THE INFLUENCE OF INDEPENDENT DIRECTORS, INSIDER OWNERSHIP AND SCIENTIFIC CONNECTIONS ON RISKY R&D INVESTMENTS: EVIDENCE FROM EMERGING MARKETS

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Abstract

R&D projects in the pharmaceutical industry are extremely risky and bring benefits in the long-run period. Self-interested managers try to avoid risk and underinvest in R&D. In this paper we study the effect of independent directors, insider ownership and scientific connections on R&D investments. Independent directors and insider ownership can mitigate the agency problem by additional monitoring and convergence of interests. Scientific collaboration promote technological development and increase R&D.

The research reveals the difference of the effects in emerging and developed markets.

In emerging markets the proportion of independent directors is positively connected with R&D investments. Such results can be explained by the fact that independent directors monitor risk-averse managers that underinvest in risky but perspective projects. Scientific connections significantly positively influence R&D investments. Empirical evidence also shows that companies with a higher proportion of independent directors have more collaborations with scientific institutions in emerging markets. Insider ownership also has no significant influence on R&D investments. Such a result can be explained by the fact that not all the insiders can influence the investment process. Moreover, beneficial owners can lack industry specific knowledge that allows them to monitor the process.

In developed markets the situation is different. The proportion of independent directors is associated with lower R&D investment intensity. As R&D investments are extremely high in developed markets, we suppose that the overinvestment problem can exist. Thus, better corporate governance can decrease the investments closer to an optimal level. Scientific connections and insider ownership are not a significant factor.

The research has wide policy implications. The results can be used by shareholders and government regulating institutions in creating optimal management structures.

Key words: independent directors, corporate governance, R&D investments, insider ownership, scientific connections, emerging markets

JEL: G32, G34.

Introduction

R&D investments are one of the major drivers of successful development and value creation of high-tech companies all over the world. R&D investments usually differ from capital expenditures in extremely low predictability of future cash flows. The higher the level of uncertainty is, the more significant the role of decision makers is. R&D investments depend not only on fundamental factors, but also on management incentives and attitude toward risk. In risky environment, corporate decisions are influenced not only by personal characteristics of managers, but also by corporate governance mechanisms and shareholders' intervention.

Since Jensen and Meckling (1976) research, the agency problem is often discussed in terms of situations where managers' incentives do not correspond to shareholders' interests. The study conducted by Brenner (2015) shows that managers often try to avoid risk; Brochet et al (2015) show that managers' planning horizon is usually short-term. Lu and Wang (2015) show that if managers are not sure about the outcome of the project, they would rather avoid it to save their reputation and posi-

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tion. Such evidence advocates that corporate governance mechanisms and shareholders' monitoring is needed to prevent investments from distortion.

In this paper we investigate the role of independent directors, insiders' incentives and scientific connections for corporate R&D investments in developed and emerging markets. Following Luoma and Goodstein (1999), we define independent directors as members of the board who have no material or personal interest in the company. We define insider ownership as company share that is owned by people that have access to inside information. Scientific connection is defined as existence of a company's collaboration with a scientific institution.

We analyze data from pharmaceutical and biotechnological industries, because R&D investments are crucially important in this sector. In these industries innovations are substantial not only for particular companies, but for the industry development. We expect the effect of corporate governance and insider ownership to be more significant in emerging markets because of weaker institutional regulation and lack of specific traditions of investment decision-making process.

The facts show that market perceives independent directors as a really important factor for the company's success, especially in risky and volatile industries, where the agency problem is urgent. The analysis of recent news shows that the appointment of independent directors leads to changes in the firm strategy and positive stock price dynamics. The most bright and recent example is Valeant Pharmaceutical history. The US pharmaceutical giant had problems with management and strategy in 2016. Lack of control led to opportunistic behavior and strange schemes that were perceived by market as close to fraud. The company lost more than half of its value during the last 12 months, but the appointment of additional independent directors pushed the stock up[1]. Analysts from Goldman Sachs and JP Morgan connect such price increase with expectations of future better operations, i.e. independent directors should mitigate the agency problem, decrease the investment distortion and bring more R&D to the company. The example shows that there is strong practical motivation for the research: empirical evidence can become foundation for rational decision-making and beneficial policy recommendations.

To sum up, this research is relevant for regulators, investors and analysts. Firstly, regulators can establish rules (for example, the minimum percentage of independent directors in the Board) that improve company's operations. Secondly, shareholders can get the information on the better corporate governance and create a better Board. Thirdly, analysts can achieve evidence that helps them correctly estimate the influence of a higher proportion of independent directors on R&D investments and make better valuation.

The structure of the paper is the following. In Section I we present existing literature review. In Section II we reveal the details of empirical research such as hypothesis, data detail, methodology and empirical results. In Section III we propose potential explanation of our main results. Section IV presents conclusions.

Literature review

Risky R&D investments influence a firm's performance. This factor is vital for highly technological firms, as their success depends on their technological advantage. Due to significance of R&D investments scholars try to determine factors that can influence investments and innovation activity of companies.

Existing literature considers two major groups of factors that influence the corporate investment process: financial determinants and behavioral factors. Financial factors are important as they describe objective characteristics that influence corporate investment activities, for example corporate budget constraints. Behavioral factors are also important because they reflect incentives of the parties that can influence the investment process.

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[1] 9 March 2016. Three additional independent directors were appointed, VRX was traded 4% up premarket just after announcement of the news, source: Businessinsider.com http://www.businessinsider.com/valeant-adds-independent-board-directors-2016-3

Objective factors

Financial factors that objectively influence investments are usually analyzed in terms of the corporate structure that is more favorable for financing large projects. The most common factors that can influence investment activity are factors that define budget constraint.

Firstly, this is free cash flow that the firm generates. A large number of studies, starting from Fazzari et al (1988), suggest that there is positive effect of higher free cash flow on investment activity. In case of perfect markets there should be no tight connection between the internally generated cash flow and investment volume, but in reality companies usually have significant costs of raising the money and placement of free funds on the external capital market. Such market inefficiency was described by Richardson S. (2006). According to Richardson's research, firms with poor free cash flow tend to underinvest, while companies with significant free cash flow tend to overinvest. Gupta and Bhatia (2016) investigated Indian companies in the period of 2004-2012 and showed that both free cash flows and cash holdings positively influence corporate investments. Alti (2003) proposed that free cash flow not only serves as a budget constraint proxy, but also signals of investment opportunities, as successful companies with higher free cash flow have more professionalism and connections that broaden a possible investment set.

