Vol. 19 | № 2 | 2025 cfjournal.hse.ru ISSN 2073-0438

JOURNAL OF CORPORATE FINANCE RESEARCH

New Research | Corporate Financial Analytics | Applied Financial Analytics | Methods | Reviews | Discussions

Journal of Corporate Finance Research

Vol. 19 | № 2 | 2025
e-journal
www.cfjournal.hse.ru
ISSN 2073-0438

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Journal of Corporate Finance Research
Vol. 19 | № 2 | 2025
www.cfjournal.hse.ru

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DOI: https://doi.org/10.17323/j.jcfr.2073-0438.19.2.2025.5-14
JEL classification: G32, G34, M10, M11, M14, M15, M31, O32

Corporate Governance Disclosure Practices in India, with an Application to the Telecom Industry

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Abstract

India offers an excellent illustration of a pattern of economic transition when an emerging economy adapts the concept of corporate governance to its economic and cultural environment. A vital component of good corporate governance is corporate governance disclosure, which has received growing attention among researchers of the Indian and BRICS economies. The present paper provides a meta-review of literature on corporate governance disclosure in India. The novelty of the analysis is severalfold. First, we highlight the existence of features in the legal framework of corporate governance disclosure that are similar to developed countries as well as outlining India-specific traits. Second, our paper surveys a range of empirical works on corporate governance disclosure in India to reveal India-specific patterns in the interrelation between disclosure and the financial performance of companies. Third, the paper gives evidence on the special features of corporate governance disclosure in India, using the example of the rapidly developing telecom industry in the country. Telecom may be regarded as a representative industry that reflects the innovative business model in India, the history of liberalization, the increase in competition, and the importance of raising profits and fostering company growth. Our analysis shows that India follows a number of approaches to corporate governance disclosure which are observed in large Western economies and that parallels can be established between disclosure practices and the legislative framework in India and the UK. At the same time, India has a number of unique traits in its corporate governance disclosure practices that may be explained by the special features of its economic development.

Keywords: corporate governance, disclosure, ESG, telecom, India, BRICS

For citation: Besstremyannaya G., Dasher R. (2025) Corporate Governance Disclosure Practices in India, with an Application to the Telecom Industry. *Journal of Corporate Finance Research.* 19. (2): 5-14. https://doi. org/10.17323/j. jcfr.2073-0438.19.2.2025.5-14

Introduction

In a market economy, corporate governance is an important component of company financial architecture that is indispensable for company value creation [1]. Indeed, "corporate governance involves a set of relationships between a company's management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined" [2, p. 9].

The attention to corporate governance is particularly noticeable in economies in transition [3–7], where a growing body of research supports the cause for raising the quality of corporate governance so as to improve the financial performance of companies [8]. A set of regulatory mechanisms targeted at corporate governance disclosure[1] may be regarded as one of the tools for this purpose [9]. Indeed, "a strong disclosure regime that promotes real transparency is a pivotal feature of market-based monitoring of companies and is central to shareholders' ability to exercise their shareholder rights on an informed basis" [2, p. 37]. Specifically, the disclosure of information about a company's board, shareholders, auditors and other inseparable components of corporate governance promotes transparency, protects shareholders from fraud and risks, helps regulatory bodies to monitor compliance with national laws, and informs the public about company strategy and activity.

The experiences of transition countries provide fascinating examples of national patterns in the development of corporate governance disclosure practices and in the interrelation between disclosure and firm performance. The present paper focuses on India – the world's second largest economy, whose real GDP growth has become the fastest in emerging and developing Asia [10] and whose history of corporate governance disclosure is the longest among BRICS countries. Indian corporate governance disclosure practices have a number of specific features, which we demonstrate using evidence from cross-industry data before focusing on emerging companies in the telecom industry. Our analysis is based on a meta-review of 70 academic works on India, selected from scientific databases with a keyword search ("corporate governance" and/or "corporate governance disclosure" and/or "ESG reporting" and "India"), with special attention paid to academic journal rankings and paper citation indices. We made sure to include the most influential articles as determined by bibliometric studies of corporate governance in India and BRICS countries [4; 11–13].

The novelty of our analysis is severalfold. First, we highlight the existence of features inherent to large Western countries along with India-specific traits in the country's legal framework for corporate governance disclosure. Second, our paper surveys a range of empirical works on corporate governance disclosure in India to reveal specific patterns in the interrelation between corporate governance disclosure and the financial performance of companies. Third, the paper gives evidence on the special features of corporate governance disclosure in India, using the example of the country's rapidly developing telecom industry.

Several characteristics of the telecom industry in India make it particularly suitable for illustrating the use of corporate governance practices and corporate governance disclosure. In a nutshell, the industry reflects business relationships and incentives in the modern Indian economy. First, the telecom industry is representative of Indian innovative economy in its reliance on indigenous enterprises as drivers of company growth and in its focus on low-cost products that are sustainable on the local market [14]. Second, the economic history of the industry is typical of other Indian sectors: 1) liberalization started as early as 1991 and 2) the changing socio-demographic profile of the country along with the development of new technologies led to a growth in demand and hence to competition among providers [15]. Third, Indian telecom companies pay particular attention to profitability and rapid growth [16]. Finally, the telecom industry has recently acquired a variety of social functions such as the delivery of welfare payments through mobile phone-based platforms. The launch of such digital payment systems in 2020s was motivated by the striving for transparency in the distribution of social payments in order to fight corruption and the embezzlement of public funds [17]. Accordingly, not only India's telecom industry is the second biggest in the world, but its mobile payment market is large and rapidly growing [18].

As we noted in our earlier paper [19], a unique trait of the Indian economy is the prevalence of family-owned firms combined with a strong regulatory role of the state, which leads to specific features in the strategic development of innovative companies. In the present paper we demonstrate how the specific features of the Indian economy manifest themselves in the interrelation between corporate governance mechanisms, corporate governance disclosure and the market performance of Indian companies. Recent studies point to the absence of a link between disclosure and firm performance and to a negative relationship between board independence and voluntary disclosure. Evidence from the Indian telecom industry also does not speak for a positive relationship between disclosure and company profitability.

Indeed, in-depth interviews with representatives of Indian companies hint that corporate governance is not their major issue of concern. Corporate governance practices tend to interest multinational enterprises more than local companies [20].

In the telecom industry, the experience of an emerging giant – Reliance Jio – shows that offering affordable products that are in demand among a growing new niche of young consumers is a more effective business strategy than drawing public attention to the company's financial transparency or quality of corporate governance.

[1] "On all material matters regarding the corporation, including the financial situation, performance, ownership, and governance of the company" [2].

It seems that the concept of corporate governance is predominantly associated with the business culture of norms and values rather than that of regulation: it is important to understand what is considered appropriate to report to outsiders [21]. This fact is especially true for the Indian economy, where widespread family ownership leads to the reluctancy to disclose information to outsiders (this can be supported quantitatively by demonstrating a negative association between the quality of sustainability disclosure and the share of family ownership in the company [22]).

However, this does not impede the performance of family firms. Contrary to evidence in the West [23], family ownership in India is associated with better firm performance (see our review in [19]). Similarly, the corporate governance literature on India shows that greater ownership control by the promoter (a term denoting the founding individual or family as the controlling shareholder) increases firm value, because the promoter's incentives better reflect the incentives of the firm [24; 25].

Another violation of the traditional connections between good corporate governance practices and firm performance is the negative relationship between board size or board independence and firm performance [24; 26]. This may be explained by coordination problems in large boards and the weakness of independent directors [24; 26; 27].

The remainder of this paper is structured as follows. The second section reviews the history of corporate governance disclosure in India after liberalization and outlines various features of the legislative framework in the country. The summary of key findings on the interrelation between the quality of corporate governance, corporate governance disclosure and firm performance in the country is given in the third section. The fourth section provides evidence from the Indian telecom industry, while the fifth section compares the features of corporate governance disclosure in India with the experience of other countries.

Legal framework for corporate governance and ESG disclosure in India

India obtained its political independence in 1947 and has been implementing market reforms since 1991. Despite its commitment to shifting from a planned to a liberalized economy, progress over the last 30 years has been very gradual. The National Party, which has led the reform process, only gained a majority in parliament in 1999, and it has taken one or two decades to pass the essential legislation for the functioning of a new economic system[2].

The history of the corporate governance and corporate governance disclosure codes in India may be traced back to the pre-liberalization period. The Companies Act of 1956 dealt with the basic principles of governance of companies and corporations, such as the approval of major actions by 51 or 75% of the shareholders and the protection of minority shareholders [28].

International standards for corporate governance began to be adopted in India after liberalization. First, the Code for Desirable Corporate Governance was drafted by the Chamber of Indian Industries in 1998 [28; 29]. Second, the Securities and Exchange Board of India (SEBI), established in 1992 to regulate the stock market and protect investor rights, created several committees to issue recommendations on corporate governance practices. These recommendations formed the foundations of the legal framework for corporate governance disclosure in India: Clause 49 of the Listing Agreement (enacted in 2000, revised in 2004 and brought into effect in 2006), which applies to listed companies [30; 31]. There are 50 mandatory items for disclosure, grouped into 9 categories [32]:

1. Company's code of governance (1 item).
2. Board of directors (4 items).
3. Audit committee (3 items).
4. Remuneration committee (5 items).
5. Shareholders committee (5 items).
6. General board meetings (6 items).
7. Other specific disclosures (4 items):
   - On related party transactions.
   - On accounting treatment in case of its difference from national accounting standards.
   - On non-compliance and penalties imposed.
   - On the whistle blower policy.
   - Means of communications (7 items).
   - General shareholder information (15 items).

There are 17 non-mandatory items for disclosure which are grouped into 7 categories in Annexure 1C to Clause 49 as follows [34]:

1. Chairman of the board (1 item).
2. Remuneration committee (4 items).
3. Shareholder rights (1 item).
4. Postal ballot (8 items).
5. Audit qualifications (1 item).
6. Training of board members (1 item).
7. Mechanism for evaluating non-executive board members (1 item).

Items dealing with the remuneration committee appears on both the mandatory and voluntary lists. The mandatory items consist of general information, such as the names of committee members, attendance during the year, and remuneration. The voluntary items include disclosure on specific remuneration packages for executive directors; the requirement for the composition of the remuneration committee (at least 3 non-executive directors, with the chairman being an independent director); the presence of

[2] According to [33], the pre-legislative stages alone of the Competition Act, the Right to Information Act, and the Land Acquisition Act lasted, respectively, 11, 15 and 17 years (see Tables 2.3 and 2.4 on p. 46 and p. 64).

all committee members at its meetings; and the presence of the chairman at the annual general meeting.

Note that the requirement on the number of directors in the audit committee, the disclosure of related party transactions (mandatory items) as well as a number of non-mandatory disclosure items appeared owing to the 2004 amendments to Clause 49 [31].

Other legislation concerning corporate governance disclosure in India includes

1) Voluntary guidelines by the Ministry of Corporate Affairs [4].
2) Amendments on corporate social responsibility to the Companies Act of 2013 and 2014 [4; 35].

Legislation that specifically focuses on ESG (environmental, social and governance) reporting includes the following:

1) Mandatory publication of business responsibility (ESG performance) reports by the top 100 listed companies, as established by the Securities and Exchange Board of India in 2012 [36], which has been extended to the top 1,000 listed companies since 2022–2023 [37].
2) ESG disclosure at the National Stock Exchange of India on a "comply-or-explain basis" since 2015 [38].
3) Voluntary adoption of integrated reporting by top 500 listed companies since the financial year of 2017–2018 with data that "pertain to areas such as environment, governance, stakeholder's relationships, etc." [39].
4) Business Responsibility and Sustainability Reporting framework introduced by SEBI in 2021 for the top 1,000 listed companies, which makes ESG disclosure compulsory in company annual reports[3].

Corporate governance disclosure legislation in India is similar in some ways to that of Western countries. First, the legislative framework resembles the codes and provisions of such leading countries as the US, UK, Australia and Switzerland. Specifically, this concerns requirements on the stronger power of independent directors when the CEO is a board chairman and on the type of positions held by directors, director training, attendance of board committee meetings, and remuneration [40]. A further similarity among country codes is observed in the provision on disclosing information in a special section of the annual report [40].

Second, the voluntary recommendations on disclosure mimic those in other BRICS countries to a large extent (possibly, with the exception of China, where mandatory rules are strong) [4].

However, there also exist unique traits of disclosure legislation in India. They relate to the unique features of entrepreneurship in the country, with a predominance of family firms [41; 42]. These traits include a smaller required share of independent directors and specific provisions for boards headed by executive and non-executive chairmen [29].

Empirical regularities on high-quality corporate governance, corporate governance disclosure and ESG disclosure in India

There is no general agreement in the literature about the association between high-quality corporate governance and firm performance in India. On the one hand, some evidence points to the presence of a positive relation between firm performance and such proxies of high-quality corporate governance as board size [4], non-executive (outside) directors [27; 43], and the corporate governance index]44]. On the other hand, a number of studies find a negative relationship between board size and firm performance [24; 43] and board independence and firm performance [26] or the absence of links between firm performance and board accountability/transparency [45], CEO power [27] and other corporate governance indicators [26].

Such literature has been particularly common in the period after the 2005 amendments to Clause 49 that led to the emergence of non-executive and independent directors on company boards [24]. Yet large ownership control by promoters (directors) seems to respond better to the needs of an emerging economy such as India than board independence, owing to a closer correspondence between the incentives of the promoter and of the company in the Indian family business culture [24; 25].

The evidence on corporate governance disclosure and firm performance in India is also mixed. Some empirical studies confirm theoretical predictions about a positive association between disclosure and firm performance [46]. However, ample evidence demonstrates either the absence of a link between disclosure and performance [45; 47–49] or a negative association between high-quality corporate governance (e.g., board independence) and voluntary disclosure [8; 22]. An explanation may be offered by the evidence that corporate governance disclosure is not necessarily regarded by companies as a tool to attract capital [20]. Disclosure seems to be linked to firm size rather than profit opportunities [47], which may be a consequence of the fact that disclosure is better practiced by multi-national companies than local firms [20], and the former are usually larger in size.

As to the extent of disclosure in Indian companies, the empirical literature points to the fact that less than 50% of voluntary items are disclosed [50–52] and that compliance with disclosure is better in private companies than public ones [53; 54]. There are major variations in the principles of corporate governance and corporate governance disclosure across companies in India [52; 55]. This phenomenon aligns with groupwise differences discovered in the interrelation between board diversity and performance: it is positive for standalone firms and negative for group-affiliated firms [56].

[3] "On all material matters regarding the corporation, including the financial situation, performance, ownership, and governance of the company" [2].

With regard to ESG disclosure in India, it is often employed to enhance company reputation [57]. ESG disclosure is widely practiced and positively related to the financial and market performance of companies [36–38; 58]. Moreover, ESG reporting is becoming an important driver of green innovation [57; 59].

Corporate governance disclosure and ESG disclosure in the Indian telecom industry

The Indian telecommunications market with 944.96 million subscribers [60, p. 1] is the second largest in the world and growing rapidly [61; 62]. The market had been dominated by international companies such as Bharti Airtel (operating in 18 countries) and Vodafone before the appearance in September 2016 of a new and rapidly growing giant – Reliance Jio. This company has adopted the business strategy of offering new products at affordable prices [61; 63; 64]. Examples include ultra-cheap data, free voice calls and the introduction of the 4G standard. This has allowed the company to acquire 100 million users during the first six months after entering the market [62]. Reliance Jio became profitable in 2018, while the revenues of the former leader Bharti Airtel dropped by more than 5 times during the period 2016–2018 [62] (Table 3). Reliance Jio very soon became the leader of the telecom market, and its share has been steadily increasing ever since (reaching 37% in 2020, [65] and 40% in 2024 [60]). Consumer preference surveys show that young people (age 15–20) unilaterally choose Reliance Jio, while consumers aged 25–50 tend to remain with their traditional provider Bharti Airtel [62].

The telecom industry in India is highly concentrated: the top four companies corner 98% of the total market (wireless plus wired) and 99% of the wireless marker. These companies, as of December 2024, are: 1) Reliance Jio Infocomm Ltd, a private non-listed company, 2) Bharti Airtel Ltd, a private listed company, 3) Vodafone Idea, a private listed company, and 4) Bharat Sanchar Nigam Ltd, BSNL, a public non-listed company [60].

The telecom industry in India may be regarded as a representative industry in its use of India-specific forms of innovative entrepreneurship. Examples include "entrepreneurial leadership and vision," "modular designs to meet user demands of affordability and functionality and operability through architectural innovation," and "exploitation of local knowledge base" [14]. The telecom is typical in its gradual liberalization history: formally liberalized in 1991, the industry saw the establishment in 1997 of an independent body – Telecom Regulatory Authority of India (TRAI) – to diminish the authority of government in price and policy regulation [15]. The telecom industry faces high competition and hence focuses on profitability and sustainability issues [16].

The above summary of findings on corporate governance disclosure in India agrees with most of the studies on the Indian telecommunications industry. The best example is Bharti Airtel (an international company), which reports both mandatory and voluntary items and continues to improve its disclosure despite the loss of revenues and market share in recent years. Bharti Airtel shows the best behavior in voluntary disclosure both in the telecom industry [49] and across the top 10 Indian companies in the economy as a whole [65]. Bharti discloses more voluntary items than the public telecom company BSNL [66], which aligns with the findings on better corporate governance disclosure by private companies in other sectors of the Indian economy.

At the same time Reliance Jio, albeit a profitable and rapidly growing company, does not seem to pay as much importance to disclosure: for example, it does not disclose voluntary information in the form of integrated reports [49].

Moreover, there seems to be no relationship between the corporate governance index – constructed by Khan and Banerji (2013) [48] for the top 10 Indian telecom companies on the basis of indicators relating to the board, audit committee, mandatory and non-mandatory disclosure – and the market cap (a relation was found for Bharti Airtel but not for the other 9 companies).

To sum up, there seems to be no link between market and corporate governance disclosure in the Indian telecom industry, and the business strategy of price competition proves to be more effective for winning the market than disclosing practices related to high-quality corporate governance. Similarly to other sectors of the Indian economy [47], the telecom industry shows that disclosure is linked to company size rather than profitability or market performance.

ESG reporting is well implemented by the companies in the telecom industry. With regard to the top companies, Reliance Jio is non-listed and does not have to integrate ESG information into its reports [49], while Reliance Industries Limited (parent company) regularly publishes ESG reports for Reliance Jio.[4] Its motivation can be largely attributed to reputational issues, such as diminishing reputational risks linked to e-waste [57]. The list of environmental initiatives by Reliance Jio is extensive, so it was no surprise that the company won the "ESG performance in the telecom sector" award at the Second ESG Summit and Awards by Transformance Forums in Mumbai in 2022 [67; 68].

Bharti Airtel, the second largest company in the Indian telecom sector, compiles integrated voluntary reports that include issues related to ESG [49]. Moreover, the company tries to enhance the energy efficiency of its products [57], contributing to green innovation. Bharti Airtel is also successful in social and sustainability disclosure practices [69].

Similar in many ways to Bharti Airtel, the international listed firm Vodafone Idea (the third in the Indian telecom industry) has compiled integrated voluntary reports since 2021, including ESG reporting [49].

[4] URL: https://www.ril.com/ar2023-24/integrated-approach-to-sustainable-growth.html

The public company BNSL, the fourth largest company in the Indian telecom, does not engage in ESG reporting in the formal sense, as it is not required to file integrated reports. However, BNSL has traditionally given importance to corporate social responsibility [70], and its activities include such ESG components as "[dealing with] natural disasters and calamities" and "provision of ambulances" [70; 71].

Discussion and Conclusion

Studying high-quality practices of corporate governance is important for assuring the successful performance of a firm [40; 72]. However, the experience of developed countries is often inapplicable to emerging economies [24; 26; 73]. This explains the importance of considering both internationally prevalent and country-specific forms of good corporate governance in a major emerging economy such as India in order to identify the most effective practices that could be used in other emerging economies.

India is a fascinating example of an emerging economy that adapts the concept of economic growth to its own specific economic and cultural context. The country shows the features of an innovation-driven economy, despite the fact that innovation occurs through a limited number of firms which are "islands" in the "factor-driven economy" [74][5].

Overall, innovation-based growth has become the basic concept of modern economic development, and the list of institutional foundations for innovation starts with a well-designed financial system for funding risky ventures [75]. Good corporate governance disclosure practices are undoubtedly an inseparable part of such a system. Indeed, "the quality of corporate governance affects the cost for corporations to access capital for growth" [2].

However, the history of venture capital in India is very short [10] and the demand of Indian firms for external capital is low [20]. This may explain the low reliance of Indian companies on corporate governance disclosure as a means of attracting capital [20] and the absence of a positive relationship between market performance and disclosure, as shown by numerous academic studies.

According to the Asian Corporate Governance Association's latest edition of its Corporate Governance Watch (2023), India ranks 6 out of 12 Asian countries in the quality of its corporate governance with a score of 59.4 (in comparison, China scores 43.7, Japan 64.6, and Australia – the top Asian country – 75.2). India has a "rule-based environment" with a legal system created on British foundations, which leads to a better corporate governance score than in China and better disclosure among Indian companies in comparison to Chinese ones [76].

However, it is acknowledged that, in India, "gaps in enforcement disclosure remain, state-owned enterprises continue to treat corporate governance (CG) rules as guidelines for other companies to follow" [77]. While disclosure has grown after the 2004 amendments to Clause 49 [47; 54], there is still considerable room for improvement in voluntary disclosure.

According to the 2020 Doing Business Report[6], India has improved for its ease of business environment (ranking 63 out of 190 economies with an overall score of 71). Improvements were also observed for several components of the overall score, such as starting a business and resolving insolvency, but no progress was manifest in the protection of minority investors.

Overall, the study of empirical regularities in Indian corporate governance has attracted growing interest among researchers, with a steady increase in the number of papers in the field and in their citation counts [13]. In the present paper, we implemented a meta-review of literature on one of the key components of good corporate governance – corporate governance disclosure – in India, focusing on corporate governance practices in general and corporate governance disclosure in particular. We discovered that many stylized facts anticipated by economic theory for high-quality corporate governance do not hold for India.

Specifically, there is a negative association between board size and firm value [24], and the busyness of outside directors and firm performance [27]. There is also no relationship between performance and corporate governance indicators [26] – for instance, in the case of multiple appointments of outside directors [27].

These facts may be explained by the weak power and capabilities of independent directors in an emerging country like India in comparison to developed countries [26]. In view of the limited pool of candidates for independent directorship in India [26], the appointees may become "puppets" "hired for namesake" [27] by their associates among controlling shareholders [8]. The presence of such directors may only impede effective decision-making by the board [22].

The phenomenon of the business ineffectiveness of independent directors is interrelated with the insignificant or negative relationship between board accountability, transparency, independence and voluntary disclosure [8; 22; 45]. It calls for filling in "lacunas in the present corporate governance framework" in India [8] with regard to the appointment of truly independent directors. At the same time, the weak power of independent directors is observed in other emerging countries such as BRIC, and so this feature is not unique for the contemporary Indian economy [79; 80].

Overall, India may be viewed as an example of an emerging economy where shareholder-based governance is weaker than in large Western countries. The reason may well lie in the fact that the formally observable indicators of cor-

[5] In fact, different patterns of economic development at the stage of early industrialization may be observed in India and China: while China focused on domestic market growth through innovation, India strived at leveraging global and technical skills in international markets [78].

[6] URL: https://archive.doingbusiness.org/en/reports/global-reports/doing-business-2020

porate governance cannot sufficiently explain the existing relationships among economic agents [20]. Arguably, the lack of corporate governance disclosure in Indian companies may be also due to its high costs in comparison to its perceived advantages and, in case of mandatory items, to the absence or expensiveness of the necessary mechanisms of law enforcement by regulatory bodies. Nevertheless, this phenomenon is inherent to transition countries in general [6; 81][7].

Acknowledgement

We would like to thank the editor Irina Ivashkovskaya for her helpful comments. The paper was prepared in the framework of the Basic Research Program of the National Research University Higher School of Economics (Moscow, Russian Federation).

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The article **was submitted on** 19.04.2025; **approved after reviewing on** 08.05.2025; **accepted for publication on** 01.06.2025.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.19.2.2025.15-37
JEL classification: G12, G32, G34

Fundamental Adjustments of Multiples as a Tool to the Business Valuation Accuracy Improvement

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Abstract

The purpose of the article is to assess the accuracy of the multiple adjustments in conditions of significant differences between the target and comparable companies. The article provides formulas for adjustments based on the Gordon model and its modifications for the P/E and EV/EBITDA multiples. The research is based on such methods as analysis, synthesis, and the longitudinal method, modeling, descriptive and regression analysis were performed. Based on a sample of 38 public railway companies from 13 countries from 2017 to 2023, it was shown for the first time that as a result of adjustments to the multiples in a sample of comparable companies, the P/E multiples standard deviation decreases from 28.7 to 1.2, the spread between 90 and 10 percentiles of P/E multiples decreases from 42.7 to 3.2, and the EV/EBITDA multiples standard deviation decreases from 35.6 to 3.3, the spread between 90 and 10 percentiles of EV/EBITDA multiples decreases from 21.2 to 6.2. Adjustments to the cost of capital and its component (in particular, the risk-free rate) lead to a significant 1% decrease in the spread between multiples of comparable companies. Adjustments for differences in the debt burden lead to a significant 10% decrease in the variability of the EV/EVITDA multiple. Adjustments for expected growth lead to an increase in the variability of multiples due to the difficulty of predicting long-term growth rates of companies. Adjustments to the cost of capital increase the accuracy of cost estimates (deviations from market data amount to 0.3 of net income and 0.5 of EBITDA). At the same time, adjustments only for the cost of capital are more accurate than adjustments for both the cost of capital and growth. Nevertheless, adjustments for both cost of capital and growth make it possible to obtain more accurate estimates than based on unadjusted multiples. In practice, it is advisable to adjust for differences in the cost of capital. If it is not possible to accurately estimate the future growth rates of the target and comparable companies, it is advisable to abandon the growth adjustment, or to carry it out only for differences in expected inflation (for companies from different countries).

Keywords: business valuation, comparative valuation, P/E multiple, EV/EBITDA multiple, multiple adjustments, adjusted multiple, justified multiple, railway industry

For citation: Gurov I., Bochkarev A. (2025) Fundamental Adjustments of Multiples as a Tool to the Business Valuation Accuracy Improvement. *Journal of Corporate Finance Research.* 19 (2): 15-37. https://doi. org/10.17323/j. jcfr.2073-0438.19.2.2025.15-37

Introduction

Accurate business valuation is essential to ensure appropriate investment decisions, particularly, in asset management, mergers and acquisitions and public share placement. A vast body of academic literature is dedicated to valuation [1–4]. In actual practice ongoing business is usually evaluated using the discounted cash flow method [5–7] and the comparable companies method [8–11].

The discounted cash flow method is premised on the company's financial model. It allows for the calculation of a cash flow forecast, for example, dividends, free cash flows for shareholders or the company. In order to apply this method a correct estimate of the discount rate is also needed (required return on equity or the weighted average cost of capital).

The multiple method (it is also often called the comparable company method, comparable company method or comparative valuation) provides an opportunity to estimate the company value by comparing it to other companies similar in terms of the principal features.

