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COMPANY INTANGIBLES: CREATION VS ABSORPTION

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COMPANY INTANGIBLES: CREATION VS ABSORPTION[3]

In the era of the knowledge economy intangibles are recognized by investors as pivotal value drivers. Previous research of portfolio forming methods based on intangibles is limited by taking into account only the quantity of intangibles. We propose a tool to select companies able to create knowledge (in contrast to the absorption of knowledge), which is a quality of intangibles. To test whether these abilities are results of skill we implement a bootstrap procedure. It shows that only 22% of companies have the skills to create knowledge, but all of them are characterized by positive results of knowledge creation. To show the practical implications of the proposed approach selected companies are combined in a portfolio. This portfolio demonstrates a higher cumulative return, Sharpe ratio and drawdown than S&P500. We also find the increasing importance of intangibles for investors during the crisis. While exogenous shocks influenced both creators and absorbers, we found that intangibles create an obstacle to a sharp drop of market value.

JEL Classification: G11.

Keywords: intangibles, portfolio, bootstrap procedure, crisis.

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1. Introduction

Innovation distinguishes between a leader and a follower.

Steve Jobs

The primary goal of a typical long-term investor is to pick a company with value growth potential. While tangible assets hardly explain market value, researchers focus on intangibles. They are regarded as key resources which contribute to competitive advantage and the enhancement of tangibles (Edvinsson, 1997; Sveiby, 1997). The growing awareness of the importance of intangibles for value creation has resulted in an increase of intangibles-related investments. However investors that are forming a portfolio lack information about the outcomes of such investments. This complicates the analysis of the value created by intangibles and therefore the process of picking companies.

Another problem is that long-term investors are interested in companies with value growth potential, provided by tangible and intangible resources. A high current value does not necessarily imply growth in the future. Therefore investors need some tool to determine the value growth potential on the basis of present performance and resources.

This paper proposes an intangibles-based tool for picking companies with value growth potential. We apply the tool to the sample of USA companies included in S&P500.

First of all it is necessary to recognize the key value driver that has an intangible nature. Secondly we propose the measurement of growth potential provided by that driver. Finally we investigate whether the ability to create value growth is random or not. The tool proposed here answers all of these questions.

In this paper we distinguish two attributes: intangibles created by the company and intangibles absorbed from the market. The first is the result of the unique ability of the company to transform knowledge into value which is exactly what an investor wants. An example is a company with a research center that patents new technology to reduce production costs. Such a reduction leads to value enhancement which raises a company's investment attractiveness. Investments in companies with the second type of intangibles can also be profitable. However we suppose the value of such companies to have strong correlation with market movements. Commonly used new software that simplifies information diffusion between company divisions illustrates intangible absorption. The term illustrates a situation when some part of a company's intangibles is not unique and commonly used in the industry, for example all workers were trained to work with new manufacturing equipment. Efficient use of both created and absorbed intangibles determines company value growth. However we suppose that commonly attainable knowledge does not bring superior value. Consequently the ability to produce long-term value is closely connected with the creation of intangibles. Therefore investors need a method of picking companies with the ability to create intangibles. This extends existing tools for picking companies that are based on tangible assets analyses. The assumption about the existence of created and absorbed intellectual capital gives the name of proposed model: “Intangibles Creation-Absorption Model” (InCAM).

The result of the analyses shows the validity of InCAM and its ability to pick shares with better future performance than the benchmark. The median S&P500 company has a negative ability to create knowledge. The total number of investment attractive “skilled creators” is small (22% of the sample). However all companies with the positive ability to create knowledge are skilled and their success is non-random. We also corroborate the importance of intangibles during the economic recession.

The remainder of this paper proceeds as follows. Section 2 introduces the nature of intangibles and their connection with stock markets. Section 3 discusses the theoretical framework of InCAM. Section 4 describes the data and econometrical method that we use to prove the success of the model. Section 5 presents empirical results and their discussion. Section 6 concludes this paper with summarizing the main results and their discussion.

2. The theoretical background

There is a growing body of literature dedicated to the definition and measurement of intangibles, the description of their nature and influence on company results. The current paper considers only a part of vast field of intangible research, which is connected with capital markets. This section contains the explanation of the term “intangibles” which is used in the paper and a critical analyses of the previous research dedicated to the connection between intangibles and capital markets.

