1 from the paper describes the pricing hedonic model for differentiated products and reviews its applications in tourism sector. In Section 2 we describe the Romanian tourism products attribute and data set within the context of hedonic model. Section 3 conducts an empirical hedonic analysis of room rates, for a large sample of establishment units from Romania; the marginal utility is estimated for each attribute embedded in the price. At the end of the paper, based on the results from the empirical analysis, we highlight the conclusions and guidelines for managers, entrepreneurs or public organizations.

1. Hedonic Pricing Analysis in Tourism

The price of the room (room rate) is one of the most important criterion for a tourist when choosing among various accommodation facilities. The price setting decision for a tourism product is driven by a number of internal and external factors to the firm, such as the following: the objectives of the firm (e.g. a target market share, profit maximization), customer satisfaction, the degree of market competition, the firm's position on the market, capacity constraints, classification and grading systems, taxation, perishable nature of tourism products, the seasonality of tourism demand (Dwyer, Forsyth, & Dwyer, 2010).

Previous studies about pricing in tourism, as Collins and Parsa (2006), Cassidy and Guilding (2007), Abrate, Fraquelli and Viglia (2012), Zhang, Zhang, Lu, Cheng and Zhang (2011), Papatheodorou, Lei, and Apostolakis (2012), among others, debate the fundamentals of pricing, pricing strategies and the pricing setting tools. Some authors, as Zhang et al. (2011) summarize and classify the hotel pricing empirical approaches into three categories, in terms of the methods used, namely consumer behavior, conjoint analysis, and hedonic analysis. The first two methods facilitate a direct investigation of the consumer's willingness to pay an implicit price for each attribute embedded in a tourism product; such an approach requires data collected through a consumer survey. As Zhang et al. (2011) point out, due to the actual and potential customer-oriented approach, the consumer behavior and conjoint analysis are more sensitive to be used by managers, and less objective than the hedonic analysis.

Focusing on the Romanian accommodation establishments market, this paper develops a hedonic pricing analysis, in order to estimate the implicit marginal prices associated to each attribute of tourism product. The theory of hedonic pricing has been developed by Rosen (1974), in the context of pricing differentiated products and services in a competitive market, under the hypothesis that "goods are valued for their utility-bearing attributes or characteristics". A tourism product is defined by a set of observable intrinsic characteristics. The overall price of the product is determined by the set of implicit prices of attributes, as these attributes are valued by the interaction of supply and demand.

In order to estimate the implicit prices of attributes, the first-stage of the econometric procedure proposed by Rosen considers a regression model in which the price of the product is considered as the dependent variable and the attributes are explanatory variables. This framework can estimate the marginal utility of the product attributes, and quantifies the willingness to pay for each attribute. The product price is regressed on their utility-bearing characteristics. The theoretical foundations of the hedonic model give little guidance in choosing a priori an appropriate functional form. Rosen (1974) mentions there are no reasons for hedonic function to be linear. As mentioned by Ekeland, Heckman and Nesheim (2004), the hedonic model is intrinsically nonlinear. In empirical research the most common used hedonic functional form is the log-linear model:

$$\ln P = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \varepsilon \quad (1)$$

respectively the log-log, the linear, and the flexible Box-Cox transformation.

The econometric methodology should be selected according to theoretical guidelines and to statistical properties of the data. Our dependent variable, the price of the room, takes positive values. Moreover, as some empirical works suggest, usually the price has a positive skewed distribution. Due to the skewed distribution of hotel prices, in Hung, Shang and Wang (2010) is applied the quantile regression to study the determinants of hotel prices. The empirical papers from tourism research usually recognize this feature, considering the logarithm of price as dependent variable, and then, the classical linear regression methodology being applied. The log-transformation is applied to improve normality, linearity, and to stabilize the variance.

Within the context of positively skewed price distribution, we highlight the generalized linear models (GLM) framework, for estimating the hedonic model. These models are adequate to a large range of probability distributions for response variable, namely the exponential family distributions, that include the normal, Gamma, inverse Gaussian, exponential distributions, but also discrete distributions, among others. The Gamma and inverse Gaussian distributions are known to be appropriate for a positive variable, right-skewed. In a GLM framework, a link function g links the conditional mean of prices $E(P|X) = \overline{P}$ to the linear predictor:

$$g(\overline{P}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k \quad (2)$$

where $X = (X_1, X_2, ...X_k)$ is the set of touristic product characteristics. The generalized linear models are fitted to data using the method of maximum likelihood. The estimates for regression coefficients, and the asymptotic standard errors of coefficients are provided (McCullagh & Searle, 2001).

Several papers have applied the hedonic pricing model in tourism and hospitality research, the most part being related to hotel industry, and to private characteristics of accommodation units. The paper Papatheodorou et al. (2012) summarize the evolution, advantages/ limitations, and applications of the hedonic price analysis in tourism.

Our approach is in line with the recent papers Chen and Rothschild (2010), Rigall-I-Torrent and Fluvià (2011), Salo et al. (2014), among others. Chen and Rothschild (2010) studied the impact on the hotel room rates of common characteristics, as room size, location, the availability of some amenities like internet access, conference facilities, swimming pool, free parking, or room service. Data, related to the hotels from Taipei, has been collected from the website of a major travel agent.

Based on a hedonic analysis, Chen and Rothschild (2010) highlight several valuable implications for the managers and policymakers in tourism. The hedonic pricing model is applied to estimate the relative contribution to the room prices of private attributes (e.g. number of rooms, star rating, located near the beach, room services, availability of garden, car park, swimming pool, sport facilities), and public attributes (e.g. variables specific for jurisdiction as police officers, population, cultural facilities, sport facilities, restaurants, hotel rooms, coves). The prices and private attributes were collected from the tour operators' brochures, for a sample of hotels from Spain.

The paper of Salo et al. (2014) focuses on the preferences of tourists regarding public attributes as revealed in the room prices for hotels and second home accommodations. The paper highlights the importance of location as a source of public attributes which tourists enjoy, as public safety, beach quality, natural environment, sports facilities, heritage sites, retail stores. Furthermore, it presents the directions and guidelines for managers to develop price and promotion strategy for competitive advantage.

As the previously mentioned papers, our study is conducted from the supplier's perspective- management of the tourism establishment. The prices, settled by managers are those observed in the markets, and posted on websites or brochures. Even more, these are the expected prices to be paid by customers. Our data, prices and attributes for accommodations establishments, were gathered from the one of the most known Romanian tourism website, namely *turistinfo.ro* (http://www.turistinfo.ro/). The rapid development of online tourism has a great impact over the tourism industry. Tourism websites facilitate communication between customers and tourism entity; the online marketing strategy dominates tourism and accommodation businesses.

2. Romanian Tourism Market: Specific Features and Statistics

After December 1989, the economy of Romania underwent significant changes, which were also

reflected in tourism. In early 1990s, both tourism demand and supply experienced a significant fall. The number of accommodation units dropped from 3,213 units in 1990 to 2,905 units in 1995, as a result of difficulties in operation and a lack of legislation on tourism privatization (Rădulescu & Stănculescu, 2012). In the following years, particularly from 2002 onwards, the tourism activity recorded an ascending trend, and 6,009 establishments are recorded in 2013. The statistics reveal a growing number of small capacity accommodation units to the detriment of large units (prevailing in early 1990s). This ascending trend is explained by the steady economic growth rate, from 2.1% in 2000 to 7.3% in 2008 (Anghelache, 2012) and by the European funds allocated to Romania for this sector, following the accession to EU in 2007. The tourism demand decreased until 2000, remained relatively constant until the outburst of the economic and financial crisis, following which it recorded a rapid drop; the occupancy rate of the accommodation capacity was of 57.8% in 1990, 35.5% in 2000, 35% in 2008, and respectively 25.1% in 2013. The inversely proportional relation between the evolution of supply and demand is supported by Romanians' desire to develop small businesses in the hospitality industry, which was considered a source of future profits.

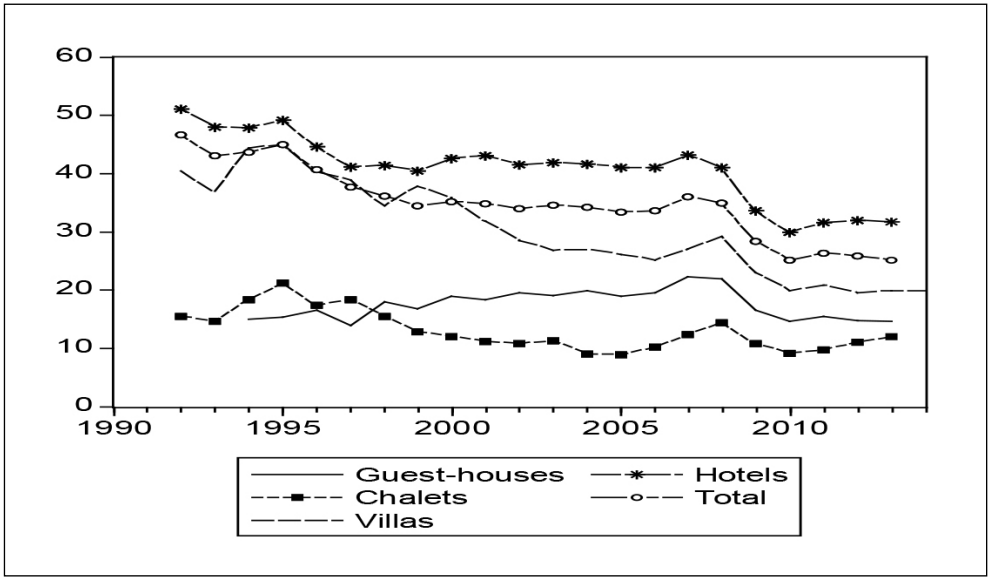
Our empirical study focuses on small and medium-sized accommodation units, such as guest houses, villas and houses, hostels and tourist chalets located in Romania. Such units are almost entirely privately-owned. The first private establishments emerged after 1990 as tourism and agro-tourism guest houses, and increased from 16 units in 1993 to almost 30 thousand units in 2013; the accommodation capacity of these units is currently about 56 thousand bed-places. The category of guest houses expanded heavily in particular after 1996, as a result of the initiative of numerous private entrepreneurs to start a business in tourism. As regards the different types of tourist accommodation establishments, in 2013 the rural and agro-tourism guest houses recorded 49% of the total accommodation units, hotels 24%, while the rest were other collective accommodation establishments (e.g. tourist villas, bungalows, hostels, tourist chalets). The data source for the Romanian tourism statistics is the National Institute of Statistics, unless otherwise mentioned. In terms of the accommodation capacity, hotels continue to rank first.

