Impact of Intellectual Capital and its Components on Firm Performance Before and After Crisis

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Abstract: The recent economic crisis has caused a significant discontinuity in the world of business. Companies and researchers are constantly trying to understand the key drivers that caused significant impact on companies' performance and how to challenge them in the future. One still insufficiently covered research issue is the role that intellectual capital and its different components have played in the performance of small and medium-sized enterprises, and how this role has changed after the crisis. Intellectual capital has become a key value creation driver in the new economy. Its positive influence on firm performance has been proved by numerous empirical studies worldwide. Several of them also investigated how the economic crisis affected this paradigm. However, the body of knowledge supported by sound empirical findings in this field is still rather scarce. Therefore, the purpose of our study is to examine the relationship between intellectual capital (IC) and its different components, and firm performance before the recent economic crisis and in the period of recovery, among SMEs in different industries in Slovakia. To measure the level of IC and its respective components we applied the Value added intellectual coefficient (VAIC™) indicator developed by Pulic. This measure, however being criticized by some authors, is the most frequent metric used to evaluate IC and its components using financial data. We selected ROA as our performance measure. Our analysis also accounted for firm size and financial leverage while investigating the effect of IC on SME performance. We based our analysis on panel data comprising of 2008 and 2011 financial statements of 1947 Slovak SMEs operating in 10 industries (sections according to SK NACE rev. 2 classifications). These data were obtained from business information portal Universal Register Plus operated by CRIF - Slovak Credit Bureau. To compare the influence of IC on firm performance we constructed pre-crisis (2008) and post-crisis (2011) regression models and analyzed the observed differences from two different perspectives. Our findings suggest a rather consistent pattern across almost all investigated industry sections showing that the role of intellectual capital performance in predicting firm's financial performance has increased in the past-crisis.period compared to the pre-crisis situation. For the industries where the relationship between IC and firm performance had been strengthened from both employed perspectives we have studied the differences in the effect of particular IC components. Our results suggest that while different IC components generally play a significant and from the time-perspective a consistent role in predicting firm financial performance, there are considerable differences across the industries. However, these different modes of interplay between IC components seem to lead to a similar pattern when the firm´s financial performance is combined with its overall intellectual performance.

Keywords: intellectual capital, intellectual capital components, firm performance, VAIC^{TM}, HCE, SCE, CEE, SMEs, economic crisis

1. Introduction

Intellectual capital is seen as one of the key value drivers in the modern economy wherein knowledge-based firms are crucial for economic development. A core strategy for gaining a competitive advantage by a firm is the use of knowledge as a resource base. As such, value is thereby created for shareholders and stakeholders. Authors such as Sveiby (1997), Edvinsson (1997) and Lynn (1998) consider intellectual capital as a main source of value creation in the new economy. It is clear that formulation of an adequate strategy is a very important component in the value creation process. Equally important is value management process in which relevant intellectual capital management is a serious challenge. Part of this challenge is also measurement of the contribution of intellectual capital to the economy. OECD (2008), in its report, stresses the importance of this issue as follows: „The current bias towards tangible assets in measuring investment may lead to inefficient policymaking, misallocation of resources by managers and increased cost of capital for investors. However, any shift toward consideration of intellectual assets as investments, rather than as expenses, must overcome a range of measurement and valuation problems".

On the micro level impact of intellectual capital on a firm´s financial performance can be measured from both short term and long term perspectives. From a short term perspective the impact of intellectual capital can be measured with selected financial performance ratios such as ROA, ROE or sales to total assets. These may be considered proxies for total value creation measurement. The long term perspective can be measured by value creation. The issues addressed above are complex and create a challenge for all types of companies but especially for small and medium size companies (SMEs). In many economies, similar to Slovakia, SMEs play a critical role in their development. In Slovakia SMEs include 99.9% of the companies, with 72.2% of total employment and 23.0% of GDP. They have their specific characteristics and managerial issues, however they must also use knowledge as source of competitive

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advantage particularly in turbulent times. Thus in our paper we have investigated whether the role of intellectual capital and its components in financial performance of Slovak SMEs, operating in different industries, has changed before and after the peak of the recent financial crisis.

In Section 2 we discuss the context of intellectual capital, the recent economic crisis and financial performance. In Section 3 we present the data and methods used in our research. Section 4 presents the results of our analysis and Section 5 discusses the findings as well as their implication.

2. Intellectual capital, economic crisis and financial performance

The most frequently quoted definition of intellectual capital is: any knowledge convertible into value (Edvinsson 1997). The essence of intellectual capital is the value creation that can be understood as a complex of intangible property, knowledge, skills, processes, applied experience and technologies used in organizations to ensure a competitive advantage on the market (Papula and Volna 2011). According to literature (Edvinsson 1997, Sveiby 1997, Stewart 1998, Bontis 2002, Mouritsen et al. 2002, Pablos 2003) intellectual capital consists of three main components: human capital, organizational capital and relational capital. As can be seen in Figure 1 (Papula and Volna 2011) human and organizational capital both contain knowledge oriented towards something inside the organization, in contrast to relational capital which contains knowledge items oriented outside the company.