One of the key assumptions of the multiple method is a strong resemblance between the target and comparable companies. However, if the differences between the companies are significant it is difficult to apply this method. For example, due to country-related differences (in case of firms from different countries) the companies may differ in project profitability, anticipated business growth, dividend policy, debt burden, exposure to systematic risk, specific risk premiums, cost of capital. These and other factors influence the value of both the target and comparable companies. Therefore, comparative valuation may overestimate or underestimate the target company value. It is possible to increase the accuracy of the valuation obtained through the comparable company method by applying multiple adjustments, provided they eliminate company-specific differences between the target and comparable companies.

Approaches to multiple adjustments acquire a special role when the number of comparable companies is small or when they differ significantly from the target company. The railway industry was chosen for approbation because use of unadjusted multiples will result in material errors in valuations of Russian railway companies for absolute want of domestic public comparable companies. As at the beginning of 2025 the companies which used to be public (including TransContainer[1], Far Eastern Shipping Company[2]) have been delisted. After delisting, shares of Globaltrans are traded only in Kazakhstan,[3] depressing the opportunity of their use as an comparable under the circumstances of capital restrictions.[4] United Wagon Company is not considered as comparable because of its financial troubles within the analyzed period.[5] The major part of public analogues for evaluation of railway companies (not numerous in itself – approximately 40 companies in the global capital markets) is represented by the companies operating abroad with fundamentally different cost factors, in particular, the cost of capital and anticipated growth. On the other hand, according to SPARK, over 3,000 railway companies operate in the Russian economy. Approximately 100 of them earn over RUB 1 billion and about 500 of them have annual revenues ranging from RUB 100 million to RUB 1 billion.[6] They are relevant for valuation due to their active involvement in mergers and acquisitions and for attracting strategic investors in this sphere.[7]

Thus, although researchers really need accurate tools for business valuation the use of multiples has limitations. At the same time, it is non-optimal to use no multiples at all and choose the discounted cash flow method because an overly positive or overly negative cash flow forecast or risk assessment may skew the valuations. The present paper makes an attempt to address this problem by developing multiple adjustments.

The paper consists of three sections. In the first section we present a literature review in the field of business valuation and application of the multiple method. The second section presents derived formulas for multiple adjustments, analysis of special features of these adjustments and compliance with industrial practices as well as data description. The third section sets forth adjustment formulas, assesses accuracy of adjustments and presents conclusions are made.

Literature Review

The issues of business valuation have been studied extensively in the academic and practical literature. However, this topic is still relevant, and numerous published papers are dedicated to it nowadays.

The calculation of the cost of capital is a key component of business valuation (discount rate or the required equity or total capital of the company yield). The discount rate

[1] URL: https://quote.ru/news/article/5f4df7899a79473b0a73436d

[2] URL: https://smart-lab.ru/blog/934422.php

[3] URL: https://www.globaltrans.com/investors/news/detail/2501

[4] In particular, cancelling dividend policy at the same time with delisting of Globaltrans from the Moscow Exchange caused a significant fall of stocks. URL: https://www.rbc.ru/quote/news/article/66d1644b9a794706d6229e77

[5] URL: https://www.vedomosti.ru/business/articles/2021/11/25/897623-pochemu-u-ovk-net-deneg-na-pogashenie-obligatsii

[6] Companies with Russian National Classifier of Types of Economic Activity (OKVED) 52.21.1 Service Activities Incidental to Railway Transportation; OKVED 49.20 Freight Rail Transport; OKVED 49.10 Passenger Rail Transport, Interurban and International; OKVED 30.20 Manufacture of Railway Locomotives and Rolling Stock.

[7] URL: https://www.rbc.ru/business/22/12/2023/658503e49a794752e8dbc8f0

is important not just to implement the discounted cash flow method but also to take into consideration differences between the target and comparable companies applying comparative valuation. Studies by Markowitz [12] and Tobin [13; 14] laid down the groundwork for modern portfolio theory which was further developed by Sharpe [15], Lintner [16] and Mossin [17] resulting in creation of the *CAPM* model that allows to determine the discount rate. Subsequent critical analysis of the *CAPM* model provided new stock yield models [18–22] including the Fama-French model and its modifications [23; 24]. Influence of certain factors, such as environmental and social ones, on the cost of capital studied [25–28]. Theoretical problems were discussed, in particular, the market risk premium puzzle [29–31]. Some studies examined the impact of certain factors, such as the size, liquidity, inflation risks, on the discount rate [32–35]. As a result, now researchers have at their disposal a vast set of methods for evaluation of the cost of capital including those which take into account specifics of the analyzed companies.

Papers by Modigliani and Miller [36; 37] laid the foundation for modern corporate finance. Thereafter, there were discussions in literature about company value formation, tax shields evaluation [38; 39], business value factors [40–42]. Besides, at present there is a consensus concerning the relationship between the total business value and the equity value and the relationship between the weighted average cost of capital and equity and debt capital. A large number of studies consider applications of business valuation [43–45], assessed influence of news on share price [46–48], mergers and acquisitions [49–51], IPO [52].

Some studies examined evaluation of share prices, on provision that a range of suppositions concerning the future business growth rate was fulfilled [2; 3; 53–55]. As a result, concise models were developed, such as the Gordon model, H-model, growth length model where the value depends on a limited number of factors. These models are convenient for development of multiple adjustments.

A vast body of literature is dedicated to the application of the multiple method. Some papers consider the multiples which are best suited for comparison [56], in particular, *EV/EBITDA* and *P/E* multiples are preferred, however, adjustments to other multiples are also considered including *EV*/revenue, *EV/GMV* (gross merchandise volume) and non-financial multiples.

A series of papers analyzed industry-specific features of business [49; 51; 57–59]. Significance of the industry factor for the multiple method justifies considering comparable companies from the same industry. In general, one of the ways to improve the comparable company method is development of approaches to a well-justified selection of comparable companies [60–62]. Depending on the industry, companies may differ to a greater or lesser extent and in general case there are no two identical companies. In actual practice, the comparable company method is usually applied to a series of companies, however, the assumption that the multiple of the evaluated company should equal the median or weighted average of the multiples of comparable companies is ungrounded and is accepted only for want of a more accurate method.

For this reason, another applied method is multiple adjustments. The obtained multiples are called adjusted or justified ones. In academic literature some papers are dedicated to justification and development of multiple adjustments [59; 63–68]. There are three main approaches:

- the one based on expert assessments;
- the one based on regression adjustments where comparable company multiples are used as dependent variables and their values are explained by the performance indicators of these companies (in particular, cost of capital, business growth rate ets.);
- the one based on fundamental adjustments, in particular, Gordon model analysis.

In actual practice, adjustments based on expert assessments are often used. On the one hand, they have an advantage of simplicity and taking into account market participants' opinion. On the other hand, expert adjustments are not strict and have no formal foundation. At the same time, regression and fundamental adjustments are more complex but they provide a theoretical basis. Despite the high relevance of adjustments research, in the present paper we turn our attention to fundamental adjustments because in academic and practical literature their application is understudied. On a number of occasions it is recommended to adjust the revenue or *EBITDA* value to account for differences in financial accounting [69]. Although these approaches are useful, they fail to take into consideration individual differences of comparable companies. Despite a large number of studies dedicated to dividend policy as a business valuation factor [70–73], dividend policy itself is usually not regarded in multiple adjustments [74]. As we are going to show below, in some instances it impairs accuracy of company valuation (both in terms of standard deviation and bias). We will also show that to take into consideration any difference when evaluating companies two alternative adjustment procedures are possible. Moreover, we did not find such division in the published papers. Next, we present our approach and develop adjustment procedures.

Methods and Data

In this paper we develop adjustments for the P/E and EV/EBITDA multiples because they are the most conventional ones for business valuation by means of comparative valuation. On the basis of the valuation presented in the paper we may develop adjustments for other multiples.

We assume that adjustment procedures should be applicable for an analyst acting as follows:

1. The analyst's purpose is to assess the stock value of the target company *T* using the comparable company method.

2. The analyst has data on the P/E and EV/EBITDA multiples for n public comparable companies B_i, i takes on integer values from от 1 to n where n is the number of comparable companies.
3. Comparable companies may differ from each other and the target company in some indicators, in particular, in anticipated growth rate, dividend policy, debt burden, beta, size, specific risk premiums.
4. The analyst has available data on the indicators stated in item 3 concerning the target company and comparable companies.
5. As for shares and the value of comparable companies the capital market is efficient in semi-strong (medium) form.

In the initial form comparable valuation represents a simplification because it is assumed that the target company resembles the aggregate of comparable companies so much that, based on their multiples, we may define the value of the comparable company. According to comparable valuation the assessment of the intrinsic value of a share of the compan $\widehat{V_T} = \theta\left(\frac{P_{B_i}}{E_{B_i}}\right) \bullet E_T$ y T based on the P/E multiple without adjustments is as follows:

$$\widehat{V_T} = \theta\left(\frac{P_{B_i}}{E_{B_i}}\right) \bullet E_T,$$

where θ is the operator which returns the median, weighted average value or the average value after winsorization of multiples $\frac{P_{B_i}}{E_{B_i}}$ for n comparable companies[8].

One of the ways to take into account company-specific features is to use the Gordon model [2; 3; 53], according to which the company intrinsic value may be calculated by the following formula if it is possible to determine the sustainable rate of dividend growth and the constant discount rate:

$$V = \frac{D}{r-g},$$

where V – intrinsic corporate stock value, D – anticipated dividend amount for the next year, r – discount rate for equity, g – expected dividend increment rate.

It is as unrealistic to follow strictly suppositions of the Gordon model as an attempt to assess accurately the company value. However, strict adherence to the suppositions is not necessary for the purposes of the present research because we aim at improving accuracy, not achieving absolute accuracy of the valuation. Therefore, at this stage it is sufficient that the Gordon model in general takes into consideration the principal value factor (dividend yield, anticipated growth, time value of money and risks). Adjustment will also be more accurate if we use other models, in particular, the H-model. However, they will be less succinct and more complex.

Since according to the accepted suppositions, the capital market is effective in the semi-strong form, we may proceed from the premise that the price of a share of each public company B_i will equal its intrinsic value [75–79]:

$$P_{B_i} = V_{B_i},$$

where P_{B_i} – market value of a share of the company B_i.

In case of deviations they will be minimum, unbiassed and temporary.

For further transformations we express the expected dividends as follows:

$$D = PR \bullet E,$$

where PR is a share of dividend in the net profits which is allocated to dividend payout, E – expected stock yield next year. Then the share price may be calculated as follows:

$$P = \frac{PR \bullet E}{r-g},$$

so, the *P/E* multiple equals:

$$\frac{P}{E} = \frac{PR}{r-g}.$$

Then we derive multiple adjustments for various cases. For the sake of brevity, we use the index B, instead of B_i, to designate a comparable company, and in the general case the adjusted multiple is calculated for each comparable company.

Adjustment of the multiple $\frac{P}{E}$ for the case of $r_T \neq r_B$, other things being equal

If the target and comparable companies have different cost of capital and are otherwise similar, adjustment is necessary only for the cost of capital r_T:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{PR_B}{r_T - g_B}.$$

Hereinafter $\left(\frac{P_B}{E_B}\right)_{adj}$ designates an adjusted multiple which takes into consideration individual differences of the target company and comparable companies.

In order to express $\left(\frac{P_B}{E_B}\right)_{adj}$ we multiply and divide $\frac{P_B}{E_B}$ by $r_T - g_B$:

$$\frac{P_B}{E_B} = \frac{PR_B}{r_B - g_B} \bullet \frac{r_T - g_B}{r_T - g_B} = \frac{PR_B}{r_T - g_B} \bullet \frac{r_T - g_B}{r_B - g_B} =$$

[8] In some instances, percentiles (for example, 25 and 75) are used to define the range of the multiples' values and other approaches. However, this aggregate of approaches to choosing the θ operator is beyond the scope of the present research and the authors leave the choice of a certain approach to the discretion of the analyst.

$$\left(\frac{P_B}{E_B}\right)_{adj} \bullet \frac{r_T - g_B}{r_B - g_B},$$

so, we obtain the adjusted multiple:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{P_B}{E_B} \bullet \frac{r_B - g_B}{r_T - g_B}. \quad (1)$$

There is an alternative way to derive the adjustment for the considered case. We raise the *P/E* multiple to the –1 power and transform it:

$$\left(\frac{P_B}{E_B}\right)^{-1} = \frac{r_B - g_B}{PR_B} = \frac{r_T - g_B}{PR_B} - \frac{r_T - r_B}{PR_B} =$$

$$= \left(\frac{P_B}{E_B}\right)^{-1}_{adj} - \frac{r_T - r_B}{PR_B},$$

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_T - r_B}{PR_B}}. \quad (2)$$

When suppositions of the Gordon model are strictly fulfilled formulas (1) and (2) are identical. However, in real practice, they deliver different results. Thus, there are two approaches to the adjustment for the multiple concerning the same difference between the target and comparable companies.

In practice it is possible to apply one of them depending on availability of accurate data for adjustments. In the first case the values of the anticipated growth rate are reqiured, in the second case – values of the payout ratio.

We would like to note that in financial literature the share of dividend payout is usually not used in calculations [74], i.e. it is tacitly presumed that $PR_B = 1$. This implies absence of investments when the capital structure is unchanged, and this should correspond to the zero rate of real growth (at which adjustments are also simplified). However, due to cash flows growth caused by inflation and short-term CAPEX-light business models, in actual life these two simplifications are not biunique. In general, as long as in real practice $0 \le PR_B < 1$ disregard of this indicator in calculations will have a significant impact on bias of the adjustment, i.e. it will result in underestimation of the impact of differences in the discount rate on the adjusted multiple.

Adjustment of the multiple $\frac{P}{E}$ for the case of $g_T \neq g_B$, other things being equal

As a rule, the anticipated growth rates of the company differ. So, it is reasonable to consider the case of $g_T \neq g_B$:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{PR_B}{r_B - g_T}.$$

If companies are otherwise identical, similar to the previous item we may show that direct adjustment appears as follows:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{P_B}{E_B} \bullet \frac{r_B - g_B}{r_B - g_T}. \quad (3)$$

Applying the alternative approach we obtain an adjustment for the reverse multiple in the denominator:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{g_B - g_T}{PR_B}}. \quad (4)$$

Adjustment of the multiple $\frac{P}{E}$ for the case of $g_T \neq g_B$, $r_T \neq r_B$, other things being equal

The situation when both the cost of capital and expected dividend growth differ is more common. For example, when comparable companies operate in the country, other than the target company's country, differences in risk-free rates and market risk premiums between national capital markets will influence r_T and r_B; differences in inflation in certain countries will influence g_T and g_B, besides, other difference factors are possible. So, under otherwise equal conditions multiple adjustment is also required for r_B and g_B:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{PR_B}{r_T - g_T}.$$

Similar to previous conclusions it is easy to show that:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{P_B}{E_B} \bullet \frac{r_B - g_B}{r_T - g_T}. \quad (5)$$

Applying the alternative approach:

$$\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_T - r_B}{PR_B} - \frac{g_T - g_B}{PR_B}}. \quad (6)$$

Detailing of the multiple $\frac{P}{E}$ taking into consideration differences in dividend policy, components of the cost of capital and dividend growth

The components of the multiple $\frac{P}{E} = \frac{PR}{r - g}$ may be detailed. Cost of equity may be represented as follows:

$$r = r_f + \beta \bullet ERP + RP,$$

where r_f is risk-free return, β – beta of a share, ERP – expected market risk premium, RP – specific risk premiums (for example, premium for size, liquidity, specific premiums including those for dependence on the key person and company management, buyers' diversification, product and geographical diversification, marginality stability and predictability, ESG factors [28; 80; 81]).

The expected dividend growth rate may be presented as follows:

$g = ROE \bullet RR,$

where ROE is average expected real profitability (of equity) of investment projects of the company, RR – the share of revenue which the company reinvests.

If corporate governance is effective for minority shareholders $RR + PR = 1$, and the anticipated growth rate may be represented as follows: $g = ROE \bullet (1 - PR)$.

So, the supposition that $RR + PR = 1$ is significant. Such adjustments will be nonapplicable for assessment, in particular, of Surgutneftegaz stocks because this company places a significant part of earnings on deposits.

Thus, we may present in more detail the multiple:

$$\frac{P}{E} = \frac{PR}{r_f + \beta \bullet ERP + RP - ROE \bullet (1 - PR)}.$$

Only the second method is applied to make adjustments of the detailed multiple because it allows to get a succinct form.

So,

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{1}{\frac{PR_B}{PR_T}\left(\frac{P_B}{E_B}\right)^{-1} + \frac{g_B - g_T - r_{fB} - \beta_B ERP_B + r_{fT} + \beta_T ERP_T}{PR_T}}. \quad (7)$$

We consider application of comparable valuation for companies from various countries as a special case. If in real terms in national currency we expect similar dividend growth rates of the target and comparable companies ($g_B - g_T = \pi_B - \pi_T$):

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{1}{\frac{PR_B}{PR_T}\left(\frac{P_B}{E_B}\right)^{-1} + \frac{\pi_B - \pi_T - r_{fB} - \beta_B ERP_B + r_{fT} + \beta_T ERP_T}{PR_T}}. \quad (8)$$

On the basis of this adjustment one may derive an adjustment for special cases. Thus, Table 2 presents adjustments for $PR_T = PR_B$ and differences in tier cost of capital $((9) - (12))$.

Adjustment of the multiple $\frac{P}{E}$ for the case of ($PR_T \neq PR_B$, $ROE_T \bullet (1 - PR_T) = ROE_B \bullet (1 - PR_B)$), other things being equal

Adjustment of the multiple $\frac{P}{E}$ for the case of $g_T \neq g_B$, $PR_T \neq PR_B$, $r_T - r_{fT} - \beta_T ERP_T \neq r_B - r_{fB} - \beta_B ERP_B$, other things being equal

In this case the adjusted multiple equals:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{PR_T}{r_B - r_{fB} - \beta_B ERP_B + r_{fT} + \beta_T ERP_T - g_T}.$$

Raise to the –1 power and transform $\frac{P_B}{E_B}$:

$$\left(\frac{P_B}{E_B}\right)^{-1} = \frac{PR_T}{PR_B}\frac{r_B - r_{fB} - \beta_B ERP_B + r_{fT} + \beta_T ERP_T - g_T}{PR_T} - \frac{-r_{fB} - \beta_B ERP_B + r_{fT} + \beta_T ERP_T + g_B - g_T}{PR_B},$$

If companies differ only in the share of dividend payout and their growth rates are equal (due to differences in return on investments) the adjusted multiple equals:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{PR_T}{r_B - g_B}.$$

So, we may present it in a succinct form:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{P_B}{E_B} \bullet \frac{PR_T}{PR_B}. \quad (9)$$

Adjustment of the multiple $\frac{P}{E}$ for the case of $g_T \neq g_B$ ($PR_T \neq PR_B$, $ROE_T = ROE_B$), other things being equal

If companies differ only in the share of dividend payout the adjusted multiple equals:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{PR_T}{r_B - ROE_B \bullet (1 - PR_T)}.$$

To express $\left(\frac{P_B}{E_B}\right)_{adj}$ we make the following transformations:

$$\left(\frac{P_B}{E_B}\right)^{-1} = \frac{r_B - ROE_B \bullet (1 - PR_T) + ROE_B \bullet (1 - PR_T) - ROE_B \bullet (1 - PR_B)}{PR_B} \bullet \frac{PR_T}{PR_T},$$

so,

$$\left(\frac{P_{\text{B}}}{E_{\text{B}}}\right)^{-1} = \frac{r_{\text{B}} - ROE_{\text{B}} \bullet (1 - PR_T)}{PR_T} \bullet \frac{PR_T}{PR_{\text{B}}} + \frac{ROE_{\text{B}} \bullet (PR_{\text{B}} - PR_T)}{PR_{\text{B}}}.$$

Consequently:

$$\left(\frac{P_B}{E_{\text{B}}}\right)_{adj} = \frac{PR_T}{PR_{\text{B}}\left(\frac{P_{\text{B}}}{E_{\text{B}}}\right)^{-1} + ROE_{\text{B}} \bullet (PR_T - PR_{\text{B}})}. \quad (10)$$

Adjustment of the multiple $\frac{P}{E}$ for the case when $g_T \neq g_B$ ($PR_T = PR_B, ROE_T \neq ROE_B$), other things being equal

To consider the cases when companies differ in the expected dividend growth rate we assume that companies have different investment projects' returns. If companies are otherwise equal it is necessary to make multiple adjustment only for ROE because other indicators represent the specific character of the company T rather accurately:

$$\left(\frac{P_B}{E_{\text{B}}}\right)_{adj} = \frac{PR_{\text{B}}}{r_{\text{B}} - ROE_T \bullet (1 - PR_{\text{B}})}.$$

To express $\left(\frac{P_B}{E_{\text{B}}}\right)_{adj}$ we transform $\frac{P_{\text{B}}}{E_{\text{B}}}$:

$$\left(\frac{P_B}{E_{\text{B}}}\right)^{-1} = \frac{r_{\text{B}} - ROE_{\text{B}} \bullet (1 - PR_{\text{B}}) + ROE_T \bullet (1 - PR_{\text{B}}) - ROE_{\text{B}} \bullet (1 - PR_{\text{B}})}{PR_{\text{B}}}.$$

Then:

$$\left(\frac{P_{\text{B}}}{E_{\text{B}}}\right)^{-1} = \left(\frac{P_{\text{B}}}{E_{\text{B}}}\right)^{-1}_{adj} + \frac{(ROE_T - ROE_{\text{B}}) \bullet (1 - PR_{\text{B}})}{PR_{\text{B}}}.$$

Consequently:

$$\left(\frac{P_B}{E_{\text{B}_B}}\right)_{adj} = \frac{1}{\left(\frac{P_{\text{B}}}{E_{\text{B}}}\right)^{-1} + (ROE_{\text{B}} - ROE_T) \bullet \left(\frac{1 - PR_{\text{B}}}{PR_{\text{B}}}\right)}. \quad (12)$$

Adjustment of the multiple $\frac{P_B}{E_B}$ for the case when there is a difference in the debt burden $Lev_{\text{T}} \neq Lev_B$, other things being equal

We use the formula by Hamada [82] which allows to take into consideration the financial leverage effect in the share's beta:

$$\beta = \beta_u \bullet (1 + (1 - MTR) \bullet Lev),$$

where β – beta of company stocks taking into consideration the debt burden (levered beta), β_u – unlevered beta, MTR – marginal tax rate, Lev – debt ratio which equals the ratio of the debt market value to the equity market value.

The formula for the discount rate is as follows:

$$r = r_f + \beta_u \bullet (1 + (1 - MTR) \bullet Lev) \bullet ERP,$$

taking into consideration previously introduced conditions that $\frac{P}{E} = \frac{PR}{r - g}$ it turns out that:

$$\frac{P}{E} = \frac{PR}{r_f + \beta_u \bullet (1 + (1 - MTR) \bullet Lev) \bullet ERP - g}.$$

If the comparable and target companies differ only in the debt burden level the formula is as follows:

$$\left(\frac{P_{\text{B}}}{E_{\text{B}}}\right)_{adj} = \frac{PR_{\text{B}}}{r_{f\text{B}} + \beta_{u\text{B}} \bullet (1 + (1 - MTR_{\text{B}}) \bullet Lev_T) \bullet ERP_{\text{B}} - g_{\text{B}}}$$

To express $\left(\frac{P_B}{E_{\text{B}}}\right)_{adj}$ we transform:

$$\left(\frac{P_{\text{B}}}{E_B}\right)^{-1} = \frac{r_{f\text{B}} + \beta_{u\text{B}} \bullet (1 + (1 - MTR_B) \bullet Lev_{\text{B}}) \bullet ERP_{\text{B}} - g_{\text{B}}}{PR_{\text{b}}} +$$

$$+ \frac{\beta_{u\text{B}} \bullet (1 + (1 - \text{MTR}_{\text{B}}) \bullet Lev_T) \bullet ERP_{\text{B}} - \beta_{u\text{B}} \bullet (1 + (1 - \text{MTR}_{\text{B}}) \bullet Lev_T) \bullet ERP_{\text{B}}}{PR_{\text{B}}}.$$

So, from $\left(\frac{P_B}{E_B}\right)^1$ we may distinguish the expression of $\left(\frac{P_B}{E_B}\right)^{-1}_{adj}$:

$$\left(\frac{P_B}{E_B}\right)^{-1} = \left(\frac{P_B}{E_B}\right)^{-1}_{adj} + \frac{\beta_{u\,B} \bullet (1 - MTR_B) \bullet (Lev_B - Lev_T) \bullet ERP_B}{PR_B}$$

From which:

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{\beta_{uB} \bullet ERP_B \bullet (1 - MTR_B) \bullet (Lev_T - Lev_B)}{PR_B}}. \quad (13)$$

Adjustment of the multiple $\frac{P_B}{E_B}$ for the case when the tax rate MTR_T ¹ MTR_B, other things being equal

$$\left(\frac{P_B}{E_B}\right)_{adj} = \frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{\beta_{uB} \bullet ERP_B \bullet Lev_B \bullet (MTR_B - MTR_T)}{PR_B}}. \quad (14)$$

Similar to the previous item we may show that in case of a difference in the marginal income tax rate:

Development of Fundamental Adjustments for the *EV/EBITDA* Multiple

The above adjustments are intended for an improvement in the accuracy of the equity valuation. In real practice they are often made for the business value (including share capital and debt capital). Even if the overall goal is to assess the value of share capital in particular, it may be obtained on the basis of the business value by deducting the debt, minority stake and adding surplus funds. In this respect, on the basis of the valuation verified above, it is reasonable to develop also fundamental adjustments for the multiple of [Enterprise value]/[Earnings before interest, depreciation, tax, amortization] (*EV/EBITDA*).

To develop the adjustments which will provide justified values of the *EV/EBITDA* multiple taking into account the differences in the target and comparable companies we are going to use an extended Gordon model considered, among other things, in [83]:

$$EV = \frac{FCFF}{WACC - q},$$

where EV is the enterprise value, $FCFF$ – free cash flows for the firm for the next year while $WACC$ – weighted average cost of capital, q – average compound rate of $FCFF$ increment.

Suppose $k = \frac{FCFF}{EBITDA}$, right ratio which shows the level of conversion of *EBITDA* to *FCFF*, then the multiple $\frac{EV}{EBITDA}$ may be represented as follows:

$$\frac{EV}{EBITDA} = \frac{k}{WACC - q}.$$

This correlation in terms of structure corresponds to the representation of $\frac{P}{E} = \frac{PR}{r - g}$. We would like to note that in general case one may derive adjustments by adjusting to $WACC$, q, k indicators and their components. Thus, if $WACC_T \neq WACC_B$, other things being equal:

$$\left(\frac{EV_B}{EBITDA_B}\right)_{adj} = \frac{k_B}{WACC_T - q_B}.$$

We derive easily:

$$\left(\frac{EV_B}{EBITDA_B}\right)_{adj} = \frac{EV_B}{EBITDA_B} \bullet \frac{WACC_B - q_B}{WACC_T - q_B} \quad (15)$$

The adjusted multiple may also be deduced by means of alternative transformations:

$$\left(\frac{EV_B}{EBITDA_B}\right)^{-1} = \frac{WACC_T - q_B + WACC_B - WACC_T}{k_B},$$

it follows from here that:

$$\left(\frac{EV_B}{EBITDA_B}\right)_{adj} = \frac{1}{(\frac{EV_B}{EBITDA_B})^{-1} + \frac{WACC_T - WACC_B}{k_B}}. \quad (16)$$

In a similar way we derive multiples for differences in the anticipated growth rates, ratios k and cost of capital (20)–(27) presented in Table 2. To assess influence of the debt burden (28), other things being equal, transformations were carried out starting from the weighted average cost of capital

$$WACC = \left(r_f + \beta_U \bullet ERP\right) \bullet \left(1 - MTR \bullet \frac{Lev}{1 + Lev}\right),$$

it is true in case the debt rate equals the risk-free rate. It is possible to deduce more accurate adjustments but they will be less succinct.