Although following an ascending trend until 2007, as shown in Figure 1, the occupancy rate of the accommodation capacity in the case of guest houses remains relatively low, ranging between 22.3% (in 2007) and 14.6% (in 2010). In the case of agro-tourism guest houses, classified as a distinct category since 2000, the occupancy rate ranged between 8% (in 2000) and 18.4% (in 2008). The guest house is defined as a low-capacity establishment (up to 20 rooms and maximally 60 bed-places). The agro-touristic guest house is a smaller accommodation structure, with a capacity of up to 8 rooms, usually located in a rural environment which provides the opportunity to partake in household or craft activities. The occupancy rate trends for guest houses, touristic villas, chalets, hotels and overall are presented in Figure 1. Although the difference between the occupancy rate of hotels and that of small-size establishments like guest houses diminished in time, the latter continue to register a low occupancy rate.

As regards other types of accommodation units, Romania has preserved a significant number of units built before 1990. In 1990, the prevailing establishments were hotels (830 units), tourist villas (151), chalets (226), campings (217), school camps (203 units). Except for hotels, the other establishments decreased in number over the following years. Most of these establishments ceased their activity, mainly as a consequence of the delayed privatization process of the tourist accommodation establishments (Rădulescu & Stănculescu, 2012).

Hotels remain the structure with the highest accommodation capacity. In 1990 a number of 830 hotels were operational, providing an accommodation capacity of 168 thousand places, and in 2013 their number increased to 1,429 units, while the accommodation capacity increased to about 182 thousand places. We can notice that investors preponderantly pursued smaller capacity hotels. The occupancy rate of the accommodation capacity decreased from 65.8% in 1990 to 31.7% in 2013, however remaining, for the entire period, significantly higher than that of guest houses (Fig. 1). The representative of the Romanian hotel associations stated that "the low occupancy rate actually reflects the touristic attractiveness

Fig. 1: Net occupancy rates of the tourism accommodation capacity



Source: own based on data from the National Institute of Statistics http://statistici.insse.ro/

of Romania. The explanations are manifold and already stereotyped, such as the transport infrastructure, the tourist areas infrastructure, the lack of efficient and consistent advertising cantered on a country brand and the lack of local advertising". An important number of hotels, respectively 84.5%, were at the end of 2013 entirely privately-owned. After 1990 began a slow privatization process of the state owned hotels; the ratio of entirely privately-owned hotels was of 25.6% in 1999.

The tourism demand registered a significant growth in the case of small and medium-sized establishments. The ratio of tourist arrivals in tourism and agro-tourism guest houses was merely of 2.4% in 2000, as compared to 14.5% in 2013. Nevertheless, the occupancy rate still remains relatively low, and the managers/ owners of these establishments are compelled to continuously adjust their tourism products to meet the market requirements, in order to preserve old customers and to attract new ones.

Our study aims to identify the factors which influence the accommodation rates variance, information which could prove useful to the owners of small and medium-sized establishments, enabling them to adjust their prices to attract more clients, to increase the occupancy rate and consequently to make the business profitable.

3. Hedonic Pricing Model: Data Sets and Empirical Results

This paper conducts an empirical analysis on a sample of small and medium-sized accommodation establishments from Romania. A database referring to room rates and specific attributes was gathered from the Romanian website *turistinfo.ro*. We chose this particular site on the consideration that it is the most popular in the Romanians hospitality industry (according to traffic.ro). This website contains a comprehensive online database about over five thousands accommodation establishments, guest-houses, villas and houses, tourist chalets from Romania, which is regularly updated. Accommodation establishments registered in the database are mostly oriented to leisure, nature and recreational tourism and are located in the rural areas of the country. Because of the specificities of the database we mention that our study does not include business tourism

oriented establishments; these are widely distributed in the urban area and they mostly include large and medium entities.

Data has been collected during the second half of January, 2014. The website *turistinfo.ro* maintains a direct contact with the accommodation units. The price shown by the website is usually the same with the final price paid by the tourist. Collected data covers 530 accommodations establishments (representing approximately 10% of the listed units), having the following structure: 59.6% guest-houses, 24.2% tourist villas and houses, 6.6% tourist chalets, 9.6% hotels. The small share for hotels is explained by the specificity of the website, in which are gathered mainly small and medium units. We mention that were selected accommodation units that had reviews made by clients, considering that these were more frequently accessed. The initial sample counted 715 accommodation establishments, but due to the lack of data on whether or not breakfast was included in the price, the location of the unit, number of stars, etc. We also excluded one star units as lacking in interest for the studio and five star units, encountered only in the case of larger hotels, which are outside the scope of this study. Eventually our sample contained 530 units, representative as regards the type of unit, type of landscape, geographical areas.

Most units are small and medium accommodation establishments. The average number of rooms per unit is of 12 rooms, with a standard deviation of 11 rooms. According to the type of landscape the distribution within the sample is: 61.7% mountain side, 20% hill side, 12.6% plane side and 5.7% sea side. In order to get a representative sample, units from all geographical areas were chosen. Percentages are between 3-8% for all regions, according to the registered number of units for each region. In respect of the stars (or flowers) rating criterion, the sample has the following structure: 25.1% units with “2 stars”, 65.8% units “3 stars” and 9.1% units “4 stars”.

The dependent variable is one night room rate for a double room. We consider the average price of the two prices, in the case when there are different rates for the same room, depending on the week period (week-day or week-end). We mention that the mean price, in our sample, is 106.8 Lei (about 24 Euro), with a standard deviation of 36.3 Lei. The distribution of room prices is skewed to the right.

The price hedonic theory offers no guidelines in selecting a specific set of explanatory variables (Andersson, 2000). Their selection in the present context is based on the previous empirical research on this topic, and in particular on the set of relevant attributes available from the website. The attributes included in our reported hedonic pricing models are indicated in Table 1, as following: the number of rooms in the accommodation establishment, the location

Tab. 1: Description of the variables and descriptive statistics (n = 530)

Variable	Description of the variable	Mean	St. dev.
Price	Room rate per night (lei)	106.79	36.32
LnPrice	Log of price	4.61	0.32
Rooms	Number of rooms	12.36	11.57
LnRooms	Log of number of rooms	2.28	0.62
Breakfast	Breakfast is provided (yes = 1)	0.44	0.49
Pet	Pets are allowed (yes = 1)	0.35	0.47
Bike	Bike/ATV for rent (yes = 1)	0.11	0.31
NearLake	Near lake (yes = 1)	0.63	0.48
NearAttraction	Near tourist attractions (yes = 1)	0.84	0.36
NearThermal	Near thermal bath (yes = 1)	0.23	0.42
NearCity	Near town (yes = 1)	0.59	0.49
IsolatedPlace	Isolated place (yes = 1)	0.21	0.41
StarRating	Star rating: 2 stars (reference category), 3 stars, 4 stars		
Type	Type of establishment: guest house (reference category), villa and house, chalet, hotel		

Source: own

(near lake, near tourist attractions, near thermal baths, near city, isolated place), stars rating (4 stars, 3 stars, 2 stars), establishment type (guest house, villa and house, chalet, hotel), and other amenities.

Table 1 also presents descriptive statistics for the dependent variable – price of room / night, and for the attributes. Except for the number of rooms, number of stars and the type of establishment, the other attributes are dummy variables (1 indicates presence of the amenity). The mean values of the dummy variables indicate the ratio of the units where the attribute of interest is present.

As a first step, the empirical analysis is conducted in log-linear traditional model, this being the approach commonly used in the empirical research literature on hedonic pricing for tourism accommodations (Salo et al., 2014). We have estimated also, the gamma regression, respectively the Inverse Gaussian regression with log-link, applying generalized linear model framework. For our data, the results obtained from the three mentioned specifications are similar. Thus, the same attributes are indicated as having a significant marginal effect on the price. Moreover, comparing the (in-sample) performance of the three specifications, the log-linear model provides a slightly better agreement between observed and predicted prices, as the mean absolute error indicator suggests. The mean absolute error (MAE) = 17.64 for log-linear model, MAE = 17.72 for Gamma regression, and MAE = 17.75 for Inverse Gaussian regression. Therefore, we report the results provided by the log-linear model (the estimated results for the other two regressions may be provided upon request).

Focusing on the log-linear specification, three models are estimated and reported in Table 2: Model 1 for whole sample, Model 2 for the sub-sample of accommodations units providing breakfast, and Model 3 estimated for the sub-sample of units not providing breakfast. There is a significant difference between room rates when breakfast is included or not (mean price with breakfast = 132.43 lei, mean price without breakfast = 86.06 lei; the Student t test for equality of two means = 18.05, p-value = 0.00).