Intangibles have vague nature and heterogeneous structure. Therefore a single definition is absent (Zambon, 2004; Clarke et al., 2010). The common practice is to interpret them according to the research purpose. In this study intangibles are defined according to the value approach. This approach appeared at the end of the 20th century when the value-based management concept and the intellectual capital framework were integrated. Thus, Stewart (1997) defines intangibles as intellectual material which consists of knowledge, experience and intellectual property and creates value (Stewart). Edvinsson and Malone (1997) define intangibles as knowledge that can be transformed to the value. Zeghal and Maaloul (2010) define it more exactly: intangibles are all the knowledge which company uses in value added creation. One of the most comprehensive definitions was given by Kristandl and Bontis (2005). They propose that intangibles are “strategic firm resources that enable an organization to create sustainable value, but are not available to a large number of firms”. They also mention that such resources are non-physical, non-financial and are not included in financial statements. Some studies use the terms “intangibles” and “intellectual capital” as synonyms. However we distinguish their meanings. The first is connected with the nature of the phenomenon while the second with managerial and accounting issues. Since the purpose of current paper is to reveal the companies with intangible-based potential of value growth, we hold to the term “intangibles”.

Ellis and Jarboe (2010) describe three models of financing for companies with intangibles. The paper underlines that investment funds and banks take into account intangibles while making financial decisions. However current investment methods need substantial improvement. Ellis and Jarboe conclude that intangible-based investing demands methods of intangible valuation. While the authors underline importance of intangibles they consider them from a theoretical viewpoint.

Jagannathan and Wang (1996) describe a CAPM that is modified in order to include human capital. They demonstrate that the inclusion of human capital explains cross-sectional differences in the average return in contrast to classic CAPM. Human capital return was measured using a proxy indicator: the growth rate of average employee salary. It underlines the importance of intangibles in explaining the return on shares. However intangibles consist of many elements and we suppose that theoretically all of them are able to transform into share returns. Therefore the results of Jagannathan and Wang’s research are of great importance, but their research idea should be expanded.

The papers of Lev and Sougiannis (1999), Chan et al. (2001), Chambers et al (2002), and Anagnostopoulou and Levis (2008) use portfolio comparisons to show the relationship between M/B ratio and R&D expenses. Chan et al. also analyses advertising expenses as a part of a company’s intangibles which influence the return on shares. However the other components of a company’s intangibles are usually ignored in forming a portfolio.

Summarizing the literature review we highlight the main drawbacks of the papers dedicated to the connection between intangibles and capital markets. Existing studies usually focus on one component of intangibles, such as human capital or R&D expenses. Intangibles are complex and extremely heterogeneous. All their components can influence a company’s outcomes and should be taken into account in the investment decision process. However, according to Kristandl and Bontis (2005) intangibles have non-physical, non-financial nature therefore their measurement is complicated. There is an extensive body of literature that analyzes the involvement of intangibles the work of a company. It avoids the measurement of intangibles and instead uses more valid indicators usually connected with value added (e.g. EVA, VAIC) and market value (M/B, MVA, Tobin's Q). While we discuss intangibles from a capital markets perspective, we choose a market value-based method.

Zeghal and Maaloul (2010), Orens et al. (2009), Youndt et al. (2004) show that M/B ratio of companies in developed countries has a robust positive relationship with intangible proxy indicators. Edvinsson and Malone (1997), Stewart (1997), Sveiby (1997), Bharadwaj et al. (1999) and Nold, (2012) show that M/B value can be used as an approximate measure of intellectual capital and the results due to intangibles?. They argue that the higher the coefficient of M/B the more intangibles a company has and consequently the more created value can be explained by the influence of intangible resources. Generally speaking M/B reflects knowledge creation based on investor expectations (Wu, 2008).

According to Brennan and Connell (2000), the coefficient has at least two weaknesses. First of all, spread between market and book value usually cannot be explained only by the influence of intangibles. The reasons are the limitations of accounting standards and market inefficiencies. Only the differences between refined book values and market values can be attributed to intangibles efficiency. Next the coefficient does not give any information about efficiency of intangible use. But since all intangibles proxies have limitations, and M/B ratio is successfully applied in the empirical research listed below, we suggest it is feasible under certain restrictive assumptions.

According to the previous discussion M/B ratio reflects the effectiveness of intangible implementation. In the process of picking investments the M/B or the inverse (B/M) is often used (e.g. Goyal & Welch, 2006; Lewellen, 2004; Campbell & Thompson, 2008). Fama and French (1992) laid foundations for the use of B/M ratio in finance. B/M coefficients explain cross-sectional variation in stock returns. Since then there has been a growing body of literature verifying the relationship between B/M ratio and stock returns. For example Kothari and Shanken (1997), Pontiff and Schall (1998) supported the same hypothesis about the Dow-Jones Industrial Average (DJIA): B/M of DJIA predicts market returns. Later Fama and French (1998) developed their primary idea and showed that stocks that are characterized by high B/M ratio (that is, a low M/B) have a higher return in the future. Moreover they found evidence of this hypothesis in different capital markets. Johnson and Soenen (2003) analyzed B/M influence on the other performance indicators and showed that companies with a high B/M have a higher Jensen's α, a higher share of economic value added in material assets and a lower Sharpe coefficient. Therefore M/B coefficient negatively relates to future share returns.