Secondly, cost of financing matters while making investment decision. If the company can attract funding with minor costs, it can accept the projects with a moderate rate of return. Frank and Shen (2016) empirically demonstrated that a weighted average cost of capital (WACC) is negatively related to corporate investment. The regression model showed that higher implied costs of capital are associated with fewer investments. This finding is in line with the research conducted by Richardson S. (2006). However, for companies from volatile sectors, such as pharmaceuticals and biotechnology, WACC not only shows the cost of capital, but also can be used as a proxy for company's current and forward risk. For highly volatile companies high WACC highlights risky strategy that implies higher risky investments. Such an effect of forward-looking WACC interpretation was proposed by Lorenz et al (2015). In their research they demonstrated that future plans and strategy should be taken into consideration and WACC can be treated as a proxy for "risk appetite".

Lee and Choi (2015) analyzed financial determinants of the corporate R&D investments in the pharmaceutical industry. They investigated the influence of liquidity ratio, debt ratio and ROI on the R&D intensity of Korean pharmaceutical companies during the period from 2000 to 2012. Linear regression analysis showed that the liquidity ratio positively influences R&D investments, while debt ratio has a negative effect on R&D intensity. Such a result is in line with the expectations that companies with higher liquidity have more resources to finance the R&D process, while companies with high leverage have fewer opportunities to attract additional capital to finance more projects. The authors have not revealed significant connection between ROI and R&D investments. The explanation of such a result is based on specific features of the industry, where clinical-stage companies do not generate any revenue and imply significant loss. Thus, the investment process is forward-looking and current ROI does not determine R&D budget.

Subjective factors

Behavioral factors play specific role for R&D investments. Such investments are very risky and the outcome is hard to predict. The main parties involved in the investment-decision process are managers and shareholders.

Managers Incentives and Board Composition. It is important to note that managers have their own incentives which can be different from shareholders' interests. The research conducted by Brenner (2015) proposes the empirical evidence that managers often try to avoid risk. The option exercising data (1996 to 2008) was taken as a proxy for risk aversion in the regression analysis. Another important concept is planning horizon. Considering managers' planning horizon the concept of «managerial myopia» is usually used. This term describes that short-term preferences are more important for managers. Brochet et al (2015) studied the conference calls with executive managers and disclosure channels and determined that the myopic behavior is typical of managers. Chowdhury and Sonaer

(2015) constructed a theoretical model of management myopia which shows that managers prefer short-term profit to firm-value maximizing behavior. One of the reasons that intensify such an effect is compensation on the current financial results. Such a system creates incentives to decrease the risky R&D expenses that are not necessary for short-term operations. This improves current financial results and minimizes the risk of negative outcome in the future that can negatively influence managers' reputation. According to such managerial incentives and information asymmetry, the agency problem arises, which was described by a significant segment of scientific research (Holderness et al., 1999; Kole, 1995; Morck et al., 1988; Schmidt, 1975 etc.). Existing literature shows that managers are not diversified and more risk-averse than shareholders. (Amihud and Lev, 1981; Hirshleifer and Thakor, 1992). Managers try to protect their reputation and wealth and avoid risky investment that can have negative outcome. Ben-Zion (1984), Bhagat and Welch (1995) and Kothari et al (2002) showed that myopia and risk-averseness of managers increased with uncertainty of the project's outcome.

Moreover, uncertain R&D projects which are hard to evaluate imply additional efforts to analyze. Thakor (1993) research shows that managers try to avoid such investments that are associated with more efforts, high risk and less current benefits.

Prior research has also proven that managers use R&D budgets to adjust company's financial result to the target. They try to avoid earnings disappointment, such as earnings decreases (Bushee, 1998) and negative surprises (Bange and De Bondt, 1998). Graham et al (2005) survey shows that over 80% managers would rather cut R&D investments to get the target financial results, 55.3% managers would simply delay the R&D project run.

Insider ownership and R&D investments. In emerging markets the external regulation and business transparency are not well-developed and such factors as managerial ownership and shareholders' monitoring matter. Thus it is important to investigate the effect of insider ownership on R&D investments. In the current research, insider ownership is analyzed as a proportion of shares outstanding held by managers and beneficial owners[2] .

Positive relationship between managerial ownership and corporate performance arises from the agency problem (Lambertini and Mantovani, 2010, Jensen and Meckling, 1976). Managers who do not own stocks have incentives to maximize their own utility regardless the interests of shareholders. Thus, managerial ownership converges with interests of managers and shareholders and positively influences corporate performance. The investigation conducted on UK companies by Crossan (Crossan, 2011) showed positive connection between insider ownership and performance.

At the same time, Morck et al. (1988) shows that relationship between managerial ownership and corporate performance is non-linear. The relationship is positive if management owns a proportion in a range of 0-5% of shares outstanding, and it is negative if managers own 5-25% shares outstanding and positive for board ownership above 5%. The scholars describe such effect by entrenched effects that can be observed when managers hold 5-25%. Such an effect is characterized by management entrenchment. Managers own a stake of the company which is not big enough to make their interest close to shareholders' ones, but they gain more power that can negatively influence the firm's performance.

Conversely, the analysis of Romanian companies conducted by Vintila and Gherghina (2013) found out negative connection between insider ownership and investment efficiency. Although the authors tested a non-monotonic model, they have not registered any positive effect of insider ownership. Vintila and Gherghina explained their results by prevalence of the entrenchment effect during the observed period (2007-2011). Although the majority of previous research identified positive influence of insider ownership in developed markets, the analysis of companies in emerging markets shows that the entrenchment effect can prevail.

Thus, there is no one clear influence pattern and the effect of insider ownership in high-tech industries should be further investigated.

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[2] Shareholders with a stake more than 10% of the company.

High probability of occurrence of agency problems requires the establishment of mechanisms for their mitigating. One of the main mechanisms that can mitigate agency problems is an independent board of directors.

Proportion of independent directors in the Board

Independent directors have no material or personal incentives in the company (Luoma and Goodstein, 1999). Their incentives are supposed to be close to those of shareholders. Thus, a higher proportion of independent directors in the board should mitigate the described above managers-shareholders agency problem. Existing literature shows that both positive and negative effects of independent directors can exist.

The positive effect is mostly associated with the fact that independent directors can objectively estimate the projects and do not require additional risk premium. They do not worry about financial targets, bonuses and their position. Dong and Gou (2010) showed that the increasing number of independent directors leads to more R&D investments. Osma (2008) also studied independent directors-R&D investment relationship and proposed empirical evidence that independent directors can mitigate opportunistic behavior of managers and reduce opportunistic decreases of R&D investments.

