

THE IMPACT OF INTELLECTUAL CAPITAL ON COMPANIES' PERFORMANCE: EVIDENCE FROM EMERGING MARKETS

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Abstract

The current study is devoted to the investigation of the impact of intellectual capital on the company's performance with the evidence from the BRICS group. Due to its unobservable and intangible nature, intellectual capital (IC) has a number of proxies. In this paper IC is approximated by a new method, proposed by Sydler et al. (2014) as well as by more traditional VAIC approach. According to Zeghal and Maaloul's (2010) approach, company's performance is segmented into three dimensions: financial, economic and stock market performance. Applying econometric analysis it is found that IC has a positive and significant impact on the performance of a firm. Furthermore, IC has a positive influence on operational margin and it reduced the cost of equity for IC intensive companies. Comparing the two proxies, it was revealed that Sydler's proxy is more relevant for stock market analysis since it directly estimates the volume of IC of a firm, while VAIC is a relative scale less measure of efficiency of the IC employment and is more closely related to the company's efficiency rates, such as operational margin. The obtained results suggest that IC intensive firms on emerging markets invest mostly in improving its operational efficiency and reducing operational and competition risk.

JEL: G30, G32

Key words: intellectual capital, intangibles, company performance, emerging markets

Introduction

The concept of intellectual capital is one of the most recent and fast developing in current financial literature. The key driver behind its rapid development is the changing conditions of the modern economy. Contemporaneous economy is claimed to be knowledge-based (Stewart, 1997), in which information and knowledge play the greatest role in a company's business activity. Induced by the shift to information-based environment, physical and financial assets do not any longer capture the full value of a company, leading to a well-known gap between the firm's market and book value. To resolve this problem the idea of intellectual capital was proposed.

The key problem of intellectual capital measurement is driven by the fact that existing accounting systems ignore it. Consequently, there is no universally acknowledged approximation of intellectual capital in the literature. Every year researchers propose new approaches. It was validated that the best measures of intellectual capital are non-monetary, but these types of measures are subjective and not suitable for empirical research. Due to that, this research concentrates on monetary terms, but applies them indirectly.

The concept of intellectual capital was created and investigated in developed markets. There is much empirical and theoretical evidence from developed economies that intellectual capital has positive and significant influence on the company's market value and performance. However, there are not many papers devoted to analogous problems in emerging markets. This study attempts to look into the five biggest emerging markets from BRICS group.

The purpose of the research is to answer the question whether intellectual capital (further IC) has a significant impact on the company's performance in emerging markets. This question is answered by application of detailed cross section and panel data analysis. The object under investigation is a set of companies from five emerging countries for several years. In the course of the paper the following problems are solved:

1. Implementation of Sydler et al. (2014) model for IC proxy calculation, calculation of VAIC measure.

2. Evaluation of the impact of IC on the company's performance in three dimensions: financial, economic and stock market aspects. Validation of hypotheses.
3. Comparison of the results between IC intensive and IC non-intensive firms.

The pioneer feature of the current paper is threefold. Firstly, an appealing new method of IC valuation, described in Sydler et al. (2014), is calculated based on data from emerging markets. The original paper uses selected industries from the UK market. This method has a number of advantages making it, potentially, more realistic and precise for the problem of intellectual capital approximation than other methods based on published financial information. Secondly, the impact of intellectual capital, approximated by Sydler's proxy and by a more well-known VAIC measure, is evaluated by means of three dimension analysis of the company's performance on emerging markets, which also has not been done before. Thirdly, the data sample is split into two subsamples – IC intensive firms and IC non-intensive firms, which provides further insights into the features of IC in emerging markets.

Definition and Classification of Intellectual Capital

Intellectual capital is an unobserved and intangible variable which corresponds to intellectual ability and wealth of the firm. Due to its extensiveness it has a number of definitions. The most commercial and well-known definition for IC was given by Edvinsson and Malone (1997). They specified IC as “the possession of knowledge, applied experience, organizational technology, customer relationships and professional skills which provide Skandia¹ with a competitive edge in the market”. There are several classifications of IC which are used in empirical studies. In this paper the most popular classification proposed by Edvinsson and Malone is considered. This classification divides IC into three parts: human capital (HC), structural capital (SC), and relational or customer capital (RC).

HC is defined as a combined capability of employees to solve business problems. It involves all the knowledge, skills and talent of employees of the company. More systematically HC includes genetic inheritance, education, experience and attitudes about life and business (Bontis, 1998). Sometimes HC is interpreted as the organization's efficiency to use its people resources. The main feature concerning HC is that it is not owned by the company. HC leaves the company together with the employees.

Contrary to HC, SC is owned by a company and includes everything that supports employees in their work. In other words, SC enables HC to function (Luthy, 1998). SC consists of all the databases, patents, know-how, brands, routines, etc. of the company. According to this list of components, SC is a diverse conception. Due to that, Edvinsson and Malone (1997) partitioned it into three more terms: organizational capital, process capital and innovation capital. Organizational capital corresponds to the company's philosophy; process capital involves techniques, programs and procedures that help the company to function. The last part, innovation capital, represents intangible assets and intellectual property of the firm. All the components of SC stay in the company irrelevant of an employee leaving the company or not.

RC is the last and most difficult component to measure. It is defined as the “strength and loyalty of customer relations” (Luthy, 1998). In financial terms RC represents the value of relations between the company and its customers. Nowadays the term “customers” should be expanded to the term “stakeholders”, as relations with other interested parties, such as suppliers or the government, also play a significant role in the company's success.

Analytical Framework

Sydler et al. (2014) proxy of IC

The proxy of IC proposed by Sydler et al. (2014) corresponds to component-by-component measurement and is estimated by means of a two-step model based on the adjusted dynamic residual income model (RIM) (Ohlson 1995). RIM is adjusted in order to accommodate for the fact that expenditures on intangibles are no longer expenses, but investments in IC. Primarily such correction was done by Ballester et al. (2002) but, however, only for human capital. Sydler et al. (2014) go further and expand the correction to

¹ Skandia AFS is an old Swedish insurance company which was a pioneer in acknowledgement of IC by a company. In 1997 Edvinsson was assigned as a director of IC in Skandia.

accommodate for other sources of IC. Particularly, IC is assumed to be formed from the corresponding expenditures on HC, SC and RC. These types of expenditures are approximated by total expenditures on employees, expenditures on R&D and marketing expenses correspondingly. Overall expenses on IC are named intellectual expenses (IE_t):

$$IE_t = \text{Personnel expenses}_t + R \& D \text{ expenses}_t + \text{Marketing expenses}_t, \quad (1)$$

HC like all the other IC components is intangible by its definition. We cannot measure the level of employees' talent and expertise directly. However, we can approximate the ability of a company to attract and then retain highly qualified people. According to Ballester et al. (2002) and Wakelin (1998) the company's expenditures on wages is a good proxy for accumulated HC. Nevertheless, this measure can be improved by adding expenditures on personnel trainings and recruiting expenses. Expensive trainings are expected to increase the level of employees' proficiency, and significant expenditures on recruiting increase the probability of hiring most suitable and talented people. All in all, total labor expenditures are assumed to be a good proxy for HC. This idea is proved empirically by Lajili and Zeghal (2006), where it is showed that investors view high total labor expenses as a high level of HC.