Summarized results of adjusted multiples are represented in analytical form in Tables 1 and 2 in the section Research Results.

Data

To verify the research results we used data about 38 public railway companies from 13 countries for 2016–2023. The data is taken by years. The research uses forward multiples *P/E* and *EV/EBITDA*. Growth rates are calculated on the basis of the blended growth rate formula which weighs forecasts of growth rates for various horizons taking into consideration discount factors [74]. A two-year growth of a corresponding indicator was used as the anticipated short-term growth rate, the anticipated nominal GDP growth rate was used for the long-term growth rate. Consolidated financial statements of companies and macroeconomic and financial statistics, analysts' forecasts were used as the data sources. Descriptive statistics of data are presented in the Appendix (Table 5).

TransContainer was used as the target company. It was chosen because it is a Russian company and now it is of relevance to improve the multiple method for assessment of the target company based on the data from the global capital markets. We calculated adjusted multiples for 38 companies which are comparable for TransContainer.

The adjustment effectiveness was evaluated on the basis of indicators of the adjusted values spread. The following indicators have been used:

- standard deviation of adjusted multiples (conventional measure), annual data from 2018 to 2023;
- spread between the 90th and 10th percentile for 2018–2023. This indicator is chosen because it shows the degree of the sample homogeneity with a 10% data winsorization from the top and bottom.

In the research the calculated standard deviations of adjusted multiples were used as dependent variables to verify statistical significance of improvement of certain adjustments' accuracy. The type of the data structure is panel data (time scale – years, spatial scale – certain types of adjustments). In future studies it is possible to apply other indicators of the adjustments' quality assessment, in particular, valuation of accuracy of the forecasts for the target company value depending on the adjustment.

On the basis of the conducted analysis we advance and verify the following hypotheses:

1. Adjustments allow to eliminate company-specific differences and improve accuracy of assessment using comparative valuation.
2. There are significant differences in influence of certain adjustments on the spread of multiples.
3. Adding to the calculation the share of dividend payout in the net profit and the ratio of the free cash flow for the company to *EBITDA* provides increases accuracy as compared to the case when these indicators are not taken into consideration while making adjustments.
4. Accuracy of direct adjustments (type 1, 3, 5, 13, 18 etc.) and adjustments based on a reverse multiple (type 2, 4, 6, 19 etc.) differ.

Research Results

Our transformations provided the following formulas for adjustment.

Table 1. Fundamental adjustments for the multiple $\frac{P}{E}$

Taking differences into account	Adjusted multiple $\left(\frac{P_B}{E_B}\right)_{adj}$
$r_T \neq r_B$	$\frac{P_B}{E_B} \cdot \frac{r_B - g_B}{r_T - g_B}$ (1) or $\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_T - r_B}{PR_B}}$ (2)
$g_T \neq g_B$	$\frac{P_B}{E_B} \cdot \frac{r_B - g_B}{r_B - g_T}$ (3) or $\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{g_B - g_T}{PR_B}}$ (4)
$r_T \neq r_B$ $g_T \neq g_B$	$\frac{P_B}{E_B} \cdot \frac{r_B - g_B}{r_T - g_T}$ (5) or $\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_T - r_B + g_B - g_T}{PR_B}}$ (6)
$r_T \neq r_B$, $r_T - r_{fT} - \beta_T ERP_T = r_B - r_{fB} - \beta_B ERP_B$ $g_T \neq g_B$, $PR_T \neq PR_B$	$\frac{1}{\frac{PR_B}{PR_T}\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_{fT} + \beta_T ERP_T - r_{fB} - \beta_B ERP_B + g_B - g_T}{PR_T}}$ (7)

Taking differences into account	Adjusted multiple $\left(\frac{P_B}{E_B}\right)_{adj}$
$r_T \neq r_B$, $r_T - r_{fT} - \beta_T ERP_T = r_B - r_{fB} - \beta_B ERP_B$, $g_T \neq g_B$, $g_B - g_T = \pi_B - \pi_T$, $PR_T \neq PR_B$	$\frac{1}{\frac{PR_B}{PR_T}\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_{fT} + \beta_T ERP_T - r_{fB} - \beta_B ERP_B + \pi_B - \pi_T}{PR_T}}$ (8)
$r_T \neq r_B$, $g_T \neq g_B$, $PR_T \neq PR_B$	$\frac{1}{\frac{PR_B}{PR_T}\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_T - r_B + g_B - g_T}{PR_T}}$ (9)
$r_T - r_{fT} - \beta_T ERP_T \neq r_B - r_{fB} - \beta_B ERP_B$, $g_T \neq g_B$, $g_B - g_T = \pi_B - \pi_T$	$\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_{fT} + \beta_T ERP_T - r_{fB} - \beta_B ERP_B + g_B - g_T}{PR_B}}$ (10)
$r_{fT} \neq r_{fB}$, $g_T \neq g_B$	$\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{r_{fT} - r_{fB} + g_B - g_T}{PR_B}}$ (11)
$RP_T \neq RP_B$	$\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{RP_T - RP_B + g_B - g_T}{PR_B}}$ (12)
$PR_T \neq PR_B$, $g_T = g_B$	$\frac{P_B}{E_B} \cdot \frac{PR_T}{PR_B}$ (13)
$PR_T \neq PR_B$	$\frac{PR_T}{PR_B\left(\frac{P_B}{E_B}\right)^{-1} + ROE_B \cdot (PR_T - PR_B)}$ (14)
$ROE_T \neq ROE_B$	$\frac{1}{\left(\frac{ù_B}{E_B}\right)^{-1} + (ROE_B - ROE_T) \cdot \left(\frac{1 - B}{PR_B}\right)}$ (15)
$Lev_T \neq Lev_B$	$\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{\beta_{uB} * ERP_B \cdot (1 - MTR_B) \cdot (Lev_T - Lev_B)}{PR_B}}$ (16)
$MTR_T \neq MTR_B$	$\frac{1}{\left(\frac{P_B}{E_B}\right)^{-1} + \frac{\beta_{uB} \cdot ERP_B \cdot Lev_B \cdot (MTR_B - MTR_T)}{PR_B}}$ (17)

Source: compiled by the authors.

Table 2 provides adjustments for the EV/EBITDA multiple.

Table 2. Fundamental adjustments for the multiple $\frac{EV}{EBITDA}$

Taking differences into consideration	Adjusted multiple $\left(\frac{EV_B}{EBITDA_B}\right)_{adj}$
$WACC_T \neq WACC_B$	$\frac{EV_B}{EBITDA_B} \cdot \frac{WACC_B - q_B}{WACC_T - q_B}$ (18) or $\frac{1}{\left(\frac{EV_B}{EBITDA_B}\right)^{-1} + \frac{WACC_T - WACC_B}{k_B}}$ (19)
$q_T \neq q_B$	$\frac{EV_B}{EBITDA_B} \cdot \frac{WACC_B - q_B}{WACC_B - q_T}$ (20) or $\frac{1}{\left(\frac{EV_B}{EBITDA_B}\right)^{-1} + \frac{q_B - q_T}{k_B}}$ (21)
$WACC_T \neq WACC_B$, $q_T \neq q_B$	$\frac{EV_B}{EBITDA_B} \cdot \frac{WACC_B - q_B}{WACC_T - q_T}$ (22) or $\frac{1}{\left(\frac{EV_B}{EBITDA_B}\right)^{-1} + \frac{WACC_T - WACC_B + q_B - q_T}{k_B}}$ (23)
$WACC_T \neq WACC_B$, $q_T \neq q_B$, $k_T \neq k_B$	$\frac{1}{\frac{k_B}{k_T}\left(\frac{EV_B}{EBITDA_B}\right)^{-1} + \frac{WACC_T - WACC_B + g_B - g_T}{k_T}}$ (24)
$WACC_T \neq WACC_B$, $q_T \neq q_B$, $q_T - \pi_T \neq q_B - \pi_B$, $k_T \neq k_B$	$\frac{1}{\frac{k_B}{k_T}\left(\frac{EV_B}{EBITDA_B}\right)^{-1} + \frac{WACC_T - WACC_B + \pi_B - \pi_T}{k_T}}$ (25)
$WACC_T \neq WACC_B$, $WACC_T - r_T = WACC_B - r_B$, $q_T \neq q_B$	$\frac{1}{\left(\frac{EV_B}{EBITDA_B}\right)^{-1} + \frac{r_{fT} - r_{fB} + q_B - q_T}{k_B}}$ (26)
$k_T \neq k_B$, $q_T = q_B$	$\frac{EV_B}{EBITDA_B} \cdot \frac{k_T}{k_B}$ (27)
$Lev_T \neq Lev_B$	$\frac{1}{\left(\frac{EV_B}{EBITDA_B}\right)^{-1} + \frac{Lev_B - Lev_T}{(1+Lev_T)\cdot(1+Lev_{B)}} \cdot \frac{\left(r_{fB} + \beta_{uB} * ERP_B\right)\cdot MTR_B}{k_B}}$ (28)

Source: compiled by the authors.

In real practice, the following formulas may be used for business valuation on the basis of adjusted multiples:

$$\widehat{P_T} = \theta\left(\frac{P_{B_i}}{E_{B_i}}\right)_{adj} \cdot E_T,$$

$$\widehat{EV_T} = \theta\left(\frac{EV_{B_i}}{EBITDA_{B_i}}\right)_{adj} \cdot EBITDA_T,$$

where θ – the operator which returns the median, weighted average value or the average value after winsorization of multiples $\frac{P_{B_i}}{E_{B_i}}$ for n comparable companies.

However, the adjustments themselves may turn out to be ineffective and against expectation degrade the quality of company valuation. This may, in particular, be due to an error in the valuation of adjusting parameters. For example, an inaccurate estimation of the cost of capital, dividend policy or anticipated growth rate of the stock price increment will result in a less accurate estimate of the stock value $\widehat{P_T}$ or business value $\widehat{EV_T}$ than in case of applying the multiple method without adjustments.

Adjusted multiples are calculated in this paper by the formulas presented in Tables 1 and 2 to evaluate effectiveness of the adjustments. In order to calculate influence when the share of dividend payout and the *k* ratio are accounted for incorrectly, we calculated adjustments for $PR_{B_i} = 1$ and $k_{B_i} = 1$ as well as the adjustments where growth rates are replaced with expected inflation values.

The results showed that use of adjustments allows to eliminate company-specific differences and improve accuracy of valuation using comparative valuation.

As long as the main goal of adjustments is elimination of company-specific differences, in our research reduction in the spread of the multiples served as the criterion for effectiveness of adjustment procedures. To assess such spread we applied estimates of multiples' standard deviation for comparable companies and the spread between the 90th and 10th percentiles of such multiples (separately for *P/E* and *EV/EBITDA*).

Table 3. Results of the adjustments which dimmish differences between comparable companies most of all

Multiple		Standard deviation	Spread between the 90th and 10th percentiles
P/E	The best adjustment (2)	1.2	3.2
	Second-best adjustment (6)	6.1	6.5
	No adjustments	28.7	42.7
EV/EBITDA	The best adjustment (19)	3.3	6.2
	Second-best adjustment (25)	6.8	6.7
	No adjustments	35.6	21.2

Source: compiled by the authors.

As we see from Table 3 adjustments allow to decrease standard deviation of multiples for comparable companies 10-fold and even more, the spread between the 90th and 10th percentiles – 3.5 times and more. This decrease is achieved with adjustment 2 for *P/E* and adjustment 19 for *EV/EBITDA* (for differences in the cost of capital). Also, adjustments (6) and (25) diminish significantly the spread of multiples. They take into consideration both the cost of capital and differences in the anticipated growth rates (the above results are obtained by approximation with expected long-term inflation).

Effectiveness of the adjustment depends on the quality of assessing the parameters for which the adjustment is made. Thus, in particular, taking into consideration the size premium by the Duff and Phelps[9] method usinig adjustment (2) entails a decrease in standard deviation by 0.1 p.p. and the spread between the 90th and 10th percentiles – by 0.3 p.p. for the *P/E* multiple (Table 4).

[9] URL: kroll.com (accessed date: 16.06.2025).

Table 4. Results of the adjustments which diminish the differences between the comparable companies

Multiple		Standard deviation	Spread between the 90th and 10th percentile
P/E, the best adjustment (2)	The cost of equity is defined on the basis of the *CAPM* model to which the size premium was added	1.2	3.2
	The cost of equity is defined on the basis of the *CAPM* model	1.3	3.5
EV/EBITDA, the best adjustment (19)	When calculating *WACC* the cost of equity was defined on the basis of the *CAPM* model to which the size premium was added	3.3	6.2
	When calculating *WACC* the cost of equity was defined on the basis of the *CAPM* model	3.6	6.1

Source: compiled by the authors.

In general, calculations showed that adjustments may both diminish the spread of multiples (i.e. to take into consideration effectively individual differences between the target and comparable companies) and increase it. In particular, the spread of multiples may increase when making adjustments for growth because evaluating the anticipated growth rate is complicated.

To assess influence of certain adjustments for diminishing the spread between multiples we evaluated the following regressions:

$$\ln(\sigma_{\frac{P}{E}adj}) = const + b_1 \bullet V_1 + b_2 \bullet V_2,$$

$$\ln(\sigma_{\frac{EV}{EBITDA}adj}) = const + b_1 \bullet V_1 + b_2 \bullet V_2,$$

where $\ln(\sigma_{\frac{P}{E}adj})$ is natural logarithm of standard deviation of adjusted P/E multiples, $\ln(\sigma_{\frac{EV}{EBITDA}adj})$ – natural logarithm of standard deviation of adjusted *EV/EBITDA* multiples, $const$ – constant, V_1 – vector of dummy variables which shows presence of adjustments for the cost of capital, risk-free rate, anticipated growth, expected inflation, differences in the debt burden, differences in anticipated project profitability, differences in dividend policy or free cash flow for the company and *EBITDA*), V_2 – vector of the variables which comprise the value of inflation and risk-free return in Russia and the USA, b_1, b_2 – vectors of evaluated ratios. Application of the natural logarithm of the dependent variable allows to assess the percentage for which use of a certain adjustment changes multiples' standard deviation in the sample of comparable companies.

Table 4 represents the results of valuation of random effects model. In the calculations we used robust standard errors. On the basis of the Breusch-Pagan test we made the conclusions that in models (1) (3) the hypothesis of heteroscedasticity is rejected at the 1% significance level, in model (4) – at the 10% significance level. The hypothesis of residuals normality according to the Pearson test is not rejected at the 1% significance level for models (1)–(3), and the 5% significance level for model (4). To verify robustness of the results we also applied the weighted least-squares method. Different calculation methods have not provided a significant difference in valuations.

Table 5. Results of evaluation of the adjustments' impact on standard deviation of the multiples

Model	(1)	(2)	(3)	(4)
Dependent variable	$\ln(\sigma_{\frac{P}{E}adj})$		$\ln(\sigma_{\frac{EV}{EBITDA}adj})$	
Regressors				
const	6.02***	4.15***	5.11***	4.02***
	(0.60)	(1.08)	(0.79)	(1.05)
Performed adjustment for the cost of capital	-2.21***	-1.69**	-2.07***	-2.10***
	(0.44)	(0.70)	(0.36)	(0.43)
Performed adjustment for the risk-free rate	-1.47***	-1.27*	-1.09***	-1.16***
	(0.51)	(0.66)	(0.42)	(0.43)

Model	(1)	(2)	(3)	(4)
Performed adjustment for the anticipated growth	2.24*** (0.44)	3.38*** (0.35)	1.26*** (0.41)	1.42*** (0.41)
Performed adjustment for the expected inflation	1.34*** (0.43)	2.41*** (0.37)	0.48 (0.35)	0.61** (0.29)
Performed adjustment for the debt burden	1.06** (0.41)	2.57*** (0.79)	-0.70* (0.43)	-0.42 (0.56)
Performed ajustment for the tax rate	-0.58 (0.40)	0.53 (0.67)	-	-
Use of reverse multiple	-0.84** (0.40)	0.04 (0.35)	-1.32*** (0.45)	-0.77*** (0.29)
Error in the adjustment for dividend policy or the k indicator	-	0.39 (0.35)	-	0.43 (0.31)
Interest rate in the USA	34.39*** (7.14)	39.04*** (7.32)	6.24 (8.70)	5.21 (9.80)
Interest rate in Russia	-50.50*** (8.73)	-59.94*** (8.29)	-31.40*** (6.65)	-27.30*** (7.08)
Inflation in the USA	3.13 (8.73)	-0.23 (8.26)	8.24 (7.26)	12.83* (7.25)
Inflation in Russia	16.19*** (4.41)	20.15*** (3.78)	17.36*** (4.12)	13.88*** (4.17)
Observations	204	174	132	114
Akaike criterion	683	573	401	332
Likelihood function logarithm	-329	-274	-190	-154

Note: *, ** and *** mean the 10%, 5% and 1% significance levels, respectively.

Source: calculated by the authors

The obtained results lead us to the conclusion that adjustments for the cost of capital entail statistically significant diminishing of the differences between the multiples of comparable companies at the 1% level. Adjustments for the risk-free rate provide a lesser but significant effect (at the 15 and 10% level depending on the model). These results confirm conclusions of Table 3 which state that adjustments achieve the highest efficiency when differences in the share capital value (for *P/E*) and weighted average cost of capital (for *EV/EBITDA*) are taken into consideration. We should note that current financial theory provides an opportunity to evaluate rather accurately the cost of capital.For this reason the potential errors in calculation of the equity value and weighted average cost of capital influence the adjustment results to the minimum extent.

Growth adjustments, on the contrary, increase the spread of multiples significantly. The reason may be that valuation of the anticipated growth (dividend or cash flow) is a complicated problem. In real practice, even forecast data is often determined on the basis of reporting [84]. Assessment of the anticipated growth rate, even taking into account the approach to calculation of the combined growth rate [74] will show a high error variance. Our analysis shows that attempts to make growth adjustments are highly likely to fail because the applied proxies for the expected growth of dividends or free cash flows for the firm are inaccurate and entail biases in the adjusted multiples' value. So, if there is no way to forecast accurately the growth rate of the target and comparable companies it is reasonable not to apply the growth adjustment. In some instances, the growth adjustment may be replaced with the adjustment for the differences in expected inflation which, however, also fails to provide a significant decrease in the multiples' variance.

Adjustments for differences in the debt burden improve accuracy of valuation of the *EV/EBITDA* multiple. Probably,

accuracy improves because such adjustments allow to take into consideration differences in benefits from tax shields.

In the research we verified the hypothesis on influence of an error when taking into account PR and k (the share of dividend payout or the ratio of the free cash flow for the firm to *EBITDA*). The hypothesis is confirmed partially: an error in taking into consideration the share of dividend payout or the ratio of the free cash flow for the firm to *EBITDA* (i.e. de facto accepting that $PR_{B_i} = 1$ and $k_{B_i} = 1$) entails a decrease in the adjustment effectiveness by 37–42%, however, the dependence is statistically insignificant and the p-value equals 0.22–0.24 for different model specifications. One of the problems with taking into consideration PR and k is that they are difficult to predict for a long term.

As previously stated, in real practice, PR and k are often overlooked when multiples are adjusted. Deducing formulas to adjust the multiple $\frac{EV}{EBITDA}$ we relied upon the ratio of $FCFF = EBITDA \bullet k$. Deriving adjustments for the multiple $\frac{P}{E}$ we used the share of returns allocated to dividend payout $D = E \bullet PR$ and then applied it for the classic Gordon model constructed on discounted dividends $V_0 = \frac{D_1}{r-g}$. In the strict sense when deducing the multiple $\frac{P}{E}$ we could have relied upon the Gordon model modification for discounted cash flows for shareholders $V_0 = \frac{FCFE_1}{r-\tilde{g}}$. For this purpose, instead of the share of dividend payout we should have used the $\tilde{k}$ ratio which establishes a relationship between a free cash flow for shareholders and the company profit $FCFE = E \bullet \tilde{k}$. Adjustments for this case are beyond the scope of the present paper, however, we should pay attention to the economic rationale of the k, $\tilde{k}$ and PR indicators. Except for some exclusions (for example, Surgutneftegas) a low PR value implies that a company invests relatively heavily. Low k and $\tilde{k}$ values also mean that the company, other things being equal, invests a lot. The reason is that cash flows turn out to be significantly lower than the *EBITDA* and returns with high capital expenditures. This follows from the formulas:

$$FCFF = EBITDA \bullet (1 - MTR) + D\&A \bullet MTR - \\ - \Delta NWC - CAPEX,$$

$$FCFE = E + D\&A \bullet MTR - \Delta NWC - CAPEX + NB,$$

where $D\&A$ – depreciation, ΔNWC – increment of net working capital, $CAPEX$ – capital expenditures, NB – net borrowing (debt increment).

Some differences may be caused by the fact that k and $\tilde{k}$ decrease if a company builds up working capital on a systematic basis (for example, rapidly growing companies) and changes in the capital structure also impact $\tilde{k}$. Nevertheless, in the long term these indicators are more stable. Thus, the economic rationale of k, $\tilde{k}$ and PR indicators is similar. They show how much a company invests and, consequently, which part of the financial results (measured as *EBITDA* or *E*) the company may allocate consistently among the owners of the share capital or, for k – owners of share and debt capital.

Additionally, we compared accuracy of direct adjustments (type 1, 3, 5, 13, 18 etc.) and adjustments with a reverse multiple in the denominator (type 2, 4, 6, 19 etc.). The obtained estimates lead to the conclusion that adjustments with a reverse multiple diminish differences in multiples by 3–75% more. However, these differences are insignificant.

The considered sample comprises the period of the COVID-19 pandemic and special military operation. To analyze influence of this period for accuracy of adjustments we added fixed time effects while the estimates of the ratios of the adjustment variables remained robust. Ratios of dummy variables of time are presented in Table 6 (2018 is taken as the basic year for valuation).

Table 6. Estimates of fixed time effects

Dependent variable	$\ln(\sigma_{\frac{P}{E}adj})$	$\ln(\sigma_{\frac{EV}{EBITDA}adj})$
2019	0.33 (0.23)	0.61*** (0.21)
2020	1.16*** (0.37)	1.48*** (0.25)
2021	1.18*** (0.27)	1.70*** (0.24)
2022	-0.11 (0.19)	0.96*** (0.19)
2023	0.71*** (0.20)	0.60** (0.29)

Note: *, ** and *** imply the 10%, 5% and 1% significance levels, respectively.

Source: compiled by the authors.

The obtained results indicate that in times of crisis adjustments are useful as well. However, their accuracy is impaired slightly. It is an expected and, probably, inevitable result because in periods of shocks uncertainty regarding the indicators of future performance of the company, which determine the value, increases.

A decrease in the variability of multiples shows that company-specific differences are taken into consideration. However, an improvement of valuation accuracy is an equally important criterion. It is also of importance to determine which valuations are more accurate: those based on the adjusted multiple ($\widehat{P_T} = \theta\left(\frac{P_{B_i}}{E_{B_i}}\right)_{adj} \cdot E_T$ and $\widehat{EV_T} = \theta\left(\frac{EV_{B_i}}{EBITDA_{B_i}}\right)_{adj}$) or those based on unadjusted multiples ($\widehat{P_T} = \theta\left(\frac{P_{B_i}}{E_{B_i}}\right) \cdot E_T$ и $\widehat{EV_T} = \theta\left(\frac{EV_{B_i}}{EBITDA_{B_i}}\right)$).

In the research we calculated deviations of the estimates on the basis of adjusted and unadjusted multiples from actual market stock prices and the company value.

According to the obtained results adjustments entail improvement of the valuation accuracy (Tables 7 and 8). So, if deviation of unadjusted multiples from actual values exceeds 12 net profits and approximately 6 *EBITDA*, the deviation for a series of adjustments amounts to about 0.2–0.3 of net profits and approximately 0.5 *EBITDA* while the multiple values differ from the actual values by 1–3%. This is indicative of the estimates' high accuracy.

Besides, in contrast to the variability of adjusted multiples' values:

- reverse adjustments (in particular, adjustment (1) is more accurate than (2) while adjustment (18) is more accurate than (19)) do not influence accuracy of estimated values);
- when researchers do not take into consideration dividend policy (to equity stock value) and the k parameter related to the ratio of *FCFF* and *EBITDA* (to assess the company value) accuracy increases (in particular, adjustments (2) and (19) when dividend policy and the k parameter are left out provide more accurate estimates than in a case when this parameter is taken into account).

Table 7. Deviations of the obtained estimates from the market stock price

Adjustment	Operator θ returns the average for the sample		Operator θ returns median for the sample	
	$\frac{\lvert\hat{P}-P\rvert}{P}$	$\frac{\hat{P}-P}{E}$	$\frac{\lvert\hat{P}-P\rvert}{P}$	$\frac{\hat{P}-P}{E}$
(1)	1%	0.3	2%	0.2
(2)	29%	-5.7	19%	-5.0
(2) leaving out dividend policy	15%	-2.8	11%	-2.9
(6)	9%	-1.8	7%	-1.7
Without adjustments	66%	12.8	48%	12.6

Source: calculated by the authors.

Table 8. Deviations of the obtained estimates from the market enterprise value

Adjustment	Operator θ returns the average for the sample		Operator θ returns median for the sample	
	$\frac{\lvert\widehat{EV}-EV\rvert}{EV}$	$\frac{\widehat{EV}-EV}{EBITDA}$	$\frac{\lvert\widehat{EV}-EV\rvert}{EV}$	$\frac{\widehat{EV}-EV}{EBITDA}$
(18)	1%	-0.2	3%	-0.5
(19)	21%	-2.6	15%	-2.6
(19) leaving out the ratio of FCFF and EBITDA	4%	0.5	4%	0.7
(25)	49%	-5.7	37%	-6.1
Without adjustments	48%	5.9	38%	6.5

Source: calculated by the authors.

Thus, the hypothesis of elimination of company-specific differences and improvement of valuation accuracy as a part of comparative valuation was confirmed. The hypothesis of different influence of certain adjustments was also confirmed. The hypotheses of improvement of influence of the estimate accuracy, provided the differences in dividend payout and the ratio of *FCFF* and *EBITDA* have been taken into consideration correctly, and also of different accuracy of direct adjustments and adjustments based on the reverse multiple were confirmed partially. If these factors are taken into account individual differences are eliminated and this entails a reduction in variability of adjusted multiples but at the same time in certain cases it results in degradation of accuracy.

Conclusion

In the paper we deduce formulas for adjustments in order to improve accuracy of business valuation on the basis of the comparable company method. The offered valuation allows to take into consideration company-specific differences between the target and comparable companies. This is of particular importance, especially when the number of comparable companies is small or when companies operating abroad prevail among the comparable companies. Adjusted multiples may be calculated by the formulas presented in Table 1 and 2.

The obtained results indicate that adjustments for the cost of capital (expenditures for equity for the *P/E* multiple and *WACC* for the *EV/EBITDA* multiple) are most effective from the point of view of reducing the spread between the multiples of comparable companies. The adjustment for differences in the debt burden diminishes the differences between the *EV/EBITDA* multiples of comparable companies. Growth adjustments result in an increase in the variability of adjusted multiples, and this is due to high error variance in the valuation of anticipated growth rates. Accuracy of valuation of shares and business taking into consideration adjustments for the cost of capital is higher than in case of adjustments both for the cost of calculation and growth. Nevertheless, adjustment for the cost of capital and growth improves accuracy in comparison to the valuation based on unadjusted multiples. The obtained results show that the growth adjustment may be recommended only when it is possible to evaluate accurately the growth rates of the target and comparable companies. If it is impossible, it is reasonable to abandon the growth adjustment or make an adjustment for differences in expected inflation values (for companies from different countries.)