Other studies show that independent directors can negatively influence R&D investments. The main reason for such an effect is the lack of information accumulated by independent directors. Gilson and Kraakman (1991), Hill & Snell (1988), Hoskisson at al. (2002) propose that independent directors have very high costs of information gathering and rely only on financial data on investment projects. Due to the fact that they have no company specific understanding of the investment process they distort R&D investments. Beekes et al (2004) formulated conditionals that are necessary for the positive influence of independent directors on the corporate investment process. The first one is incentives to monitor managers' decisions. The second condition is sufficient knowledge that allows for understanding investment opportunities and professionally correct management plans. The third condition is recognition that managers have incentives to underinvest in R&D projects to avoid the risk and improve financial result. Such understanding motivated to formulate a personal objective opinion, which is not based on the management point of view. Bhagat and Black (1999) and Peasnell et al. (2000) highlight that the second condition is often hard to meet and without it independent directors do not improve the investment process. Adams and Ferreira (2007) propose that additional monitoring from independent directors is hostile to managers and they will less likely rely on the Board advice. The critical case is not a friendly management board limiting information for independent directors and increasing information asymmetry that negatively influence the investment process.

Recent studies on corporate governance in high-tech show that the first effect is most common. Following the logic of Peasnell et al. (2000), this means that independent directors have sufficient incentives and competence to monitor managers. The result is a positive connection between the proportion of independent directors and corporate R&D investments.

Lu and Wang (2015) promote empirical evidence that a higher proportion of independent directors positively influences R&D investments in the developed markets. They built the regression for the USA firms and found out that a higher proportion of independent directors increases R&D investments and decreases capital investments. Such results can be treated as the evidence that corporate governance mechanisms can mitigate the agency problem, which is characterized by overinvestments in tangible assets and underinvestment in R&D. Excess capital expenditures are often explained by managers' incentives to «build the empire» and have more assets under control (Harford, 1999; Lang et al, 1991). ADdecreage if capital investments and increase in R&D investments in companies with a higher proportion of independent directors can be a signal of a more optimal investment structure.

Existing literature possesses sufficient empirical evidence that the proportion of independent directors positively influences company performance (Liu et al, 2015, Bradley and Chen, 2015, Aras

2015). These results do not directly show that independent directors improve investment efficiency, but these results can be treated as a proxy of overall efficiency of such a corporate governance feature.

Scientific connections. Equity analysts in investment banks usually pay extra attention to companies' scientific connections. Scientists are people who are interested in scientific development and less interested in revenue generations. Equity analysts mention that it is logical that wider scientific collaboration may push R&D activity up, but their efforts can be blocked by risk-averse management (Brenner, 2015). There is little research that analyses the final effect of scientific connections, and additional empirical analysis is needed.

Scientific connections are extremely important in pharmaceutical and biotechnological industries because they comprise a kind of resources for product development. A company bears costs while choosing a partner and establishing such a connection. However, if collaboration is successful, the company with scientists can develop a breakthrough technology that will gain the market.

We suppose that both positive and negative effects of scientific connection exist. The explanation for the positive influence is connected with new high-tech technology that can be developed only by professional scientists. The negative effect can appear because scientists often have aspiration to investigate issues that have scientific valu, but cannot be commercialized and bring success to the company. We expect the positive effect to prevail because scientific connections are usually established in order to develop a concrete product, and scientists usually have milestones that they should meet. Thus scientists have development programs that guide their research.

Empirical study: hypotheses, methods and sample

Hypothesis

We believe the level of R&D expenses depends significantly on the features of the decision-making process. R&D investments in pharmaceutical and biotechnology industries are risky and different parties have different incentives that are led by risk-averse nature, scientific interest and ambition to invent a product that will generate revenues. The main participants of the investment decision-making process are managers, shareholders and scientists. Let us consider their motives and behavior while making an investment decision, one by one.

Managers

Managers who make the decisions about investments have motives to invest less in risky projects.

Firstly, they worry about their position. R&D projects are extremely risky. Although managers have more access to insider information, they cannot certainly predict the results of scientific trials. Unsuccessful investments can be treated as the result of lack of competence, and managers try to avoid such situations (Kothari et al, 2002).

Secondly, a manager's salary often depends on the firm performance. bonuses can be connected with the revenue for the period. As R&D expanses decrease the revenue and are not necessary for getting result in the short-term period, managers do n't want to keep them at a high level.

Thirdly, the results of R&D projects make a firm prosperous in the long-time period. Often some years are needed to get the result of inventing a new product or technology. Managers are not sure about their positionnin the long-term period and do not always think about long-run perspectives (Brochet, et al 2015).

Due to these reasons managers tend to invest less in R&D. Advanced corporate governance is proposed to mitigate the described problem.PThe percentage of independent directors on the Board is considered as one of the main factors that can make decisions taken by managers less distorted.

Proportion of independent directors in the board. Independent directors have no material or personal interest in the company and they can fairly estimate risks of the project and benefits it can yield (Osma, 2008).

Hypothesis 1: *There is positive relationship between a proportion of independent directors and R&D investment intensity.*

Shareholders

Shareholders are interested in long-run company perspectives and fundamental firm value. It is important to understand the profile of peopls that invest in volatile risky companies. They prefer to get high return on the projects which imply significant risk. This means that they would like to have wide research activity that can result in developing the product that can generate significant revenues. Managerial ownership increases the planning horizon, which positively influences risky R&D investments. Managers become personally involved in the company's development process (Lambertini and Mantovani, 2010).

Hypothesis 2: *ThePpercentage of insider shares is positively associated with R&D investment intensity.*

Scientists

Scientists are always involved in the R&D process in pharmaceutical and biotechnology industries. TheMmajority of companies have the group of researchers in the company. Some companies additionally cooperate with scientific institutes and research universities. Scientists are people who are interested in technology development and have less interest in revenue generation. This gives additional incentive to invest more funds in R&D.

Hypothesis 3: *Scientific connection is positively associated with R&D investment intensity.*

It is important to note that the connection with scientific community can be linked to corporate governance and insider ownership. Institutes and research universities have special knowledge and scientific expertise that can be beneficial for an innovative pharmaceutical and biotechnological company. Thus, a lot of insiders that own share of the company and a higher proportion of independent directors can promote more scientific connections to bring accelerated development.

Hypothesis 4: *There is positive relationship between a proportion of independent directors and scientific connections.*

Methodology

In the paper we estimate the effect of independent directors, insider ownership and scientific connections on R&D investments in risky industries.

As a proxy for R&D investments we use R&D expenses intensity (R&D expenses divided by total assets), because this metric presents the volume of money spent on R&D.

We approximate the effect of independent directors as a proportion of independent directors on the board. The share of independent directors shows the degree of outside influence on corporate decisions.