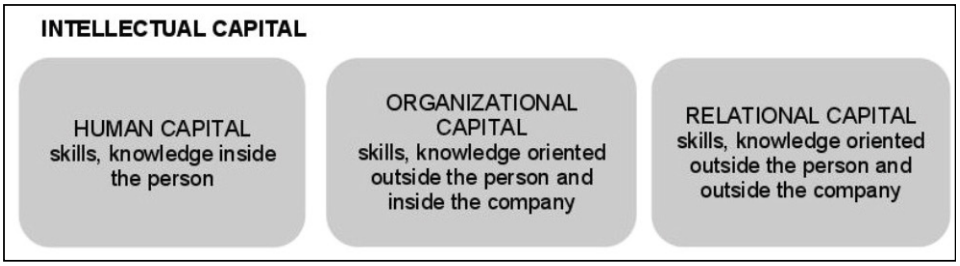

Figure 1: Components of intellectual capital

For several decades and during the last one a considerable amount of research on intellectual capital and its relation to financial performance of the company has been published. Whereas some of the results are ambiguous (Javornik et al. 2012, Iazzolino and Laise 2013), considerable amount of research confirmed positive relationship of intellectual capital and firm performance (Chen et al. 2005, Clarke et al. 2011, Alipour 2012, Mondal and Ghosh 2012, etc.). The influence of intellectual capital on firm performance both through financial and non-financial results is very well illustrated within the ARCS model for Intellectual Capital Reporting (Koch et al. 2000), that is presented in Figure 2.

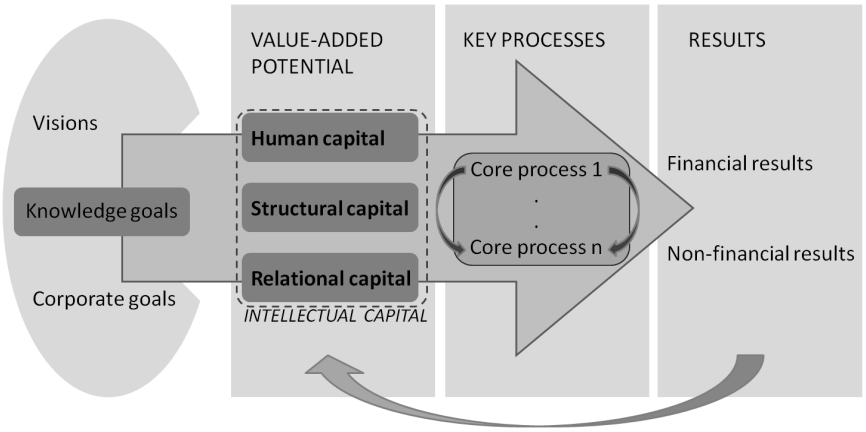

Figure 2: Process of influence of intellectual capital components on firm performance

Intellectual capital is a complex phenomenon. Due to that, a lot of questions regarding measurement of its impact on company performance remain unanswered. To a great extent it really depends on the perspective or the purpose of particular measurement. As a result, researchers have developed a number of different methods in an attempt to overcome the limitations and irrelevance of traditional measures.

In 2005, Karl Eric Sveiby presented a comprehensive analysis of 42 identified measurement methods (Sveiby 2005). According to his classification measurement methods for intellectual capital can be grouped into four main categories:

direct intellectual capital evaluation methods (DIC), scorecard (SC) methods, market capitalization methods (MCM) and return on assets (ROA) methods. DIC and SC methods identify intellectual capital components and instead of them create some index. MCM and ROA are based on decomposition of certain parameters. The value added intellectual coefficient (VAIC™), a method developed by Ante Pulic (Pulic 1998, 2000, 2004, 2008), is the only one that doesn't quite fit any of the four listed categories. Its closest fit is the ROA measurement methods (Sveiby 2005). Each of these methods has its own pros and cons. In our opinion the best way how to compare the results of the intellectual capital impact on value creation (e.g. as a part of strategy formulation process) is through methods based upon available financial information. We consider these methods the most pragmatic for this purpose.

The most frequently used methods that are based on available financial information are the Q-Tobin coefficient (Tobin 1969), EVA, MVA and FGV developed by Stern Stewart&Co., and VAIC^{TM} (Pulic 1998, 2000, 2004, 2008). Despite the fact that introduction of EVA, MVA and FGV has been innovative in firm performance measurement, and shareholder valuation, in the knowledge economy, "these basic indicators of industrial economy do not really show whether and how much value has been created" (Pulic 2000).

Pulic proposed the use of the value added as an indicator for measuring performances in a knowledge economy context. His VAIC^{TM} concept has been criticized both for his assumptions (e.g. Zeghal and Maaloul 2010, Andriessen 2004) as well as for poor results in case of relationship between VAIC^{TM} and firm performance in some industries and emerging markets (e.g. Chan 2009, Puntilla, 2009). According to Iazzolino and Laise (2013) part of this criticism is due to misunderstandings because of the different meanings that Pulic gives to the terms of human capital (HC) and structural capital (SC) in comparison to Scandia Navigator. They believe that "the bridge that Pulic created between the notions of value added and that of value creation in a knowledge economy context constitutes the strength of his proposal". On the other hand they think that the main weakness is the attempt to qualify VAIC^{TM} as a performance measurement criterion alternative (or rival) to the existing ones like EVA etc. Their opinion is that VAIC^{TM} complements existing measurement of the multidimensional concept of firm performance as an innovative indicator of intellectual capital efficiency (ICE).