In order to test the statistical significance of each coefficient, the Wald test was applied, which follows asymptotically a chi-square distribution with one degree of freedom (df = 1). The likelihood ratio (LR) test, reported on the last line from Table 2, indicate an overall goodness-of-fit of the three models, as long as the null hypothesis of jointly insignificant coefficients of explanatory variables is rejected. Reported LR test is the omnibus test, which compares the estimated model against the intercept-only model; this statistic is asymptotically chi-square distributed, and a value for LR significantly greater than zero leads to the rejection of the restriction imposed by the null hypothesis.

Turning to our empirical results from Table 2, the percentage effect, of a qualitative attribute, over the room price is given by $[(Exp(\beta) - 1] \cdot 100$ (as long as the other attributes are the same), taking account of the log-linear form of model. The coefficients for dummy variables have been exponentially transformed, being reported in Table 2 (denoted by Exp β). We note from Model 1 that all included variables have significant effect on the room price. The Nagelkerke coefficient of determination, measuring the extent to which the model explains the variation in data, suggest a medium goodness-of-fit for our model R-square = 0.67; the values of R-square lie between zero and one, and a value close to one indicates a high explanatory power of the model.

The most significant attribute when setting the room rates, is Breakfast; availability of this facility increases prices by 44.5%. This is an expected result, as long as this service is included in the displayed price of the room.

For the Star rating attribute we observe, as expected, a positive association between a better rating of accommodation establishment and its room rate per night. The star rating captures a set of quality attributes, as quality of room services, sports facilities (Salo et al., 2014). The minimum rating (2-stars) is considered as the reference category. A better star ranking leads to higher prices sustained by higher quality equipments, facilities, amenities, good location, or more services. The 4-stars rating determines an increase by 38.4% in room rate, while 3-stars by 18.1%, comparatively with the room prices for 2-stars units.

Referring to the variable Accommodation type, the guest house is settled as reference category. The most significant coefficient is observed for tourist chalets; the room price for these units is higher by 12.8% than for guest houses. A higher room rate for chalets type should be sustained by some specific attributes most of them external to the establishment itself, if we consider the usual location of chalets

Tab. 2: Summary of hedonic models (dependent variable lnPrice)

Attribute	Model 1 (N=530)		Model 2 (N=237) Breakfast included		Model 3 (N=293) Breakfast not included	
	Coeff. β (*Exp* β)	Wald test	Coeff. β (*Exp* β)	Wald test	Coeff. β (*Exp* β)	Wald test
LnRooms	0.030	2.737*	-0.018	0.438	0.063	6.397**
Bike	0.093 (1.097)	9.833***	0.113 (1.120)	7.687***	0.091 (1.094)	4.342**
Pet	-0.081 (0.922)	17.406***	-0.127 (0.880)	19.433***	-0.054 (0.948)	4.060**
NearLake	-0.045 (0.956)	5.162**	-0.061 (0.941)	4.149**	-0.031 (0.970)	1.347
NearAttraction	0.074 (1.077)	8.063***	0.064 (1.066)	2.116	0.071 (1.074)	4.753**
NearThermal	-0.046 (0.955)	4.192**	-0.010 (0.990)	0.082	-0.056 (0.945)	3.877**
NearCity	-0.047 (0.954)	5.845**	-0.069 (0.933)	5.365**	-0.033 (0.967)	1.645
IsolatedPlace	-0.071 (0.931)	9.341***	-0.101 (0.904)	8.305***	-0.055 (0.947)	3.038*
Type:		15.380***		11.35***		7.159*
Guest house	-	-	-	-	-	-
Hotel	0.095 (1.100)	6.483**	0.146 (1.157)	7.986***	0.061 (1.063)	1.181
Chalet	0.121 (1.128)	9.875***	0.116 (1.123)	4.008**	0.125 (1.133)	6.031**
VillaOrHouse	0.018 (1.018)	0.608	0.008 (1.008)	0.034	0.028 (1.028)	0.906
StarRating:		89.25***		28.97***		57.62***
2 stars	-	-	-	-	-	-
3 stars	0.166 (1.181)	53.680***	0.136 (1.146)	10.931***	0.171 (1.189)	41.406***
4 stars	0.325 (1.384)	76.732***	0.285 (1.329)	28.930***	0.360 (1.413)	35.764***
Breakfast	0.368 (1.445)	348.63***	-	-	-	-
Intercept	4.261 (70.388)	6,881.3***	4.734 (123.8)	2,987.0***	4.160 (64.051)	3,904.1***
LR test	459.77*** (df=14)		74.65*** (df=13)		97.95*** (df=13)	

Source: own

Note: *denote significance at 10%, ** significance at 5%, *** significance at 1%.

(mountain area, places with low touristic density or isolated places). The rooms from hotels are more expensive by 10% than those from guest houses. There are no significant differences between the room price for villas or houses, and the room price for guest houses.

The attractive neighbourhoods of accommodation establishment have a significant role

in the pricing policy. Similar empirical results have been obtained by Salo et al. (2014), Rigall-I-Torrent and Fluvia (2011), among others. If we consider the attribute Near tourist attractions, the empirical results suggest that there is an opportunity for higher prices supported by attractive neighbourhoods. Thus, an accommodation unit located near a tourist attraction can set, on average, a room price higher by 7.7% (other attributes being identical). Taking advantage of this attribute does not always imply a direct cost for the accommodation unit, if we assume that local communities and other private companies are involved into attracting the visitors.

All the other three attributes (near lake, near thermal baths, near city) seem to be unattractive from the price formation point of view. The coefficients associated with these attributes are borderline significant, therefore they should be interpreted with caution; at 1% significance level, these attributes have no effect on the price. For Isolated place the coefficient is significant and negative, showing that the price settled by these accommodation units is lower than for the rest of units. In other words, there is no reason to increase room rates when this attribute is present. Possible explanation could be related to external factors, as public facilities or infrastructure which do not sustain the tourism development in these areas. We also mention that during the last years increased the investments coming from European funds, especially in small and medium accommodation units, strongly contributing to increased competition.

The Bicycle/ATV rent facility has a positive effect on the price, while Pets allowed gives no reason for increasing the price. The room price at accommodation units with sports facilities is, on average, 9.7% higher. Sports facilities are positively evaluated also by other studies (Pompurová & Šimočková, 2014; Rigall-I-Torrent & Fluvia, 2011). While the first characteristic is considered a healthy habit, a sport, the latter suggests that pets are not a good reason for charging higher rates. If the first attribute attracts clients, the other seems to act in an opposite way because of the low level of tolerance coming from non-pets allowed clients; the pets are allowed usually in low rated units.

The Number of rooms has a borderline, positive effect. An increase of accommodation unit capacity seems to be associated with higher prices. For these units, there are more opportunities to develop complementary services, to be delivered with the basic accommodation one. Even more, when comparing the average prices for each type of accommodation we conclude that hotels have both more rooms and higher prices, in our sample of establishments.

On the other hand, we briefly explore the effects of attributes on room rates, for the sub-sample of accommodations units providing a breakfast (Model 2, breakfast included), and for the units not providing breakfast (Model 3, breakfast not included). Part of the empirical results is similar with those from Model 1, but some specific issues can be also seen.

Related to the Model 2, the Star rating, and the facility of Bicycle/ATV for rent, we can still observe a positive and significant effect on the room rate. For these units, that include breakfast like a mandatory service, the hotel rooms are more expensive, the rate being by 15.7% higher than for guest houses. The number of rooms, location near a tourist attraction and location near thermal baths become clearly insignificant in explaining the room price variability. There is no willingness to pay a marginal price for a location near a tourist attraction.

In the case of accommodation units with no breakfast included (Model 3), the type of accommodation has no significant impact on the room price, at conventional 5% significant level; there is still a weak association, significant at 10% significance level (the joint Wald test = 7.16; p-value = 0.067). Therefore, there are small differences between prices of the rooms for the considered types of accommodation. The number of stars remains clearly a significant determinant of room rates; the 3-stars and 4-stars accommodation units have a price significantly higher than 2-stars units, by 18.9% and 41.3% respectively. There are more variables with positive, but borderline significant influence on the room price: Bicycle/ATV for rent, number of rooms, near a tourist attraction. Presence of the attributes: allowing pets, near thermal bath and isolated place seems to be associated to lower priced rooms, but these results should be viewed with caution, taking into account that the coefficient of these variables becomes insignificant at 1% significance level. The attributes Near lake and Near city have no significant effect on the room

price; they don't contribute either to an increase or a decrease in room rates.

Conclusions and Findings for Managers and Public Organizations

A flexible pricing strategy could become an effective and efficient tool for tourism entities in order to increase their performance. On a dynamic market, the price formation policy has become a real strategic issue for the entrepreneurs from tourism sector. The hedonic pricing model makes possible to highlight the attributes that have a significant contribution to the price, and help to quantify the contribution of each of them. This analysis suggests which attributes are valued by consumers and to what extent (Falk, 2008).

This paper contributes to the empirical tourism literature by highlighting and applying the hedonic pricing model, in order to investigate the significance of accommodation attributes in the formation of room rates. Useful information for entrepreneurs from tourism can be obtained. The dependent variable, in our study is one night room rate for a double room. The data has been collected from the website *turistinfo.ro,* and covers small and medium accommodation establishments, most of them from the rural area. We consider this aspect a favorable one because it enabled us to get information about these units, which are more and more representative for the Romanian tourism market, according to the statistics.