Research and development expenditures are associated with the creation of new technological assets for the company and the improvement of existing production processes (Chan et al., 1992). Among the results of such expenses are new patents and licenses which correspond to the concept of SC. Moreover, capitalized R&D expenditures are significantly and positively correlated with stock prices (Lev and Sougiannis, 1996). This effect is also ascribed to IC and its components. All in all, R&D expenditures are considered to be a good proxy for SC.

As it is mentioned before, RC is the most difficult component to measure. In this case total expenditures on advertising and marketing are suggested as a proxy. Advertising expenses are positively correlated with the company's brand value (Barth et al., 1998), which in turn increases customer loyalty, the firm's flexibility in conditions of competitive market and efficiency of marketing communications. The high level of marketing expenditures implies close contact with customers, better understanding of their needs and corresponding efficient actions to improve possible dissatisfaction. All these factors make total expenditures on marketing and advertising a good proxy for RC.

In Sydler et al. (2014) parameter α stands for accumulation rate of IC, and δ stands for depreciation rate. Expenditures on IC grow with a constant rate g every period. We suppose that the company's expenditures in such a long period cannot grow faster than its country's GDP. A considered growth rate is an expected value, so we further assume it equal to the last observed value. In this work the risk-free rate was assumed to be equal to return on a 10-year government bond of each country.¹ The 10-year period was chosen as its length is the closest to the period examined in this research and yet being sufficiently often traded at the countries' stock markets. Return on government bonds suits our purposes best as it is the least risky for each individual country and catches the difference in local risks.

The total amount of intellectual capital at each moment of time can be expressed by the following formula:

$$IC_t = \alpha (IE_t) + (1 - \delta)(IC_{t-1}). \quad (2)$$

Here the current value of IC is formed from certain fraction of current expenditures on IC plus the previous stock of IC reduced by a certain amortization rate. Applying the recursion method to solve (2), and noting that g grow each period with rate g , we get the following relationship:

$$IC_t = \alpha (IE_t) * \left[\frac{1+g}{g+\delta} \right] = \alpha (IE_t) \phi. \quad (3)$$

Adjusted with regard to IC, Ohlson's model looks as follows:

$$MV_t = \beta_1 (BV_t + IC_t) + \beta_2 \left[(NI_t^R + \alpha IE_t - \delta IC_t) - r_f (BV_{t-1} + IC_{t-1}) \right] + \beta_3 v_t, \quad (4)$$

where MV_t – market capitalization of a company;

¹ Data source – The World Bank.

BV_t – book value of assets which is reported by a company;

NI_t^R – reported net income;

r_f – risk-free rate;

v_t – other relevant information which influences market value.

Substituting (3) into (4) leads to the following testable equation:

$$MV_t = A_0 + A_1 BV_t + A_2 (NI_t^R - r_f BV_{t-1}) + A_3 IE_t + A_4 IE_{t-1} \quad (5)$$

$$A_0 = \beta_3 v_t$$

$$A_1 = \beta_1$$

$$A_2 = \beta_2$$

$$A_3 = \alpha(\beta_1 \phi + \beta_2)$$

$$A_4 = -\beta_2 \alpha \phi (\delta + r_f)$$

$$\phi = \frac{1+g}{\delta+g}$$

Evaluation of the equation gives values for the coefficients A_1 , A_2 , A_3 and A_4 . Once these values are known, we can solve the following system of equations for accumulation rate and depreciation rate δ :

$$\begin{cases} A_1 = \beta_1 \\ A_2 = \beta_2 \\ A_3 = \alpha(\beta_1 \phi + \beta_2), \\ A_4 = -\beta_2 \alpha \phi (\delta + r_f) \\ \phi = \frac{1+g}{\delta+g} \end{cases} \quad (6)$$

The obtained values for accumulation and depreciation rates allow calculation of IC for each company and period. This value is assumed to be the first proxy for IC used in this paper.

The proxy for IC proposed by Sydler et al. (2014) is expected to be a good choice for several reasons. Firstly, its calculation is based on publicly available financial measures which, as it is discussed above, approximate IC components well. Secondly, it is not a direct evaluation of IC by means of balance sheet figures but rather a latent variable modelling which accounts for IC features as an asset. Finally, this proxy discloses important information about the mechanism of IC formation, which can be used in the management field.

Pulic (2000) proxy of IC: Value Added Intellectual Coefficient

Value Added Intellectual Coefficient was invented by Pulic (2000) and became very popular among researchers who investigate IC. This coefficient shows the ability of a company to create value and represents a measure for business efficiency in a knowledge-based economy (Stähle et al., 2011). The crucial word in this definition is “efficiency”, as VAIC is measured in relative, not absolute terms. This coefficient reflects the ability of a company to employ its resources (intellectual and physical) efficiently. Thus, it does not provide a direct estimate of the company’s IC.

VAIC is calculated by means of a three-step procedure.

The 1st step: calculation of Value Added (VA).

Value added in terms of VAIC calculation stands for the difference between the firm's total output and input which are approximated by balance sheet figures. Output is approximated by total volume of the company's sales. Input includes all the expenditures which were incurred to produce the output.

$$VA = S - cogs - DP. \quad (7)$$

The 2nd step: calculation of three major components of the company's resources.

Pulic (2000) in his work singles out three major components of overall firm's resources: human capital, structural capital and capital employed (CE). SC and HC together form an intellectual part of the firm's resources. CE is defined according to the formula:

$$CE = physical\ capital + financial\ assets = Total\ assets - intangible\ assets.$$

HC is approximated by the overall expenditures on employees; SC is calculated as the difference between VA and HC.

The 3rd step: calculation of VAIC.

VAIC measures the efficiency of the company's resources employment. The corresponding efficiency rates for each component are determined as follows:

$$VACA = \frac{VA}{CE} \text{ for capital employed}$$

$$VAHU = \frac{VA}{HC} \text{ for human capital}$$

$$STVA = \frac{SC}{VA} \text{ for structural capital.}$$

VACA represents how much value added is generated per one unit spent on capital employed. VAHU shows how much value added is generated per one unit spent on human capital. STVA is the inverse version of the analogous ratio. This inversion is done because structural capital and human capital are reverse to each other. VAIC is the sum of three efficiency ratios.

$$VAIC = VACA + VAHU + STVA. \quad (8)$$

For the purposes of analysis usually the sum of VAHU and STVA is separately considered. This sum shows the efficiency of intellectual capital employment.

$$VAIN = VAHU + STVA$$

$$VAIC = VACA + VAIN. \quad (9)$$

Formula (9) decomposes the efficiency of resources usage into intellectual and tangible aspects. Zeghal and Maaloul (2010) whose model is estimated in this paper employ this decomposition in their work.

Zeghal and Maaloul (2010) model of IC impact on the company's performance

The model proposed by Zeghal and Maaloul (2010) examines whether IC has any impact on the company's performance. The advantage of this model is that as opposed to other similar models it decomposes the company's performance into three important aspects: economic performance, financial performance and stock market performance. In compliance with this division the model consists of three equations. This model is claimed to be more comprehensive and robust compared to single equation models as the company's efficiency¹ is a general concept that can be further segmented and measured in different ways. Because of that considering only one aspect (and one proxy, correspondingly) is not enough for the analysis. In this paper we further broaden the set of variables responsible for the company's performance

¹ In this paper terms "performance" and "efficiency" are used as synonyms.

and include in total seven measures. This is done in order to get additional insights in the way IC affects different areas of the company's business. Below all the measures are stated and grouped into three above mentioned groups.