The issue of intellectual capital measurement on a micro level is relevant not only for the overall intellectual capital concept, but also for its different components. When we hold to the Pulic's VAIC^{TM} model, the value of intellectual capital performance is a result of the efficiency of human and structural capital and asset value efficiency (Pulic 1998, 2000, 2004, 2008). As an integral part of VAIC^{TM} model, this structure as well as the definition and operationalization of its respective components, face a similar criticism as the entire model, mostly based on a shift in meaning commonly assigned to the respective components (Iazzolino and Laise 2013). Again, similar to the overall VAIC^{TM}, Pulic's components of intellectual capital have been frequently utilized in empirical research as potential predictors of firm performance (e.g. Javornik et al. 2012, Joshi et al. 2013, Phusavat et al. 2011).

Economic crisis and recession periods have always required new business strategies formulation and implementation. These periods are usually accompanied by shortage of financial resources. Therefore one of the options for companies today is to put more effort on improvement of intellectual capital usage. The qualitative research study by Lennox (2012) confirmed that, due to financial constraints of the recent recession, companies have to utilize their relational capital to sustain their operations and negotiate with suppliers, customers and financiers. Theoretical grounding suggests that the role of intellectual capital in SMEs value creation should have increased as a result of economic recession. Unfortunately we haven´t found any empirical evidence based on quantitative analysis that would explain a pattern of change in usage of intellectual capital in financial performance improvement as a proxy to increase value of SMEs.

3. Research methods and data

The aim of our study was to examine the relationship between intellectual capital and its different components and firm performance before the recent economic crisis and in the beginning of the recovery period, in order to discover how the crisis influenced the importance of intellectual capital in determining firm performance among SMEs in different industries.

3.1 Sample

Our analysis is based on panel data comprising financial statements of 1947 Slovak SMEs operating in 10 different industrial sections for years 2008 and 2011. While 2008 financial statements depict the situation before the recent economic crisis, the 2011 financial statements of the same firms reflect the influence of the crisis and the beginning of

recovery period. To obtain the research sample we have used a commercial database of business information portal Universal Register Plus operated by CRIF - Slovak Credit Bureau. The vendor collected the data from the official Company register collection of documents and official Business bulletin. The original dataset contained 2370 companies with financial statements available for both 2008 and 2011. To obtain our final sample we have employed several criteria. First, we have selected only small and medium-sized enterprises adhering to the EU definition (EC 2005), applying the financial thresholds (due to missing information on staff headcount and autonomy of the enterprise these criteria were omitted). Second, we filtered out all companies with zero turnover, zero staff costs or negative equity in any of the examined years (2008 and 2011). Third, we have selected industries that contain at least 50 companies, while making sure that this selection will reasonably cover the scope of existing industries. To classify the companies into different industries we have applied SK NACE Rev. 2 statistical classification using the most aggregated level of industry sections (EC 2008). This filtering procedure resulted into the final sample of 1947 SMEs from 10 different industries. Despite the limited representativeness of this sample (due to the character of the original data) resulting from convenience sampling, its considerable scale and panel character enables us to generalize the findings to certain extent. The industry distribution of our research sample is provided in Table 1.

Table 1: Industry distribution of research sample

SK NACE	Industry section	Sample size
A	Agriculture, forestry and fishing	242
C	Manufacturing	566
D	Electricity, gas, steam and air conditioning supply	63
F	Construction	157
G	Wholesale and retail trade, repair of motor vehicles and motorcycles	522
H	Transportation and storage	103
J	Information and communication	61
L	Real estate activities	86
M	Professional, scientific and technical activities	92
N	Administrative and support service activities	55
Total		1947

3.2 Variables

As a dependent variable measuring firm performance we used the gross ROA financial indicator. This indicator is one of the most common firm performance financial indicators in intellectual capital as well as entrepreneurship and strategy research (Javornik et al. 2012, Carton and Hoffer 2006). Gross return on assets was calculated as a ratio of gross profit and book value of the company's total assets. It shows profitability of a company relative to its total assets.

To measure the level of intellectual capital in the firm we applied the VAIC^{TM} indicator developed by Pulic (1998, 2000, 2004, 2008). According to Pulic (2004) this composite coefficient is calculated as a sum of intellectual capital efficiency coefficient (ICE) and capital employed coefficient (CEE). The first coefficient (ICE) comprises an indicator of human capital efficiency (HCE) and indicator of structural capital efficiency (SCE). HCE shows how much value added (VA, a difference between the total output and total input representing the new wealth created) is created by the human capital (HC, total labor costs representing the investment in knowledge workers). The calculation is: HCE=VA/HC. SCE measures the share of structural capital (here human capital and structural capital are inversely proportional, SC=VA-HC) in the creation of value added. The calculation is: SCE=SC/VA. The value of ICE is therefore given by summing up. The latter coefficient (CEE) acts as an indicator of asset value efficiency, and it represents the value (VA) created by one unit of physical and financial capital of a company (CE). The calculation formula looks as follows: CEE=VA/CE. We present the visualization of entire VAIC^{TM} formula in Figure 3.