In the empirical section are estimated and reported the following log-linear regressions: Model 1 for whole sample, Model 2 for the sub-sample of accommodations units providing a breakfast meal, and Model 3 estimated for the sub-sample of units not providing breakfast. There are some attributes with significant effect on the room price for all three models, but with different intensity: star rating, accommodation type, pets allowed, bicycle/ATV rental. The most important empirical findings from the perspective of the attributes' contribution to the price are the following:

- Star rating, which actually captures the quality attributes, has the highest effect on the price;
- The type of accommodation has a different importance, according to the model;
- Bicycle/ATV rental, as a proxy variable for sports facilities, has a positive contribution to price increase;
- There is no empirical support for allowing pets, and location in isolated place in order to increase the price;
- Some models suggest that there is an opportunity for higher prices supported by attractive neighbourhood, e.g. the tourist attractions near the location;
- Related to the breakfast, availability of this service increases prices by 44.5%.

Tourism managers can use the information provided by hedonic analysis to price products and design effective marketing strategies (Chen & Rothschild, 2010). Papatheodorou et al. (2012) emphasize the importance of hedonic model in tourism industry for different beneficiaries – entrepreneurs and managers, from both private and public entities involved in the tourism sector.

The findings from this paper could be used for pricing policies by managers or marketers. They may use the information in the decision making process regarding the price, and can develop marketing strategies based on price, allowing them to attract loyal customers, ultimately. The managers have to pay more attention to their internal facilities, goods or amenities and to be committed to increasing the quality of their service delivery process; for example, the sports facilities, as bicycle/ATV rental, could contribute to price increase. Even more, these characteristics which contribute to price increase can also determine a differentiated offer compared with other establishments, and finally to increase the customer satisfaction, and to attract new segments of customers (Espinet, Saez, Coenders, & Fluvià, 2003).

The results of this study are valuable for the future investors in tourism, as they are for actual entrepreneurs. Even though their role is similar with the managers' one in many cases, we could add that they can get information about what part of the business to be developed and in what direction, quantitative or qualitative. Thus, they will have good opportunities to complete the offer in order to charge a higher price to the customers. For the start-up businesses they can develop a structured offer, including the required attributes which to enable them to move more quickly through the initial stages of the business, usually characterized by lower efficiency levels.

A third beneficiary of the hedonic analysis in tourism are public organizations and local administration. These organizations can

develop appropriate policies for regional development, focusing on those characteristics with high significance in price formation, as the hedonic pricing models suggest. Even though public organizations do not benefit in a direct way, they will contribute to the area development and to some other business developments as well. All these aspects will generate revenues and opportunities for a sustainable development of tourism and of the geographical region.

As already mentioned, price is a useful tool available to managers to increase revenues from accommodations. Thus, it is important to analyse all the factors which contribute to price setting in order to determine their best combination. In the service sectors, which include tourism, it is important to set the right price due to a higher customer sensitivity compared to other sectors. Whether we consider quantitative or qualitative factors, they all contribute to a higher quality of the service delivery. The right price contributes to a better ratio between the quality of the service and its price, which enables higher performance, a better market share or notoriety.

We should mention that, due to certain particularities of the Romanian tourism, the role of pricing strategies is even more important:

- As shown by the statistical data, the market has a considerable growth potential for the category of small and medium entities.
- It is known worldwide that in tourism, more than in other sectors, external factors play a crucial role for the service delivery, as well as for price setting. In Romania, the external factors – environment, surroundings and infrastructure – are less developed and therefore bear a higher potential to trigger higher prices if they are improved.
- The periods of decline – financial crisis are more sensitive for the Romanian tourism industry because of the average customer profile, characterised by lower purchasing power, income level and standard of living.

The validity of the research is given by the three models selected which reflect the Romanian specific environment of the tourism industry, in the area of small and medium accommodation units. Also, the determined sample of tourism establishments ensures the representativeness of the data and provides valuable results for price setting to entrepreneurs and managers of small and medium units.

Within a comprehensive approach, the paper recommends managers and entrepreneurs to put in place the following measures, from the perspective of the pricing strategy applied on the Romanian tourism market:

- To develop and sustain accommodation units with breakfast included;
- To focus on medium size tourism establishments, rated 3-4 stars;
- To develop additional services which contribute to higher prices – Bicycle/ATV rental;
- To choose locations for future entities nearby tourist attractions- Near Attraction;
- To put less emphasis on other services which don't actually contribute to higher prices – Pet Allowed or Near Lake, Thermal or City.

All the previous suggestions lead to a better quality-price ratio of the tourism service. Thus, the financial results could contribute to better performance.

From the perspective of local and regional development there is a need of efficient communication between the tourism managers and entrepreneurs on one hand and the public organizations on the other, in order to enhance infrastructure development. Thus, factors which according with our study don't have a positive impact on pricing strategy could become significantly important for the future.

There are some limitations of this study, highlighting further directions for research. Our sample mostly includes establishments from rural area, of small-medium size. Thus, an extension of the study could be conducted by analyzing other accommodation types, like hotels from urban areas or hotels located by the beach. The main goal of the paper was to highlight attributes with a positive influence in price increase, in order to improve the financial indicators of the tourism establishment – its efficiency. It seems to be in contradiction with the trend of decreasing prices, as long as the current tourism market is characterized by more intense competition. Within this context, future studies are useful, due to the dynamic of the external environment, in order to design an appropriate offer for each segment of customers, and to increase their satisfaction. This study was conducted from the perspective of the accommodation establishment. An increased attention should be given to find out how the strategies and policies developed by different

stakeholders are perceived by the ultimate beneficiary of the touristic product – the tourist.

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Abstract

PRICING OF THE TOURISM PRODUCT: A TOOL FOR ENTREPRENEURS TO ADAPT TO A FLEXIBLE MARKET

Anuța Buiga, Roxana Stegerean, Alexandru Chiş, Dorina Lazăr

The paper approaches the hedonic pricing analysis as a useful instrument for tourism entrepreneurs to get a competitive advantage through price setting policies. The main goal of this research is to conduct an analysis useful to measure the marginal effect of the attributes which contributes to price setting; the empirical analysis is developed on the prices of accommodation establishments from Romania. The study focuses on small and medium sized accommodation units, most of them entirely privately-owned. Within the analysis we set attributes from inside and outside the accommodation establishment as long as they are both ultimately linked with the pricing policy. Several hedonic specifications are estimated, in order to investigate the significance of accommodation attributes in the formation of room rates. There is a set of attributes with significant effect on the room price in all models, but with different intensity. The managers have to pay more attention to their internal facilities, goods or amenities (as recreational facilities), and to be committed to increasing the quality of their service delivery process, but there is also an opportunity for higher prices supported by attractive neighbourhoods. These findings are useful for the entrepreneurs interested in developing new businesses in tourism but also for managers already performing in the sector. Both categories have to face challenges such as new services development, price setting policy, choosing new locations. A flexible pricing strategy could become an effective and efficient tool for accommodation units in order to increase their performance. These elements are potential competitive dimensions and provide good opportunities for adapting to a dynamic market. Public and local administration organizations can develop appropriate policies for regional development based on hedonic models and thus, generate revenues and create opportunities for a sustainable development of tourism and also of the geographical region.

Key Words: *Tourism entrepreneurship, pricing strategy, hedonic pricing model, attributes for price setting.*

JEL Classification: *L83, L26, L11, C20.*

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LOYALTY PROGRAMS AND PERSONAL DATA SHARING PREFERENCES IN THE CZECH REPUBLIC

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Introduction

Loyal customers are a key factor for successful retail activities. Customer loyalty can be defined as a higher probability of making new and repeated purchases, spontaneously recommending a particular retailer and spreading the positive word-of-mouth. "Loyal customers are less likely to switch to a competitor due to price inducement, and these customers make more purchases compared to less loyal customers" (Dhal, 2015; Mohelska & Sokolova, 2016) For the retailers, customer loyalty is a key factor in reaching long-term commercial success and profitability. It is much cheaper to retain and curate existing customers than to acquire new ones. Similarly, customer loyalty has been increasingly studied in health and social services over the past few years – particularly in economies where the private sector dominates this field. Many such studies focus on the topic of demand regulation within the health and social services sector, which is strongly motivated by population aging and related factors occuring in developed countries (Gavurová et al., 2014; Šoltés et al., 2014).

In modern customer-oriented marketing, loyalty programs (defined as marketing programs that reward members with purchase incentives) are perceived as the strategic instrument for creating and maintaining effective contact with customers (Bacik et al., 2015). "In the retail scene, loyalty programs involve a concentrated effort by retailers to build store traffic, increase basket size and increase frequency which creates deeper relationship ties with its customer base" (Omar, Wel, Musa, & Nazri, 2010). An important part in creating consumers´ satisfaction and inducing consumer loyalty is played by the human factor (e.g. Wasan and Tripathi (2015)). It is often claimed that retail personnel should be well instructed and motivated towards increasing the number of loyal customers and creating harmony between corporate strategic aims and the customers' demand.

As loyalty programs (LPs) are implemented, managed and evaluated, retailers need appropriate data and means to identify individual participating customers. Such data allow for effective evaluation of consumers' purchasing behaviour and habits. Specifically, for the purpose of registering, uniquely identifying and properly managing customers in a LP, various identification data are required. In the Czech Republic, establishing and managing any such consumer/LP database is bound by legal framework, implemented for consumer and personal data protection. Besides legislature, customers often fear that their personal data – once passed to LP-operator – might be misused (e.g. sold to third parties and used in an intrusive manner).

Generally speaking, consumers worry about their privacy and are afraid of losing control over their personal data – to some extent. Importantly, consumers' privacy concerns are not uniform. Individual preferences, sociodemographic and lifestyle factors play a significant role. From a good-faith LP organizer point of view, the quality of personal data and contact information collected through the LP has an enormous effect on their ability to manage and evaluate LPs properly. This study provides a structured quantitative analysis of customers´ willingness to share various types of personal and contact data with LP organizers.