The first group of the company's performance is concerned with the economic efficiency of the firm. The idea is to measure how IC affects the capability of the firm to efficiently turn the inputs into outputs with minimal production, distribution and all kind of other costs. In accordance with that, a typical production process is split into two logical stages - the relative efficiency gained on the stage of manufacturing and delivering a product and the relative efficiency gained on the stage of serving the borrowed capital required to produce a product and paying taxes. Consequently, the measure of the first stage includes EBIT/Sales (also known as operational profitability) and NI/EBIT stands for the measure of the second stage. The intuition behind the influence of IC on this area of the company's performance is as follows. Highly skilled employees (HC) can enhance the volume of goods and services sold and increase the company's operational margins as well as optimize the taxation schedule. Talented researchers can implement innovations which increase the level of production efficiency and cut production costs. High relational capital (RC) can allow the company to raise debt at lower interest rates. Altogether, IC should have a positive impact on the company's economic performance.

The second group of measuring the firm's efficiency deals with financial performance. The financial performance reflects the ability of invested by the company capital to earn a particular level of profit. The connection between financial performance and IC was found in many other studies. For example, it was shown that IC intensive companies are more successful in generating the returns on their investments (Youndt et al., 2004; Chen et al., 2005). The basic idea is that the high level of management expertise and accumulated knowledge about markets allows performing deep and sophisticated analysis of investment opportunities and thus making successful investment decisions. Return on assets coefficient (ROA), economic value added (EVA) and the residual income (RI) were taken as proxies for financial performance.

The last group measures the stock market part of the firm's performance. The stock market term is split into two aspects. Firstly, it concerns the difference between the company's market and book value, or the value of its book-to-market ratio. It is suggested that if the market is efficient, companies with a higher level of IC are valued more by investors (Firer and Williams, 2003; Youndt et al., 2004; Chen et al., 2005; Skinner, 2008). Due to that, IC is assumed to have positive influence on market value of the company. Secondly, B. Lev postulates in his article "Sharpening the Intangibles Edge" that investments in IC actually increase the cost of capital for the company especially for high R&D intensive firms. The reason is that R&D investments are more risky than most other types of investments when evaluated as the volatility of future R&D cash flows. At the same time, investors' perception of the risk is exaggerated since companies typically either do not disclose any information about R&D investments at all, or provide few details in the corporate prospects. Lev et al. (2012) further look at the reasons behind the increased risk of R&D intensive firms and find that investments in R&D actually reduce competition risk, which they define as future volatility of sales, and operational risk, defined as the future volatility of cost of goods sold, but increase disruptive technology risk, defined as the future volatility of special items. Accordingly, the book-to-market ratio and cost of equity were decided to be used as proxies for the stock market performance.

Corresponding equations are presented below. The first seven equations correspond to Sydler et al. (2014) proxy for IC, while the second group employ VAIC approach. In order to avoid an obvious omitted variable bias in the estimate of IC component other factors that influence the company's performance should be taken into account. Following Zeghal and Maaloul (2010) and many other studies therein two control variables are included: the company's size and leverage. The size of the firm is approximated by natural logarithm of total assets and leverage is specified as the ratio of total debt to equity.

$$\frac{EBIT}{Sales} = \beta_0 + \beta_1 IC + \beta_2 Size + \beta_3 Lev + \varepsilon$$

$$\frac{NI}{EBIT} = \beta_0 + \beta_1 IC + \beta_2 Size + \beta_3 Lev + \varepsilon$$

$$ROA = \beta_0 + \beta_1 IC + \beta_2 Size + \beta_3 Lev + \varepsilon$$

$$EVA = \beta_0 + \beta_1 IC + \beta_2 Size + \beta_3 Lev + \varepsilon$$

$$Residual\ Income = \beta_0 + \beta_1 IC + \beta_2 Size + \beta_3 Lev + \varepsilon$$

$$\frac{Book\ value}{Market\ value} = \beta_0 + \beta_1 IC + \beta_2 Size + \beta_3 Lev + \varepsilon$$

$$Cost\ of\ equity = \beta_0 + \beta_1 IC + \beta_2 Size + \beta_3 Lev + \varepsilon$$

$$\frac{EBIT}{Sales} = \beta_0 + \beta_1 VAIN + \beta_2 VACA + \beta_3 Size + \beta_4 Lev + \varepsilon$$

$$\frac{NI}{EBIT} = \beta_0 + \beta_1 VAIN + \beta_2 VACA + \beta_3 Size + \beta_4 Lev + \varepsilon$$

$$ROA = \beta_0 + \beta_1 VAIN + \beta_2 VACA + \beta_3 Size + \beta_4 Lev + \varepsilon$$

$$EVA = \beta_0 + \beta_1 VAIN + \beta_2 VACA + \beta_3 Size + \beta_4 Lev + \varepsilon$$

$$Residual\ Income = \beta_0 + \beta_1 VAIN + \beta_2 VACA + \beta_3 Size + \beta_4 Lev + \varepsilon$$

$$\frac{Book\ value}{Market\ value} = \beta_0 + \beta_1 VAIN + \beta_2 VACA + \beta_3 Size + \beta_4 Lev + \varepsilon$$

$$Cost\ of\ equity = \beta_0 + \beta_1 VAIN + \beta_2 VACA + \beta_3 Size + \beta_4 Lev + \varepsilon$$

Hypotheses

The first set of hypotheses corresponds to the impact of IC on the company's performance. It is important to emphasize that in Hypothesis 3 the negative influence of IC on B/M ratio is expected. Other things being equal, higher IC values correspond to higher market valuation, which in turn drives the ratio boot-to-market down. The following set of hypotheses is stated with IC proxy defined by Sydler et al. (2014), but it generalizes to VAIC proxy by adding VAIN and VACA instead of IC variable.

H1: IC has a significant and positive influence on the company's economic performance: positive coefficients in front of IC term for both and regressions are expected.

H2: IC has a significant and positive influence on the company's financial performance: positive coefficients in front of IC term for , and are expected.

H3: IC has a significant and positive influence on the company's stock market performance in the form of a negative coefficient in front of IC in regression. The impact of IC on the company's risk is twofold - it increases the disruptive technology risk but decreases operational and competition risk. An overall effect of IC on the cost of capital depends on the distribution of intellectual capital expenditures and a particular sign is not hypothesized.

Data

The main two problems with initial sample are potential measurement mistakes due to the low level of transparency and authenticity in emerging markets and the high share of missing observations. Firstly, we clean the raw data in order to eliminate obvious data recording mistakes. This procedure includes checks for non-negativity of financial variables and dropping observations with a missing year or industry variable. The total number of observations after the cleaning decreased roughly by 10%.

As it was mentioned before, data from emerging markets may suffer from measurement mistakes. This reflects in presence of outliers in the sample that can bias the results of estimation. In order to detect outliers both visual and numerical analysis was performed. These analyses revealed that all the variables in all countries are characterized by the presence of the particular number of outliers. In order to deal with

such observations winsorization was performed. This method allows for getting rid of extreme values without reducing the sample. Largest and smallest 1% of observations were replaced by corresponding 1st and 99th percentile values for each country and variable.

The next step concerns the problem of missing observations. Table 1 provides an overview of the problem of missing data in our sample. On the whole 90% of the observations have at least one missing data in the set of variables used in the analysis.