Our financial data is comprised of a time series (panel data). Therefore the question of deflation and its appropriateness comes to the place. Since both the dependent and independent variables are financial ratios, it is not necessary for them to be adjusted for inflation or deflation.

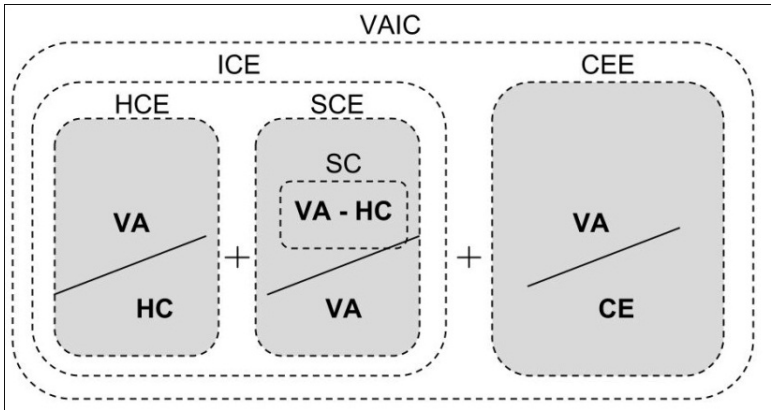

Figure 3: VAIC™ formula visualization

To control for the potential impact of other variables that may explain the observed relationship with firm performance, we have included two control variables in our analysis: firm leverage and firm size. Firm leverage was calculated as a ratio of total debt and book value of the company's total assets. The natural logarithm of the book value of total assets was used as the measure of firm size.

3.3 Methods

In order to examine the relationship between intellectual capital and its components (as measured by the VAIC™ model) and firm performance both before and after the recent economic crisis, we created two sets of regression models using forward stepwise regression analysis. This method allows for adding predictor variables into the model at each step in the regression until the best regression model is achieved (Munkova et al. 2012). The final model enables us to estimate the contribution that each of the predictive variables makes toward explaining the variability in ROA, the dependent variable. We examined the change in the relationship between the IC and ROA by creating two sets of models. The first, pre-crisis set comprised of 10 models (each for a specific industry section), depicts the strength and significance of the relationship between the VAIC™, control variables and ROA in 2008.Accordingly, the second, post-crisis set of 10 models describes the observed relationship using the same sample of SMEs in year 2011. To analyze how the relationship between intellectual capital and firm performance has been changed by the economic crisis we compared the pre-crisis and post-crisis models in particular industries and looked for differences and common patterns among these differences. We have identified the industries that showed change in the examined relationship. Further, we have also looked at these industries and focused on the particular intellectual capital components - human capital efficiency, structural capital efficiency and capital employed efficiency. We have used the respective indicators (HCE, SCE and CEE) to estimate their contribution to the variability of ROA before and after crisis. We have computed two sets of models (for years 2008 and 2011) for each industry and analyzed the differences observed between pre-crisis and post-crisis patterns.

The assumptions we made in our study regarding statistical methods were also tested for appropriateness. A plot of standardized residuals and independent variables to test the linear relationship between dependent variable and independent variables and heteroscedasticity were also constructed. This test proved the appropriateness of our models. A normal plot of residuals was also constructed. To confirm the independence of residuals the Durbin-Watson test for independence and serial correlation were applied. In a majority of cases the serial correlation value was close to 0 and values of Durbin- Watson statistics were close to 2. This indicates that residuals were independent. Outliers in our data were eliminated by setting extreme values to 5^{th} percentile or 95^{th} percentile respectively. Therefore in our case the model input data contained no outliers. Finally, to test for multicolinearity we used correlation analysis. The results of above mentioned test methods confirmed the appropriateness of the statistical method used.

4. Results

The results of the first stage of our analysis, i.e. pre-crisis and post-crisis regression models for 10 industry sections analyzed are displayed in Table 2, Table 3 and Table 4 below. For each model the overall model parameters (adjusted coefficient of determination, F value and Durbin-Watson statistics) as well as different predictor variables, their significance and explanatory power are presented.

Table 2: Overview of regression - modeling gross ROA in 2008 and 2011, industry sections A to F

Dependent:	Section: A		Section: C		Section: D		Section: F	
ROA	2011	2008	2011	2008	2011	2008	2011	2008
Predictors:								
VAIC (BETA)	0,656***	0,592***	0,499***	0,414***	0,364**	0,316*	0,598***	0,530***
Leverage (BETA)	-0,148**	-0,119*	-0,131***	-0,081*	-0,303*		-0,132*	-0,330***
Size (BETA)		-0,123*					-0,128*	
F (ANOVA)	85,435	44,205	109,633	59,816	7,388	6,764	33,782	61,516
Adj. R-sq	0,412	0,350	0,278	0,173	0,171	0,085	0,387	0,437
Durbin-Watson st.	2,238	1,827	1,965	2,310	1,537	1,224	1,874	1,756