1. Literature Review

The use of LP-related personal and contact data for the benefit of marketers and businessmen is a delicate topic, discussed by academic researchers and retail marketers, as well as by institutions supervising legal aspects of such activities (see e.g. Albrecht (2006) or Mariner and Cannella (2015)).

"Loyalty programmes, appropriately managed, are considered to allow structured and effective actions to manage, select, relate, and control customers' buying behaviour" (Lara & De Madariaga, 2007). In order to meet their objectives, LPs need to be beneficial to both the retailer and the customers. A new study by Nielsen (a corporate provider of information and insights into what consumers watch and buy), revealed that nearly 60 percent of global respondents reported that LPs were available to them through local retailers. From those consumers with access to LP-organizing retailers, 84 percent report being more likely to visit such retailers (Nielsen, 2013).

Lara and De Madariaga (2007) discuss the importance of finding a desirable balance between the volume of data required by the retailer and customers' willingness of sharing them. As consumers are disinclined to facilitate access to certain data types to the companies (LP organizers), this can be a factor that moderates consumer willingness to participate in such programme. "Ironically, even though loyalty program members crave a more personalized, relevant experience, they also show concern about sharing the information required to enable the retailer to deliver on this desire." (PR Newswire, 2013). Consumer incentives, along with trust and privacy assurances are the key strategic tools in LP consumer engagement.

Numerous studies point out that people are often afraid of their personal data becoming an object of trading among companies (see e.g. Wade (2010), Spiekermann, Acquisti, Böhme and Hui (2015)). "Compounding this problem is the common practice of businesses selling customer information to other businesses, marketing companies, mailing lists and so forth, thereby further increasing the amount of unwanted offers and advertising" (Marketing Weekly News, 2013).

In their corporate research, Aimia (2011) describe the young generation (generation Y or the Millennials, born approximately between 1977 and 1994) as being less concerned when sharing personal data with a retailer for shopping reasons. Of all named marketing channels in their survey, loyalty and reward programs are perceived as the most privacy-friendly by Millennials: fewer than 20% of Millennial loyalty program members are concerned about sharing personal information with loyalty program organizers.

As Koponen and Mangiaracina (2014) state, a good way to illustrate the increasing commercial value of personal data is by considering the recent growth of the online advertising sector. "Our culture places a high value on privacy. Putting control of the data – what may be collected and retained and what must be deleted (the right to be forgotten) – in each of our hands through a contractual arrangement with the collector or seller, promotes individual choice and control" (Anderson, 2015).

It is retail marketers' task to communicate personal data requirements to consumers as well as the advantages of LPs. Both LP-organizers and consumers may be viewed as being in a process of developing a new understanding of the rules of consumer engagement programs (such as LPs) that not only match consumer preferences but help consumers accomplish goals in real-time – see Document News (2013) for detailed discussion. Customers ought to be assured that their data will be utilized ethically, lawfully and for improving retail offers. "Imagine a member of a customer loyalty program who is completely informed and agrees that data about his shopping habits are used to optimize business processes and to provide advertising material and special offers" (Matzner, 2014).

2. Research Focus

This research is focused on customers´ behaviour, privacy and data-sharing preferences related to LP participation in the Czech Republic. According to our previous research, Czech customers are less inclined to sharing their personal and contact data as compared to customers in selected EU countries (see e.g. Tahal (2015)). We aim to help marketers with a particularly important task: to find the appropriate balance between the amount of personal data required from consumers participating in a given LP and the extent to which consumers are willing to share such data. In this paper, we use the primary survey data to answer two main research questions:

Research question 1: What determines consumer willingness to provide different types of contact and personal information to organizers of LPs within the FMCG – are there any significant differences that would be determined by socio-demographic and lifestyle factors?

Research question 2: Does the extent of individual participation in LPs affect consumer's willingness to provide contact and personal information?

It should be explicitly noted that our research activities (and conclusions made) aim towards fair LP schemes, i.e. LPs where customers may realistically feel that in exchange for the personal information provided they are rewarded by adequate purchase incentives and/or improved and more personalized services by the retailer.

Our research of consumer willingness to provide contact and personal information to LP organizers focuses on the following 6 types of personal data: (a) Name & Surname, (b) Email, (c) Address/residence, (d) Birthdate, (e) Phone number, (f) Personal ID number. Overall, this classification reflects common marketing practice, as LP-based personal data are used for retail segmentation, analysis, auditing, forecasting, etc. In this paper, the first data type (Name & Surname) and the last data type (Personal ID number) have a limited, benchmark-type usage: Providing one's name in order to participate in a LP is the very minimum requirement. Besides Czech language-specific gender segmentation, name bears little usable information and it is often seen as the least sensitive data type. Therefore, Name/Surname data may serve as a benchmark in measuring the basic propensity to share non-sensitive personal data. In contrast, the Personal ID number is a very sensitive type of information with a non-negligible misuse potential. Actually, LP organizers in the Czech Republic are not allowed to legally collect and use this type data under most practical circumstances (exceptions may apply). Also, Personal ID bears little usable information, once data types (b) to (e) are controlled for. Therefore, we use the information on consumer willingness to share their ID numbers as a second benchmark, for the other end of the personal data sensitivity spectrum.

3. Data and Research Methodology

Our research is based on primary survey data from the Czech Republic. A complex, anonymized and stratified (quota) sampling was performed during the period from November 2015 to April 2016, gathering data for a sample of 411 respondents from the population of FMCG consumers aged 15+. The stratified quota sampling was based on three factors: location, age and gender of the respondents. Hence, our methodology ensures consistency and relevance of the results – conclusions may be drawn with respect to the population of 15+ consumers. A combination of personal and online data collection was used to gather socio-demographic information, lifestyle preferences, attitudes towards different types of work and free time activities of the respondents. Both quantitative (interval based) and qualitative (Yes/No, Likert scale-based) questions were used in the survey.

The survey was organized and performed by a research team at the University of Economics, Prague. This team is led by university employees and teachers who supervise and coordinate the tasks performed by students specializing in marketing research. This study is part of a systematic long-term project of specialized marketing analyses (see e.g. Tahal and Stříteský (2014)). Our empirical analysis (logistic regression and related statistical inference) is adjusted to control for the quota sampling, thus ensuring proper conclusions are made towards the FMCG consumer population based on the results and their interpretation. Also, for survey data validation, the Wald-Wolfowitz "Runs" test was used to test the H_0 of order of observations being attributable to chance against the H_1 of potential data collection mishandling (Wackerly et al., 2008).

All the surveyed data (interval-based, Yes/No, Likert scale) need to be conveniently stored for subsequent quantitative analysis. Given the nature of our questionnaires, the gathered data may be conveniently recorded as logical (binary) variables. The transformation of Yes/No answers (e.g. for questions related to willingness to provide personal data) is straightforward. For interval-based quantitative topics such as age or income, we use binaries to record respondent's appropriate interval entry. For example, the variable *Age_65_plus* equals 1 for all the respondents aged 65 and older and is zero otherwise. Answers to Likert scale-based questions are also recorded as binary variables. For the sake of our analysis, ordered multinomial data may be approached in a way similar to the interval-based quantitative variables. For example, respondents are asked to position themselves towards a statement "I like reading books" using a five degree Likert scale ("1" = this statement describes me very

well, …, "5" = this statement does not describe me at all). Subjectively perceived importance to individual lifestyle is addressed by this question, rather than some actual measure of reading time (or page volume count). Also, the fact that "1" is a better rating than "2" (in terms of agreeing with the statement evaluated) bears ordinal meaning only, i.e. we cannot say that the difference between "2" and "4" is somehow twice as important as the difference between "4" and "5". Therefore, the surveyed answers to this statement were used to produce two binary variables: *LS_books_yes* equals 1 for those who respond "1" on the Likert scale and zero otherwise, *LS_books_no* equals 1 for respondents who dissociate themselves from the statement by answering "5" (and zero otherwise). Although binary variable may be produced for each of the Likert scale answers, we find it empirically convenient to combine statements "2" to "4" – i.e. not a very strong position of the respondent – into a single reference category. Our approach has three advantages: First, we retrieve all cases where respondents have strong personal positions on given lifestyle activities and topics such as reading books, doing sports, eating organic food, etc. Second, the combined base answers "2" to "4" may still be included implicitly in the analysis as a reference category, necessary for interpretation of the estimated regression models. Third, using such reference base de-couples the *LS_book_yes* and *LS_book_no* binaries that are not linearly dependent and may be both used as explanatory variables in the same regression model.

