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Dividend policy and corporate innovation activity: case of Russian market

Final paper by

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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

Я, Свиридов Артем Евгеньевич, студент 2 курса магистратуры направления 38.04.02 - «Менеджмент», заявляю, что в моей магистерской диссертации на тему «Дивидендная политика и корпоративная инновационная активность: пример Российского рынка», представленной в ГАК для публичной защиты, не содержится элементов плагиата.

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30.05.2023

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I, Sviridov Artem Evgenievich, a 2nd year student of the master degree of the direction 38.04.02 - "Management", declare that in my master's thesis on the topic “Dividend policy and corporate innovation activity: case of Russian market”, submitted to the SAC for public defense, does not contain elements of plagiarism.

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30.05.2023

АННОТАЦИЯ

Тема ВКР — «Дивидендная политика и корпоративная инновационная активность: пример Российского рынка».

Данная Выпускная Квалификационная Работа, далее (ВКР) написана студентом 2 курса ВШМ МКФ Свиридовым Артемом Евгеньевичем.

Научный руководитель: Профессор кафедры финансов и учета, И.о. заведующего кафедрой финансов и учета ВШМ СПбГУ, Рогова Елена Моисеевна.

Основной целью данного исследования является определение взаимосвязи между дивидендной политикой компании и уровнем ее вовлеченности в НИОКР на примере Российского рынка, а также составление практических рекомендаций на основании полученных результатов.

Для достижения данной цели были поставлены и решены следующие задачи:

1. Проведен обзор актуальных проблем для Российских инновационных компаний.
2. Проведен анализ схожих эмпирических исследований и сопутствующих теорий из области корпоративных финансов.
3. Сформулирован ряд гипотез, позволяющих достичь поставленную цель, а также определить другие финансовые решения фирмы, а именно:
    a. Влияние выплат дивидендов на интенсивность в НИОКР.
    b. Влияние уровня долгового рычага на интенсивность в НИОКР.
    c. Влияние уровня наличных средств на интенсивность в НИОКР.
    d. Влияние темпов роста выручки на интенсивность в НИОКР.
4. Разработана и обоснована необходимая методология для проверки гипотез.
5. Выбраны наиболее состоятельные и подходящие эконометрические модели с помощью специальных статистических тестов, а также объяснены статистические особенности данных тестов:
    a. Тест обычных наименьших квадратов.
    b. Тест фиксированных эффектов.
    c. Тест случайных эффектов.
    d. Системный двухступенчатый метод обобщённых моментов.
6. Собрана и обработана необходимая выборка наблюдений для проверки гипотез.
7. Выявлены наиболее и наименее часто встречающиеся индустрии в выборке.

8. Проведены все тесты на основании предложенной методологии при помощи специального программного обеспечения.
9. Полученные результаты интерпретированы, выдвинуты сопутствующие практические предложения.

Основные результаты ВКР:

1. Гипотеза о негативном влиянии выплат дивидендов на интенсивность в НИОКР подтвердилась для всей выборки, для компаний с очень высоким уровнем вовлеченности в НИОКР; не подтвердилась для компаний с низким уровнем вовлеченности в НИОКР.
2. Гипотеза о негативном влиянии уровня долгового рычага на интенсивность в НИОКР не подтвердилась для всей выборки и для компаний с очень высоким уровнем вовлеченности в НИОКР. Российские компании активно используют долговое плечо на финансирования своей инновационной деятельности.
3. Гипотеза о негативном влиянии уровня долгового рычага на интенсивность в НИОКР не подтвердилась для всей выборки и для компаний с очень высоким уровнем вовлеченности в НИОКР. Российские компании активно используют долговое плечо на финансирования своей инновационной деятельности.
4. Гипотеза о позитивном влиянии уровня наличных средств на интенсивность в НИОКР подтвердилась для всей выборки и для компаний с очень высоким уровнем вовлеченности в НИОКР. Российские компании используют собственные денежные средства для инвестирования в НИОКР, что совпадает с результатами подобных исследований.
5. Гипотеза о позитивном влиянии роста выручки на интенсивность в НИОКР подтвердилась.
6. Таким образом, Российские компании, которые хотят увеличить свои вложения в инновации, должны сократить выплаты дивидендов, увеличить собственные денежные средства и привлекать достаточный уровень долга.

Ключевые слова: инновации, дивиденды, НИОКР, интенсивность НИОКР, собственные денежные средства, долговой рычаг, темпы роста, высоко интенсивные компании.

ANNOTATION

The topic of this Master dissertation is " Dividend policy and corporate innovation activity: case of Russian market".

This empirical study was written by a 2nd-year student of the GSOM MCF Sviridov Artem Evgenievich.

Supervisor: Professor of the Department of Finance and Accounting, Acting Head of the Department of Finance and Accounting of GSOM St. Petersburg State University, Rogova Elena Moiseevna.

The main purpose of this study is to determine the relationship between the company's dividend policy and the level of its involvement in R&D on the example of the Russian market, as well as to make practical recommendations based on the results obtained.

To achieve this goal , the following tasks were set and solved:

1. The review of current problems for Russian innovative companies is carried out.

2. The analysis of similar empirical studies and related theories from the field of corporate finance is carried out.

3. A number of hypotheses have been formulated to achieve this goal, as well as to determine other financial decisions of the firm, namely:

    a. The impact of dividend payments on the R&D intensity.

    b. The impact of the leverage on the R&D intensity.

    c. The impact of the level of cash holdings on the R&D intensity.

    d. The impact of growth rates on the R&D intensity.

4. The research methodology for testing hypotheses has been developed and justified.

5. The most consistent and suitable econometric models were selected using special statistical tests, and statistical features of these models were explained:

    a. Ordinary least squares model (OLS).

    b. Fixed effects model (FE).

    c. Random effects model (RE).

    d. The two-step System generalized method moments (GMM).

6. The necessary sample of observations was collected and processed to test the hypotheses.

7. The most and least common industries in the sample were identified.

8. All hypotheses were tested on the basis of the proposed methodology by using specialised software.

9. The obtained results are interpreted, practical implementations are proposed.

The main results of this paper:

1. The hypothesis about the negative impact of dividend payments on the R&D intensity was confirmed for the entire sample, for companies with a very high level of R&D intensity; was not confirmed for companies with a level of R&D intensity.

2. The hypothesis about the negative impact of the leverage on the R&D intensity was not confirmed for the entire sample and for companies with a very high level of R&D intensity. Russian companies actively use debt leverage to finance their innovation activities.

3. The hypothesis about the negative impact of the leverage on the R&D intensity was not confirmed for the entire sample and for companies with a very high level of R&D intensity. Russian companies actively use leverage to finance their innovation activities.

4. The hypothesis about the positive impact of the level of cash on the R&D intensity was confirmed for the entire sample and for companies with a very high level of R&D intensity. Russian companies use their own funds to invest in R&D, which coincides with the results of such studies.

5. The hypothesis about the positive impact of growth on the R&D intensity has been confirmed.

6. Thus, Russian companies that want to increase their investments in innovation should reduce dividend payments, increase their own funds and attract a sufficient level of debt.

Keywords: innovations, dividends, R&D, R&D intensity, cash holdings, leverage, growth, highly R&D intensive companies.

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INTRODUTION

Innovative development is relevant for companies of any scale and any specialization. Innovation is necessary for business development. According to the research results CB Insights (Alyabyev et.al., 2018), 85% of managers in the world believe that innovation plays an important role in their business. At the same time, 41% of managers claim that their business is exposed to significant risk associated with possible radical innovations in the industry.

Nowadays, the corporate environment requires a constant search for new sources of competitive advantage for sustained success. One of the ways for modern business to achieve it is through the advantages of innovation. This is a process that creates new products, processes, and ways of working that help increase the knowledge stock (Andy N. and Jasper H., 1998). To make sure the company can continue to grow and improve its products, management needs to figure out how much money to spend on research and development (R&D). In general, the companies that participate in R&D more actively show better growth results and value higher by market than companies doing the opposite (Roper, 1997; Bloom and Reenen, 2002; Tsuda, Henry; and Bulter, 2005). When it comes to allocating resources to investments, management must choose one strategy because it determines the short-term and long-term value of the company, which has an impact on company's value (Lahiri, P. and Chakraborty, I., 2014). However, due to information asymmetry, managers of tech companies tend to use internal sources to finance the R&D, otherwise the corporate innovation secrets might leak to rivals. The same stands for dividends that are also paid by using cash holdings. Therefore, the investments in innovation might lead to cutting dividends, what undermines the value of such companies and worse the conditions for shareholders (Kim, et.al., 2021). Since, this not a trivial task for managers to optimize dividend pay outs in such a way so it would not affect the innovation development, the core goal of this study is to analyse how dividends policy influence the R&D intensity of Russian companies.

In terms of research gap, this paper will cover the lack of empirical studies on this topic for Russian market and for more relevant time period, as the similar studies covered mostly developed markets, while developing markets quite rarely, especially Russian market. The practical contribution consists in providing recommendations on how to run dividend policy for companies, so to keep enough sources for innovative development. Additionally, this study tests how other financing decisions, like leverage and cash reserves, influence the expenses on R&D, hence providing meaningful insights on how to optimize the capital structure for sake of best innovative development.

CHAPTER 1. LITERATURE REVIEW

This literature review will start with the discussion of what is the situation with the implementation of innovations among Russian companies. Then the discussion will move to consideration of theoretical side of dividends, innovations and their interaction.

Russian business and innovation implementation

One of the most important problems for innovations on the Russian market that has been persistent over last years is the low demand for innovations for the economy and its inefficient structure: it used to be profitable for enterprises to purchase ready-made devices and technological solutions abroad than to engage in their own innovative activities. This situation was leading to a stagnation of the economy due to the unwillingness of managers to participate in innovations more actively (Bezrukova T., et.al., 2017).

However, after huge amount of sanctions were imposed in the first half of 2022, many companies faced restrictions on the necessary import of equipment, installing and updating software, receiving technological services, what resulted in the gradual increase in price for all of these. Therefore, previously established innovation development model based on the import of technologies does not work anymore. However, the only way to complement the lack of required technological solutions is to substitute them with the local analogues. The termination of the activities of foreign (mostly Western) technological giants on the Russian market allows local companies to fulfil their niches that previously were unavailable. Therefore, sanctions' shocks will give an opportunity to local technological firms to intensify their own innovative development.

Only a tenth of large and medium-sized firms regard innovation to be a prioritized development strategy. Despite some encouraging trends in recent years (innovation activity rose to 10.8% in 2020), the opportunities to achieve outstanding results on innovations are still restricted. The report about innovation market in Russia made by McKinsey (Alyabyev S., et el., 2018) stressed out major obstacles for development of new technologies for Russian companies. According to this study (Figure. 1) the major reasons are the inappropriate corporate culture, poor understanding of trends and lack of specialists, while the funding constrains was mentioned by 21% of correspondents (6^{th} place in the list). However, a more recent study presented by High School of Economics (Vlasova V., Fridlyanova S., 2022) has detected that the main obstacles to the development of innovative business in Russia are financial in nature (Figure. 2).