Table 1

Missing data per county

Country	Percent of observations with at least one missing	Total number of observations
Russia	99.9	8850
China	76.6	22329
Brazil	97.4	2804
India	98.9	21908
South Africa	98.3	2506
Total	90.4	58397

We can conclude that the problem of missing data is highly relevant for our sample. Particularly, out of five countries only China has more or less enough data to work with. All the other countries' observations have only a marginal influence on the remaining sample. Although the time interval taken is the most recent, i.e. from 2005 till 2012, obviously, there are still reporting and disclosing issues in the emerging markets which hinder the availability of sound and verifiable data for the purposes of our analysis. This data problem has made our sample, in fact, consisting almost solely of Chinese companies.

Missing values are tested for randomness in order to detect a possible selection bias if any. The following dummy variable is created:

$$\text{dum_miss} = \begin{cases} 1, & \text{if there is at least one missing value in a row} \\ 0, & \text{otherwise} \end{cases}$$

Three tests for randomness were performed: correlation analysis between the dummy and the explanatory variables, testing for mean equality between groups with and without missing, evaluating a logit model. Based on the obtained results (not shown, but available upon request) missings in several variables cannot be assumed to be random. Specifically, five variables turn out to be useful for predicting the missing value in a given observation (pseudo R-squared equal to 25%) - personnel expenses, depreciation and amortization, marketing expenses, roa and sales. Thus, we can reject the hypothesis that missing data is completely random; there is some sort of dependence. Due to that, when dropping all data that have any number of missing values, we potentially run into the risk of creating a sample bias, which would bias the estimates. In order to overcome this problem one would need to evaluate the form of dependence in the missing data and recover the missings by means of the revealed and estimated dependence form. This, however, is a challenging task in itself and is not pursued in this study. Therefore, the problem of missing data limits the results of the current analysis, and some future research could be done along these lines.

All the data is retrieved from Bloomberg database. After all the procedures of data cleaning the remained sample looks as follows:

- 5 emerging markets: Russia (0,16%), China (93,34%), Brazil (1,29%), India (4,48%), South Africa (0,73%);
- time period: 2005-2012 years;
- 2481 companies from 10 industries (5600 observations after lagging).

The distribution of companies by industries is presented in Figure 1. The composition of industries is diverse, major industries are consumer discretionary, industrials and materials. Together they account for more than 60% of the sample. In this study we follow the approach used in B. Lev. (2004) and Lev et al. (2012) and distinguish between IC-intensive firms and IC non-intensive firms. Particularly,

for each year we rank firms according to intellectual capital and label the upper half (50th percentile) as IC-intensive firms in this particular year. Then the procedure is repeated for the subsequent year. It is important to notice that such a method of selecting IC intensive firms does not stick to particular industries. Contrariwise, this approach allows any firm in any industry to be IC intensive in the sense that it invests actively and heavily in IC components compared to its peers. As outlined by Lev et al. (2004) IC can be a feature of any company with good management, highly qualified personnel, etc. irrelevant of the industry it originates from.

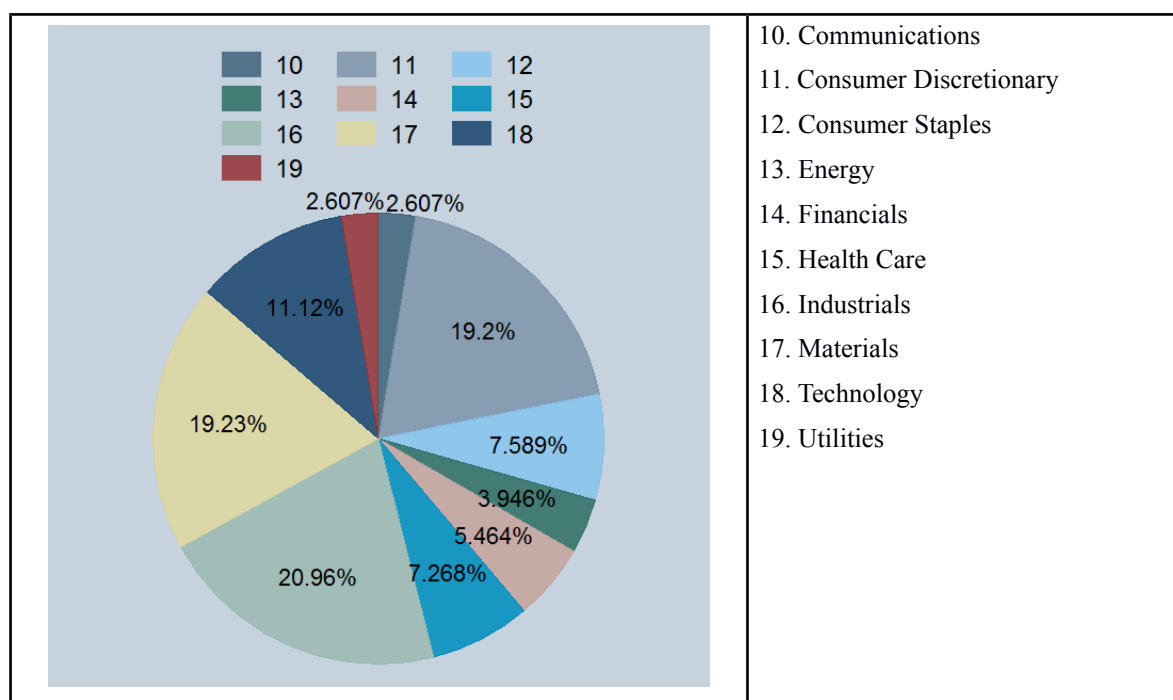


Figure 1: Distribution of companies in the sample by industries

Estimation and Evaluation

Sydler et al. (2014) proxy of IC

The structure of examined data allows us to suppose that the final model should be two-way fixed effects. Fixed effects are supported by the fact that each company is possessed of specific time-invariant characteristics which influence the company’s results and profitability, for example, corporate practices which are developed in the company. Concerning time effects, the examined time period includes crisis years which effect on companies can differ across countries, so time effects should be taken into account. Also the problems of heteroskedasticity and multicollinearity are expected.

Four panel data models were estimated: one-way and two-way fixed and random effects correspondingly. Fixed effects models reveal a significant decrease in AIC and BIC as well as an improvement in within R-squared (Table 2), especially if time effects are included in the model. In order to choose between fixed and random effects Hausman test was implemented. The resulting very small p-value suggested that random effects are inconsistent, so the fixed effects estimator is preferred.

Table 2

Comparison of panel data models: approximated value by Sydler et al. (2014) estimation

	AIC	BIC	R ² within	R ² overall	F-stat/Chi-stat
One-way fixed effects	9386.873	9410.726	0.1865	0.0981	20.56
Two-way fixed effects	8681.172	8740.803	0.3664	0.1016	27.5
One-way random effects	-	-	0.1796	0.1229	71.45
Two-way random effects	-	-	0.3497	0.1356	279.23

Taking all the factors into account, the two-way fixed effects scaled model was chosen. This type of model provides the lowest values of information criteria, the highest value of R² and consistent estimators

as opposed to the random effects model. Moreover, this model suits the assumption stated in this paper: it reflects the difference in individual time-invariant characteristics between companies, accounting for the size effect, and it also allows for the influence of the crisis year. Estimation results of this model are presented in Table 3 below.