Using the above described approach, we have transformed the surveyed material into a 402-row dataset (9 respondents were disregarded due to missing data issues) with 106 variables. Six of the variables describe consumer willingness to share personal data with LP organizers. The remaining one hundred variables form a pool of potential/conceivable regressors bearing socio-demographic, lifestyle and other relevant information that may be used to model consumers' personal data sharing preferences. For our dataset, an exhaustive (brute-force) search for a truly optimal parametric model specification is computationally inaccessible, as it would require an estimation and evaluation of 6×2^{100} models. Hence, in order to identify a small, informative and consistent set of explanatory variables, we combine a forward-stepwise selection method (this is a potentially suboptimal algorithm that produces nested sequences of models) with the non-parametric random forest approach. Differences in outputs from the two methods are analysed in order to detect any potential sub-optimality in output from the stepwise method. This approach allows for efficient and computationally feasible evaluation of individual explanatory variables with respect to prediction accuracy of the model, as only 6×100^2 models and 6×5,000 random forests are produced and evaluated (fast and automated evaluation procedures are available in R and other software packages). Although our methodology does not guarantee a truly optimal model specification, it may be regarded as an acceptable approximation with a relatively low potential for sub optimality). For detailed discussion of model selection methodology, see James et al. (2013). Hence, in order to answer the research questions (RQs) 1 and 2, the above described model selection process was used to generate a consistent model specification as outlined by equation (1):

$$\begin{aligned} y_i = {} & \beta_0 + \beta_1\,\mathrm{Female}_i + \\ & + \beta_2\,\mathrm{Age\_15\_24}_i + \beta_3\,\mathrm{Age\_65\_plus}_i + \\ & + \beta_4\,\mathrm{Moravia}_i + \beta_5\,\mathrm{Earnings\_high}_i + \\ & + \beta_6\,\mathrm{LS\_TV\_no}_i + \beta_7\,\mathrm{LS\_books\_no}_i + \\ & + \beta_8\,\mathrm{LS\_Internetuse\_no}_i + \\ & + \beta_9\,\mathrm{LS\_Paycard\_yes}_i + \\ & + \beta_{10}\,\mathrm{LS\_exotics\_yes}_i + \\ & + \beta_{11}\,\mathrm{LS\_cooking\_no}_i + \\ & + \beta_{12}\,\mathrm{LP\_Memb\_1\_2}_i + \\ & + \beta_{13}\,\mathrm{LP\_Memb\_3\_plus}_i + u_i \end{aligned} \qquad (1)$$

where y_i is a binary dependent variable – six different dependent variables are used with the left hand side of the equation and therefore six different equations are estimated using the model (1) – Yes/No answers were recorded for the question "Would you provide the following type of personal information in order to become a member of a loyalty program?" for each respondent and data category (a) to (f) as defined above. Please note that such question applies identically to consumers who already are members and/or active users of a LP as well as to individuals not participating in LPs. On the right hand side of (1), β_j are the coefficients to be estimated through logistic regression (see Davidson, MacKinnon (2009, p. 454-465)). $Female_i$ is a binary explanatory variable distinguishing between female and

male respondents, $Age\_15\_24_i$, is a binary indicating the 15-24 age group while $Age\_65\_plus_i$ depicts individuals aged 65 and older (upon variable importance evaluation as described above, age ranges 25-34, 35-49 and 50-64 are combined into a single base category). $Moravia_i$ describes the residence of respondents and Bohemia serves as its reference category. Respondents with high earnings (defined by a monthly household income over 80 thousand CZK) are discerned using $Earnings\_high_i$. Likert scale-based lifestyle variables $LS\_TV\_no_i$, $LS\_books\_no_i$ and $LS\_Internetuse\_no_i$ mark respondents who dissociate themselves from watching TV, reading books and using the internet. $LS\_Paycard\_yes_i$ indicates whether the i-th respondent uses pay cards (credit and debit) frequently and $LS\_exotics\_yes_i$ determines whether respondents are keen on spending their holidays at exotic destinations or by the sea (as the Czech Republic is a landlocked country). $LS\_cooking\_no_i$ discerns people who dissociate themselves from cooking (again, subjectively perceived importance is addressed here). $LP\_Memb\_1\_2_i$ identifies individuals (consumers) who actively participate in 1 or 2 LPs. Similarly, $LP\_Memb\_3\_plus_i$ describes respondents who actively take part in 3 or more LPs. Finally, u_i is the potentially heteroskedastic random element.

The interpretation of most of the lifestyle variables included in equation (1) is relatively straight-forward, given the intuition on Likert scale data transformation as provided above. However, the last two variables (*LP_Memb_1_2* and *LP_Memb_3_plus*) require some additional explanation: In the questionnaire, respondents were asked two questions related to the quantity of LPs. First, respondents provided the total number of LPs they are members of. The first question served mostly as a lead-in to the next question, where individuals reported their actual (active) LP participation. In this article, we focus on active LP usage rather than a simple LP membership as we find active LP participants to be a far more interesting group as far as LP organizers are concerned. Although the respondents were choosing from five options (0 LPs actively used, 1-2, 3-4, 5-9, 10+), low observed quantities in the last two categories led us to combine the last three LP categories into a single category of 3+ LPs actively used. Hence, we include *LP_Memb_1_2* and *LP_Memb_3_plus* variables in equation (1) to describe the effect of active LP participation, while consumers using zero LPs form a base (reference) category. The two LP-focused variables discussed in this paragraph are indispensable for answering the research question 2. In this context, it is worth mentioning that the inclusion of both variables is based on the variable selection (regressor importance evaluation) process described above – i.e. we didn't have to "force" the two variables into equation (1) in order to allow for answering research question 2.

The logistic function used for estimation of the β_j coefficients in equation (1) may be expressed as

$$P(y_i = 1 \mid \mathbf{x}_i^T) = G(\mathbf{x}_i^T\boldsymbol{\beta}) = \\ = \exp(\mathbf{x}_i^T\boldsymbol{\beta})/[1 + \exp(\mathbf{x}_i^T\boldsymbol{\beta})], \quad (2)$$

where $P(y_i = 1 \mid \mathbf{x}_i^T)$ is the probability of success (i.e. consumer willingness to provide the specific type of his/her personal data), given the observed row vector of explanatory variables $\mathbf{x}_i^T$. The expression $G(\mathbf{x}_i^T\boldsymbol{\beta})$ is a simplified notation for the logistic function: $\exp(\mathbf{x}_i^T\boldsymbol{\beta})/[1 + \exp(\mathbf{x}_i^T\boldsymbol{\beta})]$ which guarantees that all fitted values of the dependent variable lie within the $\langle 0, 1\rangle$ interval. In model (2), the direction of the effect of change in the explanatory variable x_j on the probability of "success" in the dependent variable is always determined by the sign of the corresponding β_j coefficient. However, the magnitudes of the individual β_j coefficients are not sufficiently informative, given the nonlinear nature of the logistic function. The effect of a change in x_j on the probability of "success" for the i-th respondent must be calculated individually: as can be seen from equation (2), a change in conditional probability of success is calculated from a compound function that depends on the following arguments: β_j, all the remaining coefficients in vector $\boldsymbol{\beta}$ and all the observed values of the explanatory variables for the i-th respondent ($\mathbf{x}_i^T$). Hence, for the i-th respondent and a chosen binary explanatory variable, say x_k, the partial effect from changing x_k from 0 to 1 (while holding all other explanatory variables unchanged) may be simply calculated as

$$\Delta G(\,.\,) = G(\beta_0 + \beta_1 x_{1,i} + \ldots + \beta_{k-1,i} x_{k-1,i} + \beta_k) \\ - G(\beta_0 + \beta_1 x_{1,i} + \ldots + \beta_{k-1,i} x_{k-1,i}) \quad (3)$$

In expression (3), we may note that the β_k coefficient is present when $G(.)$ is evaluated for $x_k = 1$ and omitted for $x_k = 0$. For each individual consumer, the expression (3) may be used for evaluation of changes in conditional success probabilities. However, for effective model interpretation, we need to summarize the individual information obtained from equation (3) across all individuals. This is done through the average partial effect (APE) statistics:

$$APE(x_k) = n^{-1}\sum_{i=1}^{n}\left[\begin{array}{l} G(\hat{\beta}_0 + \hat{\beta}_1 x_{1,i} + ... + \\ -G(\hat{\beta}_0 + \hat{\beta}_1 x_{1,i} + ... \\ + \hat{\beta}_{k-1,i} x_{k-1,i} + \hat{\beta}_k) \\ ... + \hat{\beta}_{k-1,i} x_{k-1,i}) \end{array}\right], \quad (4)$$

where $\hat{\beta}_j$ are the sample estimates of β_j coefficients. In equation (4), the expected partial effect of changing a given binary regressor x_k from 0 to 1 (ceteris paribus) is obtained for each of the survey respondents and then averaged across individuals. Using this approach, APE(x_k) values are usually reported along with their corresponding standard errors and significance statistics. Using expression (4), consistent APEs may be calculated for all binary regressors x_j in model (1). Although all regressors in model (1) are binary, the specification chosen provides enough control for diverse observed factors that it allows for a straightforward interpretation of individual APEs; a situation that is analogous to the Ignorability of treatment assumption (as in Wooldridge (2010, p. 908)).

4. Empirical Results

Individual willingness to disclose personal information to LP organizers is approached using diverse data evaluation methods in order answer RQs 1 and 2 and to quantify important sociodemographic and lifestyle aspects of this type of consumer behaviour. First, table 1 summarizes the overall consumer readiness to share personal data. Rows are organized in descending order and we may see that there are prominent differences in personal information sharing preferences related to the type of data. The willingness to share personal data ranges from 91.3% (Name & Surname) to 3.7% (Personal ID number). This range between the two benchmark data types (as described above) sets an interpretation framework for the remaining data types. In fact, as we test for statistically significant differences in observed means (relative "success" ratios, i.e. the average willingness to share a specific type of data), we find that all mean pairs are statistically different (6 categories make for 15 possible category-pairs), with the exception of Birthdate and Phone number – means of those two categories are not statistically different at any reasonable significance level. Such evaluation is based on the Wilcoxon signed rank test (for matched/correlated pairs). For detailed description of the test, see Wackerly et al. (2008). The row ordering and the positive outcome ratios shown in table 1 provide an interesting insight into individual privacy preferences and the general attitude of consumers to personal data disclosure. For example, we may point out the quite low level of preparedness to share phone numbers, that

Tab. 1: Observed willingness to share different types of personal information

Personal information type & consumer willingness to share it	No. of „Successes" (out of 402 respondents)	Positive outcome ratio	Variance
Name & Surname	367	0.913	0.080
Email	260	0.647	0.229
Address/residence	227	0.565	0.246
Birthdate	156	0.388	0.238
Phone number	149	0.371	0.234
Personal ID number	15	0.037	0.036

Source: own

consumers prefer to keep undisclosed more than other contact information such as Email and Address/residence. Most probably, this attitude is related to the avoidance of advertisement voice calls and text messages, which may be perceived as far more intrusive when compared to emails or paper-based leaflets. Deleting irrelevant e-mails is less bothering than dealing with unsolicited phone calls and text messages (e.g. Blackburn (2015)).