We can conclude that M/B is the indicator that represents the results of intangible use and predicts future share returns; this coefficient is used in the current research. Papers dedicated to the analysis of intangibles usually take into account their quantity (wage per employee, R&D and advertising expenses, etc.). From our point of view a more essential feature is their quality, in other words their ability to create value. The next section describes the method that distinguishes two attributes of intangibles based on their quality: being created by a company and or absorbed from the market.

3. Intangibles Creation-Absorption Model

To describe our intangible creation-absorption model, which can be used to choose investments on the basis of intangible quality, we first need to describe the main assumptions. It is assumed that:

1. The financial markets have semi-strong form efficiency. This assumption implies that all public information is calculated into a stock's current share price (Fama, 1970). All speculations are excluded from the analyses.
2. Book value is approximately equal to the cost of replacement. Company assets are revaluated at current prices.
3. M/B ratio reflects the effectiveness of intangible implementation. Consequently, the spread between market and book value represents the part of a company's value that is attributed to intangible efficiency.
4. Intangibles are heterogeneous. While there are a variety of intangibles classifications, in the current paper we divide them into created by company and absorbed from the market.
5. M/B ratio quickly reacts to changes in "systematic innovativeness". It means that M/B reflects all public information about innovations. Companies that are not able to innovate, absorb new knowledge from the market.
6. Companies that are able to create intangibles are more attractive for investors than those which absorb available knowledge from the market.

We calculate M/B as the ratio of company's market value (M) to book value (B). In turn market value consists of book value and some spread, named market value added (MVA) :

$$\frac{M}{B} = \frac{B + MVA}{B} = 1 + \frac{MVA}{B} \qquad (1)$$

According to the literature, for example Pulic (2000), MVA reflects the results of intangible use. That result can be divided into that created by company and absorbed from the market (the 4th assumption):

$$\frac{M}{B}=1+\frac{MVA}{B}=1+\frac{MVA_C+MVA_A}{B} \qquad (2)$$

, where MVA_C is the part of a company's MVA that is generated by intangibles created in company;

MVA_A is the part of a company's MVA that is generated by absorbed from the market.

While MVA_A is closely connected with the market, we can write the following equation:

$$\frac{MVA_A}{B}=\beta\cdot\left(\frac{MVA}{B}\right)_m \qquad (3)$$

, where $\left(\frac{MVA}{B}\right)_m$ is the ratio of market value added to book value of market;

β is the elasticity of company intangible use to market intangible use. It could be found as the coefficient of simple linear regression (6) or, in other words, by the following way:

$$\beta=\frac{\operatorname{cov}\left[\left(\frac{M}{B}\right)_i;\left(\frac{MVA}{B}\right)_m\right]}{\sigma_m^2} \qquad (4)$$

, where $\left(\frac{M}{B}\right)_i$ is the ratio of market value to book value of company;

σ_m^2 is the variance of $\left(\frac{MVA}{B}\right)_m$ value.

The coefficient β reflects intangible absorption and can take the following values:

- $\beta\in(-\infty;0)$. A company is negatively connected with market fluctuations. Considering the fact that we suppose M/B ratio to reflect the effectiveness of intangible implementation, it can be said that when the market is highly innovative, company cannot benefit from them and the company's M/B ratio declines, i.e. market innovations destroy the company's value. For example, new production technology can negatively affect value of companies that use old technology. Thus we accept that in case $\beta\in(-\infty;0)$ the absorption of intangibles destroys company market value.
- $\beta\in(0;1)$. A company has a positive but weak connection with market.

- $\beta \in (1;+\infty)$. A company's M/B ratio increases faster than market M/B ratios. The company successfully absorbs intangibles and has strong connection with the market.

$\frac{MVA_C}{B}$ is intended to be unconnected with market fluctuations. Therefore we find it through the estimation of the intercept of regression equation (4). We propose to mark it as *α*. It shows that company performs better (or worse) than expected by its correlation with market innovativeness. In other worlds, *α* shows the difference between the observed company and a company that only absorbs, and does not create, innovation. Statistically, this coefficient reflects intangible efficiency that cannot be explained by market movements connected with knowledge creation.

The coefficient can take the following values:

- α <0. The intangibles created by the company destroy its value. The company differs from the market, but if the company does not have unique features, (that is, if the company only absorbs knowledge), it will have larger M/B ratio.
- α >0. A company creates intangibles and effectively uses them to create value. In other worlds, the company's M/B ratio is larger than M/B ratio of company with the same *β* (or ability to absorb). Such a company has the ability to create value by knowledge creation.

Therefore we can write the following equation for OLS estimation:

$$\left(\frac{M}{B}\right)_i = (1+\alpha) + \beta_i \cdot \left(\left(\frac{M}{B}\right)_m - 1\right) \quad (6)$$

A company M/B ratio has a "knowledge-free" part equal to 1. This part is assumed to be M/B ratio of company that inefficiently uses intellectual capital so investors estimate its market value equal to its book value.