The model has a positive and significant impact of residual income and expenditures on IC on the company's stock price as it was expected. Coefficients in front of book value and lagged IE variables are positive but insignificant on the conventional 5% level of significance. The coefficients obtained are then used in calculation of accumulation and depreciation rates. Due to insignificance, coefficients A_1 and A_4 are assumed to be equal to zero for the purposes of α and δ estimation.¹

Table 3

Estimation results of the two-way fixed effects model; adjusted RIM evaluation

R ² within	0.3664		
R ² between	0.0833		
R ² overall	0.1016		
F(10,1622)	27.5		
Prob>F	0		
corr(u _i , Xb)	-0.2494		
Sprice	Coef.	t	P> t
sbv_share	0.42911	1.72	0.086
sRI_share	3.7928	2.31	0.021
sIE_share	2.83428	2.46	0.014
sIE_share_lag	1.05983	0.82	0.414
Year			
2007	1.27579	2.29	0.022
2008	-1.8494	-3.57	0
2009	-0.2647	-0.5	0.616
2010	-0.2978	-0.57	0.571
2011	-2.0679	-3.99	0
2012	-2.3091	-4.27	0
_cons	3.38089	5.9	0
sigma_u	2.93366		
sigma_e	1.66283		
Rho	0.75684	(fraction of variance due to u _i)	

The accumulation and depreciation rates were calculated according to the formulas (6). Accumulation rate α occurred to be the same for all the countries and years and equal to 0.74. This means that, on average, 74% of the expenditures on intellectual capital are capitalized in the company and further used as intellectual capital. The similar results are found by Sydler et al. (2014) - 84% for IC-intensive UK companies. The results of δ calculation are shown in Table 4.

Table 4

Results of depreciation rate δ calculation

	Russia	China	Brazil	India	South Africa
2006	.	-0.03	-0.13	-0.08	-0.08
2007	-0.07	-0.05	-0.13	-0.08	-0.09

¹ The IC estimation without restricting the coefficients to zero provides similar results.

2008	-0.08	-0.03	-0.13	-0.06	-0.07
2009	-0.10	-0.04	-0.13	-0.08	-0.09
2010	-0.08	-0.04	-0.12	-0.08	-0.08
2011	-0.08	-0.04	-0.11	-0.09	-0.08
2012	-0.08	-0.04	-0.09	-0.08	-0.06

Depreciation rate occurred to be negative for all the countries and years. This is different from Sydler et al. (2014) findings¹, and indicates the situation when IC gains value in the course of time. This could be possible when expenditures on IC are deployed in a lagged manner. Such a lagged deployment can also take place when expenditures on IC are done step-by-step: each year only part of components is covered, and the whole effect accumulates once every part of IC component is upgraded. For example, a company can invest in purchasing new software for employees, but the full effect of this investment occurs later in time as the employees need time to learn the software and use it to their full advantage. Thus, the case of negative depreciation rate potentially could be justified, but it requires further confirmations to be claimed robust.

Employing obtained values for α and δ IC is calculated. Due to imperfect nature of the proxy for IC some observations appeared to be negative. These values were replaced by zero, the percentage of such values made up approximately 3.3%. IC per share has an asymmetric distribution with a long right tail and high peak. For the purposes of further analysis it was also winsorized to reduce the distortion due to extreme outliers.

Estimation of Zeghal and Maaloul (2010) Model

The estimation procedure is different from that in the previous section. In this part we do not apply the fixed effects model as in the previous section, but stay with pooled OLS. This is done for several reasons. Firstly, the fixed effects together with the IC variable produce very high multicollinearity, creating difficulties for statistical and economic inferences (VIFs around 43 and 55 for IC and size variables). Analyzing the effect of intellectual capital on the company's performance we care about significance of the variables, hence the absence of high correlation between explanatory variables becomes crucial. The dummies, implied by the fixed effects estimator, correlate with the IC term as well as with the size variable, which is now included into the model as the control variable. Moreover, fixed effects may capture some of the impact of IC on the dependent variable, since IC is, by definition, unobservable and intangible - a latent and unique for each firm variable. Dummies for objects in fixed effects models are usually introduced exactly for the purpose of capturing the unobservable and unique to each object component. Hence, in the case of intellectual capital the inclusion of fixed effects might be detrimental for the evaluation of the IC term.

Therefore, for the above named reasons we employ the pooled OLS models to evaluate the impact of IC on the performance measures. Zeghal and Maaloul (2010) also use the pooled OLS estimator, however, they do not provide any motivation for it. Contrary to the original paper, we also extend our model with time dummies to capture the crisis, and we follow Lev et al. (2012) in including the industry fixed effects into the model as well. To better understand the effect of IC on the company's performance, we split the sample every year into IC-intensive firms and IC-non-intensive firms as described in the analytical framework above. Consequently, further we present results for 3 samples - pooled, IC-intensive and IC-non-intensive.

As already mentioned, the IC variable is winsorized in order to reduce the distortion due to extreme outliers. This, however, still preserves high variability in the distribution. In order to reduce the heteroscedasticity induced by this variability and to scale down IC, which is measured in mln USD, we apply the logarithmic transformation, as we do with the size variable which is the logarithm of total assets, a proxy used in Zeghal and Maaloul (2010).

¹ They find the depreciation rate to be equal to 0.64 or 64% of IC is amortized every year. Ballester et al. (2002), (2003) obtain depreciation rate of 34% for HC only, 12–14% for SC.

Impact of IC on financial performance

Table 5 presents the results of the first regression using the return on assets as the measure of financial performance. The table reports six regression estimates: the first three using Sydlar et al. (2014)'s proxy for IC (pooled, IC-non-intensive and IC-intensive samples), and the other three regressions using VAIN measure. For each regression coefficients estimates are reported along with their robust t-statistics. Below the regression estimates several summary statistics are reported, namely, the number of observations used in the regression, its adjusted R-squared and F-statistic. In the second panel of the table we report the difference in coefficient estimates of IC or VAIN variables between IC-intensive sample and IC-non-intensive sample together with a test on whether these two estimates are statistically different from each other. Significant coefficient estimates are in bold. Note also that although not presented, the year and industry dummies are present in each of the models below.

Table 5

The effect of IC and VAIN on ROA

ROA												
	Pooled		Non intensive		Intensive		Pooled		Non intensive		Intensive	
Parameters	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat
IC	0.0083	6.22	0.0021	1.16	0.0143	4.78						
VAIN							0.0019	13.44	0.0018	10.74	0.0041	7.89
VACA							0.2949	9.11	0.2163	5.56	0.3987	17.25
size	-0.002	-1.4	0.0033	1.74	-0.0083	-2.53	0.0007	0.84	-0.0002	-0.21	0.0009	0.8
lev	-0.0261	-19.86	-0.0229	-15.73	-0.0308	-13.28	-0.0178	-9.71	-0.0154	-6.84	-0.0177	-9.66
Intercept	0.0581	3.6	0.0603	2.53	0.0511	2.4	0.0058	0.35	0.0287	1.26	-0.0438	-2.23
N	5419		2620		2799		5601		2802		2799	
adj. R-sq	0.2173		0.2054		0.2008		0.4628		0.4187		0.5515	
F-stat	37.709		23.907		15.993		50.651		30.382		53.253	
Coefficient comparison between intensive and non-intensive groups												
	diff	p-value						diff	p-value			
IC	0.0122	0.0005					VAIN	0.0023	0			

Looking first at the regressions with Sydlar et al. (2014) proxy (IC), we observe that in the pooled regression IC has a significantly positive impact on the return. The regression itself is significant as well - F-statistics of 37.7 together with R-squared of 21%. The non-intensive sample displays the insignificant IC coefficient in contrast to the positive and significant coefficient estimate obtained in the intensive sample. The relative difference is also significant. Comparing the results with VAIN measure of intellectual capital provides us with the same results, except that VAIN is significant even in the non-intensive sample, although having a lower coefficient estimate. All regressions are significant, R-squared ranges from around 20% for Sydlar's proxy to 42-55% for VAIN proxy.