The variance information in table 1 is provided mostly for readers' convenience. Given the binomial nature of the underlying dummy variable representing willingness or unwillingness to share personal data, variance equals $p(1-p)$, where p is the Positive outcome ratio. Table 1 provides reasonable overall insight into consumers' personal data sharing preferences. Yet, in order to answer RQ1 and RQ2, we need to focus on the sociodemographic and lifestyle aspects. At the individual level, many random elements and factors play a significant role in defining the extent of personal data sharing. However, by means of logistic regression, we are often able to quantify statistically significant differences in personal data sharing habits between specific groups of respondents (either sociodemographic or lifestyle-based). Such results may be presented in an informative, easily accessible and often actionable form that may be used for diverse marketing and LP-management purposes.

Next, we turn our attention to the RQ1. Based on the explanatory variables (sociodemographic and lifestyle factors), model (1) was estimated for each of the six dependent variables (willingness to share different personal data types). All estimated models provide reasonable estimation accuracy and are statistically significant at the 5% significance level – with the exception of the model estimated for Personal ID number, which is only significant at α = 10%. In logistic regression, the individual coefficient estimates are not particularly informative, except for their signs and statistical significance. Therefore, we skip the regression output from equation (1) and focus on the APE values as defined in (4). In fact, all signs and statistical significances of the $\beta_{c,j}$ coefficients are unambiguously reflected in the corresponding $APE_c(x_j)$, where x_j is the j-th explanatory variable and subscript c denotes the c-th type of personal information – a dependent variable in (1). All logistic estimation outputs omitted from this article are available from the authors upon request, along with primary data and the R-code used. In table 2, all $APE_c(x_j)$ values are reported along with their standard errors (heteroscedasticity corrected values) and p-values. Columns in table 2 are organized by the overall consumer willingness to share personal data in the same descending order as in table 1 – thus allowing for a simple comparison.

For interpretation of the sociodemographic and lifestyle factors related to RQ1 – as shown in table 2 – we shall start with the variable Female as an example: Women are roughly 10% less likely to share their email address and phone number with LP organizers when compared to the reference category (i.e. men). For the remaining four personal data types, gender plays no significant role. Such interpretation is made in a ceteris paribus context – we control for all the remaining variables explicitly included in model (1). Interestingly, our findings somewhat contradict a common stereotype that regards women as more likely to conceal their age. This conclusion is implied through the dependent variable Birthdate, for which respondent's gender is not a significant regressor. For illustration and readers' convenience, the ceteris paribus effects on willingness to share personal data related to the regressor Female are included in figure 1 (along with corresponding bars showing 90% significance intervals). For example, the leftmost bar (within the Female group) shows that women are 3.5% less likely to share their name with LP organizers. At the same time, the corresponding 90% significance interval includes zero and therefore this particular effect is not statistically significant at α = 0.1 (significance level of 10%).

The remaining sociodemographic factors influencing consumer willingness to share personal data with LP organizers may be briefly summarized as follows: From table 2 we can see that people aged 15 to 24 are 21% more likely to share their birthdate compared to the age-reference group of people aged 25 to 64. For other personal data types, significant influence of the variable Age_15_24 is not identified. In contrast, respondents aged 65 and older diverge from the age-reference group rather significantly. They are almost 28% less likely to share their email addresses (note that the non-use of the Internet is controlled for

Tab. 2: APEs for selected types of personal data

	Name & Surname	Email	Address	Birthdate	Phone number	Personal ID number
Female (s.e.) [p-value]	-0.0352 (0.0269) [0.1904]	-0.1032 * (0.0407) [0.0112]	-0.0014 (0.0490) [0.9779]	0.0464 (0.0483) [0.3371]	-0.1015 * (0.0489) [0.0378]	0.0047 (0.0236) [0.8428]
Age_15_24	-0.0144 (0.0600) [0.8108]	0.0841 (0.0675) [0.2130]	0.0393 (0.0743) [0.5970]	0.2106 * (0.0751) [0.0050]	0.0820 (0.0747) [0.2724]	0.0281 (0.0361) [0.4364]
Age_65_plus	-0.0582 ˙ (0.0310) [0.0606]	-0.2792 * (0.0628) [0.0000]	-0.1520 * (0.0624) [0.0148]	-0.0306 (0.0627) [0.6261]	0.1186 ˙ (0.0629) [0.0593]	0.0085 (0.0283) [0.7629]
Moravia	-0.0179 (0.0299) [0.5503]	-0.0839 ˙ (0.0446) [0.0600]	-0.0431 (0.0489) [0.3774]	-0.0865 ˙ (0.0476) [0.0693]	-0.0094 (0.0475) [0.8436]	0.0300 (0.0244) [0.2181]
Earnings_high	-0.1349 ˙ (0.0689) [0.0503]	-0.0443 (0.1065) [0.6775]	-0.2708 * (0.1085) [0.0126]	-0.0050 (0.1006) [0.9607]	-0.1118 (0.0938) [0.2333]	-0.0383 * (0.0093) [0.0000]
LS_TV_no	-0.0863 (0.0586) [0.1409]	-0.0839 (0.1038) [0.4187]	0.0423 (0.1037) [0.6833]	0.0203 (0.1255) [0.8716]	0.0019 (0.1118) [0.9866]	-0.0385 * (0.0094) [0.0000]
LS_books_no	0.0949 * (0.0131) [0.0000]	0.1755 * (0.0700) [0.0121]	0.1460 ˙ (0.0873) [0.0943]	0.3214 * (0.0836) [0.0001]	0.1028 (0.0960) [0.2844]	0.0475 (0.0406) [0.2418]
LS_Internet_use_no	-0.0828 (0.0529) [0.1174]	-0.3343 * (0.1320) [0.0113]	-0.0191 (0.0886) [0.8290]	-0.0393 (0.0915) [0.6671]	-0.2538 * (0.0782) [0.0012]	-0.0155 (0.0207) [0.4535]
LS_Paycard_yes	-0.0361 (0.0311) [0.2464]	0.1170 * (0.0439) [0.0076]	-0.0158 (0.0508) [0.7555]	-0.0069 (0.0502) [0.8908]	0.1083 * (0.0514) [0.0353]	-0.0276 (0.0224) [0.2193]
LS_exotics_yes	0.0424 (0.0292) [0.1466]	0.0337 (0.0525) [0.5205]	0.1086 ˙ (0.0583) [0.0628]	0.1023 ˙ (0.0581) [0.0786]	0.0647 (0.0575) [0.2608]	-0.0206 (0.0198) [0.2962]
LS_cooking_no	0.0103 (0.0287) [0.7187]	-0.1707 * (0.0805) [0.0339]	-0.0290 (0.0725) [0.6886]	-0.1575 * (0.0768) [0.0404]	0.0776 (0.0808) [0.3371]	0.0073 (0.0274) [0.7890]
LP_Memb_1_2	0.1254 * (0.0230) [0.0000]	0.1015 * (0.0422) [0.0162]	0.1450 * (0.0511) [0.0046]	0.0428 (0.0583) [0.4629]	0.1807 * (0.0534) [0.0007]	-0.0294 (0.0199) [0.1405]
LP_Memb_3_plus	0.1555 * (0.0237) [0.0000]	0.2412 * (0.0484) [0.0000]	0.3267 * (0.0548) [0.0000]	0.1735 * (0.0643) [0.0069]	0.3548 * (0.0603) [0.0000]	0.0577 (0.0418) [0.1680]

Source: own

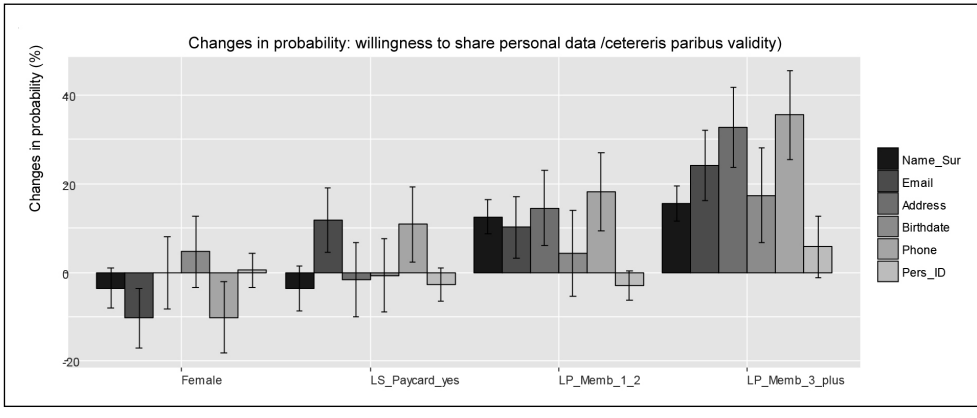
Note: * – coefficient significant at α = 0.05; ˙ – coefficient significant at α = 0.1.

by a separate lifestyle explanatory variable LS_Internetuse_no), 15% less likely to divulge their address/residence and also 6% less likely to provide their names. On the other hand, members of the age group 65+ are about 12% more likely to hand over their phone numbers when compared to the reference. The reference group exhibits a rather uniform behavior in terms of personal data sharing preferences. Hence, it is not convenient to study the age ranges 25-34, 35-49 and 50-64 individually: we combine them into a single 25-64 reference and study how the younger and older consumers differ.