Table 3: Overview of regression - modeling gross ROA in 2008 and 2011, industry sections G to L

Dependent:	Section: G		Section: H		Section: J		Section: L	
ROA	2011	2008	2011	2008	2011	2008	2011	2008
Predictors:								
VAIC (BETA)	0,436***	0,123**	0,483***	0,375***	0,472***	0,349**	0,313**	0,312**
Leverage (BETA)	-0,131**				-0,328**	-0,317**	0,216*	
Size (BETA)	-0,108**							
F (ANOVA)	54,270	8,016	30,743	16,576	17,135	10,968	6,056	9,036
Adj. R-sq	0,235	0,013	0,226	0,132	0,350	0,249	0,106	0,086
Durbin-Watson st.	1,917	2,032	1,82	1,956	1,852	1,709	1,920	1,366

Table 4: Overview of regression - modeling gross ROA in 2008 and 2011, industry sections M to N

Dependent:	Section: M		Section: N	
ROA	2011	2008	2011	2008
Predictors:				
VAIC (BETA)	0,544***	0,361***	0,403**	0,413**
Leverage (BETA)			-0,266*	-0,315*
Size (BETA)				
F (ANOVA)	37,784	13,521	6,521	10,549
Adj. R-sq	0,288	0,121	0,170	0,261
Durbin-Watson st.	1,914	1,564	1,417	1,907

The results presented in Tables 2 to 4 clearly show that VAIC™ is a significant predictor variable for ROA (the dependent variable). This is the case for both the pre-crises and post-crises models for all 10 industries. In each of the 20 presented models, VAIC™ was the predictor variable with the highest explanatory power. This indicates that none of the control variables (leverage and firm size) had higher impact on ROA than intellectual capital measured by VAIC™. In most cases, the model parameters (Durbin-Watson statistics and F value) were acceptable. The adjusted coefficient of determination explained 19.1% of ROA variance for the pre-crisis models, and 26.2% of the post-crisis models. This is a significant increase. In a few cases, especially in the pre-crisis models, the percentage of explained variance was low (e.g. sections D, G or L). However, in most of these cases, the adjusted coefficients of determination did increase considerably in the post-crises period.

Table 5 summarizes the pre-crisis and post-crisis models evidence on relationship between intellectual capital and firm performance. Changes in both the explanatory power of the VAIC™ and its value as a predictor variable are presented.

Table 5: Summary of comparisons between 2008 and 2011 regression models

Section (SK NACE)	Model Adjusted R-sq increased	VAIC (BETA) increased
A	Yes	Yes
C	Yes	Yes
D	Yes	Yes
F	No	Yes
G	Yes	Yes
H	Yes	Yes
J	Yes	Yes
L	Yes	Yes
M	Yes	Yes
N	No	No

The comparison between pre-crisis and post-crisis models indicates a relatively consistent pattern of change across almost all industries examined. In nine out of ten industrial sections (except of section N - Administrative and support service activities) the explanatory power of VAIC^{TM} predictor variable has increased. In addition, the adjusted coefficient of determination model increased in eight industries (exceptions are sections F - Construction and N - Administrative and support service activities). With respect to both the direction of change and its absolute value, the adjusted coefficient of determination increase exceeded 50% in five industries. Our results indicate that, overall, in eight of ten industries, the relationship between ROA and VAIC^{TM} has been strengthened from both analyzed perspectives. In these eight industrial sections, the median increase in the overall adjusted coefficient of determination was 66%, whereas the explanatory power of VAIC^{TM} showed a median increase of 25%. Thus, these results show that, in these industries, the impact of intellectual capital on firm performance has increased from the pre-crisis to the post-crisis periods.

The results of the second step of our analysis, i.e. pre-crisis and post-crisis regression models examining relationship between IC components (HCE, SCE, CEE) and ROA in those industry sections with increase in the impact of IC on firm performance, are presented in tables 6 and 7 below. For each model its overall parameters are presented (adjusted coefficient of determination, F value and Durbin-Watson statistics) together with the examined predictor variables' significance and explanatory power.

Table 6: Overview of regression - modelling gross ROA in 2008 and 2011, industry sections A, C, D, G

Dependent:	Section: A		Section: C		Section: D		Section: G	
ROA	2011	2008	2011	2008	2011	2008	2011	2008
Predictors:								
HCE (BETA)	0,570***	0,158*					0,478***	
SCE (BETA)		0,381***	0,534***	0,285***	0,413***	0,432***		
CEE (BETA)	0,438***	0,460***	0,549***	0,299***	0,727***	0,642***	0,487***	0,169***
Leverage (BETA)	-0,119**		-0,125***				-0,071*	
Size (BETA)	0,100*		0,070*		0,232*	0,229*		
F (ANOVA)	67,936	99,972	136,397	49,188	21,211	18,265	155,351	15,286
Adj. R-sq	0,526	0,552	0,489	0,146	0,494	0,455	0,471	0,027
Durbin-Watson st.	2,022	2,164	2,111	2,021	1,930	1,978	1,771	1,038

Table 7: Overview of regression - modelling gross ROA in 2008 and 2011, industry sections H, J, L, M