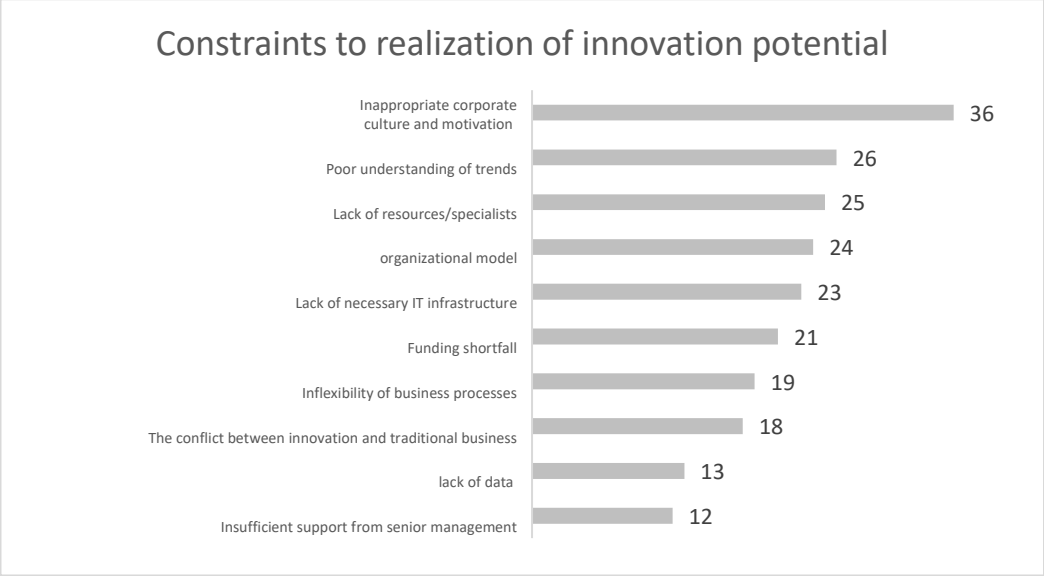


Fig. 1. *Constraints to realization of innovation potential*

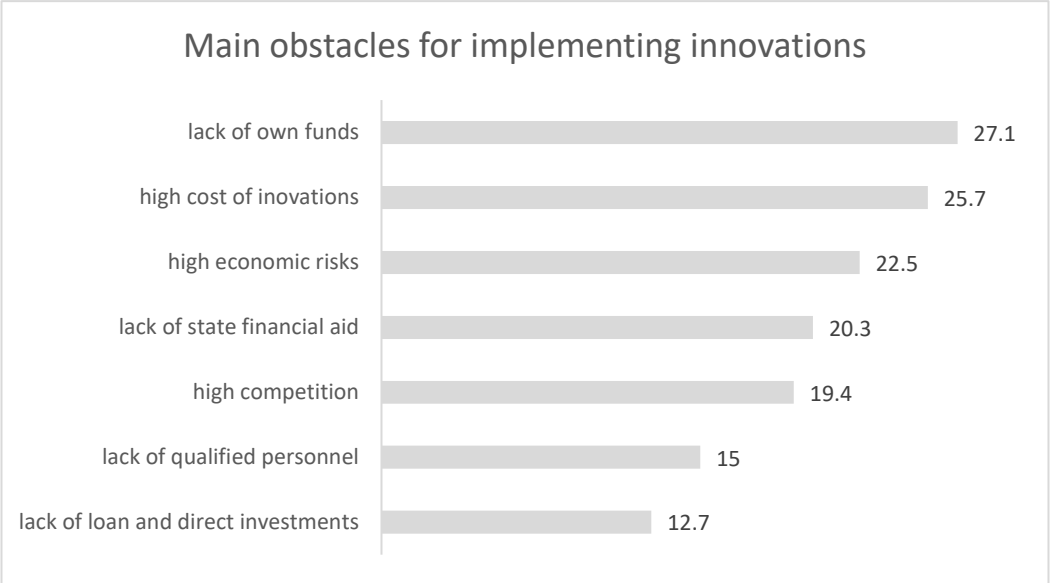


Fig. 2. *Main obstacles for implementing innovations*

In the same study from HSE was noted that all these financial problems are even more severe for highly R&D intensive Russian companies. For example, 60% of companies from innovation intensive industries like pharmaceuticals, production of medical equipment, electronics, chemical products, vehicles and some other, state that the financial constraints are the major obstacles for their developments. Moreover, the situation is complicated by the tendency of innovative companies to develop innovations mainly by using their own funds (Vlasova V., Fridlyanova S., 2022). Also, there are no risk financing funds on the Russian market that could cover investments in innovations as they go hand in hand with high levels of risk. Therefore, the issue of getting enough financial resources is very actual for modern Russian business if it wants

to seizure the current opportunity to occupy the vacant niches after Western technological companies left the Russian market. The necessity of proper resources management is also mentioned in another article by Maslova I. (2007). According to that paper, the inefficiency in the use of available resources, unbalanced investment policy of the enterprise, lead to the not reasonable waste of resources.

This discussion leads to the conclusion that Russian enterprises need proper financial management that will allow them to acquire required reserves for innovations and by implementing a proper dividend payout policy can be a useful solution in today's situation.

Innovations, dividends and their interaction

This part will include the discussion of corporate finance theories and empirical studies on the topic of dividends, innovations and how they are related. Before moving on the brief explanation of main theories that will be discussed in this part will be presented first.

Asymmetric information – this is the case when one party (for example, managers) has more and higher quality information than another party (investors). Such imbalances can lead to market failures, what means inefficient distribution of goods and services in a free market. (George Akerlof, Michael Spence, and Joseph Stiglitz).

Agency costs – in general terms these are internal companies' expenses that come from relationship between the principal and agent (acting on behalf of principal). However, agents do not always act in interests of their principals, what causes the agency costs. For example, principals (shareholders) want agents (managers) to maximize the value of the company, while agents plan to invest in projects, what will cut dividends (Jensen C. and Meckling H., 1976)

Pecking order model – Asymmetric information raises the cost of financing According to the Myers S. and Majluf N. (1984), managers prioritize different sources of funding in a hierarchy, where equity issuing is least preferable mean of financing. "The pecking order theory states that companies prioritize their sources of financing (from internal financing to equity) and consider equity financing as a last resort. Internal funds are used first, and when they are depleted, debt is issued" Stefano C. et.al (2021).

Tax preference theory – "was first developed by R.H. Litzenberger and K. Ramaswamy. This theory claims that investors prefer lower payout companies for tax reasons. They based this theory on observation of American stock market, and presented three major reasons why investors might prefer lower payout companies."

Dividends

Considering the dividend policy, in academic literature this topic considered to be one of most controversial. For instance, Black (1976) considered dividend policy as a puzzle for corporate world. Even later studies go in line with that view (Frankfurter et al. 2002). Moreover, the dividend policies in developed markets differs from those in developing markets as low dividend yields were spotted in developing countries (Ramcharran 2001), and in the way that dividends pay outs were lower in developing markets (two thirds of developed markets) (Glen et al. 1995).

Before starting the discussion on dependency between investments and dividends pay outs. The different approaches to dividend payments should be discussed first. Two different concepts of dividends distribution will be considered in the literature review. Both concepts flow from the Linter Model (Linter, 1956) that managers still use when determining the optimal dividend policy for a firm. One concept is the residual theory. Under this approach, dividends are second to concern about for managers, specific companies' objectives, investment projects or capital requirements, have higher priority. Thus, dividends under this approach are less predictive and tend to be erratic. Second approach, named the stability approach, also known as the smoothing dividends, assumes that boards set quarterly payouts at a small percentage of annual earnings. Dividend amounts to be paid only increases when the expected increase in income seems to be sustainable for a while. By this logic, the uncertainty of dividend payments significantly decreases, and they appear to be more predictable, what signal a favourable condition for investors. Shareholders and the market both favour stability and gradual rise in pay out rate, but the market has the power to penalize companies that reducing their dividends (Mantripragada, 1976; Gugler, 2003; Guttman et.al., 2010). Following a decline (increase) in earnings, managers are hesitant to reduce (increase) payouts, therefore, there exist a time lag between changes in earnings and changes to dividend policy. This also has been proved by later studies (Fama and Babiak, 1968; Aivazian et al., 2006). In the research on this topic by Laurence B. and Zhaoxia X (2007) it was found that companies existing with high level of information asymmetry tend to stick with the second approach of smoothing dividends and payments are lower.

Innovation

Innovation, as well as dividends, has signalling effect for markets, according to Hirshleifer et.al (2013) innovations can be a predictor for high returns in the future. Moreover, this is one of main contributors to companies' growth (Aghion et.al., 2013). However, compared to non-innovative enterprises, innovative firms have more liabilities, therefore, innovation should not be counted as a safeguard against failures and should be managed rather carefully. Additionally, it

goes hand in hand with information asymmetry and agency costs, because of high probability of failure, unpredictable outcomes, and the impossibly foreseeable contingencies (Holmstrom, 1989; Chemmanur and Fulghieri, 2013).

Dependency between the dividend policy and investments

The empirical data presented to date on the relationship between dividend payments and investments is ambiguous. Financial managers have a dilemma whether to pay a large, small or zero percentage of their earnings as dividends or rather preserve investments. In brief, such decisions depend on factors like, the interests of shareholders and companies' needs for development, therefore, managers have to keep a balance between these two, what is not an obvious task.

All in all, in academic studies exist two basic theories, one is dividend irrelevance, and another is dividend relevance theory. On the side of the first one stand Miller and Modigliani (1961) (MM), they demonstrated that in perfect markets, with no taxes and transaction costs and all agents behaving rationally, a firm's dividend policy has no impact on its value. This argument is predicated on the notion that choices regarding investments and funding are not related. In this study was shown that the way the firm arrange its dividend payments and issues of shares is invariant to expected return of shareholders, required to make them to keep firm's stocks. Any change in the firm's dividend distribution pattern has no impact on the market value of the company because the assets, investment opportunities, anticipated future net cash flows, and cost of capital are untouched by the dividend policy choices. The firm can choose any payout pattern without changing their value, making dividend policy unimportant. The main takeover from this study is that any company's value is determined only by its earning ability and its business risk. The dividend is the difference of company income and the amount it invests in own development. The potential for share issuances and repurchases offsets companies' ability to alter dividends to any desired level. Some other studies (Elston, 1996; Smirlock and Marshall, 1983) show quite similar results, of dividend and investment policies remain independent. Moreover, the clientele approach states that for each type of dividends pay out exist its own segment of investors, therefore any firm's value should be fair independently from its own dividend policy, because according to this theory each seller will find its buyer.

However, there exist opposite perspective, the relevance theory, on this topic that show more complex relationship between dividend and investment policies. The major claim to MM is that they do not apply their implications to the imperfect markets. As an illustration, while investors pay transaction costs every time they sell or buy shares, firms do so while trying to obtain

new money. The transaction costs connected with collecting dividends may be much lower for a small individual investor than the transaction costs involved with selling a portion of the equities (Allen F. and Michaely R., 2002). Another point raised by Gordon M. (1961/2) is about, uncertainty resolution, which means that for investors the future gains from investments are not guaranteed and they would rather prefer a firm that pays now in dividends, this theory is called a "Bird in Hand".

Another factor raised by the supports of relevance dividend theory is about taxes. Investors should aim to maximize their after-tax income, according to Farrar and Selwyn (1967). The reason is that if the effective marginal capital gains tax paid by shareholders is less than the marginal rate of this tax that would be paid on dividend income, then it is better for the shareholder to have zero dividends. For instance, investors would prefer that the company keep its revenues if capital gains tax is higher than the tax paid on dividends. In addition to that, investors prefer returns in the form of lower-taxed capital gains over highly taxed dividends, according to the Tax Preference theory put forth by Litzenberger R. and Ramaswamy K. in 1979. Therefore, a low dividend payment ratio raises the market value of the company's shares while lowering the required rate of return.

Further can be considered the segment of literature that takes side of the dividend relevance theory that is based on the accounting manipulation behavioral finance approach. Companies that pay strong dividends are viewed as being reasonably honest and less susceptible to accounting fraud, which may be a key factor in their decision to pay dividends. One of the authors who provides such view is Barron (2002), who insist on healthy dividends should be embraced by any manager, as this is a trustworthy indicator of enterprises doing real earnings. Another application of behavioural theory for dividends policies was proposed by Shefrin and Statman (1984), who stated that investors might still prefer dividends over the capital gains even if both types of income bring the same amounts of returns to their holders. The major reason behind this view is that dividends provide shareholders with the sense of the self-control. Investors do not want to gain all return now and want to leave some income for the future, this is possible to do through the dividends. This theory perfectly applies to elder people, who need stable income for years ahead, as now they are almost all retired, therefore, authors did call this life cycle behaviour.