To confirm the finding above we use another proxy for financial performance - EVA. Particularly, we employ EVA spread which is defined as the return on invested capital minus the weighted cost of capital. The results presented in Table 6 show similar patterns - despite the way IC is approximated, it has a significantly positive impact on the company's economic value added. It is interesting to point out that the impact of IC differs significantly between intensive and non-intensive samples. Although the overall impact is still significant, this distinction points at broad structural differences between intensive and non-intensive firms. In order to find out whether this is true indeed we check this hypothesis for other measures of the company's performance.

The effect of IC and VAIN on EVA

EVA spread												
Parameters	Pooled		Non intensive		Intensive		Pooled		Non intensive		Intensive	
	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat
IC	0.0118	6.61	0.0022	0.88	0.022	5.55						
VAIN							0.0018	9.58	0.0018	9.02	0.0043	6.06
VACA							0.2737	6.77	0.1519	3.65	0.4328	9.63
size	0.0022	1.15	0.0095	3.45	-0.0069	-1.75	0.0083	6.09	0.0077	4.45	0.0092	4.7
lev	-0.0063	-3.48	-0.0041	-2.16	-0.0092	-2.89	-0.0018	-0.62	-0.003	-0.76	0.0048	1.6
Intercept	-0.0296	-1.23	0.0206	0.48	-0.0526	-1.7	-0.0608	-2.51	0.0039	0.11	-0.1437	-5.3
N	5419		2620		2799		5601		2802		2799	
adj. R-sq	0.1587		0.1662		0.1597		0.273		0.2494		0.3652	
F-stat	21.504		15.779		13.839		27.976		23.96		23.289	
Coefficient comparison between intensive and non-intensive groups												
	diff	p-value						diff	p-value			
IC	0.0198	0					VAIN	0.0025	0.0004			

Table 7 reports the results for the last measure of the financial performance - residual income per share. As opposed to EVA spread measure, which comes from Bloomberg database, residual income is calculated manually according to the formula:

$$RI \text{ per share}_t = EPS_t - r_e * BV \text{ per share}_{t-1}$$

The results are again consistent with those obtained with ROA and EVA. Thus, we can confirm the second hypothesis (H2) - IC has a positive and significant impact on financial performance of the company, irrelevant of the proxy used.

Table 7

The effect of IC and VAIN on RI

Residual Income												
Parameters	Pooled		Non intensive		Intensive		Pooled		Non intensive		Intensive	
	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat
IC	0.0156	2.44	-0.0004	-0.14	0.0329	2.02						
VAIN							0.0017	2.79	0.0018	2.08	0.0034	2.18
VACA							0.5135	4.16	0.5158	2.82	0.4797	3.64
size	-0.0042	-0.93	0.006	1.73	-0.017	-1.36	-0.0007	-0.16	-0.0087	-1.22	0.0088	2.97
lev	-0.0156	-5.11	-0.0104	-4.62	-0.0217	-3.72	-0.0072	-1.68	-0.0041	-0.56	-0.0059	-1.3
Intercept	-0.0611	-1.33	0.0123	0.66	-0.1629	-1.79	-0.1974	-2.44	-0.2525	-1.3	-0.2568	-2.79
N	2764		1252		1512		2874		1362		1512	
adj. R-sq	0.1498		0.1293		0.1847		0.1094		0.0787		0.3567	
F-stat	12.394		10.826		5.845		10.938		6.8075		16.559	

Coefficient comparison between intensive and non-intensive groups											
	diff	p-value						diff	p-value		
IC	0.0333	0.0427					VAIN	0.0016	0.3473		

One of the interesting hypotheses stemming from the above obtained result is that firms earn positive EVA if and only if they invest in intellectual capital. Of 182 cases with zero intellectual capital in our sample 111 firms (61%) have negative EVA spread, whereas 71 cases (39%) actually do have positive EVA spread. Thus, our data do not support this hypothesis. This might be not surprising because of the market structure in emerging countries. Imperfect competition together with unsatisfied demand in such markets creates opportunities for companies to earn abnormal earnings by means of active marketing, aggressive pricing policy, geographical channels, etc. without actually making significant R&D investments. However, there might be a positive association between those firms who actively invest in R&D and those who achieve positive economic value added. In order to test this milder hypothesis we perform a contingency analysis. For this purpose a dummy variable dumEVA taking value of 1 if the firm displays positive EVA spread, and zero otherwise, is created. We further classify all the observations in the data sample between four cases - a negative EVA and non-intensive group, a positive EVA and non-intensive group, a negative EVA and intensive group, and a positive EVA and intensive group. We then test the strength of association between columns and rows to figure out if intensive firms have higher chances of achieving a positive EVA than non-intensive firms and the other way round. Table 8 reports the results of this exercise.

Table 8

The relationship between positive EVA and IC intensive firms

Contingency analysis			
	dumIC		
dumEVA	0	1	Total
0	2363	2122	4485
	84.33%	75.84%	80.09%
1	439	676	1115
	15.67%	24.16%	19.91%
Total	2802	2798	5600
	100%	100%	100%
Pearson chi2(1) = 63.3230 Pr = 0.000			
Cramér's V = 0.1063			

We observe that in the group of non-intensive firms 15.7% hit a positive EVA, whereas in the group of intensive companies the percentage of those who report a positive EVA increases to 24%. Consequently, if a company actively invests in IC then the chances that it will not reach a positive EVA decrease from 84% to 75%, other things being equal. Pearson's chi statistics of this association is significant given any level of confidence. Cramer's V which measures the strength of the relationship and varies between 0 (no association) and 1 (for two identical variables) equal 0.1 meaning that the association is modest.

Thus, we can conclude that active investment in IC does in fact lead to higher chances of hitting a positive EVA, but this relationship is quite moderate. As mentioned above, in emerging markets there are, probably, easier ways of delivering a positive EVA other than risky R&D investments.

Impact of IC on economic performance

Since IC has a positive impact on the firm's return on asset as well as its economic value added, it might be interesting to look at where the benefits come from. Thus, we look at economic aspect of the company

and split the production cycle into two stages - manufacturing and corporate governance. We first present the results in Table 9 for the production stage - EBIT/Sales.