While the form of the InCAM model is similar to CAPM we should highlight their key distinctions. First of all we concentrate on intangible analysis. The aim of the current paper is to determine company differences in value creation using intangibles. We choose M/B value to measure the results of value creation since it is commonly used in similar research. CAPM is created and used to explain cross-sectional differences in share returns. Second, the ability of InCAM to pick investment goals on stock market is only one possible application of this method. It can also be used to benchmark companies by their application of intangibles or to analyze company development.

We suppose that companies with high α are the most attractive investment goals. They are able to create intangibles and effectively implement them. This assumption is checked in the following sections.

4. Data description

Initial sample

We examine monthly M/B ratio and stock prices from the Center for Research in Security Prices (CRSP) data for US companies in S&P500. The sample period is from January 2000 to January 2012. The choice of US companies is justified by the fact that the role of intangibles in the US is significant, according to the Knowledge Economy Index of the World Bank and the National Intellectual Capital Model (Lin & Edvinsson, 2008), which estimate the overall level of a country's development and the efficiency of its use of knowledge. We choose S&P500 companies because such stocks are more liquid than others (due to index construction methodology) and we assume that public information is the main fundamental factor which drives for S&P500 stock prices. Further details on M/B ratio and stock prices are available from CRSP.

Market ratio

All S&P500 companies were compared with a benchmark constructed by calculating an equal-weighted sum of the company's M/B ratios (all preferred stocks were excluded). We use equal-weighting method because it is the best in the context of Occam razor principle: there is no evidence for using capitalization-weighting, so the simplest way was chosen.

Summary statistics

Table 1 contains summary statistics for the monthly returns and the monthly M/B ratio. This table contains mean values for the given dates. For example, in 2001 the mean return for all S&P500 companies during the year is 0,59%, there was 5035 observations (because monthly data is considered). The same is for M/B ratio.

There is no clear trend in returns and M/B ratio. As expected, both returns and M/B ratio decline during the crisis. As there is no clear trend, it can be supposed that cross-sectional variation is more significant than time variation: even for the crisis period (2008-2009), which is supposed to be homogeneous, the returns are similar in absolute values, but are of the reverse sign. The correlation between returns and M/B ratio is negative (-19%), but statistically insignificant (t=-0.6243).

Tab. 1. Summary statistics for monthly returns and monthly M/B ratio.

Date	Returns		M/B	
	mean	N obs	mean	N obs
2000	-	-	2,2552	5354
2001	0,59%	5035	1,6218	5992
2002	-1,39%	4712	1,4090	6090
2003	3,08%	5735	1,3405	6103
2004	1,54%	4817	1,5165	6150
2005	1,13%	5790	1,5388	6168
2006	1,32%	5756	1,5657	6168
2007	0,59%	5719	1,5477	6168
2008	-3,37%	5712	1,2090	6163
2009	3,44%	5721	0,9768	6168
2010	3,42%	4769	1,1313	6168
2011	0,05%	5721	1,2138	5680
2012	5,42%	476	1,3316	6

This table contains the mean values for the given dates. For example, in 2001 mean return for all S&P500 companies during is 0,59%, there were 5035 observations (because monthly (not yearly) data are considered). The same is for M/B ratio.

5. Methodology

α estimation

To evaluate *α* the following equation was estimated with OLS:

$$\left(\frac{M}{B}\right)_i = (1+\alpha) + \beta_i \cdot \left(\left(\frac{M}{B}\right)_m - 1\right) \qquad (7)$$

However, *α* estimation is not a sufficient result. It is essential to prove that high-*α* companies create value and are attractive for investors (which is the main practical application of our framework). To create a portfolio the dynamics of *α* are required. That is the reason we use a rolling window of 50 months and estimate 95 (this is the length of the out-of-sample period) *α* values for each company. The size of window is chosen simply to keep the initial subsample estimation period long enough, however, our results are robust for other window sizes (results are available on a request).

It is important to discuss the endogeneity problem, especially because OLS without IV was used. Two reasons for endogeneity are possible here: the interdependence between benchmark M/B value and the missing variable affecting both sides of the equation. Addressing the first reason, our benchmark is equal-weighted, so the influence of one company on the whole benchmark is minimized. Addressing the second reason, we can conclude that the "systematic innovativeness" is a potential source of endogeneity (the systematic risk in CAPM estimation is a good analogy). So, the main question is how long it takes the market M/B ratio, as our benchmark, to reflect changes in "systematic innovativeness" (e.g. new discoveries like the internet which affect the whole market). In this paper it is supposed that all public innovations are reflected in market M/B ratio.