Dependent:	Section: H		Section: J		Section: L		Section: M	
ROA	2011	2008	2011	2008	2011	2008	2011	2008
Predictors:								
HCE (BETA)					0,844***	0,878***		
SCE (BETA)	0,514***	0,427***	0,712***	0,783***	-0,646***	-0,662***	0,621***	0,464***
CEE (BETA)	0,439***	0,299**	0,532***	0,341***		0,286**	0,467***	0,644***
Leverage (BETA)							-0,170*	
Size (BETA)								
F (ANOVA)	30,027	13,858	40,871	37,616	10,446	16,880	26,583	53,381

Adj. R-sq	0,363	0,201	0,571	0,550	0,182	0,359	0,458	0,535
Durbin-Watson st.	2,013	1,880	2,374	2,032	1,911	1,871	1,719	1,949

As can be seen from the results presented in tables 6 and 7, in the case of all industry sections investigated at least two out of three intellectual capital performance components were significant predictors of the dependent variable ROA. In none of the models the control variables employed (firm leverage and firm size) showed a higher impact on ROA than any of the intellectual capital components measured using the VAIC™ model-based indicators. While the intra-industry compositions of predictors have been rather stable over the time analyzed (comparing their significance as ROA predictors in pre-crisis and post-crisis models), the intra-industry changes in predictors' explanatory power and inter-industry comparisons of predictors' composition show no consistent pattern among the industrial sections investigated. This indicates the respective role of different intellectual capital components is rather industry specific.

The human capital efficiency (HCE) was a significant predictor of the dependent variable ROA in sections A (Agriculture), G (Wholesale and retail) and L (Real estate activities). In the first two sections its explanatory power has increased in the post-crisis period, while in section L (Real estate activities) there has been a slight decrease. The structural capital efficiency (SCE) was identified as a significant predictor in 6 out of 8 industries, with three of these showing a post-crisis increase in SCE explanatory power. Interestingly, in case of industrial section L (Real estate activities) the effect of SCE on ROA has been proved to be negative in both pre- and post-crisis models. Finally, the capital employed efficiency (CEE) was a significant predictor in all models but one (post-crisis model for industry L - Real estate activities). In most of these cases (except of two models), its explanatory power has increased in the post-crisis period compared to pre-crisis time. When compared to the pre-crisis period the Slovak SMEs in almost all industrial sections still exert considerable effort mainly to increase efficiency of financial and physical capital. On the other hand, it seems they underestimate the importance of key intellectual capital components (HCE and SCE) resulting in competitive advantages for improving firms´ financial performance.

From an industry perspective, industry section L (Real estate activities) appears to have the greatest diversion from the rest of the industries. It is the only industrial section where an IC component has been proved to have negative influence on firm performance measured by ROA.

5. Discussion and conclusion

The findings from the first stage of our analysis indicate a somewhat consistent pattern across almost all industry sections investigated. This shows that when compared to the pre-crisis (year 2008), the role of overall intellectual capital performance in predicting firm's financial performance has increased in post-crisis period (i.e. year 2011). On the other hand, a closer observation of the internal structure of intellectual capital performance phenomenon in the second stage, when examining its particular components, clearly indicates that the above mentioned relation is industry specific in its internal structure. Therefore, different modes of interplay between IC components across different industries appear to lead to a similar relationship pattern between IC performance and firm overall performance, and its change after the recent economic crisis. Below we discuss our findings with respect to the recent economic recession, overall firm performance, and specific industry characteristics. In addition, we present the contrast from our findings with those of previous research and theory relative to IC, firm performance and their industry-specific nature.

At the intellectual capital level, across all industries, we observe an increasing role with respect to firm financial performance. Because contribution of the identified changes exclusively to the economic crisis would require a deeper inquiry, a more detailed investigation into these findings is required under significant changes in economic conditions. The arguments supporting this have appeal in the discussions on how the recent crisis changed the world of business in SMEs. One possible reason for the increased role of intellectual capital performance in predicting financial performance as a proxy for value creation may lie in the fact that financial constraints forced SMEs to look for internal sources to increase efficiency. It means that increased IC performance resulting from the interplay between human capital and structural capital efficiency together with the efficiency of capital employed (physical and financial assets) has become a stronger determinant of financial performance and value creation. The importance of utilizing intellectual capital appears to have increased, and it has become the source of competitive advantage in terms of value creation from a short term perspective. In simple words, good intellectual capital performers became good financial performers. The recent crisis may have forced SMEs, in terms of managerial practice and techniques, to deal with intellectual capital efficiency. Those SMEs that were successful in increasing their intellectual capital performance also became very good financial performers. Those who did not increase their intellectual capital performance experienced a decline in financial performance. Since the differences are clear while on the other hand considerable but still not dramatic in size, this can be considered a suggestion that needs further examination. Further research is

required to determine more precisely the impact of IC in the industries that don't show the full fit with the suggested pattern, with particular focus on specifics of business in these industries. The industry sections such as N (Administrative and support service activities) can be generally considered as knowledge intensive. Therefore the intellectual capital performance has probably been important value creation driver already before the crisis. In section F (Construction), even though the model and predictor parameters were slightly lower, there was still a considerable proportion of variance in ROA explained by VAIC^{TM} in the post-crisis period. It might indicate that this business' recovery will last longer, and that year 2011 wasn´t still the post-crisis period for section F (Construction).