One more view adding to the relevance theory is touching the phenomenon of agency costs. The main take here is that dividend pay outs can be a measure to make managers to use external financing, therefore, becoming a subject of external control, subsequently decreasing the agency cost. According to Jensen's (1986) thesis of overinvestments, managers might prefer to grow the size of the company rather than pay dividends. As a result, they can take on initiatives that have a

negative net present value (NPV), or they can use the internal fund for their own benefit, while cash dividends decrease the amount of cash under their control, hence dealing with the agency problem. According to Easterbrook (1984), dividend payments mitigate the overinvestment issue since they make companies more likely to turn to the equity markets for capital raises, therefore being more disciplined. Because, in this case companies become subject of close attention and monitoring from the outside market participants, as the result the agency costs are lowered. This works with other types of dividends as well, like share repurchase is also influenced by the same processes.

Additionally, a signaling theory of dividends should be covered in this paper as well, as it plays a significant role in the academic literature on the topic. According to this theory companies tend to pay out dividends so to send the signal to external markets participants that this company is doing well and expects a promising future profit. At the same time this approach is only possible under another theory, known as information asymmetry, that is very common for many topics in business literature. Information asymmetry assumes that companies' managers are actually insiders that have private information about the current and future state of their firm, while such information is obviously not available for outsiders, like investors. Information like investment projects and total profits (earnings) made by the companies is usually private and unknown to outside investors, whereas the dividends express information about changes in financial results of companies (Chen and Wu, 1999; Chemmanur et al., 2010; Ham, Kaplan, and Leary, 2020). On the side of signaling theory were such studies as (Miller and Modigliani 1961, Bhattacharya 1979, John and William 1985, and Miller and Rock 1985). Their theory's most crucial component is that businesses must make regular payments of money. When dividend increases are announced, the share price responds favourably since it is viewed as good news. The signalling theory holds well for developed markets, a favourable correlation between US listed companies' future profitability and dividend adjustments has been reported in studies of Kalay and Loewenstein (1985) and Nissim and Ziv (2001). For developing markets, especially China, the signalling-effect of dividends pay outs has been proved to have a place as well (Cheng, Fung and Leung 2009, Chi, Yang, and Young 2014). It is said that Chinese listed companies with higher earnings per share (EPS) are more likely to distribute cash dividends. Moreover, individual investors in China are ready to pay premium for dividend paying companies, as they assume them to be corporate friendly (Eun and Huang 2007). The signaling effect was found to hold especially well when companies undertake the dividends buy backs. Ikenberry et. al (1995, 2000) made an analysis long-term performance of North American markets (USA and Canada) that demonstrated significantly long-term positive abnormal returns after the buy-backs.

There are also other studies that bring some useful insights in side of relevance theory. For example, (Dhrymes and Kurtz 1967) has delighted that US companies that pay out dividends consistently, had to decrease the internal resources available for capital investments. Another more recent and one of the most important (Fama and French, 2001) show that organizations that have never paid dividends have a greater ratio of R&D to total assets than current or previous dividend payers, and that the propensity to pay dividends is inversely correlated with investment possibilities. According to other literature, corporations follow a pecking order model in which they are unwilling to issue riskier securities due to asymmetric information (Myers and Majluf, 1984) or high transaction costs. As a result, they prefer to decrease dividends to finance their investments. Similar results were derived from Jensen and Johnson (1995) that demonstrated R&D investment increased significantly before dividend decrease.

However, this argument can be fulfilled by the discussion of the role of internal cash funds available to the companies. According to the Hubbard (1998) businesses reduce their investments when they lack internal funds, assuming that dividends are determined by exogenous factors, because internally generated cash flows have variability. Hence, dividends and investments shouldn't be impacted by internal cash flows if businesses can smooth out its fluctuations by using external capital markets. Nevertheless, this logic develops further (Myers and Majluf, 1984), firms prone to cut back on their investments when internal cash flow is low, as in general external capital is more expensive than internal one. Therefore, sometimes companies choose to neglect to use external funds to cut cash downside and so refuse the possible investments (Minton and Schrand 1999).

Investments in R&D and dividends' pay out policies

The previous part of literature discussed what types of relation between dividends and investments exist and what theories and explanations underly them. Nevertheless, the investment in innovation is a specific case of investments in general, therefore an additional discussion is needed, how dividends and R&D influence each other.

In academic studies are discussed several basic views on the topic, namely, residual dividend policy, independent dividend policy and simultaneous dividend policy.

Starting with the residual dividend policy, which has been already discussed in the previous part under the consideration of Linter Model, it still has more narrow applicability when matching dividends and R&D. In this case the investment plans that serve the purpose of growth and wealth maximization are primarily to dividends, which are paid in case of funds being available or not eventually. This approach might be supported by the findings that dividends can be cut and share

prices will not be affected that much (Lang and Litzenberger 1989). Therefore, under residual dividend policy, dividends will be reversely related to the R&D investments.

The discussion on residual dividend policy, which stems from the Linter Model, will not be full without mentioning dividend smoothing and how it is interconnected with the R&D. It was revealed that more innovative firms (in terms of patents) tend to use smoothing pay out policy more often and that low cash holdings stimulate higher dividend smoothing for innovative firms (Gounopoulos D., et.al., 2021). The results are not surprising as companies with restrained cash reserves and that participate in innovation activities will try to use more predictable dividend pay-out policy. The role of information asymmetry is also high here, as it was discussed earlier in the literature review, dividend smoothing strategy tend to prevail for companies with high asymmetry of information, and companies with high R&D intensity are usually those to exist under information asymmetry.

However, going back to the discussion of three basic interactions between pay out policies and R&D, under independent dividend policy the consideration is opposite to the previous framework. Dividends are treated at first and only then goes investments in R&D. This leads to the situation that companies paying out a lot of dividends will have less expenditures in R&D. Such behaviour is common for myopic stock market, as such investors fall in companies that pay dividends and do not invest in companies with high R&D expenditures (Hall and Hall, 1993). Another study (Chan et al 2002) demonstrating the reasons behind independent dividend policy, find that the market undervalues the potential benefits of R&D investments on the future, as when firms ranked by RD/Sales, high-R&D companies' three-year average annual returns are comparable to low-R&D companies.

The last theory to be discovered here is simultaneous dividend policy, under which both sides are assumed to be the strategic decisions made simultaneously and sources of value creation. In this case, the weak interdependence between two phenomena can be traced.

Sometimes the relation between the dividends and R&D intensity is non-linear. For example, it was shown on the example of Japanese market that correlation between R&D intensity and pay outs has a form of inverse U-shape. Which means that R&D intensity is inversely correlated with dividend payouts for businesses with higher R&D intensity. However, when R&D intensity is lower, dividend distributions and R&D intensity are positively correlated. Additionally, to that, in case of companies with excess cash (net debt < 0), R&D intensity is more favourably correlated with dividend payouts and inversely for companies with excess debt (debt > 0) (Kenichi N., and Akitoshi I., 2016).

Some empirical research fulfil the relation between R&D and dividends, for example it was shown that dividend yields for growing businesses with larger R&D expenditures are lower than for non-growing businesses (Gaver, 1993).

More specific and rather significant theoretical pitfalls that explain the relationship between dividends and R&D will be considered in the next sub part.

R&D, asymmetric information, cash reserves and dividends

R&D always comes with uncertainty and high risk in most cases, therefore, firms actively participating in R&D requires ongoing financial inflows (Ehie and Olibe 2010). In corporate finance theory on the topic of R&D it has been demonstrated that cash flow is a major factor for R&D (Hillieret al., 2011; Brown et al., 2009). Studies state that due to innovation activities being subject to long-run investment cycles and requires access to funding sources, they tend to be vulnerable to financial constraints (Brown, et al. 2012; Yang, 2019).

Informational asymmetry between firm's managers and outside investors plays here a significant role as well. R&D firms are often hesitant to share the confidential information they have on their developments as they fear that competitors may use it for their own advantage (Kamien, et.al 1978). The more unique developments companies have the more they are prone to informational asymmetry (Zeckhauser and Pound 1990). Myers and Majluf (1984) suggest that in accordance with a pecking order theory, enterprises with high level of informational asymmetry should use first self-financing, then if it is not enough to attract debts with a low risk, and as a last measure issue new shares. Hardin et.al (2012) have discovered that banks' credit lines are less available for companies with higher informational asymmetry. These findings assume that companies should decrease their dividend payments and reserve enough cash holdings, in order to be able to use its own funds for R&D investments. Empirical study conducted for developed markets (UK, US, Japan and 3 European countries) that compares the R&D intensive and R&D non-intensive firms, in this study it was demonstrated that R&D-intensive businesses have much lower levels of debt and dividend payments, but longer loan maturities and bigger cash balances than businesses that don't invest in R&D (Bah R., and Dumontier P., 2001). However, it should be remarked that not all the studies, prove the same on the side of debt maturity. For example, a later study (Elkemali et. al., 2013) exhibited that R&D intensive firms from European market have shorter debt maturity, what contradicts with the previous study, but probably can be explained by the different samples and time frame for studies. However, this study coincides with the previous in its main findings that R&D intense firms have lower leverage, hold more cash and pay less dividends. An empirical study for the Korean biotech companies (Lee and Lee, 2019) that has

demonstrated negative relation between dividends and R&D investments, also hold with asymmetric information theory. Biotech companies that conduct R&D, as shown in this research are frequently reluctant to reveal the ensuing proprietary information for fear that rivals may use it. This cause the information asymmetry between management and outside investors, so the cost of outside sources, like credit lines, might be more expensive than usage of own funds. Hence, these companies use their own funds to invest in R&D, subsequently leading to conflict with dividends pay outs.

Therefore, R&D investments, which considered to be a long-term decision, are believed to be more affected by dividend pay-out policy and shortages in cash flows. Other several reasons behind that phenomenon are discussed further.

R&D expenditure is anticipated to have a significant impact on a firm's cash position, as external funding is unlikely to be used to finance R&D projects, due to increased information and agency issues (Himmelberg and Peterson, 1994), hypothetically leading to R&D and payouts to be in close competition for internal resources, thus, companies pay dividends at expense of R&D investments. This goes in line with other studies like (Berger, et.al., 1997, Biais et.al., 1999) that demonstrate that companies do not use debt to fund R&D or to pay dividends (Kalay, 1982).

Another reason, less obvious, The R&D investments will be reflected at full in the year of expense, in comparison with the capital expenditures that reflect earnings shortfall mostly through depreciation. Such situation might drag with it the short-sighted behaviour of management, which is that companies strive to make its earnings look better. According to empirical research (Bushee, 1998), businesses reduce their R&D spending when their earnings are declining.

In supplement to corporate reasons explaining relation between R&D and dividends there exist clarifications from other fields. For example, in the study conducted for the BRICS market, it has been shown that investor protection has a positive impact on the dividends. The same study, nevertheless, hold the similar results as many other studies on the topic, namely R&D intensity is negatively related with the cash dividend payments (Hasan F., et.al., 2022).