Insider ownership is approximated as a proportion of shares held by managers and beneficial owners[3]. The metric includes two effects. Firstly, higher managerial ownership leads to conversation of managerial and shareholders' interests and the agency problem mitigation. Secondly, bigger beneficial ownership leads to concentration of shareholders value in the firm. Such owners are personally involved in the company's life and conduct stronger monitoring.

Scientific connections are registered if a firm declares that it collaborates with Research University or Scientific Institute. Due to lack of information we can register only the existence of connection and we cannot estimate the collaboration power.

Table I presents' the description of variables.

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[3] 9 March 2016. Three additional independent directors were appointed, VRX was traded 4% up premarket just after announcement of the news, source: Businessinsider.com http://www.businessinsider.com/valeant-adds-independent-board-directors-2016-3.

Table I

Description of variables

The table presents the description of the variables used in the analysis. The first column shows abbreviation used in regression, the second column shows variable description.

SCIEN_CON	Dummy variable that registers whether a company has connection with Research University or Scientific Institute (1-collaboration exists, о - collaboration does not exist), 2014 data
PERC_IND_DIR	Percentage of independent directors in the Board, 2014 data
CEO_DUALITY	Dummy variable that indicates whether CEO-Chairman separation exists (1-no separation, 0 - separation exists), 2014 data
ASSETS	Total assets of the company, 2015 data
EBITDA_VAR	Variance of EBITDA, calculated for 2011-2015 period
FCF2013	Free Cash Flow to the firm, 2013 data
WACC	Weighted Average Cost of Capital, 2015 data
INS_OWN	Percentage of stock outstanding held by insiders and beneficial owners, 2014 data
Q_TOBIN	Q-Tobin, a ratio between a physical asset's market value and its replacement value, 2015 data
RESEARCH	Total expenditures on R&D activities, 2015 data
R_D_INT	The ratio of R&D expenditures to total assets, 2015 data
CAPEX	Total expenditures on R&D activities, 2015 data
BIOTECH_DC(EC)	Dummy variable that registers whether a company is biotechnological (1- biotechnological , о - other), 2015 data
PHARMA_DC(EC)	Dummy variable that registers whether a company is pharmaceutical (1- pharmaceutical , о - other), 2015 data

The Model

To evaluate the influence of corporate governance mechanisms and insider ownership we use regression analysis. The model is as following:

$$R\&D_{EXPEND\,INTi} = \beta_1 + \beta_2 PERC\_IND\_DIR_{i\,t-1} + \beta_3 CEO\,DUALITY_{i\,t-1} + \beta_4 SCIEN\_CON_{i\,t-1}$$
$$+ \beta_5 INS\_OWN_i + \beta_6 FCF_{i\,t-2} + \beta_7 WACC_i + EBITDA\_VAR_i + \varepsilon_i$$

Where the dependent variable is

$R\&D_{EXPEND\,INTi}$ – expenses on R&D 2015 divided by total assets;

independent variables:

$PERC\_IND\_DIR_{i\,t-n}$ – a lagged proportion of independent directors in the board;

$CEO\,DUALITY_{i\,t-n}$ – a lagged dummy variable for existence of CEO–Chairman separation;

$SCIEN\_CON_i$ – a dummy variable which equals 1 if the collaboration with research universities or scientific institutions exists,

INS_OWN_i – a variable that shows the proportion of shares outstanding held by managers and beneficial owners;

$FCF_{i\,t-n}$ is a lagged free cash flow to firm;

$WACC_i$ is weighted average cost of capital,

$EBITDA\_VAR_i$ is a measure of EBITDA volatility which was calculated for a 5-year horizon.

The model is lagged due to the fact that values for different years are taken into consideration while making investment decisions.

To determine the needed lags we investigated the investment programs of the companies from the sample to determine the time gap between the decision about investments in a risky R&D project and the moment or real research with costs recognition. The average lag for the pharmaceutical and biotechnological industry is close to one year. Thus the values are taken for different time periods.

The decision-making process is the following. The management decides which projects to finance according to the previous year financial results (FCF 2013), cost of debt (WACC), board control (proportion of independent directors, CEO duality), owners' preferences and opinion of scientists (scientific connection). This is why the lag for FCF is equal to 2, the lag for proportion of independent directors, CEO duality, insider ownership and scientific connection is equal to 1. EBITDA variance is calculated for 2011-2015 year period. We acknowledge that it would be better to calculate EBITDA variance for 2009-2013 year period, but the industry is emerging and have no long data history. As EBITDA 2011-2015 is used just as a proxy for risk and the companies in the sector do not change their risk-attitude, it can be included in the model. WACC data is not available for 2013, that is why we use WACC for 2015. The legitimate reason for such an approach is the duration of the process of product development. According to Association of Clinical Research Organizations (ACRO), an average process of drug development is more than 5 years, that is why we assume that the level of risk and required rate of return do not change significantly during this time.

Data and Sample

To investigate determinants of risky investments we should analyze the companies from the industries that imply a lot of risky R&D projects. Moreover, the effect of corporate governance and insider ownership on the company's investments is expected to be more perceptible in industries where the outcome of investments is unpredictable. For this reason the healthcare sector was chosen for consideration. This sector contains mainly biotechnological and pharmaceutical companies. Not all the drug-makers were included in the sample. The selection criterion was the presence of its own drug development process in a company. Generic companies that produce and commercialize already approved drugs were excluded from the sample, as they do not conduct R&D activities.

The sample contains public companies only. We investigate companies on this life cycle stage because this stage usually involves the main part of product development. Before the approval and commercialization of products, pharmaceutical or biotechnological companies mainly do not generate any revenue, but they need significant resources to spend on R&D. That is why at the stage of active research companies make IPOs and attract shareholders financing to conduct the research. Private companies usually have only early-stage R&D which does not require significant investments (Myers, 1999).

In order to estimate the effect of corporate governance and insider ownership on the R&D risky investments, we constructed two samples. The first one contains the data for developed markets (the USA, Japan) and emerging countries (China, India, Indonesia, Malaysia). We analyze these countries because public pharmaceutical and biotechnological companies with active R&D activities are based there. In other countries high-tech pharmaceutical and biotechnological industries are not developed. The total number of public pharmaceutical and biotechnological companies in the sample for developed countries is equal to 517 companies, in emerging countries it is equal to 482 companies.

We studied the operation activity of companies and excluded companies that do not conduct active R&D and just commercialize generic drugs. The samples shortened to 339 companies in the sample for developed countries, to 294 in that for emerging ones.

Then we collected the available data on corporate governance and excluded companies that do not have available corporate governance data. The final sample for developed countries consists of 259 companies; the final sample for emerging countries consists of 215 companies.