A break-down of the intellectual capital components reveals the considerable divergence of our findings. Whereas, in each industry a significant portion of variance was explained, differences existed among particular intellectual capital components. The differences were likely due to specific industry characteristics. Examining these differences for particular industries was beyond the scope of our study because of the restrictions of sample size and period of time covered. A more comprehensive study may be able to explain these differences. With full respect to this limitation, however, we propose set of arguments related to different industries that aim to illustrate possible reasons behind specific role of different intellectual capital components in particular industry. We propose these arguments to be challenged by further research.

Industrial sections A (Agriculture) and G (Wholesale and retail) showed the similar post-crisis pattern, where human capital and capital employed efficiency (with small effect of control variables) together explained significant portion of variance in ROA. Despite these industries may appear rather different at the first glance, there are several similarities. Most of all, both of them are characterized by rather low-paid labor and high requirements on operational efficiency, which may partially explain this pattern. Industrial section L (Real estate activities) showed quite contradictory pattern with high positive effect of HCE and at the same time high negative effect of SCE on firm financial performance. This pattern was same in pre- as well as post-crisis model. Looking at calculation of these components in VAIC^{TM} model, this finding seems to be quite contradictory. In our opinion this fact may be determined by the effect of firm size in terms of annual turnover, i.e. firms with high volumes of turnover (e.g. real estate developers) may report higher profitability than firms with small scale of business (e.g. small real estate agencies). Our computation doesn't control for the effect of firm size in terms of turnover (firm size as control variable is constructed from total assets instead). Industrial sections C (Manufacturing), D (Utilities), H (Transportation), J (Information and communication) and M (Professional, scientific and technical activities) showed similar pattern in post-crisis models. In their case, both SCE and CEE were identified as significant predictors with positive influence on firms' ROA. In first two cases (sections C and D) the effect of CEE dominated in size, while in remaining three industries (sections H, J and M) effect of SCE as predictor of ROA was higher than effect of CEE. Looking for potential reason for non-significant role of HCE, two arguments may appear. First, one could argue that human capital costs and their efficiency are embedded also in SCE component. Second, the efficiency of human capital in these industries may have already reached the level where differences are not that considerably spread among and businesses that it could cause significant differences in financial performance. In our opinion, in this case value added (which has greater influence in SCE indicator than in HCE indicator) probably better reflects the logic how certain businesses over-perform others in terms of profitability.

Whatever may be the interaction that exists among the different components of intellectual capital performance (HCE, SCE, CEE) across different industries, our findings reveal that the relationship between overallIC performance and firm performance significantly explained the variance in ROA, across most industries, during the recent financial crisis.

As we already mentioned, one stream of interpretation of relationship between ROA (or other performance measures such as EVA) and Pulic's VAIC^{TM}-based perspective on firm intellectual capital performance argues that these two indicators reflect different dimensions of firm performance and therefore should be perceived as co-existing indicators representing two views on performance, according to perspective employed to describe this contextual concept (Iazzolino and Laise 2013). This interpretation is against finding how intellectual capital or its components (in terms of VAIC^{TM}) imply financial performance, including performance expressed with ROA. Even though our approach violates the fundaments of this perspective, our findings may contribute to its debate. If we consider profitability-based and intellectual capital-based expressions of performance as two different perspectives of the multidimensional concept of firm performance, our results suggest that these two dimensions have been subjects of mutual convergence, when comparing pre-crisis and post-crisis situation. Therefore, we are able to argue that financial and intellectual capital dimensions of performance have come closer to reflect the similar intra-firm performance drivers.

There is still a substantial amount of research that considers intellectual capital and its components measured by VAIC™ model as the potential predictor of overall firm performance. Researchers have investigated the relationship among VAIC™-based measures and overall performance measures, such as ROA, ROE etc. with inconsistent results (Javornik et al. 2012, Iazzolino and Laise 2013). This requires additional research to resolve it. The lack of unambiguous results does not advocate for rejecting this research stream, but rather reflects the real life complexity and specifics of different industries. Our findings from the two steps of the analysis contribute to this research stream and at the same time they perfectly support our argument on industry specific nature of relation between intellectual capital or its components and firm performance. In both of these steps we took into consideration industry specifics by analyzing different industries separately. Studying the overall intellectual capital performance measured by VAIC™, our findings indicate that it represents a significant determinant of overall value creation (in terms of its proxy - a financial performance measured by ROA). The explanatory power of this predictor was considerable for most of the 10 industrial sections we studied, and especially for the post-crisis period. These findings have supported the findings by Pilkova et al. (2013). Whereas, studying the three main intellectual capital components (according to VAIC™ model), according to our opinion findings highlighted the different nature of the analyzed industries. The significance and explanatory power (and in one case also its direction) varied across industries and over time despite the fact they showed similar pattern in overall intellectual capital performance impact on firm performance. This finding definitely advocates that while intellectual capital performance may be commonly important overall firm performance driver across industrial sections, industry specifics play significant role in the internal structure of the intellectual capital performance. In addition, our results indicate that the period of recent economic crisis had positive effect on role of intellectual capital in predicting firm performance. However, in certain industries it has also changed the mode of the interplay between different intellectual capital components that have impacted overall performance. This encourages further effort within this stream of research. So far, only a minor attention has been paid to investigation how the role of intellectual capital or its components in determining firm performance has been changed during the recent economic crisis (e.g. Javornik et al. 2012).