CHAPTER 2. RESEARCH DESIGN

Hypotheses formulation

Based on the literature review done, the hypotheses for this study can be formulated. As it was discussed, the R&D comes with a high information asymmetry. Innovations are of great interest to competitors, so firms try to hide them from outsiders (Kamien, et.al 1978; Lee and Lee, 2019). Based on a pecking order theory, Myers and Majluf (1984) came to conclusion that companies with high level of informational asymmetry should use first self-financing at first and only then other measures, like loans and stock markets. Another study proving that cash flows are significant for firms' R&D was provided by (Brow et.al., 2009 and Hillier et.al., 2011). In order to assure sources of finance for ongoing R&D investments, R&D-intensive corporations typically keep comparatively substantial cash reserves when compared to other firms (Brown and Petersen, 2011; Bate, et.al., 2009; DeAngelo, 2007). However, even if companies with high information asymmetry did want to use credit lines, it would be hard to attain those loans (Hardin, et.al., 2012). As dividends are paid from the internal cash as well there might be a contradiction for managers to choose how to allocate available funds. Theories on corporate financing suggest that companies have to choose between investments in R&D and dividends as internal funding is less costly than attracted capital from outside (DeAngelo et al., 2006; Fama and French, 2002). Thus, the dividend pay-out policy of the company implies strong constrains on its R&D projects, (Gugler, 2003; Borisova and Brown, 2013; Lim et al., 2018). Also, Fama and French (2001) argue that companies with higher involvement in R&D activities do not pay dividends. Thus, R&D and dividends are in state of competence for internal cash reserves. Based on this discussion the following hypothesis can be formulated:

Hypothesis 1: *The dividend pay outs are negatively related to R&D intensity*

R&D expenditures were perceived as ground for future strong growth opportunities. Researchers have discovered that businesses with great growth prospects pay smaller dividends since the growth prospects consume free cash flow. (Rozzef M., 1982; Utami S., Inanaga I., 2011). According to the Gaver (1993), growth companies with high R&D have lower dividend yields than non-growth companies. Similar to the previous study, Barclay et.al (1995) and Fama French (2001) argued that high growth companies pay low dividend yields.

Hypothesis 1.1: *Growth opportunities is expected to be positively related to R&D intensity*

The bankruptcy cost theory states that R&D-intensive enterprises due to the volatility of their R&D project returns, have difficulty providing collateral to potential loan providers and are also unable to adhere to a inflexible payment schedule. Obtaining debt financing becomes difficult for companies that spends a lot on R&D (Arrow 1962; Hall and Lerner 2009). R&D-intensive businesses requires extra financial resources on funding its technological projects, while the obligation to serve its debts reduces the finances at disposal. The agency theory states that organizations with greater growth alternatives should display less leverage due to underinvestment (Myers, 1977). Additionally, companies that can be characterized as R&D intensive have lower leverage, according to cost transaction theory. According to Hall (2002) using financial instruments to finance innovation is not a good option, if the organization is young and R&D-focused. The study made by Elkemali et. al. (2013) for European market holds similar results on leverage, demonstrating that R&D intensity is negatively related to leverage. Another study made for Indian market has revealed similar results, businesses with higher debt usage have much lower R&D intensity (Saibal, 2012). Additionally, to these empirical studies and theories, there are some research that have analysed the market reaction on the news that a R&D intensive companies make a debt issue. For example, it was shown that US young companies from technological sector (listed on NASDAQ) were significantly worse performing after debt issue (Affleck-Graves and Spiess 1999).

Hypothesis 1.2: *leverage is expected to be negatively related to R&D intensity*

Back in the first half of 20th century Keynes (1936) assumed two positive sides of holding extra cash reserves: cash offers protection from the unstable economic environment, and it allows to reduce the transaction costs. Cash is suggested to be used to meet the everyday operations (Opler et al. 1999), nevertheless, it can be also used as the safe pillow in the case of unforeseen situations (Phan et al. 2019). The investment on R&D can be considered as one of these unforeseen situations, as it brings high uncertainty and risk. Later on, the scholars have been often putting extra focus on what role cash holdings play for innovations. As it was already discussed, it stems out from informational asymmetry and pecking order theory that companies tend to use internal sources of finance to fund its R&D activities. Only Modigliani and Miller (MM) theorem (1958) stated that there are no reason for an enterprise to preserve high cash holdings. However, the MM theory is true only for perfect market, which assumes the absence of transaction, agency and taxes costs. Such ideal market is hard to imagine in the real life, so the MM theory was refuted by empirical studies multiple times. Corporations keep cash on hand to take advantage of any future deals or investment opportunities that may present itself in order to outperform their rivals (Besley

and Brigham, 2008). According to the study made by He and Wintoki (2016) on the sample of US companies, the increase in the average cash-to-assets ratio of U.S. firms can be explained through expenses on research and development. Lyandres and Palazzo (2016) state that companies that operate in markets with products of high uncertainty, what is the case of innovative products, make them to rely more on cash holdings. In present empirical literature on how cash holdings are interrelated with the cash flow on R&D expenditures persist the view that impact of cash is either positive (Guney et al. 2017, Brown and Petersen 2011) either cumulatively positive (Bond et al. 2005). Such findings were demonstrated for developed markets (Bah R., and Dumontier P., 2001). Similar results were acquired by the Elkamel et. al., (2013), who exhibited that R&D intensive firms from European market hold more cash. Additionally, on the sample of Chines companies it was also found that the more innovative a company is the more cash holdings it holds (Cheng et. al., 2023). From the point of industries, companies that belong to computers, computer software, electronic equipment, and pharmaceuticals sectors have proven to hold the highest value of cash (Pinkowitz and Williamson 2007). Therefore, the following hypothesis can be formulated:

Hypothesis 1.3: *Cash holdings are positively related to R&D intensity*

Research methodology

Econometric method

In order to test stated hypotheses, the empirical research should be arranged. Studies like this assume data to be in panel format, what means there is more than one dimension of variables. In the case of this study there are two dimensions, namely time (t) and company (i) (Maddala, G. S. 2001; Davies, A.; Lahiri, K., 1995).

There are three major research models used for panel data analysis, pooled Ordinary least squares (OLS), fixed effects (FE) and random effects (RE). Each model has its own benefits. For example, a fixed effect model allows to take into account all time-invariant variations between the individuals, hence the estimated coefficients of the fixed-effects models cannot be prejudiced as a result of omitting time-invariant characteristics. The limitations of fixed-effects models include their inability to examine the sources of the dependent variables that are time-invariant (Kohler et. al., 2009). On the other hand, under random effects model time-invariant variables can serve as explanatory variables in since they are predicated on the assumption that the entity's error term is uncorrelated with the predictors. However, the drawback of random models is that it raises the issue of omitted variable bias, because some variables could not be available (Torres-Reyna). Instead of whether these effects are stochastic or not, the key distinction between fixed and random

effects is whether the unobserved individual effect has elements that are linked with the regressors in the model (Greene, 2008). In order to decide which model to use, a specialised tests should be. Nevertheless, there exist other specific models like GMM, 2 Squares Dummy Variable model (LSDV), Two-Stage Least Squares (2SLS) that might show more accurate results and be more robust than other models.

Estimation model and Variables

The regression models is following:

$$R\&D_{i,t} = \alpha_0 + \beta_1 DIV_{i,t} + \beta_2 GROWTH_{i,t} + \beta_3 LEV_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 CASH_{i,t} + \beta_6 COVID_t + CRISIS_t + Ind * Intensity_i + \mu_i + \tau_t + \varepsilon_{i,t} \quad (1)$$

This research is using traditional variables that are usually used in the similar empirical studies. This includes the R&D intensity as the dependent variable, DIV, LEV, CASH and GROWTH as independent variables, SIZE, CRISIS and COVID as control variables.

The R&D intensity variable will be used as a dependent variable for the test. This variable will be defined as total expenditures on R&D divided by total sales, the similar approach has been used by other scholars with similar studies (Alam et al., 2020; Magerakis et. al., 2021).

The DIV variable stands for dividends payments divided by total sales.

Growth stands for growth in sales from year to year, it is assumed that fast growing companies tend to be more R&D intensive (Hasan, 2022).

LEV stands for leverage of the company, which is defined as total debt divided by total assets, what is again a common approach (Magerakis et. al., 2021; Amidu, 2007).

Cash is the sum of cash plus short-term investments divided by the total assets, which is the typical approach used in the similar studies (Brown and Petersen 2011; Guney et al. 2017; Bates et al. 2009). According to Lazaridis and Papadopoulos (2002) Cash holdings are defined as available cash at the company's disposal as well as cash equivalents, or short-term assets with little danger of losing value owing to fluctuations in interest rates.

The size is the natural logarithm of total assets of a company. The effect of size on company's R&D can be ambiguous. According to the Jensen (1986) big companies might be affected by agency costs and their managers be myopic what will lead to lower R&D intensity and dividends pay out as well. From another perspective, investments in innovation requires a lot of resources, so this is more affordable for larger corporations. According to the trade-of idea, when a large company's activities are diversified, they often benefit from economies of scale. This may

lead to less problems with acquiring external financing, as stable cash flows ensure a company to be more trustworthy to provide with funds. This leads to lower levels of informational asymmetry, so companies might then use other sources of finance rather than only cash. The very recent study on BRICS countries (Hasan F., et.al., 2022) argue that size have a positive effect on dividend payments and R&D expenditures. There are two views on defining firm size in studies like this, namely the logarithm of market capitalization (Eddy and Seifert, 1988; Redding, 1997) another approach is to use natural logarithm of total assets (Alam, et.al., 2020). The latter method is also used by the similar study on BRICS countries (Hasan F., et.al., 2022), therefore, in this study the same approach will be used. Additionally, this study controls for time and corporate specific effects.

Considering time effects this will be the economic crisis in Russia in 2014 and effect of Covid-19 in 2020 and 2021. The study by Hasan F., et.al., (2022) reveals that companies struggled to maintain dividend payments during the Covid-19 outbreak.

The summary on the variables that will be used in the model is presented in Table 1.

Table 1. Variables definition

Symbol	**Variable name**	**Variable definition**
Dependent variable		
$R\&D_{i,t}$	R&D intensity	Ratio of expenditures on Research and Development on total sales
Independent variables		
$DIV_{i,t}$	Dividends	Ration of dividends pay outs to total sales
$GROWTH_{i,t}$	Growth rate	Sales growth from year t-1 to t
$LEV_{i,t}$	Leverage	Ratio of total debt to total asset
$CASH_{i,t}$	Cash holdings	Ratio of cash plus short-term investment to total assets
Control variables		

$\boldsymbol{SIZE_{i,t}}$	Firm's size	The natural logarithm of total assets of firm i
$\boldsymbol{CRISIS_t}$	Economic crisis of 2014 in Russia	The dummy variable that takes value of 1 if the year equal to 2014, equals to 0 if otherwise
$\boldsymbol{COVID_t}$		The dummy variable that takes value of 1 if the year equal to 2020 and 2021, equals to 0 if otherwise
i		The indicator of a company
t		The indicator of a year

Descriptive statistics

The study covers the companies from the Russian market. The time frame is 10 years in total from 2012 to 2021. This time frame provides most relevant results, at the same time covers long enough period to make meaningful conclusions and reflects the macroeconomic turmoils like economic crisis in 2014 and Covid in 2020 and 2021 (time fixed effects). The sample will cover all possible industries, which may be involved in R&D activities. All-Russian classifier of types of economic activity is used to define the industry and economic type of activity. As for search for data, the Spark database, which covers business and financial indicators of Russian enterprises, will be used. Specific burdens, like required level of R&D intensity, firm size, the temps of growth or any other have not been implied, so to have a full picture on behaviour of Russian companies. The resulted data is unbalance, what is not an unusual situation for studies like this. Unbalanced data means that there will be different number of years for each company. To be more precise, some companies could be delisted during the observation period, so number of observations might be different for each firm.

All data have been acquired from Spark, separately for each industry. All financial indicators (expenses on R&D, dividends payments, total debt, total assets, cash reserves plus short-term investments and sales) that lying in the basis of final values of variables that were presented in the previous chapter were sorted: all zero values for total assets, cash reserves plus short-term investments, sales and expenses on R&D were removed from the sample. It is particularly crucial to remove zero values for R&D as my study focuses on companies that can be named as

technological, so they should invest at least something on innovations. Additionally, to that adjustments the function “winsor 1% 99%” was applied. This function allows cut down the outliers, usually top and low 1% of observations, but can be modified by required level.

As the result the final sample to be tested for 10 years consists of 23058 observations. Table 2 shows a breakdown of observations by a particular group of economic activity. It can be seen that most observations come from Manufacturing industries and Mining, with 45% and 21% respectively. This statistics is not surprising as the All-Russian classifier of types of economic activity (OKVED) arranged in a such a way that most companies fall into category of Manufacturing industries, in case of Mining this is also not surprising considering the structure of Russian economy. The least observations come from Financial and insurance activities (0.5%) and Professional, scientific, and technical activities (1.6%). The results on the last one can tell that scientific sector of economic sector is underdeveloped. All left observations for other economic groups varies from 3% to 8% approximately.