Luck vs. skill

After α estimation we need to ask whether α significantly differs from null. To answer this question, we need a proper α inference. In this setting, the main reason why the bootstrap is necessary for proper inference is the propensity of an individual company to exhibit a non-normally distributed M/B ratio. These non-normalities arise for several reasons. First, the distribution of the M/B ratios may be non-normal. Second, the market ratio may be non-normal, and co-skewness of the market and individual M/B ratio may obtain. Further, individual ratios exhibit varying levels of time-series autocorrelation in the M/B ratio.

Thus normality may be a poor approximation in practice, even for a fairly large sample. Bootstrapping can substantially improve on this approximation, as Bickel and Freedman (1984) and Hall (1986) show.

The chosen bootstrap procedure is based on the work of Kosowski el al. (2006). For each company *i*, we draw a sample with a replacement from the residuals, which were saved in the first step when estimating companies α and β. Next we create a pseudo time series of the resampled residuals, $\widehat{e}^{b}_{i,t_\varepsilon}, t_\varepsilon = s^{b}_{T_{i0}}, \ldots, s^{b}_{T_{i1}}$,where *b* is an index for the bootstrap resample number, and where each of the time indices $s^{b}_{T_{i0}}, \ldots, s^{b}_{T_{i1}}$ are drawn randomly from $T_{i0}, \ldots, T_{i1}$ in a way that reorders the original sample of $T_{i0} - T_{i1} + 1$ residuals for company *i*.

Next, we construct a time series for the pseudo M/B ratio for this company, imposing the null hypothesis of zero true performance ($\alpha = 0$, or, equivalently, $\beta = 0$) and taking the benchmark at the same time as residual:

$$\left(\frac{M}{B}\right)^{b}_{i,t} = 1 + \hat{\beta}_i \cdot \left[\left(\frac{M}{B}\right)^{m}_{t_\varepsilon} - 1\right] + \widehat{e}^{b}_{i,t_\varepsilon} \tag{8}$$

For $t = T_{i0}, \ldots, T_{i1}$ and $t_\varepsilon = s^{b}_{T_{i0}}, \ldots, s^{b}_{T_{i1}}$. As equation (4) indicates, the artificial M/B ratio has a true α (or β equivalently) that is zero by construction. When we regress this ratio for a given bootstrap sample, *b*, on the market ratio, a positive estimated α (or β, equivalently) may result, since that bootstrap may have drawn an abnormally high number of positive residuals, or, conversely, a negative α (or β equivalently) may result if an abnormally high number of negative residuals are drawn.

Next we repeat the steps describes above across all firms $i = 1, \ldots, N$ for describing the cross-section of bootstrapped α (and β equivalently). Repeating this for all bootstrap resampling simulations, $b = 1, \ldots, 1000$, we build the distributions of these cross-sectional draws of α and β.

Portfolio construction

As mentioned above, to show the practical implications of the proposed approach a portfolio based on α was created. Our portfolio starts in March 2004. It is rebalanced each month according to the following procedure:

1. *A* of current subsample of *[t – window, t]* are estimated.
2. The bootstrap procedure is implemented to check if α are results of skill (not luck).
3. Companies with a positive α and skill are chosen.
4. Asset weights of the portfolio are calculating as α-weighted.
5. At time *t+1* portfolio contains only (3) companies with (4) weights.
6. Next period go to (1).

The result is time series of the portfolio, hereafter the InCAM portfolio. We compare the return and risk of the InCAM portfolio with return and risk of S&P500 index as a commonly accepted benchmark of market performance. It should be noted that transaction costs, liquidity and other important details are excluded from the discussion as the main goal of this paper is to analyze InCAM, not to offer a complete trading strategy. Correspondingly, the benchmark of InCAM portfolio is S&P500 index, which does not take into consideration transactions costs, either.

6. Empirical Results

All the calculations described below were made using the statistical package R. Note that we analyze companies included in S&P500 index for 12 years. The total number of analyzed companies is 514 because the structure of S&P500 changes each year.

After implementing the methodology described above we receive the α values. Their distribution is represented in Figure 1. The descriptive statistics of α are reported in Table 2.