The analyzed period includes 2013-2015 years. We use transactional data in constructing regression with lags. That is why some data is taken for 2013 year and some data is taken for 2015 year. The collection of panel data is not possible due to missing information on corporate governance for 2012 year.

The sample for developed countries

Corporate governance data was mainly collected from Bloomberg and Thomson Reuters databases. However, some companies have no information in the databases, and missing information was col-

lected from companies' annual reports. Insider ownership data was collected from Bloomberg database, SEC filings and Thomson Insider Data. In defining insider ownership we used information for the total ownership of managerial stocks and beneficial owners' stocks. The reason for that is lack of information on just managerial ownership. Concerning the university connection, the data was hand-collected. We checked whether a company declares the collaboration with Scientific Institutes or Research Universities in its annual report. If a company has such declarations, we reported for existence of scientific connection. R&D investment data and control variables were uploaded from Bloomberg database.

The sample for emerging countries

The scarce data availability for emerging markets implies a lot of hand-collected data. The tickers and main fundamental data (R&D investments and control variables) were uploaded from Bloomberg database, after which we used information from companies' annual reports to populate our sample with information on corporate governance, insider ownership and scientific connections.

Summary statistics are presented in Table II. We provide summary statistics separately for developed and emerging markets.

Firstly, we should note that in emerging markets fewer pharmaceutical and biotechnological companies have connection with scientific communities. Mean value of dummy variable for scientific connection in emerging countries is equal to 0.481, while for the US and Japan it is equal to 0.667. High standard errors for both developed and emerging countries show that the values are not grouped around average value and have high variance.

Secondly, the markets differ in their corporate governance features. Companies in the emerging markets are characterized by a lower proportion of independent directors. In emerging markets the mean proportion of independent directors in the board is only 34.43%, while in developed markets the mean value for percentage of independent directors is equal to 76.19%.

Thirdly, the mean value of assets differs more than ten times. At the first glance the fact that companies in emerging countries have more assets seems to be strange. But the deeper analysis of balance sheets of biotechnological and pharmaceutical companies shows that inflated assets are typical of such firms in emerging markets. The reason is high cash inflows from collaborations to finance operations in the future. Such companies at the clinical development stage do not generate any revenues, but have high R&D expenses. That is why they try to find the partner to finance the research. Actually, such companies usually sell the rights to commercialize the drug but retain rights to get royalty payments. That is why they archive high cash amount in advance (as well as contingent liabilities and deferred revenue in the passive side of the balance sheet). Companies in developed markets do not usually carry such extra cash and they typically raise money by follow-on or debt according to the need.

Another significant difference is the FCF for 2013. In the developed markets it is positive and equal to $2614 million. In the emerging markets FCF 2013 is negative and equal to -$43.36 million. Such a phenomenon can be explained by the fact that in the USA and Japan there are a lot of pharmaceutical and biotechnological companies that have approved drugs and generate high revenues. In the emerging markets, on the contrary, the overwhelming majority of the companies in the sector are at the clinical stage and generate losses at the current development stage.

Concerning WACC, we can conclude that on average the capital is cheaper for companies in developed markets. This fact is in line with higher risk and higher required rate of return for developed markets.

The proportion of insider ownership is higher for the emerging markets. The mean value is equal to 4.87% for developed markets and to 14.8 in the emerging markets.

On average, companies in developed markets spend on R&D projects more than in emerging markets. The R&D intensity is also higher in developed than in emerging countries. It is important to note that the standard error is very high for R&D expenses and R&D intensity. This indicated the high variance of the values.

Capital expenditures are significantly higher in emerging countries. This finding is in line with the fact that the industry appeared in developed countries first, and a lot of capital investments have already been made.

Table II

Descriptive statistics

The table presents the mean, standard deviation, minimum and maximum value of the main variables. It is constructed separately for developed and emerging countries. Statistics on the percentage of independent directors, CEO duality and insider ownership are calculated on 2014 data, FCF on 2013 data. EBITDA variance statistics were calculated for 2011-2016 period. The statistics for other variables are for 2015

Variable	Developed countries				Emerging countries			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
SCIEN_CON	0.667	0.472	0	1	0.481	0.501	0	1
PERC_IND_DIR	76.19	16.16	0	100	34.4	15.6	0	100
CEO_DUALITY	0.31	0.46	0	1	0.502	0.501	0	1
ASSETS	47779	328334	0.75	4296192	118958	950002	68.8	1.24E+7
EBITDA_VAR	7.77E+19	1.06E+21	1.53E+11	1.70E+22	7.44E+20	1.00E+22	0	1.47E+23
FCF2013	2614	18494	-7473	249128	-43.356	16938	-172953	168457
WACC	9.6	3.04	0.254	25.053	10.44	2.35	-2.28	18.16
INS_OWN	4.87	8.19	0.01	60.069	14.8	20.8	0	79.53
Q_TOBIN	4.94	10.74	0.701	164.716	3.30	2.31	0.28	13.47
RESEARCH	4497	31572	0.3	386800	2483	28717	0.19	423503
R_D_INT	0.303	0.25	0.006	1.364	0.021	0.018	7.83E-05	0.095
CAPEX	759.42	4801	0	51223	6793	58371	0.02	750705
CAPEX_INT_EC	0.018	0.029	0	0.27	0.055	0.041	0.0001	0.24

The table presents the mean, standard deviation, minimum and maximum value of the main variables. It is constructed separately for developed and emerging countries. Statistics on the percentage of independent directors, CEO duality and insider ownership are calculated on 2014 data, FCF on 2013 data. EBITDA variance statistics were calculated for 2011-2016 period. The statistics for other variables are for 2015.

Empirical Results and Discussion

In order to evaluate the effect of corporate governance characteristics, insider ownership and scientific connections on the R&D investments we use econometric analysis. We use the OLS linear model, the linear model with robust option (due to the heteroscedasticity concerns), the median model (as R&D intensity has asymmetric distribution[4]) and the robust model with Huber iterations, where high residuals are down-weighted (as the sample contains outliers).

Prior to the interpretation of results, it is worth noting that due to the heteroscedasticity concern robust errors were used. The model was checked for multicollinearity and the problem was not observed.

The results of estimation are presented in Table III.

In emerging markets the proportion of independent directors and scientific connection are significant and positively connected with R&D intensity. Insider ownership is not significant in emerging markets. In developed countries we observe another situation. The proportion of independent directors is an important factor, but it is negatively associated with R&D intensity. Scientific connections and insider ownership are not significant in developed markets.

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[4] Materials are available from authors.