Table 9

The effect of IC and VAIN on operational margin

EBIT/Sales												
Parameters	Pooled		Non intensive		Intensive		Pooled		Non intensive		Intensive	
	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat
IC	-0.0111	-2.77	-0.0216	-2.17	0.003	0.51						
VAIN							0.0079	15.94	0.0071	12.24	0.011	7.58
VACA							0.5401	9.12	0.4773	5.58	0.6737	12.96
size	0.0279	6.72	0.0437	4.55	0.0075	1.35	0.0098	3.97	0.0131	3.68	0.0021	0.66
lev	-0.0433	-11.93	-0.0452	-9.9	-0.0468	-8.68	-0.0245	-5.97	-0.0246	-4.22	-0.022	-5.03
Intercept	0.0676	2.18	-0.0211	-0.39	0.0988	2.31	-0.0816	-2.68	-0.0911	-2.19	-0.1125	-2.71
N	5419		2620		2799		5601		2802		2799	
adj. R-sq	0.0971		0.1053		0.1152		0.3213		0.2927		0.4135	
F-stat	14.167		11.086		10.736		33.736		23.588		25.398	
Coefficient comparison between intensive and non-intensive groups												
	diff	p-value						diff	p-value			
IC	0.0246	0.0337					VAIN	0.0039	0.0112			

Looking first at pooled regression we note that IC has a significantly negative impact on operational margin, given the significance of the regression on the whole. This is surprising keeping in mind the results in the previous section. It might be that the negative estimator is driven by the non-intensive observations. This hypothesis is confirmed with the negative coefficient of IC, but for the intensive sample the estimator is insignificantly different from zero. Comparing the results with another proxy for IC shows that in the case of VAIN there is a significantly positive impact of IC on the operational margin with a significant difference between intensive and non-intensive sample estimates. Thus, it can be concluded in this particular aspect that the two proxies provide counter to each other results. It might be the case that the results differ since the proxies for IC have different interpretation. While Sydler's proxy is a direct measure of intellectual capital, VAIN stands for the efficiency of IC employment, and might be closer connected to the operational margin, which is another form of company's efficiency. Alternatively, Sydler's proxy is a new measure of IC and is complicated to calculate as opposed to VAIC, which has a longer history of successful applications in the research. It might be suggestive to investigate Sydler's proxy in a more throughout way. But for the purposes of this research, we leave this suggestion for future research.

Table 10 presents the results for the second stage of the economic performance aspect - NI/EBIT. Here the results get particularly interesting.

Table 10

The effect of IC and VAIN on NI/EBIT

NI/EBIT												
Parameters	Pooled		Non intensive		Intensive		Pooled		Non intensive		Intensive	
	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat

IC	0.2839	1.19	1.8171	1.55	0.6332	1.22						
VAIN							-0.0263	-0.52	-0.0648	-0.96	0.0515	0.79
VACA							-0.8019	-0.37	-2.6373	-0.94	3.1367	0.82
size	-0.2771	-1.72	-1.4736	-1.68	-0.8611	-1.14	-0.0253	-0.13	0.2158	0.83	-0.2972	-0.93
lev	-0.2037	-0.59	-0.544	-1.02	0.1555	0.4	-0.2488	-0.71	-0.6369	-1.24	0.2418	0.48
Intercept	0.8231	0.67	-1.2206	-0.61	1.3977	2.01	1.3532	1.96	-0.734	-0.55	1.5172	2.81
N	5419		2620		2799		5601		2802		2799	
adj. R-sq	-0.0005		-0.0009		-0.003		-0.0008		-0.0022		-0.0034	
F-stat	1.0002		0.8739		0.9484		0.8048		0.7538		0.883	
Coefficient comparison between intensive and non-intensive groups												
	diff	p-value						diff	p-value			
IC	-1.1839	0.3537					VAIN	0.1163	0.2127			

Before looking at the coefficient estimates we note that all the regressions are, in fact, insignificant. In other words, a simple straight line would fit the data with the same level of goodness. A quick conclusion could be made - none of the variables included in the model has any explanatory power for the dependent variable, NI/EBIT. Thus, it seems that a higher IC does not lead to lower borrowing costs or better optimized taxation plans. What is also interesting, size and leverage also has no influence on the ratio NI/EBIT. This means that bigger companies are in fact in the same borrowing conditions as smaller companies. More leveraged companies have same access to capital market as less leveraged companies - both observations are quite doubtful. Unfortunately, up to our knowledge we do not have any evidence of such analysis for other emerging or developed markets. Consequently, this direction could be interesting for future research both for emerging and developed markets.

Impact of IC on stock market performance

The stock market aspect of the company's performance is split into two parts: analyzing the book-to-market ratio and the firm's cost of equity. Both these relationships depend on how the market evaluates the company and its intellectual capital. It is important to emphasize that if investors recognize and value intellectual capital, it should increase the market value of a firm, other things being equal. Therefore, the book-to-market ratio should decrease as IC is not acknowledged as an asset and does not participate in book value calculation according to the accounting standards.

Table 11

Presents the results for the book-to-market ratio

Parameters	B/M											
	Pooled		Non intensive		Intensive		Pooled		Non intensive		Intensive	
	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat
IC	0.0216	1.98	-0.0129	-0.65	0.0076	0.35						
VAIN							-0.0042	-3.28	-0.0044	-3.24	-0.0047	-1.19
VACA							-0.2346	-2.23	-0.2114	-1.49	-0.4471	-2.93
size	0.0172	1.27	0.1061	6.27	-0.0071	-0.31	0.031	2.81	0.0683	5.3	0.0051	0.37
lev	0.0336	1.15	-0.0165	-0.56	0.0627	1.73	0.0263	1.03	-0.0026	-0.11	0.0468	1.31
Intercept	0.5901	4.04	0.1011	0.81	0.8874	3.88	0.73	4.81	0.3803	2.41	1.0363	4.5
N	5419		2620		2799		5601		2802		2799	
adj. R-sq	0.0805		0.117		0.0818		0.0964		0.1225		0.0881	

F-stat	21.928		21.551		10.579		20.662		17.752		10.748
Coefficient comparison between intensive and non-intensive groups											
	diff	p-value						diff	p-value		
IC	0.0205	0.4347					VAIN	-0.0003	0.9393		

First of all, we note that R-squared are uniformly low for both proxies. This means that it is difficult to explain the market value of the firms given their balance figures. This is not a new observation, however, a similar regression in Zeghal and Maaloul (2010) explained roughly from 30 to 60% of the sample variation in the UK market.¹

The results for Sydler’s proxy are again less clear cut as compared to VAIN proxy. Particularly, IC has a positive impact on the book-to-market ratio in the pooled sample, which is counter to our expectation. Segmenting between non-intensive and intensive firms does not make things more clear. Moving to VAIN proxy, we observe a negative and significant coefficient in pooled and non-intensive samples, but a negative and insignificant one in the intensive sample.

In general, it looks like the market valuation of a firm is not closely related to its balance figures, at least based on our data sample. We obtain mixed results from both proxies, although VAIN seems to be more predictable. It might be the case that market valuation of a particular firm is affected by stochastic market, political, social and other factors, which drive the market price away from its fundamental value. Such deviations could become long lasting and even non-reversal in sub- or inefficient emerging financial markets. In such cases the market value could be above or below fundamental for quite a long time, thus, explaining low explanatory power of the model based on accounting figures.

Table 12 presents the results for cost of equity regressions. To remind, according to several papers including Lev (2004) high investments in IC could increase the risk of a firm. More specifically, Lev et al. (2012) found out that R&D investments actually decrease the risk associated with competition and operations, but increase disruptive technology risk, associated with the volatility of special items. The latter include restructuring expenses, goodwill impairment, write-offs from mergers and acquisition, etc. The overall effect therefore depends on the profile of R&D expenditures for each firm.