Table 2. Number of observations by the economic group

Economic group	Number of observations	% of total
Agriculture, foresty, fish farming	1149	5.0%
Mining	4847	21.0%
Manufacturing industries	10387	45.0%
Provision of electricity, gas and steam	1401	6.1%
Water supply; sanitation, organization of waste collection and disposal, pollution elimination	813	3.5%
Transportation and storage	1819	7.9%
Information and communication	1392	6.0%
Financial and insurance activities	105	0.5%
Professional, scientific, and technical activities	379	1.6%
Health care	766	3.3%
Total	23058	100%

Nevertheless, the Table 2 can be significantly detailed by listing all industries that have been used in this study. See Table 3. According to this Table, it can be concluded that the statistics acquired is almost well balanced, from the point of observations’ allocation among industries. There are no extra small or extra big values. The leaders are: Production of food, drinks and

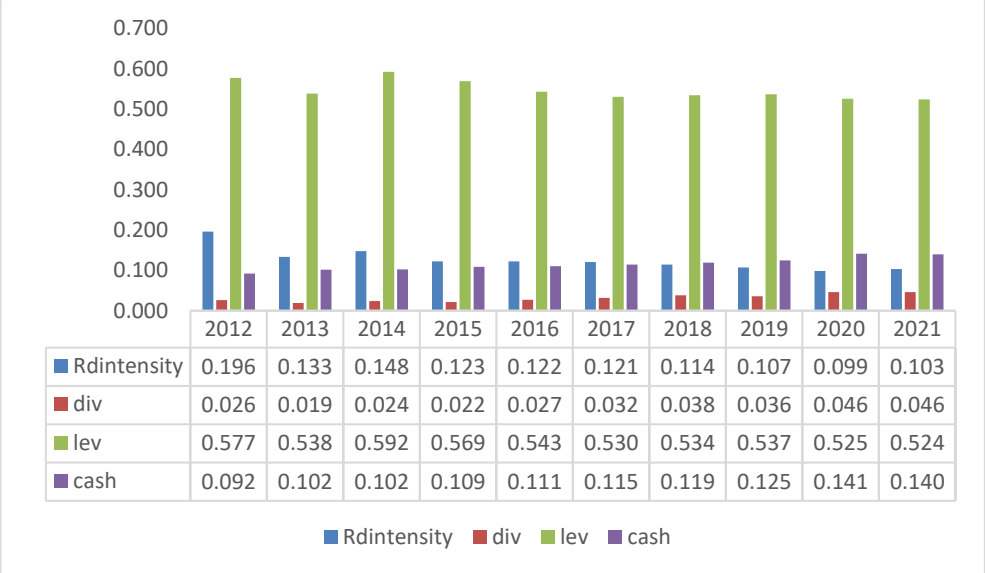
tobacco; Crude oil and natural gas extraction; Provision of electricity, gas and steam; and Production of medicines and materials used for medical purposes. The least number of observations come from: Postal communication and courier activities; Provision of professional scientific and technical services; and Information technology activities.

Table 3. Number of observations by industry

Industry	Observations	% of total
Crop and animal breeding, hunting and provision of related services	551	2.4%
Forestry and timber harvesting	136	0.6%
Fishing and fish farming	462	2.0%
Coal mining	926	4.0%
Crude oil and natural gas extraction	1472	6.4%
Extraction of metal ores	712	3.1%
Extraction of other minerals	420	1.8%
Provision of services for mining	1317	5.7%
Production of food, drinks and tobacco	2103	9.1%
Wood processing, manufacture of wood products, paper production	836	3.6%
Production of coke and petroleum products	579	2.5%
Production of chemicals and chemical products	805	3.5%
Production of medicines and materials used for medical purposes	1379	6.0%
Production of rubber and plastic products	598	2.6%
Production of other non-metallic mineral products	673	2.9%
Metallurgical production and finished metal products	283	1.2%
Computers, electronic, optical products and electrical equipment	658	2.9%

Production of machinery and equipment	754	3.3%
Manufacture of vehicles	1008	4.4%
Furniture manufacturing	126	0.5%
Production of other finished products	341	1.5%
Repair and installation of machinery and equipment	244	1.1%
Provision of electricity, gas and steam	1401	6.1%
Water intake, purification, treatment and distribution	579	2.5%
Collection, processing and disposal of waste	234	1.0%
Land and pipeline transport activities	213	0.9%
Water transport activities	1004	4.4%
Air and space transport activities	566	2.5%
Postal communication and courier activities	36	0.2%
Production of films, videos and television programs, publication of sound recordings	190	0.8%
Activities in the field of television and radio broadcasting	617	2.7%
Telecommunications activities	335	1.5%
Computer software development	171	0.7%
Information technology activities	79	0.3%
Financial and insurance activities	105	0.5%
Activities in the field of architecture and engineering design; technical testing	107	0.5%
Fundamental, applied scientific activities and experimental developments	198	0.9%
Provision of professional scientific and technical services	74	0.3%
Health care activities	766	3.3%
Total	23058	100.0 %

Figure. 3 demonstrates the year average values of R&D intensity, DIV, LEV and CASH. From the point of R&D intensity the highest median values were observed in 2012 and 2014. Since 2014 the R&D intensity was steadily declining in average. The opposite situation is observed for level of dividends, that demonstrated the steady growth from 2015 to 2021, reaching its peak in 2020 and 2021. The leverage was highest at 2012 and 2014, in next it was fluctuating. Considering the Cash, it similarly to dividends, it has been increasing steadily through whole period of observations. Also, Figure 3 explicitly shows that companies from the observations were spending more on R&D rather than on dividend payments.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rdintensity	0.196	0.133	0.148	0.123	0.122	0.121	0.114	0.107	0.099	0.103
div	0.026	0.019	0.024	0.022	0.027	0.032	0.038	0.036	0.046	0.046
lev	0.577	0.538	0.592	0.569	0.543	0.530	0.534	0.537	0.525	0.524
cash	0.092	0.102	0.102	0.109	0.111	0.115	0.119	0.125	0.141	0.140

Fig. 3. *The median values for each year*

Figure 4 shows the summary statistics for all variables acquired by Stata. R&D intensity has the mean value of 11.8%. According to Zakrzewska (2010) the companies with level of R&D intensity of 8% and higher can be considered as highly intensive. Dividends have mean value of 3%, meaning that companies from the sample spends 3% on dividend payouts relatively to their sales, however the standard deviation of dividends is higher than the mean, therefore the dividends payments were volatile through observations. Leverage equals 54%, what means that companies from the sample have a good balance of debt to equity on average. Companies were quite slowly growing through the years of observations – 1.44% on average. Companies had a cash holdings on the level of almost 12%.

	Observations	Mean	Std. Dev.	Min	Max
R&D intensity	23058	0.1183302	0.3612165	0.000158	3.060717
Dividends	23058	0.0339173	0.083352	0	0.511106
Leverage	23058	0.5416506	0.3876044	0.000038	2.181569
Growt(%)	23058	1.4430120	1.773525	0.307598	15.58896
Cash	23058	0.1198792	0.1601031	0	1
Size	23058	20.6818600	2.03627	10.7364	30.14141
Covid	23058	0.2633793	0.4404759	0	1
Crisis 2014	23058	0.0848729	0.2786986	0	1

Fig. 4. *Summary statistics*

Figure. 5 reports the correlation matrix between all variables for this study. The * denomination stands for level of significance, for this study the level of 5% was chosen. From the results it can be seen that almost all correlations, except for correlation between the leverage and crisis, are significant, meaning that results are trustworthy. The correlation between R&D and dividends is negative; between R&D and leverage is negative; between R&D and growth is positive; between the R&D and cash is negative; between R&D and size is positive; between R&D and cov is negative; between R&D and crisis is positive.

	RDinte~w	div_w	lev_w	growth_w	cash	size	cov
RDintensit~w	1.0000						
div_w	-0.0470*	1.0000					
	0.0000						
lev_w	0.0928*	-0.1763*	1.0000				
	0.0000	0.0000					
growth_w	0.1607*	-0.0501*	0.1129*	1.0000			
	0.0000	0.0000	0.0000				
cash	-0.0861*	0.1684*	-0.2359*	-0.0235*	1.0000		
	0.0000	0.0000	0.0000	0.0004			
size	0.1138*	0.1029*	0.0150*	0.0203*	-0.1045*	1.0000	
	0.0000	0.0000	0.0227	0.0020	0.0000		
cov	-0.0292*	0.0855*	-0.0265*	-0.0204*	0.0770*	-0.0314*	1.0000
	0.0000	0.0000	0.0001	0.0019	0.0000	0.0000	
crisis	0.0251*	-0.0354*	0.0396*	-0.0061	-0.0338*	-0.0029	-0.1821
	0.0001	0.0000	0.0000	0.3537	0.0000	0.6637	0.0000

Fig. 5. *Correlation matrix*

Specification tests

Since this sample contains observations with very different levels of R&D intensity values, the results coming from it might be not indicative enough. Some studies apply additional

tests, where samples are divided into subsamples depending on the level of R&D intensity. For example, Bah and Dumontier (2001) used the threshold of 5% for R&D intensity to distinguish between high and low R&D intensive companies. Nagasawa and Ito (2016) also tested the relation between dividends and R&D by applying different level of R&D intensity. Elkemali et.al. (2013) focused on upper and lower extreme values (tertiles) of R&D intensity to test their hypotheses. Therefore, this study will apply the similar approach by testing all hypotheses on the sample of R&D intensive and R&D non intensive companies. To do that, the whole sample will be decomposed in two subsamples, first one consisting of observations with observations of upper quartile of R&D intensity values (top 25%); the second one will contain lower quartile (bottom 25%) of R&D intensity values.

Table 4 is similar to the Table 2. It reports the distribution of observations for both subsamples among the economic groups. For agriculture group the number of observations in relative measures (per cents) have increased for R&D intensive companies and decreased for R&D low intensive companies, 8.7% against 5% and 2.9% against 5% respectively. This means that agricultural companies spend a lot on innovations. The similar situation can be observed for Mining group. However, for manufacturing group the situation is opposite, there are more observations for R&D low intensity group, while manufacturing industries are usually considered to be more R&D intensive. Provision of electricity, gas and steam has also more observations in the sample of low R&D intensive companies. All industries connected with water supply, sanitation and pollution elimination remained on the almost similar level for all types of samples, 3.5%, 3.1% and 3.7% respectively. For companies working in transportation and storage there are lower R&D intensive companies than high ones. There are more observations in highly intensive group for Information technologies, what is logical because this sector is considered to be more R&D intensive. Financial sector remained on the same low level. For R&D sector it turned out that there are more observations for low R&D intensive enterprises. Observations for Healthcare sector for both subgroups have decreased in comparison with the main sample, between subgroups there are no big difference.