In order to check the stability of the main results we build several models (linear models, the model with Huber Iterations, the median model) that have showed similar results. We additionally checked these models on different parts of the sample to make sure that the identified relationship is not occasional. Regressions built on the different sample's part show the stability of our results.

Why do independent directors have different influence on R&D investment intensity in developed and emerging markets? Our empirical results show that the proportion of independent directors negatively influences corporate R&D investments in developed countries and positively influences risky R&D investments in emerging countries. As the governance mechanisms are used in order to improve companies' efficiency, the question of optimal R&D investment arises. Summary statistics show that not only is the R&D investment intensity higher in emerging countries, but also the absolute volume of R&D investments is higher. Such results can be explained by the fact that such huge investments are excessive and corporate governance decreases them to a more optimal level. Such explanation is in line with

Table III

Main results in developed markets

The table shows the effect of the factors on R&D investments intensity in developed markets. The second column reports the results using the OLS linear model, the third column represents the results of regressions with robust errors, the fourth column shows the results of the median regression, the last column shows the results of the model with robust errors and Huber Iterations. A number of observations, regression R^2 are given in the last three rows. ***, **, * shows significance 1%, 5%, 10% respectively.

Samle	Emerging markets			Developed markets		
VARIABLES	Robust Regression	Median Regression	Robust Regression with Huber Iterations	Robust Regression	Median Regression	Robust Regression with Huber Iterations
PERC_IND_DIR_EC (DC)	0.00012*	0.00014*	6.97E-05	-0.003**	-0.002	-0.002**
	-8.53E-05	-7.97E-05	-5.83E-05	-0.001	-0.001	-0.001
CEO_DUALITY_EC (DC)	0.002	0.001	0.003*	-0.016	-0.046	-0.037
	-0.002	-0.002	-0.002	-0.037	-0.039	-0.029
SCIEN_CON_EC (DC)	0.006***	0.005**	0.005***	0.053	0.037	0.035
	-0.002	-0.002	-0.002	-0.035	-0.038	-0.028
INS_OWN_EC (DC)	-2.22E-05	-4.00E-05	-5.51E-05	-0.002	-0.002	-0.002
	-5.34E-05	-5.26E-05	-3.84E-05	-0.002	-0.002	-0.002
WACC_EC (DC)	0.001*	0.001	0.001	0.001	0.003	0.01**
	-0.001	-0.001	-0.0004	-0.006	-0.006	-0.004
FCF2013_EC (DC)	2.08E-08	9.54E-09	3.35E-08	-3.68E-08	1.13E-06	-1.07E-06
	-2.30E-08	-6.42E-08	-5.87E-08	-1.30E-06	-2.84E-06	-2.62E-06
EBITDA_VAR_EC (DC)	0***	0	0	0	0	0
	0	0	0	0	0	0
PHARMA_EC (DC)	0.002	0.005	0.005*	-	-	-
	-0.005	-0.004	-0.003	-	-	-
BIOTECH_EC (DC)	0.0036	0.007	0.009**	0.027	0.124***	0.066**
	-0.006	-0.005	-0.004	-0.039	-0.0399	-0.029
CHINA	0.009**	0.009	0.006	-	-	-
	-0.004	-0.006	-0.006	-	-	-
INDIA	0.018***	0.014*	0.008	-	-	-
	-0.006	-0.007	-0.006	-	-	-
USA	-	-	-	0.357***	0.246	0.242**
	-	-	-	-0.106	-0.165	-0.121
Constant	-0.013*	-0.012	-0.006	0.057	0.06	0.046
	-0.007	-0.009	-0.007	-0.084	-0.152	-0.111
Observations	214	214	213	258	258	257

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R-squared	0.183	0.176	0.085	0.117
Pseudo R-squared	0.1134		0.084	
Standard errors in parentheses				

*** p<0.01, ** p<0.05, * p<0.1

Source: authors' calculations

The recent research, conducted by Chan et al (2015). They studied the effect of R&D investment cuts in the USA and found out that R&D investment cuts positively influence corporate performance and stock price. Scholars conclude that empirical results show that overinvestment in R&D exists and R&D investment cuts resolve the problem of non-optimal resource allocation.

Such results are in line with the explanation that in developed countries companies pay extra attention to R&D and they excessively invest in it. We distinguish the possible reasons for overinvestment in R&D in developed countries and underinvestment in R&D in emerging countries.

Life Cycle Issue. Companies have different potential of R&D projects on different stages of their life cycle. Young companies in biotech and pharmaceutical industries often do not have commercial-stage products, but have sufficient growth potential. Thus, for young companies it is essential to make significant R&D investments. For mature companies that have approved of products it can be more rational to have stable moderate R&D. This explanation is in line with Lambertini and Mantovani (2010) and Chan et al (2015). In the USA and Japan there are a lot of stable healthcare companies that have a lot of commercialized products. Such companies can have excess R&D investments and R&D investment reduction can be the optimal strategy. Thus, improvement of corporate governance can lead to a more optimal strategy. As concerns the incentives of management to underinvest, in developed markets such a negative effect can be mitigated by an optimal reward system such as stock based compensation. Managers are personally involved in the company's operations and the independent director' opinion can be very useful for objective R&D project evaluation.

In emerging markets, young companies with high growth potential prevail. High risk and high information asymmetry lead to investment distortion. Risk-averse managers try to protect their position and reputation and underinvest in R&D projects. Empirical evidence of such an effect in emerging markets was proposed by Hasan et al. (2015). The scientists claim that management discretion is higher in emerging markets and superior corporate governance mitigates this problem.

Corporate disclosure matters. Biotech and pharmaceutical companies are concerned about investors' attitude to them. As such companies commonly attract investors' funds to finance their projects, they want to make a signal of their future prospects. According to Chan et al. (2015), R&D investments are perceived as a positive signal that indicates future development and benefits for investors. The difference between developed and emerging markets appears because of the different corporate disclosure level.

In developed countries the level of disclosure is higher and investors pay extra attention to companies' investments in R&D (Chan et al. 2015). Managers try to establish favorable reputation and signal to investors that their company is high-tech by increasing risky innovative investments. This leads to excess R&D expenditures. Independent directors are often not tightly connected with all the chain of corporate processes including investor relations. They would rather concern about investment efficiency than about signaling function of R&D expenses.

In emerging countries the disclosure level is not high and investors evaluate rather the idea and scientific perspectives than financial statements. Moreover, companies in emerging markets have fewer opportunities to raise additional capital. Such an effect was described by Harvey et al. (2008). In case companies have tight budget constraints, managers are even more risk-averse. They will think that in case of failure they will lose their bonuses and even their position. Independent directors in the board will be more adequate in project evaluation in such case. Thus, the increase in the proportion of independent directors can cause higher R&D investment intensity.