In future studies it is recommended to verify effectiveness of adjustments for the samples of companies from other industries and for other adjustment quality indicators, in particular, for accuracy of the stock price forecast based on adjusted multiples. The authors also believe that there are a lot of promising future research areas: adjustment of the *EV*/revenue multiple, *EV/GMV* multiple, *EV/EBIT* multiple and non-financial multiples. Development of adjustments on the basis of alternatives for the Gordon model, for example, the H-model is also promising.

We made an important conclusion that taking into consideration dividend policy (for the *P/E* multiple) and the ratio of the net cash flow for the firm and *EBITDA* (for the *EV/EBITDA* multiple) is theoretically substantiated and decreases variability of adjusted multiples at the 1–5% significance level (depending on the specification) and accuracy of adjustments relative to the cases when such ratio is not used. Nevertheless, in real practice, taking these factors into consideration did not result in improvement of the valuation accuracy and in certain cases more accurate valuations (in terms of deviation from the actual market stock prices and the company value) were obtained when adjustments left out of account dividend policy and the ratio of *FCFF* and *EBITDA* and reverse multiples were not used. These results may be due to the fact that valuation over long time horizon of dividend policy and the ratio of *FCFF* and *EBITDA* has high error variance. Probably, it is one of the reasons why dividend policy and the ratio of *FCFF* and *EBITDA* are usually not considered by analysts despite their fundamental role in creating the company value.

Multiples' adjustment is a drift towards the discounted cash flows model in value estimation. Adjustments make the multiple method more labour intensive and create risks of degradation of accuracy in valuation in case of errors in determining the values of the factors used for adjustments. Therefore, when adjustments are used for valuation, it is important not just to calculate correctly the values of the factors applied in the adjustments but also rely on professional judgment and contemplate critically the obtained results. Nevertheless, the results of the present research lead us to the conclusion that correct use of adjustments provides an opportunity to improve accuracy of the estimate based on formal theoretically substantiated valuation.

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Appendix

Table 9. Descriptive statistics of variables

	Minimum	Median	Maximum	Average	Standard deviation
P/E	0.7	19.5	219	26.2	26.7
EV/EBITDA	0.2	12.4	503	17.2	35.7
$\ln(\sigma_{\frac{P}{E}adj})$	-0.17	3.36	8.90	3.46	1.73
$\ln(\sigma_{\frac{EV}{EBITDA}adj})$	0.06	2.61	8.40	2.74	1.65
Inflation for all countries	0.0	0.02	0.08	0.03	0.02
Inflation in the USA	0.03	0.04	0.07	0.04	0.01
Inflation in Russia	0.03	0.07	0.12	0.07	0.03
Expected blended growth rate of profit	-0.18	0.03	0.13	0.03	0.05
Expected blended growth rate of EBITDA	-0.28	0.03	0.25	0.03	0.10
Risk-free rate for all countries	0.01	0.02	0.13	0.03	0.03
Risk-free rate in the USA	0.00	0.02	0.05	0.02	0.02
Risk-free rate in Russia	0.05	0.07	0.11	0.08	0.07
Market risk premium	0.04	0.06	0.11	0.06	0.01
Beta	0.54	1.00	2.40	1.13	0.37
Debt burden	0.00	0.33	5.58	0.62	0.68
Income tax rate	0.15	0.25	0.34	0.26	0.04
Return on equity	-0.07	0.10	0.49	0.12	0.09

Source: compiled by the authors on the basis of calculations.

Table 10. Correlation matrix of variables

	$\ln(\sigma_{\frac{P}{E}adj})$	$\ln(\sigma_{\frac{EV}{EBITDA}adj})$	Risk-free rate in the USA	Risk-free rate in Russia	Inflation in the USA	Inflation in Russia
$\ln(\sigma_{\frac{P}{E}adj})$	1	0.71	-0.22	0.08	-0.09	-0.20
$\ln(\sigma_{\frac{EV}{EBITDA}adj})$	0.71	1	-0.11	0.59	-0.21	-0.16
Risk-free rate in the USA	-0.22	-0.11	1	0.41	0.13	0.22
Risk-free rate in Russia	0.08	0.59	0.41	1	-0.05	0.12
Inflation in the USA	-0.09	-0.21	0.13	-0.05	1	0.64
Inflation in Russia	-0.20	-0.16	0.22	0.12	0.64	1

Source: calculated by the authors.

Contribution of the authors: the authors contributed equally to this article.

The authors declare no conflicts of interests.

The article **was submitted on** 19.04.2025; **approved after reviewing on** 08.05.2025; **accepted for publication on** 01.06.2025.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.19.2.2025.38-52
JEL classification: G32

Economic Policy Uncertainty and Corporate Risk-taking in Russian Companies: The Role of Corporate Governance

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Abstract

This study investigates the relationship between economic policy uncertainty (EPU) and corporate risk-taking in Russian firms, focusing on the moderating effects of corporate governance mechanisms. Using a panel dataset of 126 companies listed on the Moscow Exchange Broad Market Index from 2010 to 2021, the study applies a fixed-effects model to examine how corporate governance factors, including board independence, the presence of a risk committee, and state ownership, influence corporate risk-taking under conditions of economic uncertainty. The results show that economic policy uncertainty is positively related to risk-taking, with corporate governance characteristics moderating this relationship. Specifically, higher board independence and the presence of a dedicated risk committee are associated with reduced risk-taking in periods of increased uncertainty. Conversely, state-owned enterprises (SOEs) exhibit a higher propensity for risk-taking due to the security provided by government backing. These findings contribute to the growing literature on corporate governance and risk management, particularly in emerging markets. This research provides practical insights for corporate managers and policymakers, suggesting the need for tailored governance structures to mitigate risk in volatile economic environments.

Keywords: corporate risk-taking, corporate governance, economic policy uncertainty, board of directors, state ownership, emerging markets

For citation: Gataullina R., Kokoreva M. (2025) Economic Policy Uncertainty and Corporate Risk-taking in Russian Companies: The Role of Corporate Governance *Journal of Corporate Finance Research.* 19. (2): 38-52. https://doi. org/10.17323/j. jcfr.2073- 0438.19.2.2025.38-52

Introduction

Corporate risk-taking plays a defining role in firms' ability to generate new income streams, maintain their market position and acquire funds to develop the business. Thus, effective risk-taking strategies are one of the critical factors in achieving sustainable operation and corporate success. In this context, it seems prudent to explore how internal characteristics such as corporate governance and financial aspects of a firm, as well as external influences such as economic policy uncertainty (EPU), affect firms' risk choices and discover which mechanisms moderate the response of firms in times of uncertainty.

Although many studies have focused on explaining the risk-taking behaviour of firms from a corporate governance perspective, more research is needed to examine how external macro factors, e.g., economic policy uncertainty, affect the corporate decision-making process in general and risk-taking in particular. Few papers have explored the interrelationship between uncertainty, corporate governance and risk-taking, with virtually no research on this topic in the Russian corporate sector.

This paper aims to examine how corporate risk-taking is affected by economic policy uncertainty in the context of Russian firms and determine fundamental corporate governance mechanisms that moderate the relationship between EPU and corporate risk-taking.

Our study contributes to the broad literature on the corporate governance determinants of corporate risk-taking and the growing literature that studies the role of economic policy uncertainty on corporate risk-taking in particular and provides information that may be helpful to the development of enterprises. Understanding how businesses respond to economic policy uncertainty may enable companies to manage risk skillfully, without succumbing to overreaction and ill-advised decisions.

Literature Review

Risk-taking and uncertainty

Risk is versatile, and there is no single formal definition. Risk is broadly viewed as suffering failure in some undertaking when the outcome is uncertain. In this context, risk is intimately connected with danger, and its negative implications become the primary focus. However, such a definition neglects the other integral part of risk-opportunity [1].

Numerous studies indicate that corporate risk-taking positively influences a company's growth rate and profitability [2]. These results illustrate that competent risk management practices assist in safeguarding against the negative consequences of shocks and enable firms to choose the best risks.

In our research, we follow the definition of Wright et al. [3], which states that corporate risk-taking is amount of volatility associated with expected outcomes and cash flows resulting from new investments.

The concepts of risk and uncertainty are divided in the theoretical literature. F.H. Knight establishes vital differences between the two, the main one being the possibility of mathematical measuring [4]. The outcomes themselves are unknown in both cases; however, the risk is supposed to be quantifiable in the sense that the probability of distribution of said outcomes is known, while in the case of uncertainty, there is no convenient way to ascertain the probability of an occurrence.

The differences in perception of risk and uncertainty are well documented in the papers of behavioural economists. Since people lead firms, examining the distinction in attitudes seems prudent. According to Kahn and Sarin, individuals are more sensitive to information about the likelihood of an event when dealing with risk compared to uncertainty [5]. It has also been established that individuals find it more difficult to discriminate between probabilities when coping with uncertainty rather than risk. Generally, people prefer "risky" choices to "uncertain" ones.

When we discuss the unanticipated changes that affect the economic system and can lead to alterations in governmental policies, we refer to economic policy uncertainty (EPU). In other words, EPU reflects the economy's fluctuations due to the unpredictability of fiscal, political, regulatory and monetary policies [6]. While it is evident that uncertainty does influence the readiness to take risks, the direction of this influence is not as clear. Several theories may assist in examining the driving forces behind firms' behaviour in times of uncertainty[1].

The first to be considered is the loss aversion theory proposed by Tversky and Kahneman as a part of the framework for prospect theory [7]. According to this concept, individuals and firms do not view potential losses and gains equally and are more sensitive to negative outcomes than positive ones. When an agent feels losses more keenly, more significant gains must be offered to offset this "loss aversion" effect. Generally, in periods of uncertainty, losses are expected to be more substantial. Suppose the potential gains offered by particular pursuits are insufficient (according to the firm's sensitivity to losses) to balance the possibility of a negative outcome. In that case, such risky projects may not be undertaken, and existing ones may be reconsidered. Thus, the overall level of risk-taking is likely to be lower than the "habitual" one.

Another concept in prospect theory is the so-called "reflection effect". This effect assumes that attitudes towards risk are susceptible to different framing, which makes people more inclined to be risk-averse under favourable conditions and risk-seeking under negative ones [8]. Studies by March and Shapira on managerial attitudes towards risk highlight that managers believe in avoiding actions that might worsen the company's position when the situation is stable and sound and in making riskier choices when the organisation fails in some respect [9].

[1] We use terms "uncertainty", "economic policy uncertainty" and "EPU" interchangeably.

Myopic loss aversion theory is another offshoot that streams from prospect theory and may offer some insights. The study conducted by Gneezy and Potters through a series of experiments demonstrated that individuals tended to place a bet more readily immediately after a loss and considerably less frequently after a win. It is postulated that people tend to focus on short-term losses and gains rather than long-term ones [10]. Using this theory as a foundation, the assumption can be made that when companies experience a specific setback that usually accompanies the start of uncertainty periods, they may decide to become more aggressive in their risk-taking to offset this short-term drop in performance due to being "myopic" in their perception of losses.

The discussed theories present alternative ways for firms to behave when faced with uncertainty, and researchers are not unanimous in their opinion of EPU's impact, as relevant literature provides empirical support for both of these views.

Zhang et al. recognise that the impact of EPU on risk-taking has a dual nature and may simultaneously promote and hinder risk-taking through different channels [11]. After analysing the data, the authors conclude that the motivation to capitalise on opportunities ("opportunity expectation") outweighs the fear of potential losses among managers and firms. Consequently, the relationship between economic policy uncertainty and risk-taking is positive.

Other studies have found that the impact of EPU is negative, as managers' pessimism regarding financial limitations proves to be the deciding factor [12]. A survey conducted in several European countries supports these findings [13].

Interestingly, the negative effect of EPU is more frequently reported in research dedicated to companies in developed economies and the positive effect for those in emerging markets. This may be due to the differences in institutional quality and market characteristics between the markets. In emerging markets, there is more significant political and economic uncertainty and less developed legal and regulatory frameworks, which can create a more volatile business environment. The uncertainty may lead firms to be more willing to take risks to achieve their goals, as they may feel that taking risks is necessary to remain competitive and gain a foothold in the market. Developed markets, on the other hand, typically enjoy more stable business environments with well-established regulations. In this case, firms may be less willing to take risks, believing that they can achieve their goals through more certain and predictable means. Additionally, developed markets generally have more mature and established industries, which makes it more difficult for firms to gain a competitive advantage solely through daring risk-taking. Thus, the expectation is that for Russian firms, the relationship between economic policy uncertainty (EPU) and corporate risk-taking is more likely to be positive since the market bears all the relevant characteristics of an emerging one.

Hypothesis 1: EPU is positively related to the corporate risk-taking of Russian firms.

Hypothesis 1 could work well for moderate levels of uncertainty, providing firms with growth opportunities that can lead to increased risk-taking. However, as uncertainty becomes too high, the risks associated with investment and expansion may outweigh the potential benefits, leading firms to become more cautious and risk-averse. Thus, we hypothesise that the relationship could have an inverted U-shape [14].

Hypothesis 2: EPU and corporate risk-taking relationship follows an inverted U-shaped pattern.

Corporate governance and risk-taking

Corporate governance refers to the system of rules, practices, and processes by which a company is directed and controlled. It can help better align managers' interests with those of shareholders and influence the decision-making process at its core, including risk choices. Some studies have found evidence that effective corporate governance significantly reduces the degree of risk-taking [15]. Others argue that stricter corporate governance practices, on the contrary, would lead to a greater appetite for corporate risk-taking [16].

According to *Thematic Review on Risk Governance (2013),* the board of directors oversees the firm's risk management strategies to ensure that the existing risk governance framework is appropriate for the company's business model[2]. As the board of directors is also responsible for management supervision, its composition influences all the decisions made and the general effectiveness of its work. That is the primary reason behind numerous regulations and guidelines offered by several international bodies, including the IMF, ACCA and the OECD, as well as national ones, regarding how to build an effective board.

With board composition, special attention is paid to independent directors. In Russia, independent directors on the board are required to list on the stock exchange[3]. The primary purpose of having an independent director is to have an impartial professional opinion with no undue influence to impede the exercise of objective judgment.

Research has shown that having independent directors on the board contributes to stricter monitoring of management, which can, in turn, lead to a conscientious approach to dealing with risk. Thus, it can be assumed that firms with more independent directors on the board tend to take on less risk than firms with fewer independent directors. Similar notions find confirmation in relevant studies [17]. Therefore, we propose the following relationship between the rate of independent directors and risk-taking:

Hypothesis 3a: The higher the proportion of independent directors on board, the lower the level of corporate risk-taking.

[2] URL: https://www.fsb.org/2013/02/r_130212/

[3] URL: https://www.moex.com/s575

Hypothesis 3b: The relationship between EPU and corporate risk-taking is less positive for firms with a higher proportion of independent directors on board.

Another potentially crucial corporate governance practice is to have a standalone risk committee whose sole purpose is to assess risks and devise effective risk management strategies, as opposed to having an audit committee take on this responsibility in addition to the already existing ones. In Russian firms, such a committee may be called a risk committee, a strategy committee (a strategic development committee) or even a risk and strategic planning committee. Regardless of the name, these committees are usually tasked with similar duties of monitoring and assessing risks, as well as preparing reports for the board. The general assumption is that such committees help strengthen the risk control system, increasing the effectiveness of risk recognition and measurement and consequently decreasing risk-taking [18]. For this study, the presence of a risk or strategic committee, or both, would be considered equivalent to a standalone governing body on the board professionally responsible for risk identification and management.

Hypothesis 4a: The presence of a *standalone* committee dedicated to risk assessment on the board reduces corporate risk-taking.

Hypothesis 4b: The relationship between EPU and corporate risk-taking is less positive for firms with a standalone committee on the board dedicated to risk assessment.

Corporate governance mechanisms are formed and operate differently depending on the key strategic owners. In particular, state-owned enterprises (SOEs) are very different in the decision-making processes of SOEs and their risk-taking. Intervention from the government and non-economic objectives limit a firm's capability to engage in risky activities. However, the state's provision of funds and resources negates this inconvenience to a certain extent. Overall, state-owned enterprises tend to prefer more conservative strategies and choose low-risk investments [19]. Thus, SOEs are expected to be characterised by lower risk-taking than private firms. As for the potential moderating effect, some studies provide evidence that the relationship between EPU and corporate risk-taking is affected by state ownership [20].

Hypothesis 5a: Corporate risk-taking is lower for companies with a significant proportion of shares owned by the state.

Hypothesis 5b: State ownership can reduce the positive impact of EPU on corporate risk-taking.

Decision-making processes are heavily dependent on the CEO's personal characteristics and traits. Extensive evidence in the empirical research indicates that CEO characteristics exhibit a statistically significant influence on the overall operational level of risk taken by the firm [21, 22]. CEOs make major corporate decisions, manage overall operations, and set the company's strategic direction as part of their direct responsibilities. If highly respected, they may also influence the board's opinion. In this study, the CEO's age and power, as proxied by CEO duality, are chosen as the most likely factors that significantly influence corporate risk-taking.

Younger CEOs tend to be more risk-seeking than older CEOs. This may be due to many factors, including a greater willingness to take on risk, a greater focus on growth and innovation, and a lower level of risk aversion. Younger CEOs may also pursue riskier investments to build a reputation [23]. On the contrary, older CEOs are more likely to use traditional management styles, invest less in research and development, make more diversifying acquisitions and maintain lower operating leverage [24].

Hypothesis 6a: Companies with older CEOs demonstrate lower corporate risk-taking than companies with younger CEOs.

Hypothesis 6b: The CEO's age can reduce the positive impact of EPU on corporate risk-taking.

CEO duality refers to the situation where the CEO also holds the position of chairman of the board of directors. Research has shown that CEO duality can impact corporate risk-taking, and several studies have examined this relationship. Dual positioning as both CEO and board chairperson leads to reduced risk-taking. The added responsibility serves to make the CEO more reserved [25]. Studies suggest that even risk-preferring CEOs curb their risk-taking tendencies when put into the position of simultaneously bearing responsibility as the chairman of the board because of managers' reputation concerns [26]. It is relevant to note that in Russia, according to the corporate governance code, the CEO is not allowed to also hold the position of chairman of the board since 2014. Thus, we could test the hypothesis over a limited period.

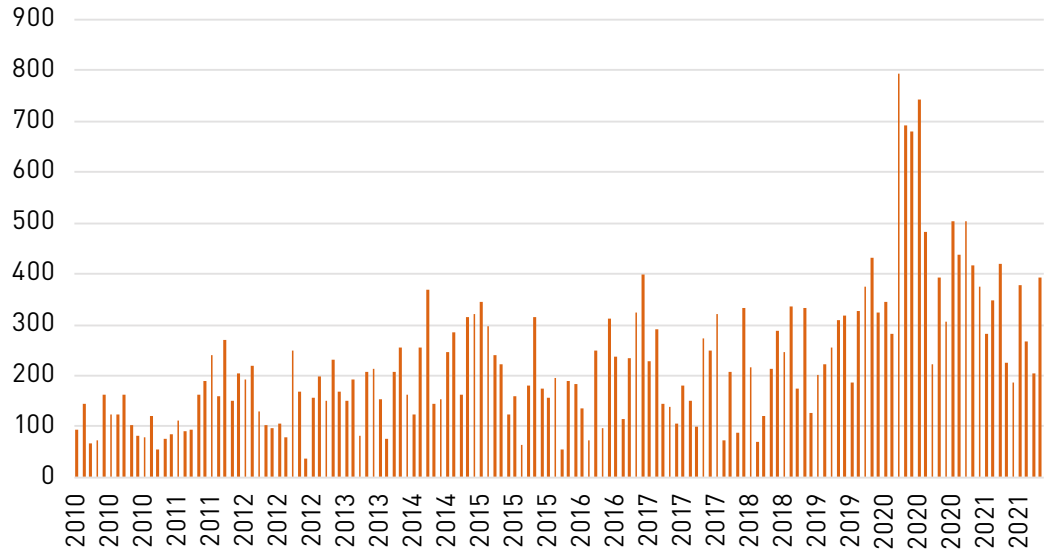
Hypothesis 7: Companies with CEO duality have lower corporate risk-taking than those without CEO duality.

Data and methodology

The dataset of Russian firms included in The Moscow Exchange Broad Market Index (MOEX BMI) is constructed to conduct the study. These companies are at the top of the Russian corporate sector. They supposedly take more outstanding care in following modern, effective corporate governance practices or at least comply with the required minimum established by the authorities. In addition, these organisations disclose more information than small and medium-sized businesses. Financial sector companies are excluded from the sample due to their specific nature.

Characteristics of corporate governance of all the remaining companies are collected from annual reports for all available years from 2010 to 2021. Financial information is retrieved from official financial statements under IFRS. The final sample includes 126 Russian companies. The majority of top companies belong to either basic materials (23%), utilities (22%) or consumer sector (18%). Slightly less represented are the energy sector (18%) and industrials (12%), while several enterprises belong to the technology (7%) or healthcare (5%) groups.

Figure 1. Russian Economic Policy Uncertainty Index.



Source: Author's diagram based on data of Baker et al. [27].

Economic policy uncertainty

The EPU monthly index by Baker et al. [27] measures economic policy uncertainty in the country [13; 20]. The index is constructed on frequency counts of newspaper articles containing keywords such as "uncertain" or "uncertainty", "economic" or "economy", and one or more policy terms that include "policy", "tax", "spending", "regulation", "central bank", "law", "budget", terms relating to political institutions, etc. The leading newspaper used is Kommersant, primarily the sections covering economics and politics[4]. Figure 1 demonstrates the dynamic of the Russian economic policy uncertainty index for 2010–2021. The graph shows fluctuations with the most prominent peaks in 2014–2015, the end of 2016 – beginning of 2017 and a significant rise in 2020, consistent with periods of local political and economic turbulence and worldwide uncertainty caused by the coronavirus outbreak. For this study, the monthly arithmetic mean is calculated to obtain annual uncertainty, and later, the logarithmic transformation is used to approximate the models' residuals to the normal distribution to increase the chances of receiving an adequate model.

Measures of risk-taking

The chief corporate risk-taking measure is earnings volatility, defined as the standard deviation measured by ROA (return on assets) [11]. The standard deviation of ROA is widely used in literature as a proxy to capture corporate risk-taking, as companies that take on more risk are likely to experience more significant fluctuations in their profitability. Additionally, the variability of ROA is believed to be a good indicator that does not exclude any type of risk from consideration as long as it is realised in the firm's earnings.

This study defines ROA as the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to the company's total assets at the end of each year from 2010 to 2021. To account for the effects of the industry bias, the individual firm's ROA is adjusted to its industry average in the following way:

$$AdjROA_{it} = \frac{EBITDA_{it}}{total\ assets_{it}} - \frac{1}{n}\sum_{j=1}^{n}\frac{EBITDA_{jt}}{total\ assets_{jt}}, \quad (1)$$

where i stands for the given firm, j – for all the other firms in the given industry, n denotes the total number of firms in the industry, and t represents the year.

Next, the standard deviation of the adjusted ROA is calculated for each firm in each year in the following manner:

$$Risk\_1_{it} = \sqrt{\frac{1}{N-1}\sum_{n=1}^{N}\left(AdjROA_{it} - \frac{1}{N}\sum_{n=1}^{N}AdjROA_{it}\right)^2}, \quad (2)$$

where N represents the rolling period of 3 years, n indicates the number of given years.

For the chief alternative measure of corporate risk-taking, we follow Jiraporn et al. [15] and calculate the volatility of stock prices supposing it reflects the degree of risk that investors believe is associated with a company. In this context, a firm that engages in daring risk-taking may be more likely to experience higher levels of volatility in its stock prices. The standard deviation of daily stock returns is calculated based on data extracted from *investing.com* for each year in the chosen period (*Risk_2*).

Table 1 contains the descriptions of all the variables. We use firm size, profitability, revenue growth, financial slack, and GDP per capita as control variables.

Corporate governance characteristics, such as the proportion of independent directors on the board, the existence of a strategy or risk committee, CEO's age, CEO duality and a few variables to measure state ownership and control are added to test the proposed hypotheses.

[4] 'Measuring Economic Policy Uncertainty' by Scott Baker, Nicholas Bloom and Steven J. Davis at www.PolicyUncertainty.com.

Table 1. Description of variables

Variables	Definition
Risk-taking measures	
Risk_1	The standard deviation of the enterprise's industry-adjusted return on assets (ROA) for each year in 2010–2021
Risk_2	The standard deviation of the enterprise's stock returns for each year in 2010–2021
Uncertainty measures	
EPU	Natural logarithm of the monthly arithmetic mean of the EPU index [27]
Control variables	
Size	Natural logarithm of total assets at the end of the year
Profitability	EBITDA / Total assets
Rev_growth	Annual growth rate of revenue
Leverage	Total debt / Total assets
Fin_slack	Cash and short-term investments / Total assets
ln_GDP	The natural logarithm of GDP per capita
Corporate governance	
Board_ind	The proportion of independent directors on the board of directors
Risk_com	The presence of a standalone risk or strategy committee within the board
CEO_age	Age of CEO
CEO_duality	A dummy variable indicating whether the enterprise's CEO is simultaneously the chairman of the board of directors (1 if yes, 0 if no)
State_1	A dummy variable indicating whether the state holds between 0–25% of the company's shares in total (1 if yes, 0 if no)
State_2	A dummy variable indicating whether the state holds between 25–50% of the company's shares in total (1 if yes, 0 if no)
State_3	A dummy variable indicating whether the state holds more than 50% of the company's shares in total (1 if yes, 0 if no)

Model specifications

The primary specification to test the first hypothesis is as follows:

$$Risk_{it} = \alpha_0 + \beta_1 EPU_{it} + \beta_2 Size_{it} + \beta_3 Profitability_{it} + \\ + \beta_4 Rev\_growth_{it} + \beta_5 Leverage_{it} + \\ + \beta_6 Fin\_slack_{it} + \beta_7 ln\_GDP_{it} + \varepsilon_{it}. \quad (3)$$

To test the second hypothesis, the value of EPU squared is added (Model 2).

To test hypotheses on the effect of corporate governance characteristics, relevant variables are included in the primary model:

$$Risk_{it} = \alpha_0 + \beta_1 EPU_{it} + \beta_2 Size_{it} + \beta_3 Profitability_{it} + \\ + \beta_4 Rev\_growth_{it} + \beta_5 Leverage_{it} + \\ + \beta_6 Fin\_slack_{it} + \beta_7 ln\_GDP_{it} + \\ + \beta_6 Corporate\_gov_{it} + \varepsilon_{it}. \quad (4)$$

Finally, to test hypotheses about moderating effects, interactive terms with EPU are introduced to the previous specification:

$$Risk_{it} = \alpha_0 + \beta_1 EPU_{it} + \beta_2 Size_{it} + \beta_3 Profitability_{it} + \\ + \beta_4 Rev\_growth_{it} + \beta_5 Leverage_{it} + \\ + \beta_6 Fin\_slack_{it} + \beta_7 ln\_GDP_{it} + \\ + \beta_6 Corporate\_gov_{it} + \beta_7 EPU_{it} \bullet \\ \bullet Corporate\_gov_{it} + \varepsilon_{it}. \quad (5)$$

Since the data is in panel form, the primary econometric method adopted is a fixed-effects model that controls for all time-invariant differences between companies and eliminates the risk of bias because of omitted time-invariant characteristics. Including year-fixed effects may be of assistance in controlling aggregate trends. Moreover, due to heteroscedasticity, the model is estimated using the Huber-White robust standard errors.