Table 4. Economic groups distribution for different levels of R&D intensity

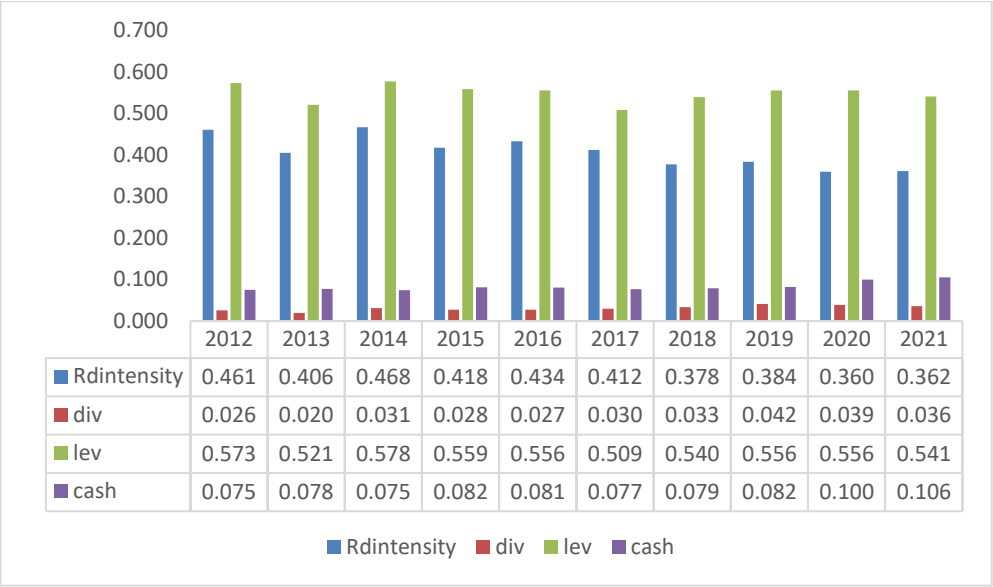
	R&D top 25%		**R&D low 25%**	
Economic group	**Number of observations**	**% of total**	**Number of observations**	**% of total**
Agriculture, foresty, fish farming	500	8.7%	167	2.9%
Mining	1892	32.8%	702	12.2%

Manufacturing industries	1739	30.2%	2964	51.4%
Provision of electricity, gas and steam	391	6.8%	426	7.4%
Water supply; sanitation, organization of waste collection and disposal, pollution elimination	181	3.1%	215	3.7%
Transportation and storage	376	6.5%	607	10.5%
Information and communication	439	7.6%	388	6.7%
Financial and insurance activities	48	0.8%	27	0.5%
Professional, scientific and technical activities	74	1.3%	126	2.2%
Health care	125	2.2%	143	2.5%
Total	5765	100%	5765	100%

The Table 9 that is similar to the Table 3 that shows the distribution of observations among industries but for highly and low R&D companies can be found in the Appendix. Just to note here, the most R&D intensive industries are crude oil and natural gas extraction, provision of electricity, gas and steam and production of medicines and materials used for medical purposes.

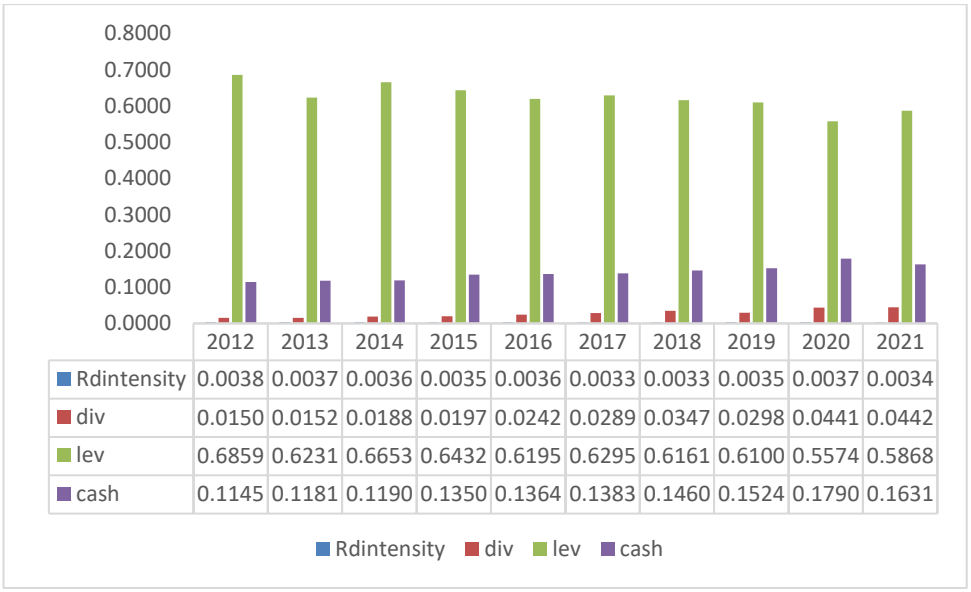
Figure 6 illustrates similar results as Fig. 3, but for high R&D intensive companies. The behaviour of variables' averages is similar to the trends of whole sample. For example, yearly average R&D intensity was decreasing since 2014. The level of dividends was fluctuating, reaching its peak in 2019, but still the was higher in last years of observations than in first ones. In case of leverage, its yearly average values is quite similar to the values of whole sample. Cash has been also increasing steadily from 2012 but is lower than for all observations.

Figure 7 demonstrates same results but for lower quartile of R&D intensive companies. R&D intensity has been also decreasing through years, therefore this trend is common for all types of companies. Dividends ratio has been also increasing, but the growth rate is much higher, it has increased in approximately three times from 2012 to 2021. Leverage for this group of observations is higher than for other groups, but it has decreased more gradually since 2012, what has not been seen on other two groups. Cash holdings ratio has been increasing, like in other samples, but it level is higher.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rdintensity	0.461	0.406	0.468	0.418	0.434	0.412	0.378	0.384	0.360	0.362
div	0.026	0.020	0.031	0.028	0.027	0.030	0.033	0.042	0.039	0.036
lev	0.573	0.521	0.578	0.559	0.556	0.509	0.540	0.556	0.556	0.541
cash	0.075	0.078	0.075	0.082	0.081	0.077	0.079	0.082	0.100	0.106

Fig. 6. *Upper 25%*



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rdintensity	0.0038	0.0037	0.0036	0.0035	0.0036	0.0033	0.0033	0.0035	0.0037	0.0034
div	0.0150	0.0152	0.0188	0.0197	0.0242	0.0289	0.0347	0.0298	0.0441	0.0442
lev	0.6859	0.6231	0.6653	0.6432	0.6195	0.6295	0.6161	0.6100	0.5574	0.5868
cash	0.1145	0.1181	0.1190	0.1350	0.1364	0.1383	0.1460	0.1524	0.1790	0.1631

Fig. 7. *Lower 25%*

Figure 8 and 9 reports the summary statistics for upper quantile and lower quantile of R&D intensity observations, respectively. Both subsamples contain 5765 observations. The mean value of dividends for high R&D intensive group is a bit higher than for low R&D intensive group. The mean value of leverage is higher for low intensity group, 63% against 54%. If to compare leverage between the whole sample and subsample of higher quantile, then it is on the same level almost, 54.16% against the 54.74% respectively. The growth mean value of highly intensive companies is higher than for low intensive companies. Companies from upper quantile are a bit larger. The standard deviations for many values in both subsamples are usually higher than mean values.

Variable	Observations	Mean	Std. Dev.	Min	Max
R&D intensity	5765	0.4014175	0.6431019	0.0849703	3.060717
Dividends	5765	0.0324527	0.0855151	0	0.5111062
Leverage	5765	0.5474729	0.3973813	0.0001815	2.181569
Growt(%)	5765	1.6864220	2.409097	0.3075981	15.58896
Cash	5765	0.0847786	0.1268597	7.27E-08	0.9389435
Size	5765	21.3534100	2.210013	13.45741	28.24931
Covid	5765	0.2404163	0.4273734	0	1
Crisis 2014	5765	0.0954033	0.2937967	0	1

Fig. 8. *Summary statistics for upper 25%*

Variable	Observations	Mean	Std. Dev.	Min	Max
R&D intensity	5765	0.0035074	0.0024894	0.0001575	0.0085697
Dividends	5765	0.0304828	0.0778919	0	0.5111062
Leverage	5765	0.6313015	0.399558	0.0001363	2.181569
Growt(%)	5765	1.4101400	1.7118305	0.3075981	15.58896
Cash	5765	0.1465174	0.184852	2.53E-07	0.9797511
Size	5765	20.21337	1.829807	13.19561	27.50269
Covid	5765	0.27268	0.4453763	0	1
Crisis 2014	5765	0.0853426	0.2794151	0	1

Fig. 9. *Summary statistics for lower 25%*

Figures 10 and 11 reports the correlation matrixes between variables for both subsamples. The level of significance is set on 5%. All correlations, except for crisis are significant for observations from upper quantile group. Starting with the results from Figure 10 for highly intensive companies, the correlation between R&D intensity and dividends is negative and less in two times in comparison with the same correlation from Figure 5, -0.0975 against -0.0470. The correlation between R&D and leverage is positive and higher in comparison with the whole sample. The correlation with the growth is positive and also higher. The correlation with cash holdings is negative. The correlation with size is positive, but less than in whole sample, 0.0451 against 0.1138. The correlation with covid is negative and with crisis is positive. In the case of correlation matrix for lower quantile of R&D intensive companies, R&D is positively correlated with dividends, while the correlation with leverage is negative. The correlation with growth is also negative, but not significant. The correlation with size is positive and non-significant. The correlation with time effects, covid and crisis, is positive and not significant as well.

	RDinte~w	div_w	lev_w	growth_w	cash	size	cov
RDintensit~w	1.0000						
div_w	-0.0975*	1.0000					
	0.0000						
lev_w	0.2064*	-0.1563*	1.0000				
	0.0000	0.0000					
growth_w	0.2070*	-0.0818*	0.1610*	1.0000			
	0.0000	0.0000	0.0000				
cash	-0.0727*	0.1565*	-0.2340*	-0.0426*	1.0000		
	0.0000	0.0000	0.0000	0.0012			
size	0.0451*	0.1454*	-0.0455*	-0.0096	-0.0774*	1.0000	
	0.0006	0.0000	0.0005	0.4679	0.0000		
cov	-0.0356*	0.0329*	0.0014	-0.0392*	0.0802*	-0.0834*	1.0000
	0.0068	0.0125	0.9155	0.0029	0.0000	0.0000	
crisis	0.0334*	-0.0051	0.0246	0.0117	-0.0255	0.0074	-0.1827*
	0.0112	0.7002	0.0621	0.3758	0.0530	0.5717	0.0000

Fig. 10. *Correlation matrix for upper 25%*

	RDinte~w	div_w	lev_w	growth_w	cash	size	cov
RDintensit~w	1.0000						
div_w	0.0582*	1.0000					
	0.0000						
lev_w	-0.1245*	-0.2194*	1.0000				
	0.0000	0.0000					
growth_w	-0.0372*	-0.0263*	0.0774*	1.0000			
	0.0047	0.0455	0.0000				
cash	-0.0205	0.2122*	-0.2588*	-0.0098	1.0000		
	0.1189	0.0000	0.0000	0.4592			
size	0.0085	0.0403*	0.1029*	0.0478*	-0.0761*	1.0000	
	0.5184	0.0022	0.0000	0.0003	0.0000		
cov	0.0163	0.1071*	-0.0646*	-0.0067	0.0835*	-0.0032	1.0000
	0.2151	0.0000	0.0000	0.6103	0.0000	0.8067	
crisis	0.0113	-0.0459*	0.0400*	-0.0157	-0.0455*	-0.0206	-0.1870*
	0.3910	0.0005	0.0024	0.2326	0.0006	0.1185	0.0000

Fig. 11. *Correlation matrix for lower 25%*

To sum up on the part of descriptive statistics, the wide of Russian companies from different industries was acquired for a period from 2012 to 2021. The main sample consists of 23058 observations, most of which are coming from the Mining and Manufacturing economic groups. Then other two subsamples, were formed in accordance with approaches in other empirical studies with similar topics. First subsample contains observations only with a high level of R&D intensity values, namely top 25% from the main sample, while second one contains only observations with low R&D intensity values, namely low 25%. Similar studies apply the notion of high R&D intensity not to any company that just spends some portion of money on R&D expenses, but to

those enterprises that have relatively high expenses on R&D relatively to sales. Therefore, this will allow to test the stated hypotheses of this study more accurately.

The histograms on years' averages of R&D, DIV, LEV and CASH, allowed to access the financial behavior of Russian enterprises over the period of interest. It can be observed that for all groups R&D was steadily decreasing through 10 years, while the level of dividends and cash holdings was increasing. The level of leverage was almost fluctuating.