Table 12

The effect of IC and VAIN on the cost of equity

Cost of equity												
Parameters	Pooled		Non intensive		Intensive		Pooled		Non intensive		Intensive	
	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat	Coef.	Robust t-stat
IC	-0.0032	-6.79	0.0004	0.43	-0.0065	-6.75						
VAIN							0.0001	1.54	0	-0.02	0.0002	1.37
VACA							-0.0302	-4.65	-0.0118	-1.7	-0.051	-5.8
size	0.003	5.73	0.0001	0.05	0.0056	5.56	0.0008	2.38	0.0012	2.61	-0.0001	-0.29
lev	0.0008	1.88	0.0006	0.98	0.0011	1.87	0.0003	0.6	0.0001	0.23	0	-0.07
Intercept	0.0813	17.59	0.0652	8.73	0.0956	16.18	0.081	17.36	0.0686	10.96	0.0972	15.76
N	5418		2620		2798		5600		2802		2798	
adj. R-sq	0.4141		0.3926		0.4261		0.4135		0.3992		0.4309	
F-stat	195.09		95.972		105.44		165.11		81.92		92.463	
Coefficient comparison between intensive and non-intensive groups												

¹ Zeghal and Maaloul (2010) estimated the regression without time and industry dummies.

	diff	p-value						diff	p-value			
IC	-0.0069	0					VAIN	0.0002	0.2104			

As it can be seen from the table, all regressions are significant with relatively high R-squared. Looking first at Sydler’s proxy, IC has a highly significant negative impact on the cost of equity. Segmenting this impact between non-intensive and intensive samples provides additional insights - a significant reduction in the cost of equity occurs for IC intensive firms, whereas for non-intensive companies such effect is absent. It means that those firms who seriously and actively invest in intellectual capital benefit from reduced operational and competition risk.

The results for VAIN proxy are insignificant in both samples with the coefficients close to zero in absolute value. Again, the difference might be driven by the relative difference between two proxies - Sydler’s proxy directly estimates intellectual capital whereas VAIN provides a measure of the efficiency of IC usage.

Summary

Here we briefly summarize the main conclusions derived from the analysis above.

- Intellectual capital has a positive impact on financial performance of the company measured by ROA, EVA or Residual Income. The influence is statistically significant irrelevant of whether Sydler’s proxy or more traditional VAIN measure is used.
- The impact of intellectual capital on economic performance measured by operational margin delivers less clear cut results. It is significantly positive for VAIN proxy, which is what we expected, but significantly negative for the pooled and non-intensive sample for Sydler’s proxy. The NI/EBIT regression appeared to be insignificant for both proxies, implying that IC is not relevant for explaining NI/EBIT ratio.
- Investigating the stock market performance measured by the book-to-market ratio resulted in mixed evidence. Sydler’s proxy revealed a positive impact of IC on B/M ratio for the pooled sample, whereas VAIN proxy resulted in a significantly negative impact for the pooled and non-intensive samples, which is what we intuitively expected. The cost of equity regression revealed a significantly negative impact of IC on the overall level of the firm’s risk in case of Sydler’s proxy, and an insignificant impact in case of VAIN measure.
- The difference in results obtained using the two proxies for IC could lie in the different aspects approximated by these proxies. While Sydler’s proxy is a direct estimate of IC, VAIN is a measure of the intellectual capital’s usage efficiency. This might have led to VAIN being more relevant for explaining operational margin and Sydler’s proxy being more relevant for the cost of equity and book-to-market analysis as it approximates the intellectual capital itself, which is what market is trying to evaluate.
- Comparing the intellectual capital intensive and non-intensive firms we find that IC intensive companies display significantly better financial performance in terms of ROA, EVA and Residual Income. It looks like IC intensive firms on the emerging markets invest in IC in order to increase its operational efficiency by means of, for example, reducing its operational costs, optimizing the production cycle, etc. Moreover, the investments of IC intensive firms lower the cost of equity for such firms, as also evidenced by Lev et al. (2012).
- We also find some evidence concerning the low relation between market evaluation of the firm and its fundamental value. It might be the case that the prices in the emerging stock markets are driven by other non-fundamental factors, for example, political situation, or business climate. Moreover, firms in emerging economies have various opportunities to achieve positive EVA other than investing in intellectual capital, which characterizes such markets with imperfect competition and unsatisfied demand.

Conclusion and discussion

This research deals with a couple of important topics in the area of intellectual capital: IC estimation and evaluation of the effect of IC on corporate performance. Estimation of IC is a vital topic since the notion of IC is vague in itself. Intangible nature together with absence of accounting standards regulating the IC reporting makes the task of IC estimation a tough challenge to accomplish. Evaluation of the IC effect on the company's performance is another key topic because it allows companies to evaluate the efficiency of their spending on IC components, regulatory institutes to develop a system of accounting rules in order to decrease the information asymmetry which exists in the market. Lev (2004) in his motivating article calls for the increased attention to the intellectual capital phenomenon. He argues that there still remain two actions to be done by companies and regulatory institutes: regular ROI calculation of R&D investments and recognition of R&D as an asset rather than a cost. This should solve the problem of underinvestment in R&D projects and increase the current level of R&D investments, which he estimates to be one third of the optimal level. Intellectual capital is often associated with the difference in the market and book value which market assigns to the intangible quality of management, professional practices, patented software, licenses, know how, etc. In the conditions of a new knowledge economy, traditional production resources - physical capital and labour - merely become commodities. It means that these resources generate some standard level of profit, theoretically, equal for all firms in a given industry. What differentiates the firms is the level of intellectual capital, and increasing the quality and efficiency if IC usage enhances profitability of a firm.

In the course of the study three problems were solved. Firstly, Sydler's proxy was estimated on the five biggest emerging markets. We obtained a dollar estimate of each firm's intellectual capital. However, this measure displays high variation and is subject to a number of assumptions. In some instances in the subsequent analysis it provided distinctly different results compared to VAIN proxy and hence should be treated with caution.

Secondly, using two proxies for IC an analysis of the impact of IC on three aspects of the company's performance was performed. It was revealed that IC has a positive and significant influence on ROA, EVA and residual income. Although the hypothesis that firms which do not invest in IC cannot reach a positive EVA was rejected, a contingency analysis confirmed positive and significant association between intensive investing in IC and delivering a positive EVA. Further based on the results from the analysis we may suggest that firms in the emerging countries invest mostly in increasing the operational efficiency by means of cutting production costs, developing better practices and etc. Although not confirmed by Sydler's proxy, a positive and significant impact of IC on operational margin is found in regressions with VAIN. More evidence in favor of this suggestion is found in the cost of equity regressions: IC has a negative impact on the risk of the company, leading, as postulated by Lev et al. (2012) to a decrease in competition and operations risks. Based on the stock market aspect of the company's performance, we find low evidence of the market valuating intellectual capital. The reason might be that in the emerging financial markets prices might deviate from their fundamental values for quite a long time due to the impact of other factors, for example, political or social.

Thirdly, comparing the intellectual capital intensive and non-intensive firms we find that IC intensive companies display significantly better financial performance in terms of ROA, EVA and residual income. Moreover, the investments of IC intensive firms lower the cost of equity for such firms. IC non-intensive firms merely try to mimic the behavior of IC intensive firms and follow after them in the introduction of new products, new production schemes, cutting cost programs, etc. This, however, leads to lower economic returns associated with such behavior as compared with intensive firms.

The present study has also a number of limitations. Firstly, the share of missing data implies some structure, making the missing data nonrandom and leading to, possibly, a bias. For the full representativeness it is necessary to model the missing data generating process and try to recover the part of the distribution which we did not have in the present data. Secondly, in the course of the analysis we ran into a puzzle with NI/EBIT regression. According to the results obtained, neither IC, nor the size and leverage affect the dependent variable. NI/EBIT accounts for the debt raising capability of a firm, realizing in a high or low interest rate, and for taxation plans. The capability of a firm to raise debt under a certain interest rate

should, in principle, depend on the size of the firm (small firms do not have access to stock markets) and on the leverage (highly leveraged firms are restricted in new borrowings). Thus, the insignificance of the regression containing NI/EBIT should be verified in future research.

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