As far as implications of our results are concerned, to confirm increasing role of intellectual capital across industries, with industry-specific intrinsic nature of this relationship, we suggest that examination of relationship between performance of intellectual capital or its components and firm financial performance before and after the recent economic crisis should be repeated in other contexts. As a part of this research stream, we suggest to pay attention to investigation how mean values of intellectual capital performance measurement constructs (VAIC™ and its components HCE, SCE and CEE) in different industries have changed during the recent economic crisis. Regarding the implications for SME management practice, we recommend SMEs managers or owner-managers to focus more on increasing their company intellectual capital performance, with specific focus on intellectual capital component that is a key driver of value creation in their industry. The relationship between intellectual capital, its components and firm financial performance leading to value creation appears to have gained on importance after the recent economic crisis. Therefore, we argue that intellectual capital has become more and more important driver of SME value creation.

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Appendix 1

Statistics summaries for VAIC™, 2011

Section	A	C	D	F	G	H	J	L	M	N
N	242	566	63	157	522	103	61	86	92	55
Mean	2,929	2,450	3,382	2,457	2,785	3,120	2,998	3,125	2,615	3,434
Median	2,684	2,290	3,126	2,142	2,325	2,736	2,766	2,381	2,211	3,051
Std. Dev.	1,165	0,917	1,543	1,145	1,365	1,306	1,114	2,064	1,432	1,636

Statistics summaries for VAIC™, 2008

Section	A	C	D	F	G	H	J	L	M	N
N	242	566	63	157	522	103	61	86	92	55
Mean	2,627	2,586	3,136	2,867	3,413	3,523	3,396	3,367	3,142	3,973
Median	2,503	2,303	2,776	2,542	2,867	3,081	2,837	2,422	2,698	3,209
Std. Dev.	0,938	1,187	1,576	1,282	1,736	1,606	1,587	2,435	1,859	2,145

Statistics summaries for HCE, 2011

Section	A	C	D	G	H	J	L	M
N	242	566	63	522	103	61	86	92
Mean	2,1536	1,6510	2,5948	2,0330	2,1306	1,6257	2,4691	1,8063
Median	1,8892	1,4656	2,2825	1,6005	1,7505	1,4131	1,7745	1,3086
Std. Dev.	0,9586	0,7043	1,3024	1,1149	1,0879	0,7290	1,6391	1,1792

Statistics summaries for HCE, 2008

Section	A	C	D	G	H	J	L	M
N	242	566	63	522	103	61	86	92
Mean	1,9106	1,7267	2,4190	2,5163	2,4399	1,9703	2,5315	2,0191
Median	1,7822	1,4694	1,9290	1,9836	1,9980	1,4499	1,5549	1,4318
Std. Dev.	0,7391	0,9183	1,3467	1,4394	1,3707	1,1876	1,8751	1,4564

Statistics summaries for SCE, 2011

Section	A	C	D	G	H	J	L	M
N	242	566	63	522	103	61	86	92
Mean	0,4653	0,3261	0,5095	0,4072	0,4325	0,3006	0,4526	0,3426
Median	0,4707	0,3215	0,5619	0,3807	0,4287	0,2923	0,4691	0,2658
Std. Dev.	0,1878	0,2037	0,2458	0,2325	0,2286	0,2114	0,3010	0,2698

Statistics summaries for SCE, 2008

Section	A	C	D	G	H	J	L	M
N	242	566	63	522	103	61	86	92
Mean	0,4255	0,3262	0,4566	0,4933	0,4784	0,3634	0,4522	0,3874
Median	0,4396	0,3216	0,4816	0,4972	0,4995	0,3103	0,4710	0,3687
Std. Dev.	0,1720	0,2208	0,2679	0,2285	0,2323	0,2472	0,3176	0,2827

Statistics summaries for CEE, 2011

Section	A	C	D	G	H	J	L	M
N	242	566	63	522	103	61	86	92
Mean	0,2957	0,4380	0,2498	0,3028	0,5059	0,7024	0,1353	0,4483
Median	0,2848	0,3882	0,1938	0,2551	0,4655	0,6995	0,0739	0,3759
Std. Dev.	0,1147	0,2454	0,1778	0,1880	0,2679	0,3322	0,1663	0,3269

Statistics summaries for CEE, 2008

Section	A	C	D	G	H	J	L	M
N	242	566	63	522	103	61	86	92
Mean	0,2817	0,4726	0,2484	0,3639	0,5320	0,7461	0,1342	0,5076
Median	0,2676	0,4247	0,1881	0,3347	0,4801	0,7273	0,0728	0,4422
Std. Dev.	0,1131	0,2685	0,1767	0,2129	0,2602	0,3252	0,1542	0,3780