Results

The empirical results for hypotheses 1 and 2 are reported in Table 2 with robust standard errors in parentheses.

In *Model 1*, the coefficients of EPU are positive and highly significant (for both risk-taking measures). These findings imply that corporate managers react to higher levels of economic policy uncertainty by engaging more actively in corporate risk-taking, which is consistent with the previous studies and supports Hypothesis 1 [11].

The preliminary conclusion is that in the Russian corporate sector, the incentives to seize the opportunities for higher yields hidden in uncertainty periods generally prevail over the fear of more significant losses and the cautious nature of the managers. Such a result is not unexpected for emerging markets; several studies on Chinese and other emerging markets corroborate these findings [20].

Profitability is negatively associated with risk-taking [13; 28]. When firms perform better, managers are more interested in maintaining their strong position and are less willing to take risks. Furthermore, financial leverage also has a positive impact on corporate risk-taking. The agency problem between managers and creditors can explain this relationship. Due to the information asymmetry between corporate managers and creditors, firms tend to exploit creditors by investing in high-risk investment projects at their expense. Higher leverage increases corporate managers' incentives to take risks [13].

Model 2 aims to test whether there is evidence of an inverted U-shaped relationship between EPU and corporate risk-taking. Specification constructed with Risk_1 (standard deviation of ROA) as a dependent variable gives statistically significant estimations at the 5% level. The squared EPU is negatively related to corporate risk-taking, giving some authenticity to the assumption of an inverted U-shaped link. Moderate levels of uncertainty can provide firms with opportunities for growth and innovation, which can lead to increased risk-taking. However, when uncertainty becomes too high and exceeds the firm's tolerable threshold, the danger of substantial losses on investment and expansion will likely outweigh the potential benefits, leading firms to become more risk-averse. The result is not verified using Risk_2, with its coefficient's statistical significance being slightly outside of the 10% level of significance. Due to the above, all remaining models are estimated without a squared EPU variable.

Table 2. Results of fixed effects regression (Model 1–2)

	Model 1		*Model 2*	
VARIABLES	**Risk_1**	**Risk_2**	**Risk_1**	**Risk_2**
EPU	**0.00746*****	**0.000305*****	**0.01491****	**0.000439*****
	(0.00249)	(1.02e-05)	(0.00249)	(0.000145)
EPU^2	-	-	**-0.01255****	**-0.00923**
			(0.00641)	(0.00316)
Profitability	-0.0500***	-0.00330	-0.0437*	-0.0211**
	(0.0171)	(0.00203)	(0.0287)	(0.0041)
Size	-0.00330*	-0.00147	-0.00701***	-0.00250
	(0.00093)	(0.00313)	(0.00028)	(0.00203)
Rev_growth	0.00021*	4.25e-07	0.00036**	4.25e-07
	(0.00009)	(8.3e-05)	(0.00016)	(8.3e-05)
Fin_slack	0.0148	0.0092	0.0141	0.0125
	(0.0127)	(0.0287)	(0.0178)	(0.0425)
Leverage	0.0156**	0.0291***	0.0173***	0.0254***
	(0.00643)	(0.0059)	(0.00674)	(0.0077)
ln_GDP	0.123***	0.156**	0.145**	0.188**
	(0.0395)	(0.00674)	(0.0397)	(0.00754)

	Model 1		*Model 2*	
VARIABLES	**Risk_1**	**Risk_2**	**Risk_1**	**Risk_2**
Constant	-1.099***	-1.165***	-0.4346**	-2.100***
	(0.358)	(0.372)	(0.209)	(0.655)
Observations	1,029	1,029	1,029	1,029
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
R-squared	0.143	0.159	0.149	0.139

Robust standard errors in parentheses

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

In Table 3, *Models 3–6* investigate the influence of selected corporate governance characteristics on firms' risk-taking and examine whether these mechanisms influence the relationship between EPU and risk-taking through interaction.

According to *Model 3*, the proportion of independent directors on the board negatively affects risk-taking, confirming hypothesis 3a. This result aligns with the results of Ongsakul & Jiraporn [17]. Independent directors are more likely to make objective choices due to the lack of incentives to pursue riskier activities for better profits that come with having connections to the company. Consequently, they may be a bit more reserved in their estimations of the appropriate level of risk. The results of *Model 4* show whether this effect moderates the relationship between EPU and risk-taking by introducing an interaction term. The results support hypothesis 3b and demonstrate that the impact of EPU on corporate risk-taking is weaker when the proportion of independent directors on the board is higher. It may be construed as the persistence of independent directors' more cautious perspective on risk, meaning that when the rise in EPU provides incentives for firms to increase their risk-taking, independent directors might mitigate excessive enthusiasm by taking on an even more conservative approach considering the presence of EPU.

According to the results obtained in *Model 3*, the presence of a risk (strategy) committee negatively affects a company's risk-taking. This result is in line with the work of Bhuiyan et al. [18]. By having a dedicated committee focused on risk assessment and strategy development, the board can ensure that the company's objectives are aligned with its risk appetite and that risks are appropriately evaluated and addressed, preventing excessive risk-taking and reducing overall risk-taking levels. The presence of such a committee may prove to be especially important in times of rising uncertainty since it moderates the influence of EPU on corporate risk-taking by weakening it (see *Model 5*).

Model 3 indicates that the CEO's age is negatively associated with corporate risk-taking, which aligns with hypothesis 6a. Older CEOs are less likely to engage in risk-taking. There is no evidence to support hypothesis 6b, meaning there is no proof that a CEO's age can affect the link between EPU and corporate risk-taking. There is no indication that CEOs change their risk preferences markedly differently as a reaction to economic policy uncertainty.

To investigate the effect of CEO duality on corporate risk-taking, the CEO_duality variable was first added to *Model 3*, but the coefficient proved insignificant. This result is not altogether unexpected since the corporate governance reform in 2014 when CEOs were prohibited from combining their position with that of the chairman of the board of directors. From that point onwards, most companies on the list report no occurrences of CEO duality. After 2015, there were 11 cases of de-facto CEO duality compared to 31 prior to that year. However, the disparity between the number of observations before 2014 is still severe (504 against 31). The results are similar for the years 2010–2015.

Table 3. Results of fixed effects regression (Model 3–6)

	Model 3	*Model 4*	*Model 5*	*Model 6*
VARIABLES	**Risk_1**	**Risk_1**	**Risk_1**	**Risk_1**
EPU	0.00634**	0.00721***	0.00739***	0.00668***
	(0.00266)	(0.00257)	(0.00187)	(0.00252)
Profitability	-0.0670***	-0.0663***	-0.0356***	-0.0504***
	(0.00674)	(0.0137)	(0.00621)	(0.0171)

VARIABLES	*Model 3* Risk_1	*Model 4* Risk_1	*Model 5* Risk_1	*Model 6* Risk_1
Size	-0.00144*	-0.00177*	-0.000335	-0.00318
	(0.00186)	(0.00192)	(0.00106)	(0.00199)
Rev_growth	9.15e-05	9.96e-05	-2.85e-05	4.97e-05
	(0.000190)	(0.000103)	(0.000183)	(9.46e-05)
Fin_slack	0.0259**	0.0251**	0.0208**	0.0143
	(0.0116)	(0.0116)	(0.0102)	(0.0128)
ln_GDP	0.133***	0.146***	0.102*	0.122***
	(0.0225)	(0.0469)	(0.00343)	(0.0400)
Leverage	0.00702*	0.07672*	0.0628**	0.0162**
	(0.00132)	(0.00113)	(0.00519)	(0.00652)
Risk_com	**-0.0159*****	-0.0177**	**-0.0198***	-0.0144*
	(0.00531)	(0.00967)	(0.01267)	(0.00203)
Board_ind	**-0.00138****	**-0.00171****	-0.00168**	-0.00147**
	(0.000644)	(0.00140)	(0.00154)	(0.00350)
CEO_age	**-0.00049****	-0.00056*	-0.00045*	**-0.00038***
	(0.000121)	(0.000347)	(0.000297)	(0.00276)
CEO_duality				
EPU * Board_ind		-0.00123**		
		(0.000934)		
EPU * Risk_com			-0.00098**	
			(0.000057)	
EPU * CEO_age				-0.00002
				(0.00854)
Constant	-1.236***	-1.351***	-1.090***	-1.521***
	(0.209)	(0.427)	(0.361)	(0.498)
Observations	875	866	843	875
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
R-squared	0.192	0.199	0.177	0.173

Robust standard errors in parentheses

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

Models 6–10 are built to analyse the effect of state ownership on risk-taking and ascertain whether it influences the strength of the relationship between EPU and the propensity to take risks (Table 5). Variables State_2 and State_3 denote the aggregate ownership of between 25% and 50%, and more than 50% of the company's shares by the state have positive coefficients at 5% and 1% of significance, respectively. The model indicates that state ownership has the opposite effect to the one proposed in hypothesis 5a and promotes risk-taking rather than hinders it (the impact is significant for ownership over 25% of shares). Several possible explanations can be offered. One is that state-owned firms may be subject to political pressure to generate high returns and compete with private firms, which can incentivise them to take on more risk.

Additionally, state-owned firms may have access to government subsidies and other forms of support; therefore, the assumption was made that this support serves as an easier way to obtain necessary resources, which could discourage firms from engaging too actively in risk-taking. However, the support may have another effect, and a generous and stable supply of funds from the state might mitigate the risk of failure, allowing companies to take on riskier projects with this kind of "safety cushion". Finally, state-owned firms may have a social or political mandate to pursue initiatives perceived to be in the public interest, which may involve taking on greater risk than a purely profit-driven private firm would. Our results are consistent with those studies that found a positive relationship between state ownership and corporate risk-taking [29; 30].

Models 9–10 demonstrate slightly positive coefficients for interactive terms, meaning that in line with hypothesis 5b, state ownership indeed moderates the effect of EPU on risk-taking. To be precise, a high proportion of a company's shares owned by the state facilitates the positive connection between uncertainty and the propensity to pursue riskier undertakings. SOE's managers sometimes believe they can also reduce external uncertainties through political relations [31]. In any case, the information advantage that enterprises with a pronounced presence of the state enjoy may be partly responsible for the strengthening effect of state ownership.

Table 4. Results of fixed effects regression (Model 6–10)

	Model_6	*Model_7*	*Model_8*	*Model_9*	*Model_10*
VARIABLES	**Risk_1**	**Risk_1**	**Risk_1**	**Risk_1**	**Risk_1**
EPU	0.00741***	0.00735***	0.00724***	0.00777***	0.00715***
	(0.00250)	(0.00249)	(0.00249)	(0.00254)	(0.00253)
Profitability	-0.0500***	-0.0500***	-0.0500***	-0.0502***	-0.0499***
	(0.0171)	(0.0171)	(0.0171)	(0.0171)	(0.0171)
Size	-0.00338*	-0.00310	-0.00332	-0.00294	-0.00330
	(0.00200)	(0.00202)	(0.00203)	(0.00201)	(0.00202)
Rev_growth	3.37e-05	4.21e-05	3.42e-05	3.75e-05	3.42e-05
	(9.56e-05)	(9.51e-05)	(9.55e-05)	(9.43e-05)	(9.60e-05)
Fin_slack	0.0149	0.0150	0.0143	0.0156	0.0144
	(0.0127)	(0.0128)	(0.0128)	(0.0128)	(0.0128)
Leverage	0.0156**	0.0156**	0.0158**	0.0159**	0.0158**
ln_GDP	0.122***	0.123***	0.123***	0.122***	0.123***
	(0.0399)	(0.0397)	(0.0397)	(0.0396)	(0.0397)
	(0.00673)	(0.00663)	(0.00674)	(0.00665)	(0.00675)
State_1	**0.000939**				
	(0.00218)				
State_2		0.00449**		0.00488*	
		(0.00122)		(0.00203)	
State_3			0.00340**		0.00293**
			(0.00154)		(0.00113)
EPU*State_2				0.000651**	
				(0.00021)	
EPU*State_3					0.000485**
					(0.00018)

VARIABLES	*Model_6* Risk_1	*Model_7* Risk_1	*Model_8* Risk_1	*Model_9* Risk_1	*Model_10* Risk_1
Constant	-1.094***	-1.102***	-1.099***	-1.087***	-1.098***
	(0.361)	(0.358)	(0.358)	(0.357)	(0.358)
Observations	1,029	1,029	1,029	1,029	1,029
R-squared	0.143	0.146	0.140	0.141	0.139

Robust standard errors in parentheses

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

Models 3-6 given in *Table 3* present results obtained using variable Risk_1. The results are robust for Risk_2[5].

Endogeneity concerns

The IV approach has been implemented to address the ever-present endogeneity problem. The US monthly EPU index is adopted [27] to instrument the EPU measure used in the models. Since the US economy is one of the largest in the world, fluctuations in its economic policies and uncertainty frequently spread to other regions. Therefore, the assumption is that the US EPU index is a good approximation of Russian economic policy uncertainty (a good correlation score is anticipated). At the same time, it would not seem contrary to expect Russian EPU to have no direct impact on US economic policies [32]. Hence, the US index can be used as the instrumental variable for Russia's EPU.

The IV estimations are mostly consistent with the main model specifications' conclusions, indicating the findings' stability and reliability and serving as the basis for reasonable expectations of the lack of obvious heavy biases (see Appendix).

Conclusion

This study investigates the effect of economic policy uncertainty on corporate risk-taking in the Russian corporate sector. It highlights the critical role of corporate governance in the relationship between EPU and corporate risk-taking.

Overall, economic policy uncertainty increases corporate risk-taking in Russian firms. Certain theoretical frameworks could be used to justify this increased willingness to deal with risk, such as prospect theory, myopic loss aversion and agency theory. Positive connections are more frequently reported in studies of firms in emerging markets. Another point of interest is that state ownership, contrary to expectations, also exhibits a positive influence on risk-taking, probably due to the strong support from the government that allows them to overcome the risks of possible inefficient risk management, among other reasons. State ownership strengthens the positive connection between EPU and corporate risk-taking, though this effect is relatively modest. One way to lessen the increase in risk-taking activities associated with the rise in EPU is to expand the number of independent directors among board members or introduce a standalone risk committee for more efficient internal control and an objective outlook on the appropriate level of risk under the influence of uncertainty. The same notion holds for CEO age, though it somewhat reduces risk-taking without any statistically significant moderation power over the relationship between EPU and corporate risk-taking.

The findings of this study may be of assistance to several parties. Bringing awareness of the effects of uncertainty to managers and executives may help devise risk-management strategies with a lesser probability of being suboptimal due to not being adjusted with regard to the effects of EPU. Owners may benefit from examining corporate governance mechanisms' general influence on risk-taking and their capability to moderate firms' responses to uncertainty. This knowledge could be helpful when making decisions with implications for corporate governance within the organisation, such as appointing directors to the board to align the interests of different parties better and enhance the effectiveness of internal practices that are of the greatest importance for the successful further development of the enterprise.

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Appendix

Endogeneity

Comparison of outputs between the main FE model and IV model

	IV	Fe
VARIABLES	Risk_1	Risk_1
EPU	0.0124***	0.00746***
	(0.00291)	(0.00242)
Profitability	-0.0499***	-0.0500***
	(0.00615)	(0.00635)
Size	-0.00952***	-0.00330*
	(0.00243)	(0.00175)
Rev_growth	-9.66e-06	3.36e-05
	(0.000239)	(0.000182)
Fin_slack	0.0256*	0.0148
	(0.0106)	(0.0106)
ln_GDP	-	0.123***
		(0.0207)
Leverage	0.0175***	0.0156***
	(0.00497)	(0.00542)
Constant	-0.0325	-1.099***
Observations	1,029	1,029

Standard errors in parentheses

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

	IV
VARIABLES	Risk_1
EPU	0.0112***
	(0.00250)

Profitability	-0.0585***
	(0.00685)
Size	-0.00511*
	(0.00098)
Rev_growth	8.71e-05
	(0.000187)
Fin_slack	0.0274**
	(0.0117)
Leverage	0.00940
	(0.00640)
Risk_committee	0.0181***
	(0.00546)
Board_indep	-0.00635**
	(0.00527)
CEO_age	4.33e-05*
	(0.000146)
state_1	0.00106
	(0.00304)
state_2	0.0101**
	(0.00441)
state_3	0.00894*
	(0.00483)
Constant	-0.0923***
	(0.0343)
Observations	831
R-squared	0.231

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

Contribution of the authors: the authors contributed equally to this article.
The authors declare no conflicts of interests.
The article **was submitted on** 19.04.2025; **approved after reviewing on** 08.05.2025; **accepted for publication on** 01.06.2025.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.19.2.2025.53-66
JEL classification: G12, G24, G32, G34

Strategic Resilience as a Factor of Long-Term Abnormal Stock Returns on Russian Stock Market

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Abstract

The article considers the influence of non-financial strategic business resilience factors on abnormal stock returns. Its purpose is to develop an approach to their consideration in Russian company valuation. Research methodology entails the identification of corporate resilience criteria as competitive advantages that ensure business autonomy and their quantitative assessment through the developed strategic resilience score. Information base for factor assessment was formed by financial and management reports, materials of consulting and statistical agencies and leading business media. The score significance was tested using the least squares method for a spatial sample consisting of ordinary shares of a total of 34 Russian companies included in the IMOEX with a quotation history of at least five years, over the time interval of 2005–2022. The dependent variable is the average annual abnormal return (Alpha) as the difference between the actual total return and the return calculated by CAPM. Strategic resilience was a significant factor in positive abnormal returns, explaining 70% of its variation. The risk of resilient companies is comparable to the risk of sovereign debt. The results are interpreted as market inefficiency in a semi-strong form. It is proposed to apply a different equity risk premium to assess resilient and fragile companies and to modify the CAPM model by adding risk premium for fragility. The paper contributes to the study of the relationship between non-financial components of a business model and asset pricing in Russia. The novelty lies in the development of an approach to construction of the business viability rating and the determination of its influence on the emergence of abnormal returns.

Keywords: strategic resilience, business model viability, rating score, asset pricing, abnormal return, market inefficiency, business valuation

For citation: Sarakvashin D. (2025) Strategic Resilience as a Factor of Long-Term Abnormal Stock Returns on Russian Stock Market. *Journal of Corporate Finance Research.* 19. (2): 53-66. https://doi. org/10.17323/j. jcfr.2073- 0438.19.2.2025.53-66

Introduction

Scholarly discussion assigns great importance to the issues of sustainable development and corporate sustainability as a business strategy based on the implementation of environmental, social and governance priorities (ESG strategy) in order to ensure long-term survival of business and increase its value [1]. Over 70 methodologies [2] have been developed in 2012–2022 to evaluate the corporate sustainability level. This suggests that there is no scientific consensus concerning measuring, and consequently, defining the concept. Hence, the results of empiric studies of the influence of this practice on business value are sometimes conflicting, which makes our research theoretically relevant. Growing economic turbulence makes practically significant the search for new approaches to the concept and elements of sustainability, as well as to determining the ways of its quantification in order to incorporate it in business valuation .

The theoretical and methodological foundation of the research is comprised by the organization theory inasmuch as it defines the concept of resilience, the resource dependence theory of J. Pfeffer and G. Salancik with respect to identification of its components, the CAPM model and Jensen's approach for calculation of abnormal return, Fama-French and Mehra-Prescott methodologies for taking this factor into account in the capital asset pricing model.

The information base for the evaluation of resilience factors included annual financial statements with notes, management discussion and analysis (MD&A), presentations and annual reports of companies, materials of statistical agencies and leading business media. The resilience rating has been compiled and calculated manually.

To test the statistical significance of the resilience factor, we used a sample comprising companies included in the MOEX index as of 31.12.2022 except for the issuers listed at the exchange for less than five years. The sample totaled 34 companies. The time frame of analysis ranged from 2005 to 2022.

Literature Review

Concept of Strategic Resilience

The agenda of Sustainable Development Goals, which is at the root of the "corporate sustainability" definition is of a somewhat temporary, political, and declarative nature. The following observations confirm this fact:

1) The program sets mutually exclusive goals for social and economic development and secological sustainability [3]. When this inconsistency is conveyed to ESG practices, it produces the following empirical results: a positive influence of this factor on business value [4], especially during crises [5]; although the factor is significant, it explains only a small part of return variation [6]; there is no difference in stock returns of the companies with high and low ESG rating [7]; the influence of the ESG rating is also diversified by sectors [8]. It is logical that insufficient theoretical validity creates the concept of "greenwashing" [9] and gives rise to a business discussion on the genuine contents of the ESG agenda [10];
2) After several years of campaigning, CEO of BlackRock L. Fink cancels support of ESG in order to increase energy generation, including nuclear energy [11]. This change in rhetoric coincides with D. Trump's presidency and the re-withdrawal of the USA from the Paris Climate Agreement;
3) The United Nations Sustainable Development Report [12] points out stagnation in achieving the majority of the Sustainable Development Goals (SDG), negative results for some of these goals, while only two of them show progress in 2020–2023. Besides, as at 2023, the world is still at a moderate distance from achieving most SDGs, and a "long way off" and "very long way off" from nine SDGs. Therefore, the feasibility of implementing this agenda by 2030 becomes increasingly elusive and, consequently, the ESG concept turns out to be non-viable.

Summarizing the above, partial dependence of the ESG strategy on political decisions prevents us from considering it a clearly reliable solution for long-term survival of business. Therefore, the present paper offers an alternative approach to strategic resilience[1] of business. As will be shown below, it has little in common with the G component of the ESG strategy and disregards the company's environmental and social policies.

According to [13], resilience is associated with the ability to anticipate, maintain, manage and absorb, which together comprise the ability to survive. The description is consistent with the strategic management theory, which defines resilience as the ability to demonstrate minimal success over the long run while resisting shocks [14]. Return on government securities may function as a quantitative benchmark for such results, serving as a point of reference for the calculation of the required rate of return for any investment, and the only provisionally guaranteed financial instrument. If we interpret strategic resilience through the lens of financial science, it is the *quality of a company's business model that enables its stocks to offer returns not lower than the risk-free rate at the horizon exceeding five years regardless of stock market crises, making the risk of investing in such a company comparable to sovereign debt risk.*

The above interpretation becomes especially relevant in the modern economic environment, which is characterized by a negative trend in the average lifespan of public companies. According to the McKinsey report [15] the average duration of listing of companies in S&P 500 decreased from 61 years in 1958 to 18 years in 2011: the companies were

[1] The concept is used to avoid collision with the term "corporate sustainability" as an ESG strategy.

bought out, became a part of merger transactions or went bankrupt. A similar trend is observed in the stock market of the United Kingdom: 76% of the companies from the leading FTSE 100 index were closed down in 1988-2018 [16]. This understanding of resilience will assist in making a contribution in the analytical instruments that assess Russian companies operating in the environment of regular and enormous economic shocks.

Strategic Resilience Components and Advancement of Hypotheses

Consideration of strategic resilience as a feature of an organization leads to the application of the organizational approach, which construes an enterprise as a living organism that aims at certain goals in its relations with other organizations. Thereby, the resource dependence theory is of interest. It was described for the first time in the paper The External Control of Organizations: a Resource Dependence Perspective [17]. The authors place the greatest emphasis on the idea that it is necessary to maximize autonomy because an organization's dependence on external factors generates uncertainty and jeopardizes its survival. This premise underlies the definition of the business model viability factors:

Company's own resource base. The principle of a resource base consists in getting the source of resources under control, thus eliminating the need for their purchase in the market and minimizing the negative effect of shocks on the supply side. Such a business solution also prevents the existing and potential competitors from accessing the sources of resources. From the corporate finance perspective, vertical integration decreases cost of equity by reducing information asymmetry and mitigating operational risk [18]. If a company possesses a proprietary source of resources, it ensures its maximum resilience. Purchase of resources in the domestic market is considered to provide moderate resilience, while import entails the greatest uncertainty caused by exchange rate fluctuations and sanctions pressure.

Manufacture of diversified products. This component of the business model is intended to mitigate the risk of a shift in demand for a certain product and ensure protection from hostile activity of the organizations that dominate the market. Therefore, a diversified business is more resilient than a focused one. An extensive customer base also enhances financial resilience due to the coinsurance effect [19]. However, if a company diversifies its operations in non-related industries, it deprives itself of possible synergetic effects, thus reducing its growth potential without decreasing downward risks. This gives rise to the so-called "conglomerate discount" caused by the inability to run unrelated businesses efficiently and the investor's ability to independently diversify the portfolio. As a result, the conglomerate value is less than the sum of its parts [20].

Market power. Competition is a source of uncertainty and a threat to business survival. Horizontal integration allows to decrease the existing rivalry within an industry [21], establish barriers to potential market competitors and control pricing. However, the oligopoly position effect depends directly on market capacity. So, we propose to define oligopolies in the global market as the most resilient businesses and those in the national market – as moderately resilient.

The above mechanisms of increasing business resilience incentivize mergers and acquisitions [22; 23]. When combined with their positive dynamics [24], it is indicative of the unity of theory and practice.

However, mergers and acquisitions require significant funding that is why the next strategic resilience component is related to access to financial resources.

Extensive potential shareholder base. The smaller the capital market share available to a company, the greater the financial power of its potential shareholders and the higher the desired returns. The lack of analytical coverage caused by a small shareholder base also triggers cost of equity increase [25]. Registration of a business abroad provides an optimal opportunity to acquire access to international capital markets and serves as a factor of additional international legal guarantees for foreign investors. As for registration abroad, it should be noted that in 2022 a geopolitical attack on economic foundations occurred. As a result, capital restrictions were introduced in the Russian stock market [26], reducing companies' and their parent divisions' opportunities to choose a jurisdiction. However, these processes are of a non-economic nature. From the economic point of view, access to international funding sources by means of registration abroad preserves its methodological significance as a resilience factor. In the coming years, an alternative financial center based on the BRICS currency [27] may bring back this resilience factor for Russian companies when they are registered in certain countries.

Government and quasi-government ownership, on the contrary, reduces the potential shareholder base. The main benchmark for government companies is not value maximization, rather, it is social orientation [28]. Such corporations are not concerned with their own investment attractiveness and expansion of analytical coverage and thus, discourage potential investors. Quasi-government companies use no debt financing, have a circular ownership structure, accrue surplus spare funds, and fail to publish reports on a regular basis (this list is not exhaustive).

Up to this point, we took into account characteristics of the economic environment from a static standpoint, which is acceptable for short-term analysis. Economic landscape dynamics is aligned with the change of technological paradigms, which represent the certainty on which all economic operators depend. Over the long term, the economic significance of the abovementioned factors fades if the achievements of technological progress are not taken into consideration.

*Ecosystemic business transformation.*Technological transformation clearly demonstrates the limited nature of the industry-related approach to business in favor of considering a company as a part of the community organized around an innovation, which is known as a business ecosystem [29]. Digital tools help to create inter-industry plat-

form solutions, simplify and upscale business processes [30]. However, new structural solutions encounter a lack of funding, an issue that is often concealed, while banks, on their part, face the threat of a merger if they fail to cooperate with IT [31]. Processing of quantitative information is intrinsic to financial institutions more than to others, so cooperation with IT allows banks to comfortably expand the range of products offered beyond traditional financial services. Digital companies, in their turn, get access to the deposit network and data on the financial habits of bank customers for the purposes of service customization and personalization. In this way, a special synergy between banks and IT emerges. Therefore, a digital ecosystem operating on the basis of a financial institution is its most perfect, accomplished form that demonstrates self-sufficiency – the key criterion of ecosystems [32] – and is considered a resilient business structure. Rendering financial and other digital services separately is recognized as a non-complete ecosystem transformation and is associated with a moderate resilience level.