Respondent domiciled in Moravia are roughly 8.5% less likely to share their email and birthdate compared to the reference group (Bohemia combined with the separately surveyed region of Prague). Consumers with high earnings are 27% less likely to provide LP organizers with their address/residence, most probably as a security precaution. Similarly, they are 13.5% less likely to provide their name. Education (surveyed as primary/secondary/university degree) does not have a significant effect on individual willingness to share different types of personal data, once the other factors in model (1) are controlled for. Therefore, education-related variables are omitted from equation (1) and from table 2.

Next, we briefly summarize the RQ1-related lifestyle factors that influence consumers' willingness to share data most prominently. Generally speaking, people who dissociate themselves from reading books (LS_books_no equals 1) are more likely to provide their personal data to LP organizers when compared to the reference group (active book readers combined with people without a strong position on this topic). The difference is most prominent for the Birthdate dependent variable – we observe a 32% increase in probability. Respondents who dissociate themselves from using the Internet (LS_Internetuse_no) are less likely to share their personal data: we observe a decrease of 33% in willingness to share email (for obvious reasons, people who dissociate themselves from using the Internet are less likely to actually have an email address), a 25% decrease in likelihood of sharing phone number and even an 8% decrease in willingness to share name (however, this result narrowly misses statistical significance at $\alpha = 0.1$). In contrast, a statistically significant effect of LS_TV_no is observed only for the Personal ID number (a decrease of 3%). Consumers who report being active paycard users (42% of the respondents strongly identify themselves with using a credit or debit card as measured by the Likert scale-based variable LS_Paycard_yes) are 12% more likely to share email address and 11% more likely to share phone number with LP organizers, while the effect of this lifestyle factor is not statistically significant for the other four types of personal data. For illustration, the variable LS_Paycard_yes is also included in figure 1.

Fig. 1: Illustration of selected results from table 2



Source: own

Individuals who identify themselves with spending holidays at exotic destinations (including holidays by the sea as the Czech Republic is landlocked) are depicted by the regressor LS_exotics_yes. Such individuals are 11% more likely to share their addresses and 10% more likely to share their birthdate when compared to the reference group – perhaps the reason is that such consumers are used to share such data with different tour and travel operators. However, the effect of the LS_exoticsc_yes is not significant for the remaining four data types considered (including Personal ID). People who dissociate themselves from cooking (subjectively perceived importance to one's lifestyle controlled for using the variable LS_cooking_no) are less inclined to share their personal data with LP organizers as follows: -17% for emails and -16% for birthdates.

The last two regressors in model (1) – LP_Memb_1_2 and LP_Memb_3_plus – are used for answering our RQ2. From table 2 as well as from figure 1 we can see that active LP members are significantly more inclined to share personal data with organizers of a "new" LP they want to become members of. The interpretation of the last two rows in table 2 is somewhat different from the above factors as both LP_Memb_1_2 and LP_Memb_3_plus are interpreted with respect to the same reference group – i.e. consumers who are not active members of any LP. This may be illustrated using the Phone dependent variable: consumers who participate in 1 or 2 LPs are 18% more likely to share their phone number with LP organizers as compared to the reference. For consumers who participate in 3 or more LPs, this willingness increases by 35.5% as compared to the reference group of LP non-participants (i.e. 1-2 LP users are not directly compared with 3+ LPs participants). Similarly to the Phone data, 1-2 LP users are 15.5% more likely to share address and 10% more likely to share email, while for 3+ LP users the increase in probabilities (compared to base group) are 33% and 24% respectively.

For correct interpretation of the results in table 2, we need to keep in mind that the $APE_c(x_j)$ values in different columns of each row (as the influence of a selected factor is studied across different data types) are mutually independent by the nature of our regression-based methodology. This does not directly alter the interpretation of table 2, yet due to observed positive pairwise correlations among different personal data types (consumer willingness to share such data), some of the $APE_c(x_j)$ values for individual x_j regressors (i.e. values in rows of table 2) may be relatively similar in their signs, magnitudes and significance levels. We skip detailed correlation output from this article, yet the typical correlation between two personal data types (willingness to share) ranges from + 0.2 to + 0.3. The most prominent correlation was observed between the Address and Birthdate variables (+ 0.44), while correlation of Personal_ID with other dependent variables is somewhat lower (roughly + 0.1 to + 0.2). We do not find evidence for any mutually exclusive consumer preferences in personal data sharing – i.e. none of the dependent variables are negatively correlated.

Conclusions

In this paper, we apply various quantitative analysis tools to examine personal data-sharing preferences that are related to consumer participation in loyalty programs. In addition to sociodemographic aspects, we also focus on different lifestyle factors. Our detailed and stratified research results may be used by professional marketers and academic researchers in order to identify differences and similarities in consumer willingness to share diverse types of personal data. As far as different sociodemographic and lifestyle variables are concerned, we may conclude that the willingness to share personal data and contact information changes significantly among specific consumer groups. Most of the important aspects and answers to our research questions are explicitly interpreted in the paper. However, readers may easily draw their own conclusions upon the estimates provided in tables 1 and 2, given the sociodemographic group and/or data type of their interest.

Among other topics, our research emphasizes the fact that personal data-sharing preferences are a convoluted phenomenon which requires a complex, structured and quantified research approach. Marketing professionals and LP organizers can use our results to amend the incentives incorporated in their LPs to optimize consumer data-gathering processes. Cost-benefit assessments may lead LP managers into focusing relevant purchasing incentives and other LP-based benefits towards consumer groups that are least willing to share

their data. Alternatively, such analyses may lead towards data-gathering compromises: partial redefinitions of LP structures and evaluation processes may take place in order to require only such personal information that target customer group-members are willing to share.

To highlight some of our empirical results, respondents aged 65 and older are significantly less inclined to share their personal data as compared to other age groups – which conforms to our prior (pre-research "general expectations"). On the other hand, we do not find statistical evidence for education-based differences in data sharing preferences: i.e. individual willingness to share personal and contact information does not depend on the education level achieved. The lifestyle-based structure of data-sharing preferences is complex and may be best observed from table 2. Finally, consumers who already participate in some LP are significantly more likely to share their personal data in order to sign up for a new LP. This overall increase in personal data-sharing propensity is even more prominent for consumers who participate in three or more LPs.

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Abstract

LOYALTY PROGRAMS AND PERSONAL DATA SHARING PREFERENCES IN THE CZECH REPUBLIC

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Effective loyalty program management and evaluation requires that retailers have access to relevant data. In most cases, loyalty program organizers aim to establish consumer databases for the purpose of identification of individual customers: loyalty program members. The structure and quality of customer data often has a strategic effect on retailers' decision-making accuracy and profitability. On the other hand, consumers worry about their privacy and fear their personal data may be misused. For a good-faith loyalty program organizer, it is an ongoing task to reconcile their corporate interests with the interests of consumers who are often rewarded by purchase incentives and personalized services.

Consumer's willingness to disclose personal information to loyalty program organizers is not uniform. In fact, individual preferences, sociodemographic and lifestyle factors play a very important role. This study provides a structured quantitative analysis of customers´ willingness to share selected key types of personal and contact data with loyalty program organizers in the Czech Republic. Cost-benefit assessments based on our results may help marketing managers with establishing and/or amending key LP incentives. We identify and discuss important differences in personal and contact data-sharing preferences among specific consumer groups. To highlight some of the empirical results, respondents aged 65 and older are significantly less willing to disclose personal data as compared to younger consumers. On the other hand, we do not find a statistically significant evidence for education-based differences in data sharing preference. Our results may be utilized by marketing professionals (loyalty program organizers) as well as by academic researchers in order to optimize their consumer data-gathering processes.

Key Words: *Loyalty program, customer data, personal data, data sharing preferences.*

JEL Classification: *C25, D12, M31.*

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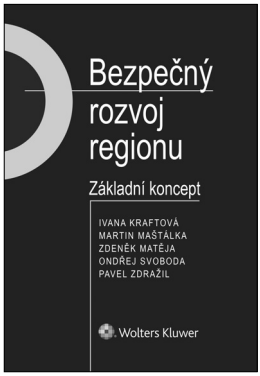

BEZPEČNÝ ROZVOJ REGIONU. ZÁKLADNÍ KONCEPT

Authors: Ivana Kraftová, Martin Maštálka, Zdeněk Matěja, Ondřej Svoboda, Pavel Zdražil
Publisher: Wolters Kluwer ČR, Praha, 2016

The new interesting publication has appeared on the professional book market recently. Authorial collective led by Ivana Kraftová reflects particularly topical and urgent security theme in it. Security problems nowadays relate to not only military, resp. military-political aspects but also social, technological, economic and others which authors examine mostly in the context of regional framework. As it is evident, globalization process and global economy open a new perspective on security of region among others and make it even more urgent than it was common in past.

The monograph is structured into 7 free-relating chapters. The first one introduces main thinking connected with regional security topic. On this base the authors formulate basic concepts of region and security as interdisciplinary and mutually interconnected problems. Main stress is put on socially-economic aspects of regional security. The second chapter explains relating terminology of security and presents its traditional and modern concepts. Chapter 3 is devoted to regional aspects of security. Chapter 4 then analyses socially-economic factors of security and potential economic resistance of regions; also prevention aspect is included in the text of the chapter.

Chapter 5 concentrates on population as an object and a subject of regional development and a possible factor of security risks connected with actual trends of development and movement of human sources. Chapter 6 examines entrepreneurial environment and a structure of capital in particular regions of the Czech Republic. Chapter 7 contains a historical review of municipality genesis and its linkage to region and security; also some actual trends in municipality development are included.

The monograph is compact, and logically arranged. The authors draw on wide range of internal and foreign literary sources which confront also with own research outcomes. So, potential readers of the book may gain a complex insight into regional security topic and its latest trends.

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