So far, correlations' matrixes for all groups of observations suggest that the effect of dividends will be negative on R&D intensity in general and for highly intensive companies in particular; and will be positive in case of low intensive companies. Nevertheless, the results on cash and leverage might be opposite to the hypotheses.

CHAPTER 3. RESULTS AND DISCUSSION

This part provides empirical results and the discussion of financial meaning of acquired results. To tests all hypotheses the Stata software is used.

First test covers the whole sample. As a default model the OLS model will be applied with the regard to robustness and autocorrelation. However, a more profound model, either random effect or fixed effects is needed. In order to decide between the random effects and fixed effects, the Durbin-Wu-Hausman test is applied. According to this test the fixed effects should be used for whole sample, since the Prob Chi2 < 0.05. In case with FE model, it is also required to test if it needed to count for time fixed effects. To do that the Stata code "testparm" can be applied. In the case of this study time fixed effects should be accounted. Therefore, the second model will be the fixed effects with accounting for time fixed effects, heteroskedasticity and autocorrelation.

However, besides Hausman test allows to decide between the RE and FE models it also detects the problem of endogeneity, if the Prob Chi2 < 0.05. Therefore, the fixed effect model has a problem of endogeneity. In order to address this issue an additional statistics model is needed.

Going back to the discussion on what model to be used. Among all models mentioned before, the GMM (Generalised method of moments) is one of the most accurate and robust models to be used for panel data studies, which was developed by the Arellano and Bover (1995); Blundell and Bond (1998). This technique makes use of instrumental variables generated from the orthogonality relationships between disturbances and lagged values of the dependent variable. Additionally, the OLS and fixed effects models, if being regressed with the usage of lagged dependent variable as independent variable, will show upward (for OLS) and downward (for fixed effects) result for this lagged variable, while the usage of GMM will give more accurate result, usually between those two. Moreover, this approach is compatible with the panel data, especially for studies with relatively short time frames against large cross-sectional dimensions, what is applicable in my case as T = 10 years and N = 23058 observations (Asongu et al., 2018). Also, the GMM allows to solve problems like measurement errors, unobserved heterogeneity, endogeneity, omitted variable bias, time fixed effects and prevention from cross-sectional and time-series heteroscedasticity (Hall and Urga 1999; Lasfer 2003; Alam et al., 2019; Mthanti and Ojah, 2017), what is actually not possible to achieve at once under any other standard models like OLS, RE and FE. However, GMM is mostly applicable in case of pooled OLS models and fixed effects, while random effects count for unobserved heterogeneity and so for endogeneity. It also should be noted that expenses on R&D and dividends pay outs are endogenously determined that is why applying GMM is justified in this study.

By itself the GMM can be used in four different ways: Difference GMM one step/two steps, System GMM one step/two steps. The drawback of the Difference GMM that it cannot estimate the coefficients of the variables since they are deleted because they do not vary over time. At the same time Zhao et. al. (2021) state that System GMM is able to deal with the limited sample size of Difference model. If to compare the one step and two step sub options, then the two-stage method is not affected by heteroscedasticity. Additional measure to decide which one GMM model to use, one should simply run all four types of GMM regressions separately and compare them with the results of regressions of OLS and FE models that uses dependent variable (R&D intensity) lagged by one period as an independent variable. The command "xtabond2" is used in Stata, so to apply the GMM.

Therefore, to test all hypotheses on the main sample, three statistics model will be used, the OLS, fixed effects and as an additional test that should bring more accurate results will be the two step System GMM.

Table 5 reports results for all type of regression models. In comparison with static panel data models, like OLS and FE, a dynamic panel model like GMM also uses lags, of the dependent variable as independent variables. Therefore, the GMM includes the coefficient for R&D intensity lagged by one year. It should be noted that GMM models usually reduces the number of observations, in the case of this study the GMM has reduced it to 15599 observations. For all three models the F-statistics is equal to 0, so all the results did not happen by the chance and that the joint effect of variables is significant. In case, of GMM model the there are no 1st order and not 2nd order autocorrelation. To identify if the instruments used in two step system GMM are valid, the Hansen test of overidentification restrictions should be applied. The Prob Chi2 = 0.434, meaning that instruments are valid (H0: all overidentifying restrictions are valid) (Kripfganz, S. 2019; Kiviet, J. F., and S. Kripfganz 2021). The only drawback with the results of GMM is that the standard deviations are higher than the values of coefficients.

Under all models the effect of dividends has proved to be negative and statistically significant for OLS and FE models. Therefore, the H1 can be accepted. The effect of leverage is turned out to be positive for all three models and significant for OLS and FE. Hence, the supporting hypothesis regarding the leverage should be rejected. The effect of growth is positive for OLS, FE and GMM, therefore the hypothesis regarding growth effect should be accepted. The effect of cash is negative under OLS and FE but positive under GMM, as the level of significance for GMM is satisfactory (0.035) and the model by itself is more accurate and accounts for endogeneity, the results from GMM will be accepted as the major one, hence accepting the hypothesis that cash

holdings have positive effect on R&D intensity. The effect of size is positive under all three models and significant under OLS and GMM. Covid effect is negative and significant under OLS and FE and omitted due collinearity under GMM. The effect of crisis is positive under OLS and GMM and negative under FE, but significant only under OLS, therefore the positive effect will be considered as true.

Table 5. Empirical results

	OLS	**Fixed effects**	**GMM**
Variables		**Coefficients**	
$R\&D_{t-1}$			0.5001872***
div	-0.13188***	-0.0758953**	-0.0012422
Lev	0.0519679***	0.0980923***	0.0565043
Growth	0.0304309***	0.0026635	0.0333044
Cash	-0.1164701***	-0.0613085***	0.2106591**
Size	0.0190434***	0.0076704	0.195939**
cov	-0.0092469*	-0.0782997***	Omitted
crisis	0.0249034***	-0.0195995	0.0125761

* - denotes the significance level, where

* - <10%

** - <5%

*** - <1%

Additionally, the control test will be applied in order to enhance the results from the Table 5. To do that, the similar test will be applied, but the dependent variable will be DIV and R&D intensity will be the regressor. There are no 1st and 2nd order autocorrelations in GMM model. According to Hansen test, the instruments used in the GMM are valid.

Results acquired through OLS and FE are negative and significant, while under the GMM is positive and non-significant. These results enhances the results from the Table. The effect of leverage on dividends is negative and significant under all models, suggesting that debt is used for R&D expenses rather for dividends payments, so enhancing the rejection of leverage hypothesis.

The effect of growth is negative on dividends under all models and significant under OLS and FE, enhancing the hypothesis that growing companies would rather spend on innovations than pay out dividends. The effect of cash is positive for all models and significant under OLS and GMM, again this correlates with the results of the main regression from Table 5. The effect of size is positive under OLS and negative under FE and GMM, but significant under OLS and FE, since FE is assumed to be accurate than OLS than the effect of size on dividends would be accepted as negative. This also correlates with the results from the main test.

Table 6. Control test

	OLS	**Fixed effects**	**GMM**
Variables		**Coefficients**	
DIV_{t-1}			0.1150112***
R&D	-0.0068607***	-0.0051358**	0.0088416
Lev	-0.0294379***	-0.0031278	-0.0202521**
Growth	-0.001304***	-0.001465***	-0.0068822
Cash	0.0729872***	0.0105039	0.1025318***
Size	0.0051498***	-0.0062728***	-0.0009991
cov	0.0135345***	0.0333381***	Omitted
crisis	-0.0033681**	0.0138175***	-0.008712***

* - denotes the significance level, where

* - <10%

** - <5%

*** - <1%

Specification tests

Table 7 presents specification results for subsample of high R&D intensity observations and for low R&D intensity observations. These tests will allow to enhance conclusions received from the results of Table 5.

In case of sample with high R&D intensity, the time fixed effects are not needed in FE model, since the testparm test failed to reject the null hypothesis. OLS and FE models accounts for heteroscedasticity. The GMM test does not have any type of autocorrelation, also Hansen tests shoes that instruments are valid. The level of standard deviation is only higher for dividends' coefficient, but slightly.

It should be noted that random effects model has been applied to the sample of low R&D intensity, because the Hausman test accepted the null hypothesis, meaning that RE should be preferred over the FE. This also means that there are no endogeneity problem, as RE model by itself accounts for unobserved heterogeneity. Hence, the GMM, which helps to address endogeneity, is not required. The OLS model is also not needed for this subsample as the Breusch and Pagan Lagrangian multiplier test for random effects rejected the null hypothesis, meaning that RE is better than OLS. The RE in this study covers the problem of heteroscedasticity. There is no need to count for serial correlation as this problem occurs mostly for samples with long time series (20-30 years) (Torres-Reyna, 2007).

Starting with the discussion of results for highly intensive sample, the effect of dividends is negative for all three models, especially for GMM, and significant for OLS and FE. Moreover, the coefficients under all models are higher in several times than same results from the Table 5, thus proving the assumption that more R&D intensive companies are less dividends they tend to pay. The effect of leverage is positive and significant under OLS and FE. The values by itself are larger than in Table 5, meaning that highly innovative companies relies on the leverage as the source of financing. The level of growth is positive under OLS and GMM, and significant under OLS. Additionally, the coefficients are higher than in Table 5, so highly intensive companies are fast growing in general. The effect of size is positive and significant under OLS, but FE and GMM shows that the effect of size is negative and significant under FE, since these two models are more accurate than OLS, then the size effect will be assumed to have a negative effect on high innovative companies. The effect of Covid is negative and effect of crisis is positive, what coincides with the results of Table 5.

Considering the results for low R&D intensity observations, the effect of dividends is positive and significant. The effect of leverage, growth and cash is negative and significant. The effect of size, covid and crisis is positive but not significant. These results support the previous results and assumptions.

The discussion of acquired results for all tests from the corporate finance perspective will be provided in the next part.

Table 7. Specification tests

	High R&D intensity			Low R&D intensity
	OLS	**Fixed effects**	**GMM**	**Random effects**
Variables	**Coefficients**			
$R\&D_{t-1}$			0.605122***	
div	-0.4798355***	-0.2268468***	-1.235094	0.0012222***
Lev	0.2726815***	0.3453677***	0.2822765	-0.0006968***
Growth	0.0464256***	-0.0018016	0.1219263	-0.0000388**
Cash	-0.0466281	0.004482	0.827574	-0.0005449***
Size	0.0178741***	-0.1269086***	-0.0458716	0.0000322
cov	-0.0253568	-0.01264	Omitted	0.0000314
crisis	0.0506389*	0.0371851	0.0513641	0.0000972

* - denotes the significance level, where

* - <10%

** - <5%

*** - <1%

Financial interpretation of results

The effect of dividends

Regarding the results of the dividends effect on R&D intensity, it has proven to be negative under all three statistical models. In control test, where the dependent variable is dividends and R&D intensity is the regressor, the inverse relation has remained, what enhances the results of the research. The recent study made by Hasan et. al. (2022) for BRICS countries have also shown the dividends and expenses on R&D are negatively related. First of all, it should be noted that the Miller and Modigliani (1961) theory of dividends irrelevance on investments decisions does not hold in this study, basically meaning that Russian market is imperfect. In particular, the results correlates with Fama and French (2001) proposition that investment possibilities, like expenses on innovations, are inversely correlated with paying dividends. Also, Jensen and Johnson (1995)

shown that decrease in dividend pay outs is followed by R&D expenses increase. The simultaneous theory, under which there are no contradiction between dividends and innovations as both considered as sources of value, should be also rejected. Therefore, for Russian companies is either residual dividend policy (investments over dividends) or independent policy (dividends over investments) is true.