The business model components that demonstrate the extent of its viability are generalized in Table 1.

Table 1. Business model viability factors

Business model component	Minimum resilience	Moderate resilience	Maximum resilience
Company's own resource base	Import of resources	Purchase of resources in the domestic market	Production of resources by the company itself
Product diversification	Conglomerate	Focused production	Combined production
Market power	Competitive market player	Oligopolistic position in the Russian market	Oligopolistic position in the international market
Extensive potential shareholder base	Government ownership	Private ownership registered in the Russian Federation	Foreign registration of business or controlling shareholder
Ecosystem transformation of business	Business does not conduct ecosystem transformation	Incomplete ecosystem transformation	Complete ecosystem transformation

In a comparison of the proposed resilience methodology with official ratings[2], it is important to point out some external similarities with the rating score of the corporate governance quality which, apart from other criteria, takes into consideration the company's market position, its maintenance of the supply chain resilience and its ownership structure. The proposed approach differs in a more detailed analysis of these factors targeted precisely at evaluating the unique long-term competitive advantages of the business, while the corporate governance quality rating assesses the extent of the management system's contribution to protection of stakeholder rights and compliance with ESG requirements.

The described approach to the concept and components of strategic resilience predetermines the following hypotheses:

1) Strategic resilience was a factor of positive long-term abnormal return.
2) Stocks of resilient companies demonstrate long-term returns that are not lower than the risk-free rate, thus defying the principle of arbitrage-free pricing.

Research Methodology

Calculation of the Strategic Resilience Score

The strategic resilience components are of qualitative nature. We propose to define their three possible states in order to evaluate them quantitatively in a manner similar to the methodology of research [30] and that of rating agencies[3]: resilient, marginal, and fragile. Each of the states is assigned a rating of (1), (0), or (–1), respectively. The information base for the evaluation of resilience factors is comprised by the annual financial statements with notes, management discussion and analysis (MD&A), presentations and annual reports of companies, materials of consulting and statistical agencies and leading business media.

Assessment of the "company's own resource base" factor

The criterion of owning the resource base means that a company can obtain a resource in a way other than purchasing it in the market. From this point of view, extracting companies a priori have proprietary resources at their disposal and are assigned a score of (1). Processing com-

[2] The methodology for assignment of the governance quality ratings by Expert RA is taken as an example for comparison: https://raexpert.ru/docbank//c45/b06/d33/3ff74b5c2488a9de0ced544.pdf

[3] URL: https://raexpert.ru/ratings/methods/current/

panies disclose information on their own sources of raw materials and in case when resource endowment is >50% they are also assigned a score of (1). This requires an additional note: in accordance with art. 1.2 of the Federal Law On Subsoil [33], the subsoil is the property of the Russian Federation – this is a static characteristic. In economic dynamics, the right to use the subsoil is granted to other parties by a license, i.e., a government decision, which is a non-market factor. Thus, a company gains actual control over a source of raw materials and there any form of ownership may extend to the extracted commercial minerals, including private ownership – art. 11 and 1.2 of the above Federal Law. By comparison, industrial companies may trade, i.e., purchase raw materials in the market for further processing, but the share of trading is negligible.

As for the companies that do not conform to the above criteria, the expenditure item with the greatest weight in the cost price is analyzed taking into consideration depreciation, but excluding staff costs. Evaluation of dependence on the human factor seems to be a promising research area but the lack of fact-based materials limits empirical opportunities. As a rule, materials, depreciation, goods for resale have the greatest weight in expenditures. In some cases, companies disclose the country of origin of the factor. If they fail to do so, it is determined based on publicly available sources whether it is produced in the domestic market or imported, so, the score (0) or (-1), respectively, is assigned. This methodology allows to take into consideration companies integrated "backwards", those not integrated but purchasing the production factor in the Russian Federation and importers.

Evaluation of proprietary resources of financial organizations is to be commented on separately. They cannot acquire a source of their main resource (money), so they obtain it on conditions of interest payment and refundability. Therefore, financial organizations a priori do not have proprietary resource sources at their disposal. Thus, similar to the abovementioned methodology, if the share of international borrowings in the structure of the resource base of a financial organization exceeds 50%, the score of (-1) is assigned, otherwise, it is (0).

Evaluation of the "manufacture of the finished diversified products" factor

The Herfindahl-Hirschman index (HHI) is used to calculate the score. According to the McKinsey [34] methodology, if HHI>0.56 or, equivalently, if the share of one product exceeds 75%, the business is classified as operationally focused, and the score of (0) is assigned. If HHI<0.56, which is always true if the share of one product is less than 66%, the score of (1) is given. If the shares of finished products, which are non-resource products, are within the established limits, the revenue item, which is the second in weight, is analyzed. According to the McKinsey methodology, a conglomerate is defined as an enterprise running three or more business units with no common customers, production facilities or technology [35], and its diversification factor is assigned the score of (–1). In case of financial organizations, a conglomerate emerges when any non-core assets are purchased knowingly, i.e., not because a borrower of a certain bank is in default. The methodology provides an opportunity to distinguish between the combined, focused business and "faltering giants".

Evaluation of the "horizontal integration" factor

There are various indexes used to assess concentration. The most common of them is the Herfindahl-Hirschman index. However, there is a problem with determining the threshold at which an entity's position may be considered oligopolistic. According to the Reserve Bank of St. Louis, if a share exceeding 60% belongs to the five largest firms, the market is considered to be obviously oligopolized [36]. At the same time, the methodology of the IBISWorld [37] consulting company states that if the four largest manufacturers collectively hold a 40% share, the industry is considered to be moderately concentrated. The author prefers the criteria of the FRS and consulting companies over those of the Federal Antimonopoly Service because they have years of expert experience and vast analytical coverage. In the present research, the concentration level of 50% for five firms is adopted as the threshold value.

First of all, the geographical revenue structure is assessed. If the share of exports exceeds 50%, the business is considered to be export-oriented, and the share of the Russian Federation in the global market of the corresponding product is evaluated. The author acts on the premise of coordination of efforts of local exporters in the external market. Therefore, if the share of five exporting countries, including Russia, exceeds 50%, the companies that supply the corresponding product are considered oligopolists in the global market and get the score of 1, otherwise the score of (–1) is assigned. If the share of exports is less than 50%, the concentration of companies in the domestic market of a corresponding product is analyzed. In case of industrial companies, the share in manufacture is assessed; in case of retail and services – the share of sales in total sales, and for a financial organization – the share in total assets. If a company occupies an oligopolistic position in Russia, it is assigned the score of (0), otherwise – (–1). This methodology allows to take into consideration the concentration and size of a corresponding sales market.

Evaluation of the "foreign registration and form of ownership" factor

The score of (–1) is assigned to companies with a share of direct or indirect government participation exceeding 50% and quasi-government companies.

If a business or its controlling shareholder is incorporated abroad, it is assigned the score of (1). Other companies have the score of (0). The approach allows to take into consideration the country of registration, which is a formal criterion, and the ownership structure of share capital.

Evaluation of the "ecosystem business transformation" factor

According to the Concept of General Regulation of the Activities of Groups of Companies Developing Various Digital Services on the Basis of One "Ecosystem" [38] set forth

by the Ministry of Economic Development, a business model combining two or more product groups is considered to be an ecosystem. It means that an ecosystem where a financial organization is the leader is a structure, which in addition to financial services renders two or more services of another category (score of 1). Fully digital or financial companies are considered to be incomplete ecosystems and are assigned a score of 0. The business model of the companies operating beyond digital and financial services is considered fragile (score of –1).

The generalized methodology of evaluation of strategic resilience factors is presented in Table 2.

Table 2. Methodology for calculating resilience factor scores

	Score (–1)	Score (0)	Score (1)	Source of methodology
Company's own resource base	>50% of imports of the most cost-intensive production factor	Purchase of the principal production factor in Russia	Mineral company or >50% of its own resource base	The author's work
Product diversification	>3 unrelated businesses	HHI of revenue is >0.56	HHI of revenue is <0.56, no signs of a conglomerate	McKinsey
Horizontal integration	Criterions of HHI are not met	Share of five companies including the evaluated company is >50%	The share of five exporting countries including Russia is >50%	RB of St. Louis, IBISWorld
Extensiveness of shareholder base	Government share is >50% or quasi-government company	There is no controlling shareholder or there is a domestic registration	Share of the foreign shareholder is >50% or foreign registration	Formal-and-analytical criterion
Ecosystem business transformation	The company is neither financial nor technology one	Financial or technology company	Finance + two groups of other digital services	Ministry of Economic Development

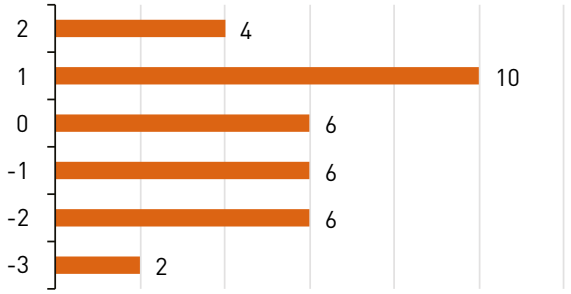
Next, we calculate the annual scores of companies and then, based on the premise that the weights of factors are equal, we sum up the obtained scores, thus creating the strategic resilience score. The maximum and minimum score may reach (5) и (–5), respectively.

Data and Model for Evaluation of Significance of the Strategic Resilience Score

The sample comprises shares of Russian companies included in the MOEX index at the time of its final rebalancing within the considered period of 2005–2022, which was performed on 16.12.2022, except for Ozon Holdings and Fix Price, which were first listed on the exchange in 2020 and 2021, respectively. Their circulation period is insufficient to test resilience. We also excluded the preference shares of PJSC Tatneft, Sberbank, Transneft and Surgutneftegas because of the specifics of their legal nature. The components of the Moscow Exchange index account for about 85% of the securities capitalization based on the results of trading at the end of 2022 [39]; twenty-six companies from the sample were in the Top 50 by the amount of corporate income tax paid in 2022 [40].

The period chosen for analysis meets the duration criterion, contains some diverse and profound crisis events: the financial and economic crisis of 2008–2010, the currency crisis of 2014–2015, the recession of 2020 caused by the COVID-19 pandemic and the geopolitical crisis starting in 2022, and paves the way for testing strategic factors.

Figure 1. Distribution of companies by the resilience score



For the overwhelming majority of companies, the factor score remains unaltered from period to period. This is indicative of the unchanging nature of the business model and allows to calculate a uniform rating for the entire period. When assessing certain factors, a change in one of the business model components was detected for some companies from a specific point onwards. In this case, the final score equals the score that has been assigned for the majority of periods.

Figure 1 presents the distribution of companies by their score.

From the point of view of calculated scores, a uniform distribution of companies into resilient (with a score of 1 and more) and fragile (-1 and below) is observed. This enhances the reliability of the conclusions concerning the significance of this factor for the business value.

Strategic resilience is not a factor that influences the variation of stock returns from period to period. Thus, as long as "the average stock price is associated with the average ability to earn profits" [35, p. 513], it seems reasonable to test the factor using the average value, an approach that also complies with the interpretation of resilience in this research. This approach is consistent with the study by I.V. Ivashkovskaya, where the growth sustainability index is calculated on the basis of the average sales growth rate [42], and the study by Ryabova and Samodelkina, where growth is assessed on the basis of the average compound growth rate of the company equity [43]. A classic example of applying the average value is the development of the cyclically adjusted price-to-earnings ratio (P/E) based on the paper by J. Campbell and R. Shiller [44].

To test hypothesis 1, abnormal return on an asset is calculated relative to the expected return by the CAPM model using M. Jensen's approach [45]. This asset pricing model was chosen because of its solid theoretical foundation and compliance with investor behavior [46]. As long as the periods of circulation of the sample components are different, the abnormal return is calculated for different time intervals. A comparison seems feasible because for all companies we used for analysis a long-term period of five years that includes two shocks out of four that took place in 2005–2022: by 2008 the sample comprised 23 companies, and by 2013 – 30 out of 34 companies[4]. In order to check the reliability of the score, hypothesis 1 is also tested using a more balanced sample of companies with the minimum stock circulation period of 10 years – 30 companies in total.

First, we calculated the actual return on the asset for the analyzed period as the compound annual growth rate (CAGR) with dividend reinvestment. The premise for the calculation is the payment of the entire dividend amount at the end of the year. Dividends and stock quotations issued in foreign currency have been denominated in the ruble according to the Central Bank exchange rate as at December 31 of the corresponding period. The formula for the calculation is as follows:

$$CAGR_i = \left(\prod_{t=1}^{n} \frac{P_t + D_t}{P_{t-1}}\right)^{\frac{1}{n}} - 1. \quad (1)$$

Since the sample consists of stocks with different circulation periods, the risk-free rate, benchmark yield and the β factor required to calculate the Alpha were calculated separately for each company for the period from the date of a company's addition to the sample to 31 December 2022[5].

The zero-coupon yield curve of government bonds according to the Central Bank of the Russian Federation was used as the risk-free rate. The benchmark return is calculated as the average compound return of the MOEX Russia Total Return Index (ticker: MCFTR). The β factor is calculated on the basis of monthly price-adjusted close prices and the MCFTR index. The quotes are downloaded from TradingView. The equation to calculate the dependent variable finally is as follows[6]:

$$Alpha_i = CAGR_i - R_f - \beta_i \times \left(CAGR_{MCFTR} - R_f\right). \quad (2)$$

The basic specification of the model for testing hypothesis 1 is presented in the following equation:

$$Alpha = const + \beta_i \times RS_i + \varepsilon_i, \quad (3)$$

where *RS* – resilience score.

The variable "score" is created as a system of factors of fundamental strategic competitiveness of a business of any size irrespective of its industry affiliation, while the "ecosystem transformation" component essentially relies on the non-industry approach. The factors that in their turn influence resilience are already of a non-economic nature. Based on these deliberations, it is considered superfluous to take into account other variables.

In order to analyze the obtained spatial data, we apply the least squares method with robust standard errors to solve the possible heteroscedasticity problem.

The results of the regression of the Alpha variable for the resilience score are presented in Table 3.

Table 3. Alpha regression analysis results

Dependent variable	Alpha	Alpha
Interest variables:		
Resilience score	0.048***	0.47***
Const	-0.01	-0.01
Model characteristics:		
R-squared adjusted	0.7	0.67
N	34	30

The interest variable turned out to be significant at the 1% level, while the adjusted determination coefficient exceeded 70%. The positive sign of the variable is indicative of a direct dependence between the Alpha and the strategic resilience level. This confirms hypothesis 1. Elimination of companies with a circulation period of up to 10 years from the sample changes the regression results insignificantly.

To verify hypothesis 2, we present descriptive statistics of returns of resilient companies exclusive of the risk-free rate and calculate the confidence interval. See the results in Table 4.

[4] The time intervals used for analysis are listed in Appendix 1, column N (period).

[5] For example, for NLMK the zero-coupon yield curve was taken for 01.2006 with maturity of 17 years, average compound return of MCFTR for the period of 2006–2022, β of monthly returns for the same period. The data for calculation of the Alpha for all companies is presented in Appendix 1.

[6] The values of abnormal return of companies from the sample are presented in Appendix 1.

Table 4. Descriptive statistics and confidence intervals for resilient companies' returns

Parameter	Value of CAGR-Rf of resilient companies	Value of the Alpha of resilient companies
Average	0.071	0.0499
Median	0.057	0.039
Standard deviation	0.062	0.061
Minimum	-0.051	-0.058
Maximum	0.177	0.180
Confidence interval of 99%	0.044	0.044

There is a probability of 99% that average long-term return on stocks of resilient companies exclusive of the risk-free rate is above the threshold of 7.1% -4.4% = 2.7% per annum. This confirms hypothesis 2, moreover, the Alpha of resilient companies is not negative.

Results and Practical Significance

Based on the results of testing hypothesis 1, the existence of a strategic resilience premium is established. Its value at different long-term horizons is presented in Table 5, with 01.01.2023 as the starting point.

Table 5. Yield spread of resilient and fragile portfolios in different periods

	5 years	7 years	10 years	12 years	15 years
ResilientMinus Fragile, %	12.56	12.55	12.69	13.95	13.57

From the point of view of market efficiency, such a premium is possible only due to the increased risk of resilient companies. However, strategic resilience is aimed at mitigating this risk. Therefore, the interpretation of the result as a consequence of market inefficiency in semi-strong form seems better substantiated. The existence and maintenance of a stable premium amount may be due to the fact that financial analysis mainly takes into consideration the values calculated by the issuer himself and disclosed directly in the reports, while the resilience methodology implies a more profound study of special features of operation of a certain business up to the study of narrowly specialized factors. The most up-to-date financial analytics also take into account the information from sustainable development reports, although they only disclose the ESG component. A significant amount of important information is left beyond the scope of investment analysis; therefore, the market does not recognize the advantages of resilient companies. Another reason may be the so-called short-termism of financial markets. It is a condition understood as short-term priorities of investors [47].

Testing of hypothesis 2 revealed the possibility of asymptotic arbitrage of the first kind, which implies a positive probability of getting arbitrarily rich with an arbitrarily low risk of loss [48]. Risk-free return is fixed for any outcome, while a share of a resilient company has the price growth potential in a positive scenario. The actual comparison of averaged returns of a resilient portfolio and risk-free rate at different long-term horizons is presented in Table 6.

Table 6. Resilient portfolio return and risk-free rate comparison (%)

	5 years	7 years	10 years	12 years	15 years
Resilient portfolio	10.58	15.96	16.13	12.26	11.11
Risk-free rate	7	10.26	6.80	7.84	6.64

To adjust the evaluation of Russian companies' equity as a component of its weighted average cost of capital, it is proposed to take into consideration the strategic resilience factor in the CAPM model.

In the long term, resilience provides the company with a return not lower than the risk-free rate. This allows to compare its risk with the sovereign debt risk. For this reason, at the stage of transition to an efficient market it seems possible to apply to resilient companies, according to the Mehra-Prescott methodology, an equity risk premium that corresponds to a reasonable level of risk aversion [49]. For the American economy, it was less than 1% with the observed premium of 6%. Consequently, the premium of 11.18% indicated by A. Damodaran for the Russian market in 2024 [50] seems extremely high for resilient companies. Although emerging markets are in general riskier than developed ones [51], the ERP score will be biased without additional differentiation of these markets' participants not only by industry but also by the applied business model.

For an efficient market state, a modification of the CAPM model is proposed by means of adding the fragility factor calculated as a spread of returns of fragile and resilient portfolios (FragileMinusResilient, FmR). This is consistent with the Fama-French approach [52]. A positive beta coefficient of the FragileMinusResilient factor is indicative of the company's exposure to the risks related to the use of a fragile business model and, therefore, increases the required return. A negative beta coefficient denotes the opposite effect.

The implementation of the suggested adjustments to the calculation of the cost of equity is possible with any model of business value assessment based on the discounting method: DCF, economic value added (EVA), adjusted present value (APV), etc.

A summary of the actual and proposed models is presented in Table 7.

Table 7. Current and prospective models for estimating the cost of equity of companies

	Evaluation of the cost of equity of resilient companies	Evaluation of the cost of equity of fragile companies
Actual state	$R_{fact} = R_f + \beta_1 \times (R_m - R_f) + \beta_2 \times ResilientMinusFragile$ (4)	
Transitional phase	$R_e = R_f + \beta \times "fair" ERP$ (5)	$R_e = R_f + \beta \times consensusERP$ (6)
Efficient market	$R_e = R_f + \beta_1 \times (R_m - R_f) + \beta_2 \times FragileMinusResilient$ (7)	

In assessing current company value, the choice of the equity evaluation model depends on the analyst's judgment concerning the extent of market efficiency.

Conclusion

The paper studies the influence of strategic resilience on long-term return-risk parameters of the highest-liquidity stocks of the largest Russian companies that operate in the principal industries of the Russian economy.

Instead of the ESG agenda, the interpretation of the resilience concept was linked to the extent of a company's self-sufficiency achieved by developing its own resource base, diversifying business operations, seizing the market power, choosing the form of ownership and country of incorporation, ecosystem transformation based on the synergy of financial and digital technologies. This allowed their stocks to gain returns not lower than the risk-free rate in the long term despite market shocks. An assessment methodology is developed for each component in order to form the strategic resilience score as a universal indicator that comprehensively demonstrates the specifics of the business model.

It was possible to test the variable because sufficient and relevant empirical materials have been accumulated: the period of 2005–2022 is used as the analysis horizon, and the sample comprises all companies within the Moscow Exchange index that have been listed for over five years.

Due to accounting for strategic resilience, we were able to explain over 70% of abnormal return on the stocks of companies which, although classified as blue chips of the Russian economy and considered by analysts as peers in certain industries, were incomparable from the point of view of riskiness of the applied business model. The direct influence of strategic resilience on the Alpha was considered as the inefficiency of market pricing in a semi-strong form. The annual premium for owning a resilient portfolio not compensated by taking additional risk amounted to approximately 12% on different horizons ranging from five to fifteen years. The resilience factor also ensured portfolio returns not lower than the risk-free rate in spite of numerous and various stock market shocks, which was considered to be a violation of the arbitrage-free pricing principle.

To make the cost of equity of resilient companies more precise, adjustments to the CAPM model were developed. At the phase of transition to an efficient market, we suggest evaluating their equity at a rate close to the risk-free rate using, according to the terminology proposed by Mehra-Prescott, the "genuine" equity risk premium. For an efficient market state, we propose to improve the CAPM model by adding a risk premium for fragility calculated, similarly to the Fama-French methodology, as a spread of returns of fragile and resilient portfolios.

Further theoretical development of the problems of accounting for strategic resilience when determining company value may primarily consist in improving the methodology for assessing the factors and increasing its operationality. This will allow to expand the sample and perform a regression of certain resilience components for the empirical clarification of their independent influence on the variation of stock returns. The results of these studies will bring about the opportunity to identify the most effective combinations of resilience components from the point of view of maximizing shareholder value.

Another vector of quantitative research may entail the testing of the suggested pricing model applying the Fama-MacBeth procedure [53], conventionally used in this case, as well as other practices.

Acknowledgements

This research would not have been possible without the exceptional support of my research advisor I.N. Gurov. His enthusiasm, knowledge, demanding and patient guidance underlie the final version of this work.

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Appendix 1. Calculation of the alpha coefficient for the companies in the sample

Ticker	CAGR, %	Period	MCFTR t0-t1		Rf, %	Rm, %	N	Beta	ERP, %	Alpha, %
AFKS	-3.19	2007–2022	1617	4549	6.56	6.68	16	1.35	0.12	-9.91
AFLT	0.90	2005–2022	548	4549	8.48	12.48	18	0.82	4.00	-10.86
ALRS	4.83	2012–2022	1628	4549	8.62	9.79	11	0.94	1.17	-4.89
CBOM	8.80	07/2015–2022	2128	4549	11.12	10.66	7.5	0.52	-0.46	-2.08
CHMF	17.61	07/2006–2022	1380	4549	6.88	7.50	16.5	1.06	0.62	10.07
DSKY	1.81	2017–2022	3225	4549	8.03	5.90	6	0.82	-2.13	-4.47
ENPG	-14.35	2018–2022	3208	4549	7.04	7.23	5	1.23	0.19	-21.62
FIVE	10.44	2005–2022	548	4549	8.48	12.48	18	0.99	4.00	-2.00
GAZP	2.97	2006–2022	1079	4549	6.89	8.83	17	0.96	1.94	-5.78
GLTR	5.40	07/2008–2022	1760	4549	7.13	6.77	14.5	1.3	-0.36	-1.26
GMKN	21.52	2005–2022	548	4549	8.48	12.48	18	0.93	4.00	9.32
HYDR	-3.88	07/2008–2022	1760	4549	7.13	6.77	14.5	0.84	-0.36	-10.71
IRAO	6.24	07/2008–2022	1760	4549	7.13	6.77	14.5	1.1	-0.36	-0.49
LKOH	14.12	2005–2022	548	4549	8.48	12.48	18	0.93	4.00	1.92
MAGN	9.51	2006–2022	1079	4549	6.89	8.83	17	1.2	1.94	0.29
MGNT	13.97	07/2006–2022	1380	4549	6.88	7.50	16.5	1.02	0.62	6.46
MOEX	12.47	2013–2022	1766	4549	6.80	9.92	10	0.93	3.12	2.77
MTSS	10.32	2005–2022	548	4549	8.48	12.48	18	0.89	4.00	-1.72
NLMK	10.28	2006–2022	1079	4549	6.89	8.83	17	0.98	1.94	1.49
NVTK	16.21	07/2006–2022	1380	4549	6.88	7.50	16.5	1.07	0.62	8.67
PHOR	26.12	07/2011–2022	1879	4549	8.41	7.99	11.5	0.74	-0.42	18.02
PIKK	0.80	2007–2022	1617	4549	6.56	6.68	16	0.61	0.12	-5.83
PLZL	11.55	07/2006–2022	1380	4549	6.88	7.50	16.5	1.2	0.62	3.93
POLY	3.56	2012–2022	1628	4549	8.62	9.79	11	0.61	1.17	-5.77
ROSN	6.92	07/2006–2022	1380	4549	6.88	7.50	16.5	1.12	0.62	-0.65
RTKM	4.40	2005–2022	548	4549	8.48	12.48	18	0.4	4.00	-5.68
RUAL	0.77	2010–2022	1568	4549	8.60	8.54	13	0.95	-0.06	-7.77
SBER	16.57	2005–2022	548	4549	8.48	12.48	18	1.4	4.00	2.49
SNGS	2.46	2005–2022	548	4549	8.48	12.48	18	0.77	4.00	-9.10
TATN	18.86	2005–2022	548	4549	8.48	12.48	18	1.45	4.00	4.58
TCS	21.66	2014–2022	1781	4549	8.03	10.98	9	1.13	2.95	10.30
VKCO	-8.08	2011–2022	1895	4549	7.84	7.57	12	1.19	-0.27	-15.60
VTBR	-11.09	07/2007–2022	1734	4549	6.54	6.42	15.5	1.04	-0.12	-17.51
YNDX	5.68	07/2011–2022	1879	4549	8.41	7.99	11.5	1.13	-0.42	-2.26

Appendix 2. Rating score of the companies in the sample

Num	Ticker	Resource	Diversification	Market power	Shareholder base	Ecosystem transformation	Rating
1	AFKS	0	-1	-1	0	0	-2
2	AFLT	0	0	0	-1	-1	-2
3	ALRS	1	0	1	-1	-1	0
4	CBOM	0	0	-1	0	0	-1
5	CHMF	1	1	0	0	-1	1
6	DSKY	-1	1	-1	0	-1	-2
7	ENPG	-1	0	-1	0	-1	-3
8	FIVE	0	1	-1	1	-1	0
9	GAZP	1	-1	1	-1	-1	-1
10	GLTR	0	0	-1	1	-1	-1
11	GMKN	1	1	1	0	-1	2
12	HYDR	1	-1	0	-1	-1	-2
13	IRAO	1	0	0	-1	-1	-1
14	LKOH	1	1	1	0	-1	2
15	MAGN	0	1	0	1	-1	1
16	MGNT	1	1	-1	0	-1	0
17	MOEX	0	1	0	0	0	1
18	MTSS	-1	0	0	0	1	0
19	NLMK	1	1	-1	1	-1	1
20	NVTK	1	0	1	0	-1	1
21	PHOR	1	1	1	0	-1	2
22	PIKK	1	0	-1	0	-1	-1
23	PLZL	1	0	0	1	-1	1
24	POLY	1	0	0	1	-1	1
25	ROSN	1	1	1	-1	-1	1
26	RTKM	-1	1	0	-1	0	-1
27	RUAL	-1	0	-1	1	-1	-2
28	SBER	0	0	0	0	0	0
29	SNGS	1	0	1	-1	-1	0
30	TATN	1	0	1	0	-1	1
31	TCS	0	1	-1	1	1	2
32	VKCO	0	-1	-1	-1	0	-3
33	VTBR	0	-1	0	-1	0	-2
34	YNDX	0	0	-1	1	0	0

The article **was submitted on** 23.04.2025; **approved after reviewing on** 12.05.2025; **accepted for publication on** 04.06.2025.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.19.2.2025.67-81
JEL classification: G12, G17, G32

Evolution of Factor Pricing Models and Their Application in the Russian Financial Market

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Abstract

The article examines the evolution of asset pricing models in the stock market and explores their practical application in the Russian market. Despite the limited use of the capital asset pricing model and multi-factor models for forecasting stock return, their emergence has played a significant role in elucidating the nature of the equity risk premium and in identifying persistent return anomalies. Factor investment strategies have become the most important application of these models, as they are prevalent in mutual funds in major markets and available to private investors. The article analyzes the potential of factor investment strategies in the Russian stock market and presents an author's methodology for constructing factor portfolios. Their advantage is evidenced by improved diversification compared to the primary indices of the Moscow Stock Exchange and the ability to hedge through factor strategies across different stages of the business cycle. We conduct the analysis using a large sample of 891 stock issues from 2007 to 2024. Most of the 15 long-factor portfolios categorized by total shareholder return significantly outperform the MOEX-TR index at a moderate risk level. The effects of factor strategies are most pronounced in stocks from the first and second listing tiers; however, these effects are further amplified by including stocks from the third tier. Examination of factor strategies in corporate finance enhances the comprehension of dividend policy's impact on total shareholder return and market capitalization growth. Increases in dividend yield often slow down the growth of capitalization, creating a dilemma in evaluating the performance of top management. The article justifies the advantage of the total shareholder return as an indicator emphasizing that its growth can be achieved through either an increase in dividend yield or price appreciation, depending on the specifics of the issuer.