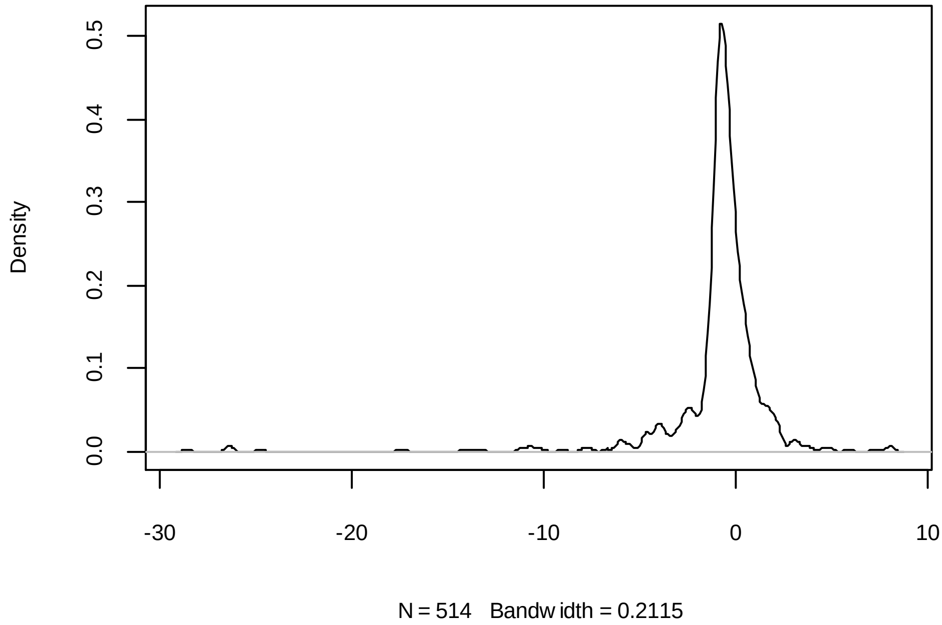

Fig. 1. The distribution of α

Tab. 2. The descriptive statistics of α

Minimum	1st quantile	Median	Mean	3rd quantile	Maximum
-28.56	-1.101	-0.6514	-0.9798	-0.0033	8.041

The mean and median values are negative but close to zero. It means that the majority of companies are not able to create knowledge and any knowledge created by them destroys value. The distribution has long left tail. Therefore our sample includes companies with a large negative value of α, which means that creators can substantially decrease their M/B ratio. Knowledge creation is risky: a company that does not follow the market can destroy its value and decrease M/B.

After evaluating α, we implement the bootstrap procedure and determine whether the α is the result of luck or skill. The indicator of skill (pink line) is reported on the lower part of the Figure 2. The upper part represents the corresponding value of α that was grouped by the progressive total (black line). The skill indicator line takes lower position if the α results from the luck and higher position if the α results from the skill. The figure reveals very important conclusion: all skilled companies are characterized by positive α. It means that negative α is always the result of chance while the positive α is mostly merited. Note, however, that the positive α is not necessarily the result of skill. We have a number of companies (lower right) that have positive α because of the luck.

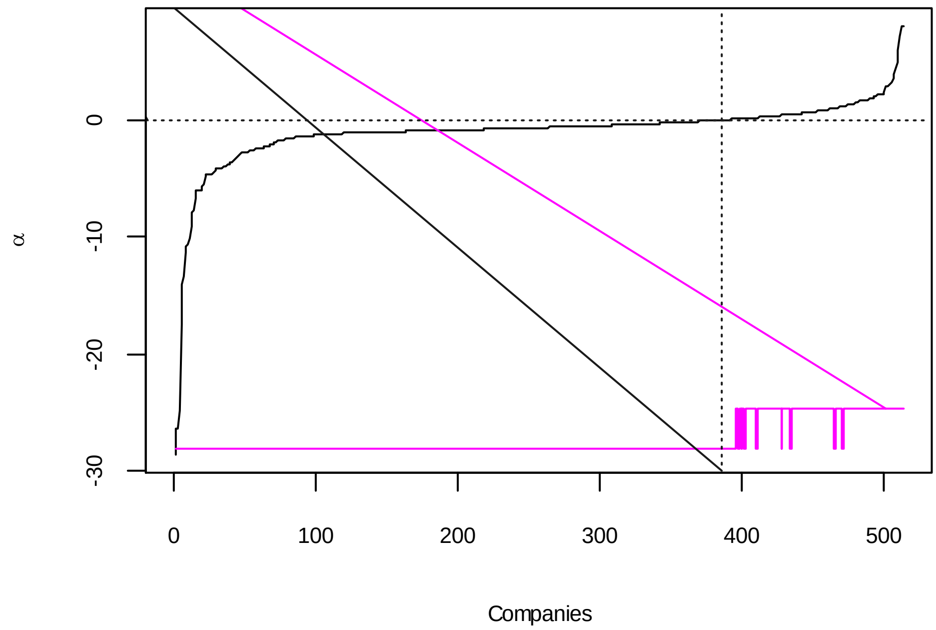

Fig. 2. Skill indicator line (pink) and the corresponding values of α (black)

Finding a close connection between skill and positive α value can be also corroborated by the correlation analyses. The correlation between α and skill is significantly positive (0,39); t-statistic is 12,79. Therefore if a company is skilled and creates knowledge it leads to increase in M/B.

Only 113 companies of our sample (that is approximately 22%) have the skills to create knowledge. It is a surprising finding: we analyze well-known, stable and liquid companies, however less than a quarter of them create knowledge.