Institutional environment. A company's investment strategy can also be connected with external governance. Institutional environment is very important in the decision-making process. In developed countries there exist a lot of external incentives to make innovations. There is an established mechanism of getting grants or subsidies from the government. That is why the decision making process in companies is adapted to the fact that the government encourages innovations. In emerging countries the system of innovation incentives also exists. But it is not steady yet, and firms have not adopted the government's positive attitude toward R&D investment.

However, in weak institutional environment the effect of corporate governance mechanisms is more significant. The reason for such a pattern is the substitution effect between external and internal governance. A similar concept was investigated by Hasan et al. (2015). The scientists studied 13 countries in emerging markets and showed that the relationship between corporate governance and corporate R&D investments is stronger in the countries with weak country governance.

Thus, the different effect of independent directors in developed and in emerging markets can be explained. We suppose that our results are due to the fact that there is overinvestment in R&D in developed markets and underinvestment in R&D in emerging markets. A higher proportion of independent directors decreases this investment distortion.

Insider ownership does not significantly influence R&D investments

Our regression analysis shows that the proportion of insider ownership does not significantly influence corporate risky R&D investments both in developed and in emerging markets.

Insider ownership accounts for both managerial ownership and ownership of beneficial owners. That is why we cannot conclude on the effect of managerial ownership separately. The data on the proportion of shares held by managers is not available for emerging markets and we could not conduct a deeper analysis.

The main result shows that an increase in the proportion of large shareholders in companies and an increase in managers' stake do not positively influence R&D investments.

Existing literature proposes that a higher stake of beneficial owners have positive relationship with corporate performance (Pant and Pattanayak, 2007; Selarka, 2005). However, we should also account for specific features of pharmaceutical and biotechnological industries. Management of such companies requires specific knowledge, and shareholders cannot monitor the decisions or interfere with the company's operations. Even if a shareholder has the stake of more than 10% of the company, they do not significantly influence the management process and strategy.

We should note that all the insider ownership that comprises both managerial and beneficial owners' ownership is not the best indicator for analysis. We cannot make any conclusion on the effect of the proportion of stocks held by managers. This fact does not allow us to clarify whether managerial ownership reduces the agency problem or the entrenchment effect prevails.

Overall, the results demonstrate that corporate governance does matter in the investment process. CEO duality has no significant effect on corporate risky R&D projects while the proportion of independent directors is supposed to decrease the investment distortion. In developed markets, where overinvestment in R&D is common, a higher proportion of independent directors is associated with lower R&D investments. In emerging markets, where underinvestment in R&D is supposed to be, a higher proportion of independent directors leads to higher R&D investments.

Independent directors improve scientific connection in emerging markets

It is essential to understand whether corporate governance has an effect on collaborations with scientific institutions. This provides the understanding whether independent members in the Board and CEO-Chairman separation widen the innovation collaborations or not. The existing theory proposes

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two different effects concerning the number of independent directors: improved operations because outside directors can objectively evaluate the projects (Osma 2008; Dong and Gou 2010) and deterioration due to the fact that they can be not aware of all firm-specific information (Hoskisson et al, 2002). Within this research, it is important to precisely understand how collaboration with universities is linked to corporate governance.

For a further analysis of the effect of corporate governance we build the regression of scientific connection on the proportion of independent directors and CEO duality.

 Regression is significant for emerging markets (p-value = 0.02). We can conclude that a higher proportion of independent directors has a positive influence on scientific collaborations in emerging markets. We failed to demonstrate significant relationship in developed markets. The possible explanation of such results is based on the fact that companies in developed markets operate for a long time and have long established connections with different Research Institutes and Scientific Universities. The proportion of independent directors and CEO-Chairman separation might potentially improve these connections, but our model does not fix it because we account only for the existence of collaboration (the dummy variable).

In emerging markets we analyze mainly young companies and we suppose that the period of investigation fixed the period of establishing communications with scientific connections. In such conditions better corporate governance positively influences scientific collaborations.

Do superior R&D investments positively influence performance?

We determined that the proportion of independent directors positively influences risky R&D investment intensity in emerging markets and negatively influences R&D investment intensity in developed markets. In order to understand these findings it is important to understand the effect of R&D investments on corporate performance.

We studied the effect of R&D investment intensity on companies' performance. We used a proxy of Q-Tobin to account for corporate performance. We assume perfect markets and we believe that market can estimate companies' future perspectives.

In developed markets corporate R&D investment intensity does not significantly influence Q-Tobin. The regression is not significant. This can be explained by the fact that in developed countries there are a lot of commercial-stage companies, and their Q-Tobin is determined rather by commercial success of their existing products than by their scientific progress.

In emerging markets we observe a different result. Corporate R&D investment intensity significantly influences Q-Tobin. The regression is highly significant (p-value=0); Graph I shows a 95% confidence interval for Q-Tobin dependence on corporate R&D investment intensity.

Such results show that market pays more attention to R&D in emerging markets. This can be explained by the clinical stage of the majority of the pharmaceutical and biotechnological companies in emerging markets.

Q-Tobin highly depends on the factors which can lead to higher efficiency and new product development. Acemoglu at al (2016) show that investors are sensitive to the factors that can influence the company's future operations. The research shows that even connections to officials can influence efficiency and stock price.
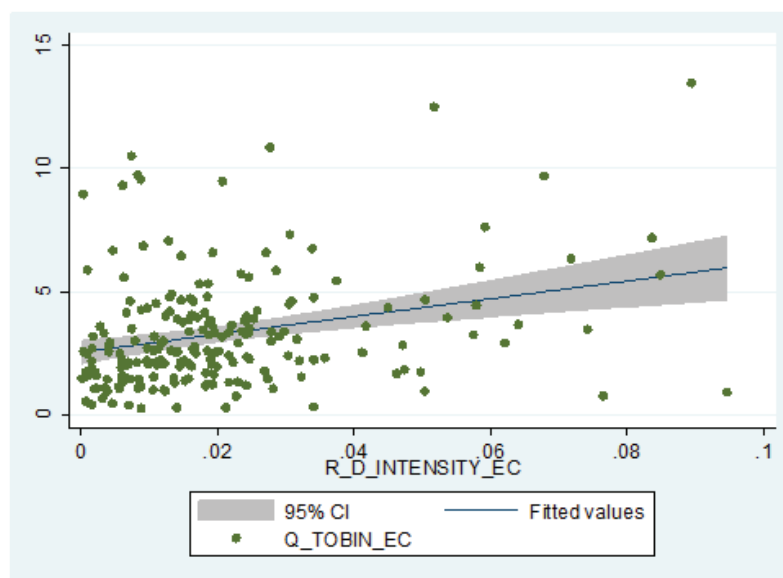
Graph I. Q-Tobin and R&D investment intensity

The graph demonstrates the dependence of Q-Tobin on R&D intensity. The horizontal axis shows the R&D intensity, the vertical axis shows Q-Tobin value. The scatter diagram shows exact combinations of R&D intensity and Q-Tobin values for companies in the sample. The line shows predicted values of Q-Tobin according to the regression of Q-Tobin in R&D intensity. The 95% confidence interval is marked with grey.