The specification tests have enhanced results even more, as the coefficients have increased in several times for highly intensive companies. At the same time, the effect of dividends for low intensive companies is positive. These results go in line with the results of Bah and Dumontier (2001), who shown that high R&D intensive companies pay less dividends than low R&D intensive companies. Moreover, the result of my study strongly correlates with findings made by Nagasawa and Ito (2016) for Japanese markets. According to their research, lower levels of R&D intensity is positively associated with dividend payments, however the high R&D intensity is negatively correlated with dividend pay outs. Theoretically this is explained through the contingency version of reputation hypothesis, meaning that investors consider high investments in R&D as enterprises' commitment to increase their value in long-term, so managers do not have to pay large dividends to build up its reputation among investors. This logic coincides with smoothing dividends and signaling theories. Companies still have to attract funds and send positive signals to investors, it can be done through increasing dividend pay outs, but in the case when companies spend a lot of its reserves on R&D activities, they have less holdings left to increase pay outs, therefore these companies make their payments more predictable, what is also preferable by some investors. Additionally, the dividend clientele approach states that for each of type of investor preference exists its own type of pay out policy.

Therefore, as it was suggested by Hypothesis 1, the effect of dividends on R&D is negative for Russian market, what goes in line with other similar empirical studies but for other markets.

The effect of capital structure

The effect of leverage and cash holdings should be considered jointly. In the first for the whole sample the effect of cash is negative under OLS and FE, but positive under GMM. In the beginning of the Chapter 3 it was mentioned why GMM is more accurate and robust model than other two and counts for endogeneity what is not done under OLS and FE, therefore, the positive effect of cash is presumed to be true in this study. These results coincide with many other studies discussed in this paper (Bah and Dumontier 2001; Elkamel et. al. 2013; Magerakis et. al. 2021; Wang et. al. 2023) However, the effect of leverage is also positive, and the coefficients are even higher, meaning that leverage is preferred by Russian companies to fund its R&D activities. This

result contradicts with the findings of other studies (Hasan et. al. 2022; Elkemali et. al. 2013; Saibal, 2012). The discussion can be supplemented by the results of control test from Table 6. The effect of leverage on dividends is negative, while the effect of cash holdings is positive under all models. In combination, these results might mean that Russian companies use cash holdings mostly to pay out dividends and the rest goes on investments in innovation, while the leverage is exclusively used for R&D. This contradicts with the assumption made by pecking order model to some extent. According to this theory, companies with information asymmetry should rely on internal reserves in the first place to fund its projects, and debt is used for this purpose in the second order.

However, these results have been acquired for whole sample, which includes the companies of very different R&D intensity levels. Therefore, the informational asymmetry might be not very applicable for all companies in the sample. By separating the highly intensive companies, the effect of cash become positive under FE, and the positive coefficient has increased under GMM. Thus, more R&D intensive companies rely more on cash than low or R&D intensive companies. This result correlates with the recent findings made by High School of Economics (Vlasova V., Fridlyanova S., 2022) "innovative companies develop innovations mainly at their own expense (account for 55.3% in cost structure)." At the same time, the effect of leverage has remained positive and has even increased under all models, so enhancing the previous conclusion that Russian innovative companies rely on debt to fund its investments. However, the leverage variable does not specify between the short-term debt and long-term debt and according to Myers (1977), if companies decide to fund R&D by debt, short term debt will be privileged as it matures before the end of project. This suggestion has been approved by Elkemali et. al. (2013), as they have revealed that R&D has strong positive and statistically significant effect on short-term debt. Another explanation can be that Russian companies that get into the sample have easy access to external funding (see Table 10 in Appendix). For example, among the highly R&D intensive companies the largest proportion of account for such industries as crude oil and natural gas extraction; provision of electricity, gas and steam; coal mining, which very often are affiliated with state-owned companies, so they have less burdens acquiring the loans. This partially correlates with the statement from the study by HSE that "problems with access to external financial resources (government support, borrowed funds) are not primary for enterprises."

Therefore, the hypothesis that cash holdings have positive effect on R&D intensity should be accepted, while the hypothesis that leverage has negative effect on R&D intensity should be rejected.

The effect of growth and size

The rate of growth has proved to be positively related under all models, what coincides with many of other studies (Elkemali 2013; Ghosh 2012; Lee and Lee, 2019). The same results have been acquired for highly R&D intensive companies. Moreover, the effect of growth is negative for dividends according to Table 6. This means that growing companies prefer to invest further in their growth opportunities rather than distribute the dividends. This conclusion is supported by the findings of low intensive companies, as those have a positive relation with dividends and negative with growth. Therefore, the hypothesis regarding the positive effect of growth can be accepted.

The effect of size is positive for whole sample and negative for highly R&D intensive companies. As it was discussed previously, the effect of size might be ambiguous, as large companies have more financial opportunities and more access to loans, but they can be affected by agency costs what leads to lower R&D intensity and dividend payouts (Jensen 1986). In combination with results of growth, it can be suggested that highly R&D intensive companies are just smaller and that is why the growth is positively correlated with R&D, because usually small and medium companies grow faster than large one. This might explain why the effect of size is positive for whole sample, as it includes very small and very large enterprises. The additional specification control test was solely implied in order to justify these conclusions (Table 9, Appendix). To do that the similar approach as with major specifications tests was applied, meaning that smallest and largest 25% of companies were left in the sample and then tested by the FE and GMM models. For these additional tests only, coefficients were left as they are the target of interest here. So, for the sample of smallest companies the effect of growth is positive and significant, the effect of size is also positive and stronger (0.018) under the FE model. GMM has shown the positive results for both variables as well. In case of sample with the largest companies, FE model reports the effect of growth to be positive but not significant and effect of the size is negative and strongly significant (<1%). The GMM for this sample has shown positive coefficients but insignificant results for both variables, however the standard deviations for these variables in approximately two times larger than the beta coefficients, in such cases the results of FE models are preferred. To sum up on these additional results, they basically prove the discussion above that R&D intensive companies are of smaller size and they are fast growing.

The effect of Macroeconomic turmoils

The economic Crisis of 2014 and Covid-19 are the exogenous time factors that reflect the impact of macroeconomic turmoils on the financial decisions of Russian managers. The effect of

Covid was negative for all companies, while the effect of crisis 2014 turned out to be positive. What is interesting these effect were opposite for dividends. For highly intensive companies the effect of both events have remained the same. In case with low R&D intensive companies, both incidents had slightly positive but insignificant effect, basically meaning that such companies did not react to these events. In order to clarify, why the effect of covid turned out to be negative, while the effect of crisis positive, an additional tests should be done, which would reflect the structure of these crises.

CHAPTER 4 CONCLUSION

The main obstacles that Russian companies face on the way to implementing innovative projects are primarily financial constraints. Last year, they were also supplemented by restrictions related to the introduction of a large number of new sanctions, which disrupted the previous model based on the import of high-tech products. However, this situation has freed up many technological niches for Russian business, moreover, the investments in R&D brings great growth opportunities by itself. Hence, in order to take advantage of this opportunity, Russian managers need to find sources of financing that they lack so much. One of the possible solutions may be the proper allocation of financial resources within the company, for example, cutting dividend payments in favour of R&D investments. This idea is supported by the results of studies that investigated the impact of dividends and R&D expenses on each other.

Therefore, the goal of this research was to study what type of relation exists between the dividend pay outs and R&D intensity for the Russian market. Additionally, this research has tested what financial sources are preferred by the management of companies to finance its innovation activities. To do that the big sample of observations from 2012 to 2021 of Russian companies have been used. Also, the control test and two specification tests have been implied in order to enhance the findings. The OLS, fixed effects and two step System GMM models have been used for these tests.

The effect of dividends is negative for whole sample, strongly negative for highly R&D intensive companies and slightly positive for low R&D intensive companies, thus coinciding with results of similar empirical studies, with the contingency reputation hypothesis and dividend smoothing. The positive correlation for low R&D intensive companies is also supported by the simultaneous dividend policy. The practical recommendation for Russian companies will be to significantly reduce the level of pay outs, if they are highly involved into innovations, keep the same level of dividends, if they are low intensive, in other cases it should be recommended to adjust its dividends pay outs slightly.

Table 8. Managerial implications

	Reduce the dividend pay outs	Keep the same level of pay outs
High R&D intensive	+	
Low R&D intensive		+

The cash holdings have proved to have a positive effect on the R&D intensity, what has been shown in plenty other studies, however, the leverage effect turned out to be also positive, what makes the pecking order model not fully hold for Russian market. Additional tests will be required, in order to distinguish between short-term and long-term debt, since this is assumed that short-term debt might have a positive effect on R&D activities. The managerial implications of the current results will be to increase cash holdings and attract sensible amount of leverage if a company wants to participate in innovations.

The rapid growth of the company and its small size have a positive effect for highly R&D intensive companies. This means that fast growing and relatively small companies have a space for further growth opportunities and can be a good target for investors, who prefer to allocate funds in high-tech companies. This conclusion was supported by the additional tests.

The effect of covid is negative, while of economic crisis 2014 is positive. These results are not intuitively clear, therefore, the additional tests that will address the nature of each macroeconomic turmoil are needed.

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APPENDIX

Table 9. Number of observations by industry

	R&D top 25%		R&D low 25%	
Industry	**Number of observations**	**% of total**	**Number of observations**	**% of total**
Activities in the field of architecture and engineering design; technical testing	18	0.31%	42	0.7%
Activities in the field of television and radio broadcasting	198	3.43%	143	2.5%
Air and space transport activities	99	1.72%	245	4.2%
Coal mining	328	5.69%	115	2.0%
Collection, processing and disposal of waste	51	0.88%	80	1.4%
Computer software development	31	0.54%	82	1.4%
Computers, electronic, optical products and electrical equipment	62	1.08%	255	4.4%
Crop and animal breeding, hunting and provision of related services	326	5.65%	39	0.7%
Crude oil and natural gas extraction	876	15.20%	105	1.8%
Extraction of metal ores	289	5.01%	99	1.7%
Extraction of other minerals	116	2.01%	91	1.6%
Financial and insurance activities	48	0.83%	27	0.5%
Fishing and fish farming	134	2.32%	95	1.6%
Forestry and timber harvesting	40	0.69%	33	0.6%
Fundamental, applied scientific activities and experimental developments	44	0.76%	61	1.1%
Furniture manufacturing	24	0.42%	38	0.7%
Health care activities	125	2.17%	143	2.5%
Information technology activities	11	0.19%	45	0.8%
Land and pipeline transport activities	55	0.95%	62	1.1%
Manufacture of vehicles	123	2.13%	394	6.8%

Metallurgical production and finished metal products	36	0.62%	121	2.1%
Postal communication and courier activities	1	0.02%	11	0.2%
Production of chemicals and chemical products	103	1.79%	239	4.1%
Production of coke and petroleum products	264	4.58%	124	2.2%
Production of films, videos and television programs, publication of sound recordings	83	1.44%	53	0.9%
Production of food, drinks and tobacco	199	3.45%	537	9.3%
Production of machinery and equipment	76	1.32%	250	4.3%
Production of medicines and materials used for medical purposes	372	6.45%	248	4.3%
Production of other finished products	49	0.85%	107	1.9%
Production of other non-metallic mineral products	131	2.27%	189	3.3%
Production of rubber and plastic products	102	1.77%	168	2.9%
Provision of electricity, gas and steam	391	6.78%	426	7.4%
Provision of professional scientific and technical services	12	0.21%	23	0.4%
Provision of services for mining	283	4.91%	292	5.1%
Repair and installation of machinery and equipment	23	0.40%	118	2.0%
Telecommunications activities	116	2.01%	65	1.1%
Total	5765	100.00%	5765	100.0%
Water intake, purification, treatment and distribution	130	2.25%	135	2.3%
Water transport activities	221	3.83%	289	5.0%
Wood processing, manufacture of wood products, paper production	175	3.04%	176	3.1%

Table 10. The effect of size on the R&D intensity

	Small Companies		Large companies	
	Fixed effects	**GMM**	**Fixed effects**	**GMM**
Variables				
$R\&D_{t-1}$				
div				
Lev				
Growth	0.014212*	0.0785292	0.0088506	0.0289542
Cash				
Size	0.0189828	0.0017004	-0.1055463***	0.0087947
cov				
crisis				

* - denotes the significance level, where

* - <10%

** - <5%

*** - <1%