Keywords: factor investing, financial market, private investors, fundamental analysis, disclosure, dividend policy.

For citation: Abramov A., Chernova M., Akhmetzyanov T. (2025) Evolution of Factor Pricing Models and Their Application in the Russian Financial Market. *Journal of Corporate Finance Research.* 19. (2): 67-81. https://doi. org/10.17323/j. jcfr.2073- 0438.19.2.2025.67-81

Introduction

Against the background of increasing participation of private investors in the Russian stock market it is important to discuss the strategies which make this process more attractive and less risky. From the point of view of corporate issuers, there also arises the question of the fundamental indicators, targeting of which would encourage the growth of their capitalization.

Factor strategies have significant potential in the Russian financial market because they offer two advantages: they enhance the effects of portfolio diversification and allow to manage portfolios more efficiently at different stages of a business cycle. Their popularization will attract investments and increase capitalization of a wider range of issuers. So, there will be a significant shift of the portfolios of private investors and investment funds towards the largest companies. These strategies are easy to use and provide an opportunity to rely more consistently on corporate fundamental characteristics when making investment decisions without accepting excessively high risks.

A distinctive feature of factor strategies is that, unlike typical stock market indexes, they are based on an extensive sample of shares in the market. This ensures greater benefits from diversification, mitigating serious risks related to the active selection of securities and frequent portfolio rebalancing.

The paper studies factor investment strategies in the Russian domestic market. The research was based on the data regarding monthly stock price returns and dividend payout for 891 stock issues traded on Russian stock exchanges in the period of 2007–2024.

The novelty of our paper resides in analysis of the extent to which the potential of factor strategies diminishes when the stocks sample is limited only to the first and second tiers of listing. When third-tier shares are added the premium increases while the risks raise inconsiderably insignificantly due to diversification effect.

It is shown that the advantages of factor strategies are preserved only in case of high diversification. In general, implementation of factor strategies would not only increase returns of private investors but also promote development of the financial market in Russia by distributing liquidity and cash inflow more evenly across shares and listing tiers and decreasing concentration of blue chips in individuals' portfolios.

The paper is structured as follows. First, we provide a review of academic papers which describes the evolution of factor pricing models and present day's aspects of the problem. Then we describe the sample and the research methodology. In the third section factor strategies and their risk premiums are analyzed from the point of view of the issuer and investor. Then we discuss the risks of factor strategies and their relation to business cycles. In the last section we make conclusions.

Theory of Factor Pricing and Investing

The factor pricing models which offer to explain the equity risk premium by its sensitivity to changes in the return on the market portfolio and a set of risk premiums of various groups of issuers united by fundamental characteristics [1] represent one of the most popular theories among investors and securities issuers.

Factor pricing models have experienced a complex evolution starting from the Capital Asset Pricing model (CAPM) substantiated by William Sharpe [2], John Lintner [3] and Jack Treynor [4]. Multifactor models emerged at the next stage. Their authors strived to find more accurate empirical explanations for the anticipated equity risk premium by constructing regression models with portfolio return based on certain characteristics of the issuers' operations and stocks, etc. Instead of equilibrium theory they were premised on the principles of Stephen Ross' arbitrage theory of capital asset pricing [5]. These models could comprise several factors. Each of them described a certain compensation for additional market risk.

The constant expansion of the variety of factors entailed a phenomenon known as the "factor zoo" encouraging the search for the most significant ones from the point of view of predictive power for stock returns as well as analysis of the relationships between these factors. The current wave of studies of the same problem passes on from simple searching to methods of advanced machine learning and use of artificial intelligence.

The CAPM initially proposed by Sharpe and other economists is based on strict premises assuming that investors take decisions on the basis of uniform expected return and standard deviations. All of them are risk-averse, invest within the same time interval, possess the same essential information and evaluate the stocks prospects in the same way. Securities markets are perfect, i.e. they do not feature investment-impeding factors, and there is a risk-free rate which enables investors to lend (invest) or borrow money unhindered [6]. The fundamental idea of the CAPM was that in equilibrium the expected return on an asset equals the return on the risk-free asset plus the return premiums of the market portfolio, multiplied by the indicator which characterizes the sensitivity of changes in the return on the above asset to the return on the market portfolio. This indicator, known as beta, characterizes the systematic risk of the asset.

However, under real-life conditions the return on asset often deviates from the theoretical value. Therefore, most often in empirical estimates decomposition of the expected return on asset also comprises an estimate of alpha – undervaluation of a stock or its stable premium in relation to the equilibrium value.

A lot of strict premises, simplification of uncertainty to just one systematic risk and the complexity of empirical tests of the model catalyzed the academic community. On the one hand, there emerged modifications of the model which

undermine some theoretical premises (taking into consideration the restrictions on borrowing [7], non-traded assets [8], intertemporal relationships [9], consumption [10], liquidity [11] etc.).

On the other hand, empirical tests started to detect some consistent patterns which the theoretical model failed to explain. Thus, Fama and French [12; 13] were among the first to determine the relatively stable excess return of small companies and value companies. Their explanation was that, for example, small companies face an elevated risk due to high uncertainty of their future: they could develop into a large company or fail and close down their business. They expanded the basic model into a three-factor model paving the path of future development for the academic community which is still of high interest.

As for other stable anomalies, the momentum effect [14] and liquidity [15] may be considered the most common ones. The Carhart four-factor model [16], the Fama-French five-factor model [17] emerged. Scientists started developing models with an increasing number of factors. Cornell Bradford's paper [18] showed that a higher ESG rating of companies had an adverse effect on expected return on their stocks decreasing investors' interest in them. However, the resulting lower cash flows discount rate is beneficial particularly to companies driving up their market value.

However, the reasons for such anomalies are not always explained from the point of view of an additional systematic risk source, as was done by Fama and French [12; 19]. Lettau and Ludvigson [20] thought that the value stocks premium was related to cyclical factors, Lakonishok et al. [21] and Betermier et al. [22] believed that the value stocks premium and small-cap stocks premium was related to anomalous investor behaviour.

A scientific substantiation of causality in factor investing is still a rather intricate problem [23]. The risk premium for the majority of factors is not explained by theoretical models, it is rather interpreted post factum. It is also difficult to create empirical tests or independent experiments to test the hypotheses more thoroughly. Interrelations between the factors, for example, between momentum and the value factor pose an additional obstacle [24]. There is even a study which demonstrates lack of independence of the momentum factor caused by high autocorrelation of the premium of other factors, thus, momentum takes on the role of enhancing the effect of other factors [25].

Although the theory of equilibrium pricing models was developed in the USA empirical tests spread quickly to other countries. The key risk factors were detected both in developed and emerging stock markets [23–34]. At the same time, not all factors which have become classical were significant, especially in emerging markets. The constituent patterns more specific for each country were detected. They could result from the country's economic or institutional development.

Another difficulty in identifying the factors is the choice of a quantitative analysis approach. Thus, studying cross-sectional premiums or time series one may reveal various sets of factors [35]. The authors also suggest taking into consideration influence of the market factor in other detected premiums and have developed a methodology for establishing factors at the level of individual stocks instead of applying the more popular portfolio approach. Another method revealing the factors is the principal components method or its variations [36] as well as LASSO [37; 38].

Enhancing of computational capabilities and accumulation of stock price data have entailed a new round of search for the sources of risk or anomalies unexplored yet which accelerate growth of companies' capitalization. However, an increase in the number of explanatory variables has not ensured discovery of a universal model. On the contrary, the number of detected factors or anomalies which increase returns of a certain group of companies grew so much that researches conducted special studies which aggregate and verify all such findings. Their authors attempt to solve an important problem of understanding whether a single factor may be considered a true source of the fundamental risk premium and, consequently, a stable anomaly with predictive power or whether it is just a result of excessively detailed data mining based on historical stock prices.

The academic community started using the term "factor zoo" which describes the variety of variables applied in the factor models. In a review of various modifications of the CAPM model, applied by researchers, Subrahmanyam [39] counted 50 variables explaining expected stock returns while McLean and Pontiff [40] proposed 97 factors. Campbell et al. [41] after study of 434 publications dedicated to stock pricing models counted 316 factors in them which supplement this model. In the opinion of some researchers, the factor zoo plays a positive role ensuring a more effective search for the most significant factor pricing models applying methods of machine data processing [42].

Some detected anomalies cast doubts because attempts to mimic and replicate the results of the initial studies using historical data may not lead to positive solutions. For example, Hou et al. [43] tried to model 452 factors from other papers but only 82% of them were significant at the 5% level. 150 factors were tested applying modern econometric analysis by constructing a composite index instead of selecting a fixed set of benchmarks. As a result, a small number of premiums were significant [38]. Nard and Zhao [44] tested all possible models and a sample of 99 factors. They arrived at a conclusion that the most successful pricing models consisted of the market factor and the Fama-French factors while the remaining factors provided no new information. Dick-Nielsen et al. [45] made similar conclusions concerning both stock and bond markets.

Arnott et al. [46] assumed that the majority of factors do not ensure a positive premium after publication of the studies which revealed them. Apart from that, factor investing cannot rely on the diversification principle and use several risk protection strategies in a portfolio. Most factors show high pair correlations which increase in the periods of shock in the financial markets when portfolio protection is most essential.

At the same time, Jensen et al. [47], on the contrary, used the Bayesian factor replication model based on data on 153 factors in 93 countries and showed that the data from the models with the indicated factors were stable and may be reproduced in various tests. The researchers proposed a taxonomy of factors with classification by 13 topics and made the conclusion that it was unlikely to determine one single characteristic which defined accurately the ratio of risk and return.

As the range of factors expands and new quantitative analysis methods emerge a new stage in development of the factor model consisted in an extensive use of machine learning methods (MLM) applying artificial intelligence. They provide an opportunity to detect more complex relations between the stock premium and different variables including nonlinear dependences, forecast the expected return more accurately and improve the portfolios' parameters significantly according to the return and risk criteria.

Kelly et al. [42] applied an artificial intelligence pricing model (AIPM) using a large language model (LLM) on the basis of monthly data on US stock return with 132 characteristics for each stock issue. The researchers came to the conclusion that a wider range of data on stocks and taking into consideration the relationship between the indicated data in the machine learning model enables them to construct portfolios with significantly higher Sharpe ratios as compared to portfolios made on the basis of conventional models with linear relationships between a limited set of variables. Research by Jensen et al. [48] offers MLM which build portfolios based on various factors taking into account the amount of trading costs related to their construction and nonlinear relationship between the factors. Paper by Chen et al. [49] presents nonlinear stock pricing models using deep neural networks on the basis of analysis of data on all available US stocks from the CRSP database with monthly returns from 1967 по 2016 in combination with 46 time-varying characteristics of issuers and 178 macroeconomic time series. The authors substantiate their advantages over other benchmark approaches represented by linear models and deep neural networks that do not use in their algorithm the no-arbitrage condition for asset pricing.

However, use of MLM prompted new questions concerning the sampling methods, correctness, sustainability and explainability of the obtained results. In research by Avramov et al. [50] the authors confirmed the theory that investments based on machine learning may hold significant promise for asset management. However, efficiency of the portfolios based on the above methods decreases significantly when reasonable trading costs are added to the calculations, and micro company stocks, distressed stocks or cases of high market volatility are excluded. Paper [51] offers a protocol (a set of mandatory rules) for backtesting of investment strategies.

Probably, today the opinion of financial science historian Peter Bernstein is of relevance for factor models concerning the CAPM which popularity "among practitioners is surprising given the model's invalidity in numerous statistical tests" [52]. The reason is that the majority of factor models deal with future expectations which are difficult to predict and rely on a range of other assumptions that fail to come true in practice. These models rather offer a key to understanding of the stock pricing process than provide accurate forecasts for the future. However, in actual practice the factor models ensure solving of such problems as evaluation of the cost of raising equity [53], measuring the efficiency of stock portfolios' management, detecting anomalies in the return on certain groups of stocks in order to construct factor investment strategies and some other problems. And even in the field of prediction of expected stock returns use of multi-factor variables and harnessing the potential of machine learning and artificial intelligence methods enhance the likelihood of obtaining more accurate predicted values over the short and medium term.

The most spectacular example of practical significance of the factor models is collective investments where performance of portfolio managers is widely assessed through alpha and almost all actively managed portfolios in the majority of countries are obligatorily classified by the growth cost criterion and the size of issuers' shares[1].

Data and Methodology

In order to test factor strategies and premiums we adjusted the methodology developed in the papers by Eugene Fama, Kenneth French and Mark Carhart for the US market. It is difficult to apply it to the Russian market because of significant differences in liquidity both between and inside the tiers of stock listing, prevailing of blue chips in trading turnover and investor portfolios, and a rather small number of stocks outstanding. Besides, the merger of RTS and MICEX since 2012 entailed loss of certain data and a reduction in the number of issuers with available information concerning the analyzed factors from 250-300 in 2007-2012 to 160-200 in 2020-2024 as a result of delisting of issuers, lack of historical data on some exiting issuers and worse disclosure caused by sanctions.

Data on characteristics and financial statements of issuers for 2021 was collected using the Bloomberg terminal which publishes information often unavailable in national databases. For example, the Moscow Exchange publishes the quotes of delisted issuers only partially, however, disclosure of this information improved significantly in 2024 with the use of API. Since 2022, data has been collected from multiple sources. Moscow Exchange API, Cbonds API and SPARK-Interfax prevail. Even in spite of the great number of information platforms there are problems with disclosure of consolidated statements on some issuers in the machine-readable format. This complicates evaluation

[1] According to Investment Company Institute (USA) in 2023 out of all stock funds with the assets amounting to USD 10.3 trillion of this self-regulating organization the funds which assets amount to USD 9.9 trillion have been classified according to the above factor strategies. Morningstar applies approximately the same approach.

of indicators such as P\E or P\B as well as dividend payout ratios and some other parameters.

Evaluation was made on the basis of data regarding monthly prices of all stocks listed on any Russian exchange from 2007[2] to 2024. In total, the sample encompasses historical series of 891 issues of Russian companies' stocks taking into consideration delisted or merged tickers as well as archival data which are often eliminated from international databases. 198 of them may be classified as the first and second listing tiers. As long as classification of listing into the first, second and third tiers was adopted only after the merger of exchanges into the Moscow Exchange the earlier historical period was compared and brought into conformity with the modern method of stocks grouping. Thus, previously unlisted shares are classified as third-tier stocks, A1 and A2 shares are considered to be first-tier stocks while the rest are classified as the second-tier stocks.

As there is no limitation concerning the sufficient liquidity level allowing to add stocks to complete portfolios it is possible to describe the risks and advantages not only of the liquid part of stocks which is mainly in the focus of all existing studies of the Russian market or stock exchange benchmarks. In actual practice factor strategies are applied through the collective investment mechanism. In their large portfolios the risks of illiquidity of some issues become less significant. Besides, expansion of funds' demand for potentially more profitable (illiquidity risk premium) but yet illiquid stocks may boost their liquidity, decrease the demand concentration around a limited group of stocks and become an important link part in development of the Russian market.

From the point of view of factor strategies' construction one may consider that the most important differences in the first- and second-tier stocks are the requirement to disclose IFRS statements to ensure a more accurate evaluation of financial parameters and other information as well as maintaining liquidity of trading in these instruments[3]. Apart from that, non-qualified investors may purchase such stocks while unlisted stocks or third-tier stocks may be purchased only if they pass tests because these stocks are considered to be high-risk ones (complex) [4]. Thus, it is relevant to test whether factor strategies retain the edge in case of a limited sample of liquid stocks.

When selecting factors in the Russian stock market we took as a premise their popularity in the actual investment practice. As a rule, a rather small range of characteristics lies at the root of the strategies popular in the global market of mutual and exchange-traded funds while such criteria as the issuer's size and the value growth factor prevail. In the Russian market of collective investment factor strategies are applied extremely rarely. There is no comprehensive analysis of the advantages of the factor strategies' "zoo". This is partly due to the difficulties the researchers face when they access data over long time horizons. Therefore, one of the fundamental ideas of the paper is to substantiate the advantages of the simplest factor investment strategies taking into consideration the "survivor bias" factor. This may give impetus to new research which will attempt to expand the range of strategies.

Modeling of factor strategies in the Russian market may be divided into a series of stages.

The first stage comprises collecting and preparation of the data necessary to classify stocks into factor portfolios. The only indicator is selected for each factor and is used to divide all stocks in the sample into two portfolios. For each portfolio (out of the two) a hypothesis is advanced stating the indicator value (high or low) which may potentially result in higher expected returns.

The small company factor is considered to be the most stable in all markets, developed and emerging ones. On the Russian market that there is a series of small companies, usually in the third tier, which disclose virtually no information. Their fair value is analyzed and assessed mainly by indirect parameters, and it is very difficult. Another problem is an extremely low liquidity of such stocks: transactions with them may be concluded once a month or even once a year. Together with the small number of stocks in circulation and low investor interest this makes such stocks exposed to manipulation, for example, manipulating third-tier stocks through social networks. Novice investors are often enticed into such manipulations. All mentioned risks are embedded in an elevated premium.

The value and market-based valuation factors are similar and constructed on the basis of the coefficients with the stock price in the numerator: price-to-book-value (PB) and price-to-earnings (PE). Portfolios with the highest risk and higher expected return as a premium for this risk encompass stocks which prices are either low or have dropped significantly. This is partly similar to the size factor. However, the special feature of these factors consists in their attempt to measure the amount of relative revaluation or underestimation of stocks.

The inertia momentum effect is relatively short -term and is as follows: the stocks that have grown most rapidly recently will continue growing rapidly for some time. Over a longer period, this effect is often replaced by a reversal effect - meaning the stocks that previously rose rapidly tend to experience a steeper decline compared to other stocks. This may be due to a return to the average rate of stock price growth. The drawbacks of momentum strategies are the need for frequent adjustments to the portfolio composition entailing high transaction costs which are not taken into consideration in the offered factor indexes.

[2] In the paper series since 2007 are presented for comparability taking into consideration sufficiency of data on the first and second listing tiers. See complete series in the database Risk Factors of Shares in the Russian Market 2024 (Abramov A.E., Radygin A.D., Chernova M.I. State Registration Certificate No. 2024624283).

[3] Moscow Exchange website. Russian issuers' stocks. URL: https://www.moex.com/a2584

[4] Federal Law No. 39-FZ of 22.04.1996 On Securities Market, art. 3.1. Specifics of Execution of Instructions of a Customer who is an Individual Person. URL: https://base.garant.ru/10106464/

Table 1. Principles for creating factor strategies with higher and lower expected returns based on various indicators of stock classification

	Indicator of stocks distribution	Expected return on stocks portfolio	
		Higher	Lower
Broad market factor	The whole sample	The main benchmark for factor strategies is a capitalization-weighted index of all stocks in the considered sample taking into account concentration restrictions, it is more diversified than the Moscow Exchange Index and poses increased risks due to adding small-company and illiquid stocks, and this results in higher returns	
Size factor	Capitalization at the end of the previous quarter	**Small companies** pose higher risk because among them there are companies at early stages of life cycle or companies after a significant drop in stock price caused by negative events	**Large companies** are most resilient ones with a significant market share in their industry, less risky from the point of view of future prospects
Value factor	Price-to-book-value (PB) ratio at the end of the previous quarter	**Value stocks** have low value at the stock exchange as compared to the nominal value of equity capital. Risk source: the company is either underestimated and has a chance to grow or its capitalization dropped rapidly as a result of negative events	**Growth stocks** have high capitalization as compared to the nominal value of equity capital, it is often greater by several fold. It manifests itself more often against the background of stocks overvaluation, thus, impeding their growth in future
Market valuation factor	Price-to-earnings (PE) ratio at the end of the previous quarter	**Low PE stocks** potentially may be underestimated, pose higher risks and offer higher future returns	**High PE stocks** potentially may be overestimated, future growth of stock price
Momentum factor	Growth of stocks value in the previous period (quarter), same as share price return	**Winners** are stocks with the highest price growth in the previous period. There is a belief that a trend is maintained and expands to future periods	**Losers** are stocks with the lowest price growth in the previous period. They are expected to go on falling or lag behind the market over a short-term horizon
Dividend yield factor*	Dividends paid in the previous year	**Stocks without dividends.** If a company reinvests its total profit it potentially has investment projects and opportunities for development, a greater growth of price return is expected against an indefinite total return	**Stocks with paid dividends.** Cash outflow from the company with a high payout coefficient may be indicative of limited growth opportunities and of attracting investors in the circumstances of low demand for stocks
	Overall dividend yield in the previous year	**Stocks with high dividend yield** have potentially higher total return due to dividends	**Stocks with low dividend yield** do not compensate investors for the premiums as compared to the stocks without dividends by total return
Ownership factor*	Government share in equity capital directly or indirectly exceeded 10% in the previous year	**Private companies** pose higher risks, have less government support, greater potential for technological development and efficiency of operations	**State-owned enterprises (SOE)** have better access to capital raising, lower risks and, as a rule, are less effective in terms of technological development. speed This impairs their competitiveness

Note: * factors occurring in literature less frequently, distribution by expected return is provided by the authors and may vary from country to country.

The dividend yield factor is of particular importance in the Russian market because it plays an essential role in maintaining domestic investors' confidence in stocks and is considered by the government as a fiscal revenue source. Among new trends in this sphere are the increasing dividends on third-tier stocks and irregular dividend payout by the majority of companies[5].

The ownership structure factor which is specific to the Russian market is the last important approach to factor investing. Based on international approach, we define state-owned enterprises (SOEs) as companies where the government holds directly and indirectly through ownership chains 10% of equity or more. Taking into consideration the fact that there are quite a few SOEs among the largest issuers, there is a potential premium for the risk related to private companies. This is due to the fact that state-owned enterprises have easier and cheaper access to borrowed funds, may count on various types of government support and, as a rule, are somewhat behind their private competitors in the speed of technological development [54].

The principles of distributing stocks into portfolios with more or less high expected return by different indicators are presented in Table 1.

At the second stage the indicator chosen for each factor was ranked using the entire sample of stocks (and separately only for the sample of first- and second-tier stocks). The frequency of stocks sorting and, correspondingly, the expected portfolio rebalancing is different because of the special features of the Russian market.

The size and value factors as well as the market valuation factor are subject to recalculation on a quarterly basis. Besides, in the size factor the capitalization amount at the end of the previous quarter is used, and in the value and market valuation factors – at the end of the previous half-year because the lag between preparing and disclosure of quarterly financial statements is taken into consideration (for example, at the beginning of October when the portfolio was constructed for the whole upcoming 4th quarter of 2024, as a rule, only statements as at the end of the 1st quarter of 2024 were available). As for the value and market valuation factor, in the complete sample 40% of the stocks, average by the value of the indicator, are eliminated. For example, the value stock portfolio encompassed the securities with the PB ratio below the 30% quantile among all the coefficients of companies with completed data for this quarter. However, for the first and second listing tiers division by the median of all stocks is used because the sample is reduced. The momentum (inertia) factor has a short-term effect and is adjusted on a monthly basis.

Dividend, dividend yield and ownership structure factors are revised only once a year due to their specific character. In case of dividend factors it is due to the methodology for dividend yield evaluation which sums all dividend payouts for a calendar year. As a rule, frequent revision is not necessary for the ownership structure factor due to stability and rare changes in the government's share in corporate equity.

For factor portfolio construction, we applied capitalization weighting (consistent with traditional index methodology) along with a single-issuer weight limit[6]. In the entire sample, due to the decreased number of stocks in the early historical periods, a maximum weight of 30% is used, however, calculation of factor portfolios for the first and second listing tiers was performed on a shortened horizon and with a limit of 15% per issuer.

The returns of factor strategies were evaluated in two ways: by stock price return and by total return (including dividends). For this purpose, in calculations the returns in the month of the ex-dividend date were increased by the amount of the estimated dividend yield of the current payout which was calculated on the basis of the price as at the beginning of the calendar year.

Effectiveness of Factor Strategies

Factor portfolios are compared against the main benchmark – the Moscow Exchange Index. From the point of view of the potential such strategies offer to investors comparisons are made on the basis of total returns from 2007 to 2024.

The most extensive wide portfolio counts approximately twice as many stocks as the first- and second-tier portfolio, and the latter, in its turn, comprises about twice as many stocks as the Moscow Exchange Index. The diversification effect and its waning are most apparent when wide portfolios of all stocks of the historical sample and first- and second-tier stocks are compared (Table 2). Both portfolios are significantly ahead of the Moscow Exchange Index. The return of the Moscow Exchange Index is 8.16% per annum, the portfolio return of the first- and second-tier stocks is 12.27%, and the return of portfolio of all stocks – 13.29% over the longest horizon of 2007–2024. When the number of stocks in the wide portfolio was doubled the stock price return increased by a little more than 1 p.p. The main effect produced by diversification from the point of view of the wide portfolio results in expanding the sample to the first and second tiers in total. Then the effect of increasing the number of securities in the portfolio wears off.

For the most part, limiting portfolios to the most liquid and transparent first- and second-tier stocks reduces returns but ensures a slightly better risk control.

The small-company premium is mainly based on high-risk third-tier stocks and is earned by means of diversification.