To validate the analysis we made brief cases studies. The most interesting companies (the so-called “skilled creators”) are characterized by a positive α that is the result of skill. Our examples are Netflix Inc., Intuitive Surgical Inc., C.H. Robinson Worldwide Inc.

Netflix is an American provider of on-demand Internet streaming media. It was created in 1997 to organize a DVD-by-mail service during the VHS era. Netflix recognized the potential of DVDs and created new kind of service. The innovation used by Netflix nowadays is “Video on demand”. The company permanently improves the quality of its network capacities by using innovation. As a result approximately 30% of all downloaded US internet traffic is films and TV shows watched through Netflix “Video on demand”. The Canadian company Sandvine mentioned in their report (2011) that Netflix fundamentally changed the internet market. Therefore it can be called a “skilled creator”.

Intuitive Surgical Inc. manufactures robotic surgical systems. It is the leader of the industry. Intuitive Surgical Inc. developed their surgical system named the da Vinci Surgical System and has installed 2799 systems worldwide as of July 2013. The company has 1250 US and foreign patents and more than 1150 US and foreign patent applications. It creates knowledge as a result of skill implementation.

C.H. Robinson Worldwide Inc. is large transportation and logistics company. It does not patent any research and development results like Intuitive Surgical Inc. or use a unique idea like Netflix. However C.H. Robinson Worldwide uses network development and relationships with approximately 56,000 transportation providers worldwide. Relationships with company stakeholders are the part of its intangibles. Therefore C.H. Robinson Worldwide creates knowledge by building trusting relationships, and co-operating with a large number of providers.

“Skilled creators” like the examples described above are potentially attractive for investors. Investor expectations can be met in market value and measured by return, Sharpe coefficient, Jensen’s α, drawdown, etc. Three indicators are used to evaluate the results of investments: mean return, Sharpe ratio and maximum drawdown (Tab. 3). The Sharpe coefficient is used to take into account both profitability and risks. Drawdown is a more practice-oriented indicator. The cumulative return of analyzed portfolios is presented on Figure 3 below.

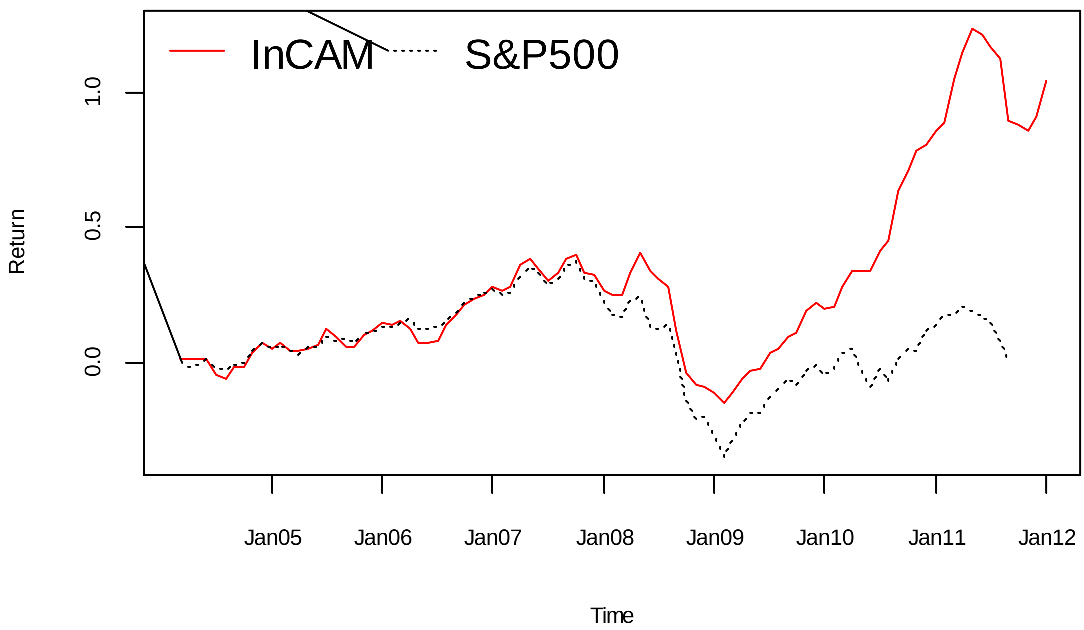

Fig. 3. Cumulative return of InCAM and S&P500 portfolios

The cumulative return of the InCAM portfolio is higher than the S&P500 return for most of the analyzed interval. Another important finding is that the return of the InCAM portfolio started to exceed S&P500 significantly during financial crisis of 2008-2009. The recovery period is also characterized by higher InCAM cumulative return. We conclude that "skilled creators" performed better during the crisis. Their independence from the market movements allows them to maintain market share, turnover and correspondingly the support of investors.