Source: authors' calculations

Conclusion

In this paper we examined how corporate governance and insider ownership influence corporate R&D investments in developed and emerging markets. We analyzed the data from pharmaceutical and biotechnological industries, where R&D investments are a crucial element of the business model.

The analysis includes econometric tools of several approaches: the OLS regression, the regression with robust errors, the median regression and the regression with Huber Iterations. Our empirical results revealed that the examined factors have different effects on risky R&D investments in developed and emerging markets.

We have revealed that in emerging markets a higher proportion of independent directors is associated with higher R&D investments. We suppose that such an effect appears due to the mitigation of the agency problem. In emerging markets managers try to protect their reputation and avoid risky projects. Moreover, their bonuses are based on current financial results, and short-term planning horizon makes them prefer current welfare to the company's future prospects. Independent directors have not so biased incentives and can fairly make the investment decision.

In contrast, in developed markets the proportion of independent directors negatively influences R&D investment. Such results contradict Dong and Gou (2010) and Osma (2008) findings, who advocate that independent directors positively influence R&D investments. Our explanation of this contradiction is based on the ratio between real and optimal R&D investments. The current research shows that the optimal level of R&D investments is higher for emerging markets. Biotech companies in emerging markets are mainly in the clinical stage of development and have breakthrough technology which needs to be developed. In developed markets companies in the pharmaceutical and biotechnological sectors often have commercial products, and it seems rational to develop these products than to have wide and risky early-stage clinical investments. Thus, the optimal level of R&D investments is higher for emerging countries. Real R&D investments, by contrast, are higher for developed markets. These companies have a higher level of disclosure and a much wider access to capital markets, while in emerging countries budget constraints are stronger.

Insider ownership is an insignificant factor in determining of R&D investments. This contradicts Lambertini and Mantovani (2010) research findings that insider ownership significantly influences companies' operations. It can be due to the fact that in high-tech companies not all the insiders can influence the investment process. Moreover, beneficial owners can have no industry specific knowledge that allows them to monitor the process.

The research also shows that in emerging countries companies with a higher proportion of independent directors have more scientific connections. Independent directors are less risk-averse and bring more innovation to the company. In developed countries these factors are not connected. Such a result can appear due to the fact that we account only for the existence of the connection. Companies in developed markets are more mature and a lot of them have scientific connections. The power of connection may be stronger for companies with better governance, but we do not account for it. In emerging countries now it is the period of making collaborations, and that is why our metric of existing connections is representative.

The study revealed that higher R&D investments lead to higher expectations of investors. Such an effect appears because higher R&D expenses make more research available, which increases the chance to get breakthrough inventions. In developed markets there are no such relations: there are a lot of commercial-stage companies and investors pay more attention to their success in delivering existing drugs.

Obviously, we determined that corporate governance matters in the investment decision-making process and a higher proportion of independent directors influences R&D investment intensity. We also revealed that insider ownership have no significant effect on R&D investment intensity. However, we should not overinterpret such results.

We believe that the positive relationship between the proportion of independent directors and risky R&D investment intensity can be the result of the non-observed firm quality characteristics. Such a difference may appear as a result of experience or better human resources. As a result «more experienced firms» have better corporate governance and lower (in case of overinvestment) R&D investments in developed markets. In emerging markets «better firms» have better corporate governance and higher R&D investment intensity. But we believe that even if such an effect exists, the influence of the proportion of independent directors on R&D investments exists. The effect can be lower than the coefficients in our models, but the rational explanation together with empirical results proposes that corporate governance does matter for firm operations.

The analysis of relationship between risky R&D investments and ownership concentration is a good subject for further research. People with special preferences invest in risky industries, and they may want to get high return on their investments. However, if they have a large stake in a company they bear extremely high risk. It would be interesting to understand whether high ownership concentration leads to a decrease in risky investments in order to decrease volatility of the business.

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«ЭФФЕКТ РАЗМЕРА» И ЗАТРАТЫ НА СОБСТВЕННЫЙ КАПИТАЛ

Фомкина Софья Анатольевна[1]

«Эффект размера» до сих пор остается одной из загадок рынков капитала. Данный эффект впервые был обнаружен Банзом [Banz, 1981] при тестировании модели ценообразования активов (CAPM) на американском рынке. Данное открытие повлекло дальнейшее исследование этой закономерности на других развитых и развивающихся рынках капитала. Однако до сих пор в научной среде нет единого мнения о действительном существовании данного эффекта на рынках капитала и его размере. Вместе с тем премия за малую капитализацию активно используется в практической деятельности компаний, фондов и отдельных аналитиков в процессе оценки затрат на собственный капитал.

В работе представлен обзор исследований, посвященных анализу данного эффекта на развитых и развивающихся рынках капитала. Систематизированы и обобщены различные подходы к оценке влияния размера компании на величину затрат на собственный капитал, сопоставлены предлагаемые авторами прокси размера, проведен анализ полученных эмпирических результатов. Обсуждаются особенности, выявленные в рамках анализа эффекта размера, и причины их возникновения, а также появления наблюдаемого эффекта в целом на рынках капитала и его дальнейшего исчезновения в ряде стран.

Ключевые слова: эффект размера, премия за размер, затраты на собственный капитал, рынки капитала

JEL: G12, G15, G32

Открытие «эффекта размера» и его эволюция в исследованиях на развитых рынках капитала

Предпосылки модели ценообразования активов (CAPM) не раз подвергались критике. Многие авторы [Banz, 1981; Reinganum, 1981; Fama, French, 1992; Fama, French, 1993] отмечают недостаточность объясняющей силы рыночной премии в динамике доходностей акций при использовании реальных данных рынков капитала.

Сложившаяся ситуация послужила началом дальнейших исследований и попыток усовершенствования модели CAPM. В последние несколько десятилетий разработаны и предложены новые способы оценки рисков и соответствующие модели определения затрат на собственный капитал. Тем не менее тестирование данных моделей приводит к противоречивым результатам.

«Эффект размера» (size effect) впервые был обнаружен Банзом [Banz, 1981] при тестировании модели ценообразования активов (CAPM) на американском рынке. Согласно данному иссле-

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