Tab. 3. Portfolio comparisons

	Mean return	Standard deviation	Maximum drawdown	Sharpe ratio
InCAM	5.476%	0.0049	0.5513	0.11
S&P500	31.95%	0.0438	0.7225	0.073

Table 3 presents the results of portfolio comparisons. The algorithm of portfolio construction was described above. The mean return of S&P500 is higher than the return of the InCAM portfolio. However the InCAM portfolio has a much lower standard deviation. As a result the InCAM portfolio is characterized by a higher Sharpe coefficient. We also found that "skilled creators" have lower drawdowns. The results show that the combination of skill and the ability to create knowledge allows companies to reduce possible risks. Investors do not evaluate them at a higher rate therefore their return is less then S&P500 portfolio return. However they considered such companies as less risky, especially during the crisis.

7. Conclusions and discussion

The literature review shows that methods of portfolio forming based on intangibles are limited by the use of one component of intangibles: human capital, R&D expenses or advertising expenses. Moreover papers dedicated to intangible analysis usually take into account their quantity (wage per employee, R&D and advertising expenses, etc.). From our point of view a more essential feature of intangibles is their quality, in other words their ability to create value. That is why we propose a method that distinguishes two attributes of intangibles based on their quality: created by a company and absorbed from the market. The method predicts which companies have value growth potential on the basis of their ability to create knowledge.

We propose an instrument, which can divide a company's ability to create and absorb intangibles. According to Stewart (1997), Sveiby (1997), Nold (2012), companies that create intangibles raise the P/B ratio and, therefore, are attractive for investors. Using our model for making investment decisions, it is necessary to explicitly control for a potential "data snooping" bias: "there is always the possibility that any satisfactory results obtained may simply be due to chance rather than to any merit inherent in the method yielding the results" (White, 2000). We examine the statistical significance of the performance and performance persistence of the "best" and "worst" companies with a flexible bootstrap procedure applied to InCAM. The proposed algorithm was used on a database which consists of S&P500 companies and covers the period from 2000 to 2012.

The pivotal findings of InCAM implementation into portfolio forming are the following:

– The sample consists of the smaller share of "skilled creators". Only 22% of companies have skills to create knowledge. Also companies' median ability to create knowledge is negative. Therefore, despite the fact that we analyze well-known, stable and liquid companies from S&P500 index, the majority of them are not good investment goals. Their success cannot be explained by knowledge creation and they are highly correlated with market movements.

– All skilled companies are characterized by positive α. Companies have negative α as the result of chance while the positive α is mostly merited. Therefore we can hypothesize that investors usually positively evaluate the potential of growth of companies that create knowledge non-randomly.

– Portfolio comparison shows the availability and validity of InCAM use for picking investments. The InCAM portfolio demonstrates higher cumulative returns, Sharpe ratio and a lower drawdown than S&P500. The InCAM portfolio success is based mainly on reduced risks rather than higher returns. That means that "skilled creators" do not ensure higher profitability in comparison to other S&P500 companies. However they are less volatile, especially during the crisis.

– The results underline the increasing importance of intangibles for investors during the crisis. While exogenous shocks influenced both creators and absorbers, we found that intangible creation prevents a drop of company market value. The idea that company intangibles are of great importance during an economic recession is widespread. Current research extends the understanding of the role of intangibles during a crisis by the fact that created knowledge is more profitable than other intangibles.

The limitations and shortcomings of the study should be enumerated. The first limitation is connected with taking into account transactions costs. Both the InCAM portfolio and S&P500 index are analyzed without transaction costs. The second shortcoming is the benchmark construction. It was decided to use equal-weighted sum of company M/B ratios. The third is connected with the difficulties of α, β, and luck and skill estimation. Using InCAM would require the use of the bootstrap approach in order to determine “skilled creators”. Therefore the benefits and costs of InCAM implementation should be measured prior to calculations.

Suggestions for future research are mainly connected with improvements of portfolio comparisons and regression estimation:

- to use a cross-sectional bootstrap method that can deal with cross-sectional correlations in company M/B ratios;
- to take into account another period. Portfolio formation in the recovery period may show interesting results;
- to test another sample. We tested InCAM on a sample of US companies that are included in S&P500 index. However the fit of InCAM should be tested in other capital markets and for SMEs. We hypothesize that the results would be worse because the other markets are less perfect and do not reflect investors expectation based on intangibles analysis as well.
- here we are estimating our model according to statistical criteria, but it is more trustworthy to build a trading strategy based on InCAM and calculate economic profit taking risks and the costs of investment.

In summary, our research shows the need for differentiating companies’ abilities to create and to absorb intellectual capital. A company’s α seems to be at least one investment benchmark, but it is necessary to evaluate its persistence, bootstrapping helps us to reduce (but does not eliminate) problems with ex post sorts as described above.

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