[5] Abramov A.E., Chernova M.I. A Fair of Generosity: Key Trends in Dividend Policies of Russian Companies. Econs-online. 2024. URL: https://econs.online/articles/opinions/yarmarka-shchedrosti-glavnye-trendy-dividendnoy-politiki-rossiyskikh-kompaniy/

[6] We employ weights based on companies' market capitalization at month-end, which creates a look-ahead bias that may overstate factor strategy results. While alternative weighting methods (beginning-of-month, average, or equal weights) impact absolute returns, our robustness checks show that they preserve both relative performance rankings and factor premium estimates.

The total return on a small company portfolio amounted to 31.33% per annum, which exceeds the Moscow Exchange Index approximately 4 times. It should be noted that a large-company portfolio also outperforms the Moscow Exchange Index due to higher diversification, however, predictably, it shows lower results than the wide portfolio. When the sample is limited to the first- and second-tier listing the advantage of small companies decreases because the issuer risks are mitigated. A more pronounced growth of this portfolio falls within 2022–2024 and coincides with the beginning of active use of social networks and attracting of inexperienced investors against the background of a decrease in the overall liquidity of the stock market. As a result of targeted actions and drawing investors' attention to certain stocks, their value experienced a sharp and often ungrounded increase, and this poses the risk of an equally rapid fall in the future.

Table 2. Statistics on factor strategies, total return, % per annum

Factors	The entire sample			First-second tiers		
	2007–2024	2014–2024	2019–2024	2007–2024	2014–2024	2019–2024
Long portfolios						
Moscow Exchange Index	8.16	13.15	11.28	8.16	13.15	11.28
Wide portfolio	13.29	19.68	19.47	12.27	18.11	17.24
Large	12.36	19.49	19.19	11.89	17.74	16.87
Small	31.33	35.33	47.52	14.58	22.23	25.00
Growth	14.80	20.69	21.32	8.66	15.91	14.42
Value	13.31	14.99	14.11	11.76	15.11	12.13
High_PE	14.10	18.86	17.70	8.48	16.15	15.55
Low_PE	13.62	21.04	21.66	13.84	17.55	16.23
Low_Return	7.78	9.17	7.75	7.50	9.88	5.85
High_Return	17.59	24.23	25.42	14.97	21.95	24.72
Dividend stocks	11.50	19.11	18.24	11.79	17.14	15.17
High dividend yield	15.40	21.85	19.44	11.86	17.47	15.05
Low dividend yield	10.28	16.08	14.62	10.75	16.99	13.25
Stocks without dividends	12.03	15.62	16.25	7.59	9.68	7.92
SOE	9.29	17.39	16.74	8.59	15.11	12.76
Private	16.27	20.97	19.88	13.64	18.83	17.53
Long-short premiums for each factor						
Size premium	18.97	15.84	28.33	2.70	4.50	8.13
Low PB premium	-1.49	-5.70	-7.22	3.10	-0.80	-2.29
Low PE premium	-0.48	2.18	3.96	5.36	1.40	0.68
Momentum premium	9.82	15.06	17.68	7.47	12.07	18.87
Premium of stocks without dividends	0.54	-3.50	-1.99	-4.20	-7.45	-7.25
Premium of high dividend yield stocks	5.11	5.77	4.82	1.11	0.48	1.80
Private company premium	6.98	3.58	3.13	5.05	3.72	4.77

Source: authors' calculations.

Growth stocks turned out to be more profitable than value stocks in contradiction to the predicted fundamental characteristics. If we limit the stocks sample by the first- and second-tier listing the value stocks premium manifests itself only over the longest horizon. This trend rather confirms that factor strategies are more often long-term ones.

As for the PE ratio, there is no premium of stocks with a low market valuation over the entire period across the whole sample. It is positive only over shorter horizons which indicates that the correct valuation of this type of risk started to form. Another situation is characteristic of the first- and second-tier stocks where the premium is observed over each investment horizon. This suggests that in the liquid part of the financial market the correctness of risk assessment is higher.

The effectiveness of the strategy of investing in the stocks which have grown most of all over the past 3 months is rather high and sustainable. In the longest term such stocks generate 9.82 and 7.47% per annum for the entire sample and the first- and second-tire stocks, respectively. Over shorter horizons this premium is also relatively high.

Due to historically high dividends of Russian companies investors benefit more from the stocks with a high dividend yield. Stocks with dividends paid in the previous year outperformed stocks without dividends. This is indicative of the importance of the dividend factor for domestic investors and the high share of dividend yield in the TSR.

In the Russian market the private company premium is observed both in the entire sample and in the first- and second-tier listing. The return on the portfolio of state-owned enterprises is the same as the Moscow Exchange Index after taking dividends into consideration. It means that such companies prevail in the total capitalization of the benchmark. This is of great importance at the current stage of development of the Russian financial market since SOEs in particular are exposed to sanctions and geopolitical pressure most of all. Therefore, one may expect that the private company premium will be maintained and there is a potential for growth.

Issuers may use factor strategies as a method for assessing beta and, correspondingly, the cost of equity. However, in the environment of high volatility of the domestic stock market and discontinuance of trading in Russian depositary receipts abroad the obtained results should be adjusted and double-checked.

Under current conditions it seems that it will be more practical to apply knowledge on factor pricing for setting the goals of dividend policy and corporate governance in public companies, especially taking into consideration the pursuit of the target established by Decree of the President of the Russian Federation No. 309 of 07.05.2024 On the National Development Goals of the Russian Federation for the Period up to 2030 and for the Future up to 2036 concerning an increase in capitalization of the stock market up to 66% of GDP in 2030. The specified target in itself does not apply directly to companies, however, the Ministry of Finance and the Bank of Russia aim at promoting the capitalization growth through a system of target indicators for the top management of state-owned enterprises and the requirements of the corporate governance code for all issuers. At the same time, in relation to SOEs the requirements of the Resolution of the Government of the Russian Federation of No. 1589-r of 11.06.2021 remain in force since 1 July 2021. They describe the mandatory dividend payout of at least 50% of net adjusted profit for the year calculated on the basis of consolidated financial statements in accordance with IFRS.

The goals of increasing companies' dividend yield may contradict the growth of their value. As shown in Table 3, high dividend yield stocks typically exhibit low price appreciation and, consequently, slower capitalization growth. Over all considered horizons the premium of high dividend yield stocks relative to low dividend yield stocks was negative. For example, for the period of 2007-2024 it amounted to –0.07 percentage points for the stocks of the entire sample and –2.72 p.p. for the stocks of the first- and second-tier listing. Dividend payouts, as a rule, influence the reduction of the issuers' net profit allocated to development and this is often accompanied by a slowdown in the long-term growth of the company value.

Table 3. Long-short premiums by factor strategies, price return, percentage points

Factors	Entire sample			First-second tier		
	2007–2024	2014–2024	2019–2024	2007–2024	2014–2024	2019–2024
Size premium	21.28	19.70	31.37	3.75	5.20	7.53
Low PB premium	1.08	-1.75	-3.08	3.85	0.75	0.08
Low PE premium	0.66	1.70	1.58	4.42	-0.08	-1.50
Momentum premium	6.32	9.18	7.96	4.17	6.59	11.18
Premium of stocks without dividends	5.45	3.37	5.26	-0.23	-1.91	-0.83

Factors	Entire sample			First-second tier		
	2007–2024	2014–2024	2019–2024	2007–2024	2014–2024	2019–2024
Premium of high dividend yield stocks	-0.07	-0.90	-1.75	-2.72	-4.35	-3.32
Private company premium	5.91	2.71	3.10	4.12	3.02	4.24

Source: authors' calculations.

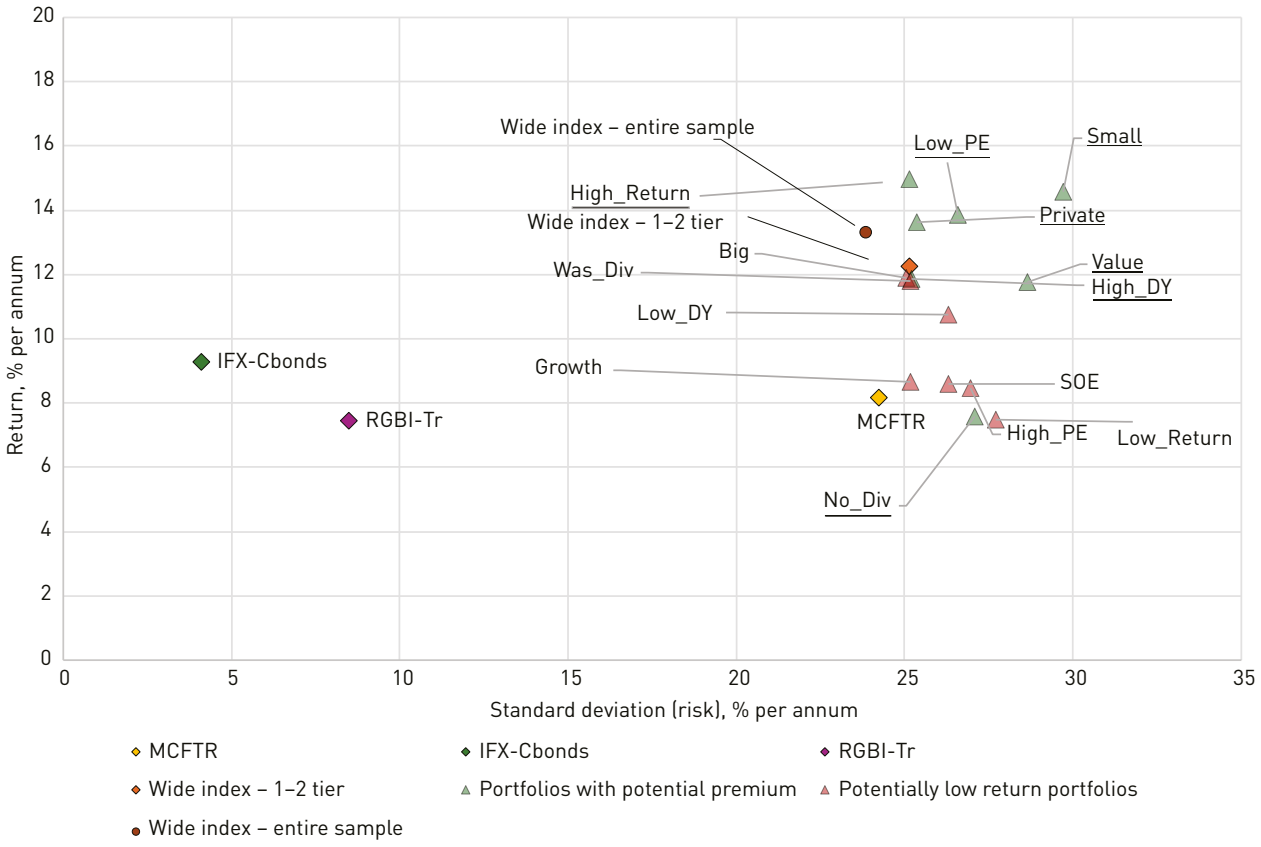
Total Shareholder Return (TSR) seems to be the most justified goal for companies. It is affected not only by the dividend yield but also by the dynamics of the stock price. This approach is recommended in the Information Letter of the Bank of Russia and Recommendations for Developing a Strategy for Increasing Shareholder Value No. IN-02-28/68 of 13.01.2025 which provide for the use of the TSR indicator as the key target indicator of the strategy for increasing the company shareholder value.

As shown in Table 3, according to the TSR criterion, over different time horizons companies with high dividend yield outperform the ones which do not pay dividends and the low dividend issuers. This is indicative of their higher investment attractiveness for investors. Under such circumstances the weaker dynamics of high dividend stocks in terms of stock price yield may be justified and be due to the specifics of the companies' life cycle.

Risks and Returns of Factor Strategies

The composite map of risks and returns resulting from applying factor strategies over a long time horizon shows that the majority of factor portfolios outperform the main benchmarks (Figure 1). This is with the exception of some strategies and only in terms of total return (reverse, stocks without dividends). There is an increase in risks caused by applying factor strategies, however, it remains at a moderate level. The use of the majority of factor strategies improves the overall risk-return ratio in the stock market for domestic investors.

Figure 1. Map of risk and return of factor portfolios, shares of the first and second listing tiers, total return, 2007–2024, % per annum



Source: authors' calculations.

Table 4 shows the classic risk and return measures of factor portfolios both for the complete sample and for the first- and second-tier samples taking into consideration total return. The Sharpe ratios exceed the benchmark for all portfolios (except for two portfolios from the reduced sample). This is due to greater diversification as compared to the concentrated Moscow Exchange Index. The maximum drawdown values are comparable to the benchmark. This indicates that factor strategies provide no protection against severe losses during crises but do not increase them either. Only 8 strategies out of 15 generate significant and positive alpha in a more liquid sample.

Table 4. Measures of return and risk of factor portfolios, total return, 2007–2024

	First-second tier			Entire sample		
	Sharpe ratio	Alpha	Max. drawdown	Sharpe ratio	Alpha	Max. drawdown
Stocks without dividends	0.129	0.49	-70.03	0.281	3.98	-65.76
Low_Return	0.131	0.22	-63.11	0.157	1.38	-64.44
Moscow Exchange Index	**0.137**	**0.00**	**-67.91**	**0.137**	**0.00**	**-67.91**
High_PE	0.160	0.97	-77.46	0.348	5.76**	-67.45
Growth	0.160	0.83	-75.00	0.386	6.15***	-66.05
SOE	0.161	0.92	-67.60	0.185	1.47	-67.92
Low dividend yield	0.235	2.81	-65.80	0.220	2.38	-65.55
Value	0.270	4.14	-73.93	0.322	6.13*	-72.13
Dividend stocks	0.273	3.51***	-68.70	0.262	3.1***	-64.62
Higher dividend yield	0.276	3.74*	-72.01	0.409	6.55***	-61.88
Large	0.276	3.56***	-66.90	0.295	3.85***	-65.10
Extensive portfolio	0.290	3.92***	-67.43	0.330	4.67***	-64.01
Private	0.339	5.32***	-72.58	0.441	7.34***	-65.64
Low_PE	0.339	5.62**	-72.50	0.338	5.3***	-68.46
Small	0.352	7.16*	-73.93	0.807	21.38***	-55.34
High_Return	0.383	6.41***	-69.05	0.477	8.91***	-64.18

Note: * – p <0.1; ** – p <0.05; *** – p <0.01
Source: authors calculations.

Another important advantage of factor strategies is their potential for application at different business cycle stages. Tests of the factors in the Russian market revealed countercyclicity of some premiums (Table 5). Among first- and second-tier stocks such constituent patterns are less pronounced than in the entire sample. This emphasizes dependence to a certain extent of third-tier stocks on market movements.

The small company premium is of most significance in the periods of market decline which were defined as the periods when the monthly stock price return of the Moscow Exchange Index was below -3%. The premium for lack of dividend payments and for high dividend yield among stocks with dividends behaves in a similar way, although with high variance (statistically significant values only for the entire sample). The private company premium is also countercyclic which is due to a high share of SOEs in the main benchmark used to classify periods.

Table 5. Factor premiums and market phases, percentage points per month, average, 2007–2024

	Premium	Market growth (over 3% per month)	Neutral market movement	Market decline (less than 3% per month)
Stock price return				
SMB	Small size	0.197 [0.355]	0.157 [1.596***]	1.128* [3.704***]
HML	Low PB	1.236** [1.296*]	0.070 [-0.403]	-0.407 [-0.246]
MOM	A significant price increment in the past	-0.006 [-0.346]	0.448 [0.062]	0.354 [2.001**]
DY	High dividend yield	-0.873* [-0.871*]	-0.018 [-0.171]	0.383 [1.445***]
DIV	Absence of dividends	-0.558 [-0.101]	-0.060 [-0.135]	1.145* [2.334***]
PRIV	Private companies	-0.132 [-0.277]	0.543* [0.518*]	0.563 [1.300**]
PE	Low PE	0.780* [0.413]	0.083 [-0.412]	0.131 [-0.111]
Total return				
SMB_TR	Small size	0.173 [0.165]	0.087 [1.358***]	0.901* [3.540***]
HML_TR	Low PB	1.093* [1.080*]	0.073 [-0.580*]	-0.519 [-0.444]
MOM_TR	A significant price increment in the past	0.205 [-0.047]	0.654* [0.264]	0.683 [2.239**]
DY_TR	High dividend yield	-0.612 [-0.622]	0.221 [0.332]	0.858 [1.816***]
DIV_TR	Absence of dividends	-0.853 [-0.423]	-0.325 [-0.561*]	0.746 [1.945***]
PRIV_TR	Private companies	-0.092 [-0.260]	0.599* [0.606**]	0.646 [1.372**]
PE_TR	Low PE	0.779* [0.411]	0.146 [-0.413]	0.238 [-0.033]

Note: * – p <0.1; ** – p <0.05; *** – p <0,01; premiums are calculated as differences in returns on pair factor portfolios (for example, SMB = small companies return – large companies return) and are normalized to standard deviation of 10%; values for the entire sample are placed in brackets, values for the first- and second-tier listing are without brackets.
Source: authors' calculations.

The premium for value stocks and stocks with low market valuations (PB and PE factors) may be classified as procyclical strategies among liquid stocks. The inertia and private company factors are the strongest in neutral periods and market decline periods.

So, use of factor strategies may provide protection against negative market movements.

Conclusion

Thus, our study showed that most of the considered factor strategies outperformed benchmarks. Increasing risks caused by use of factor strategies is moderate. Application of the majority of factor strategies improves the overall risk-return ratio in the stock market.

We believe that use of factor investment strategies in the Russian stock market has promising future. Their main advantages reside in simplicity and effectiveness of application for a wide range of investors. Factor strategies provide an opportunity to overcome excessive focusing of individuals and institutional investors on a limited range of issuers and make it possible to attract investment to the stocks of new, growing companies without transferring high risks to investors.

This makes factor investment not just a simple and effective way to improve the well-being of a wide range of domestic investors but also to finance the actual process of the Russian economy transformation. In case of financial organizations, factor strategies allow to expand the range of financial instruments with competitive risk-return indicators, thus, encouraging the harmonious growth of the domestic financial market.

The issuers who know factor strategies can set forth more accurately the goals of dividend policy and corporate governance system.

The implementation of multiple measures is required to broaden the application of factor strategies. First of all, popularization of new indicators of factor strategy portfolios as well as understanding of risk premiums and capitalization growth by corporate issuers, and the desire of collective investment managers to provide easier access to simple portfolio strategies for investors.

Acknowledgement

The article was prepared within the framework of the RANEPA state assignment research program.

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Contribution of the authors: the authors contributed equally to this article.

The authors declare no conflicts of interests.

The article **was submitted on** 19.04.2025; **approved after reviewing on** 08.05.2025; **accepted for publication on** 01.06.2025.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.19.2.2025.82-95
JEL classification: G69

Does Diversification Lead to the Financial Stability and Efficiency of Commercial Banks in Ethiopia? A Simultaneous Equation Approach

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Abstract

The purpose of this study is to investigate the impact of diversification on the financial stability and efficiency of commercial banks in Ethiopia. The data was obtained from a sample of 17 banks from both the public and the private sector operating in Ethiopia for more than a decade. The balanced panel presented operational and financial stability and efficiency metrics for the decade starting from 2013. A seemingly unrelated regression model was used to estimate the impact of diversification on bank stability and efficiency by controlling endogeneity between diversification, stability, and efficiency. The study found that geographic, asset, and sectoral credit diversification, as well as intellectual capital efficiency, significantly improve bank stability, while investment diversification has mixed effects, and income and deposit diversification have negligibly positive effects. The study further found that geographic, asset, sectoral credit, and deposit diversifications have a significant negative effect on the efficiency of commercial banks. The results of this study provide valuable insights. Bank managers can better understand the impact of diversification on banks' financial stability and efficiency. This study encourages policymakers and the top management of respective banks to pursue strategic geographic, asset, and sectoral credit portfolio diversification to maintain their financial stability and efficiency. To the best of our knowledge, this is one of the rare studies to investigate the effect of diversification on the financial stability and efficiency of commercial banks in Ethiopia.

Keywords: diversification, financial stability, efficiency, Herfindahl–Hirschman index, commercial banks, Ethiopia

For citation: Filatie Y.S., Sharma D. (2025) Does Diversification Lead to the Financial Stability and Efficiency of Commercial Banks in Ethiopia? A Simultaneous Equation Approach. *Journal of Corporate Finance Research.* 19. (2): 82-95. https://doi. org/10.17323/j. jcfr.2073- 0438.19.2.2025.82-95

Introduction

A national economy consists of organizations and markets that raise capital for investment and finance projects, with financial institutions acting as intermediaries to manage risk [1]. Financial system development is crucial for a nation's economic growth, necessitating upgrades through financial innovation, regulation, legal system improvement, efficient fund mobilization, and improved service delivery [2; 3]. Banks are essential financial institutions that offer loans, securitization, and bond issuance. They underwrite debt securities and leverage balance sheets and participate in derivative markets, impacting capital costs through swaps and certificates of deposits [4]financial institutions, capital markets and institutional investors are also sources of long-term finance that is finance which is available for an extended period of time1. The importance of long-term finance lies in its pivotal role in satisfying long-term physical investment needs across all sectors in the economy and specifically in key drivers of growth, competitiveness and employment such as the infrastructure, real estate, R&D and new ventures. Traditionally, banks have been a key player in the financial system, transforming savings into long-term capital to finance private sector investment. Over time, two main changes have taken place in the structure of the financial system. First, the banking model has evolved, becoming increasingly dominated by wholesale markets and in particular derivatives, to the detriment of the more traditional deposit-taking and lending activities. Second, disintermediation and the growth of capital markets has led to a shift in the structure of the financial sector, with institutional investors such as pension funds, insurance companies, mutual funds, and, most recently, sovereign wealth funds, also becoming central players as providers of long-term capital. After the financial crisis, the traditional sources of investment financing are all facing challenges – whether it be fiscal constraints on government spending, or the weak economic outlook not proving conducive to corporate investment (with implications for both the debt and equity markets. Banks usually have significant control over the financial systems of developing nations. Bank deposits are the primary type of household savings, whereas bank loans are the primary means of obtaining external funding for companies [5]. Crucial for facilitating capital flow, the banking industry acts as an intermediary in the financial system and promotes economic stability and development by transferring funds between surplus and deficit areas [6]. Banks receive deposits or loans from money markets and utilize excess funds to generate loans or acquire stocks. Interest rates serve as value indicators for individuals, organizations, and governments [7]. The financial performance of banks is crucial for economic growth, contributing significantly to GDP and catalysing economic expansion [8].

In the 21st century, diversification has become a topic of debate among scholars of the banking sector. There are arguments in support of and against its effect on banks' financial stability and efficiency. There are differing opinions on the influence of diversification on banks' financial stability, with some arguing that diversification has a detrimental effect and others stating that it has a positive effect. To enhance performance and remain stable in a competitive market, banks are forced to diversify businesses and apply value-added innovative activities such as value-added intellectual capital. Intellectual capital is a crucial intangible asset that may help organizations, particularly the banking sector, to achieve their objectives, yet it is often overlooked. Moreover, few studies have explored the relationship among diversity, financial stability, and efficiency in the banking industry, specifically in developing nations, by including intellectual capital as a variable. The few scholarly works that treat developing countries such as Malaysia, Indonesia, Kenya, Ghana, Bangladesh, and Ethiopia [9–14] use different variables and methodologies. In addition, there are inconsistent findings about the effect of diversity on financial stability across various countries. For instance, [11]commercial banks have been diversifying their business by increasingly offering new services such as mobile banking, agency banking, bank-assurance, faceless banking and integrating microfinance in their banking system. Diversification by the commercial banks is premised on the need to enhance financial performance. This has mainly emanated from banking industry having undergone numerous regulations regimes which over the years have affected financial performance of these entities. Empirical literature shows that diversification may not always lead to higher financial performance due to increased overheads and exhausted economies of scale. The study sought to determine the effect of diversification on financial performance of commercial banks in Kenya. The specific objectives of the study were to determine the effect of income diversification on financial performance of commercial banks in Kenya, to examine the effect of geographical diversification on financial performance of commercial banks in Kenya and to examine the effect of product diversification on financial performance of commercial banks in Kenya. Secondary data used by the study was collected for five years period (2013-2017 on annual basis found that geographical and income diversification has a significant and positive impact on the competitiveness of commercial banks in Kenya, while asset diversification has a negative yet insignificant impact. On the other hand, [12] investigated bank portfolio diversification, which has a significant positive effect on performance and competitiveness, and found that bank size significantly moderates the relationship between diversification and performance. Further, [10] showed that diversification of asset and income adversely affects cost efficiency, financial stability, and profitability while human capital efficiency has a significant positive effect and significantly mediates the association between diversification and bank performance. Moreover, these studies, far from being detailed and comprehensive, consider only a few diversification schemes as explanatory variables. Furthermore, the few studies that have been conducted on the impact of intellectual capital on financial stability and efficiency in the banking sector, particularly in the context of developing countries, gave mixed results in different countries.

In this regard, exploring the impact of diversification on the financial stability and efficiency of banks is very important for an emerging economy such as Ethiopia, where the government dominates the financial sector. Despite facing significant pressure from the United States, the Ethiopian government persists in enacting legislation prohibiting foreign banks' entry into the country. The presence of barriers to entry into the banking industry strengthens inefficient state-owned firms by providing them with protection. The government is apprehensive that permitting foreign banks to operate in Ethiopia could potentially result in a loss of economic control. The basis of this position is rooted in the argument of the infant industry: by implementing a prohibition on foreign bank entry at present, the domestic banking sector would be safeguarded against potential weakening resulting from unjust competition posed by foreign banks [13]. The government of Ethiopia has taken small steps toward liberalizing its tightly controlled financial sector by granting licenses to foreign-owned banks such as Kenya's Equity Bank and the Kenyan Central Bank, enabling them to create subsidiaries in a country of more than 115 million people. The Ethiopian banking industry comprises the National Bank of Ethiopia, a state-owned development bank, a public commercial bank, and 29 private commercial banks [14]. Therefore, this study aims to investigate the impact of diversification and intellectual capital on the financial stability and efficiency of Ethiopian commercial banks. This study is mainly based on portfolio theory, stakeholder theory, resource-based view theory, and agency theory, which were not considered by earlier studies. Therefore, the findings of this study should benefit the banking sector by identifying the role of diversification in enhancing financial stability and efficiency, thereby reducing risk. Therefore, it encourages the government and policymakers to take policy and regulatory measures to facilitate the financial system in order to smooth the development and stability of the country's economy. Earlier studies in Ethiopia were conducted on the impact of each diversification scheme separately, such as income diversification, investment diversification, or credit diversification, on the financial performance of commercial banks [15]. As a result, detailed compressive research incorporating a greater number of diversification schemes (income, asset, geographical, sectoral, investment, and deposit diversification) is essential, particularly for developing countries such as Ethiopia. In addition, this study employs an advanced econometric model using the simultaneous equation approach and, in particular, Seemingly Unrelated Regression (SURE) to capture endogeneity issues among variables. Hence, this study explores the effect of diversification through different diversification schemes on banks' financial stability and efficiency.

Literature Review and Hypothesis Development

Diversification is a very challenging concept to define in real terms. An issue that arises from the ambiguity of diversification or relatedness indices is the contradiction of findings that previously seemed to support the same stance. The often-employed metrics of related diversification lack reliability as measures of relatedness within business portfolios, posing a significant challenge for academics. Managers also face genuine difficulties as a result. Because of its complexity, the definition of diversification proves to be very subjective [16]. Diversification involves transferring risk from one institution to another, and recent financial system transformations, such as deregulation, have allowed institutions to expand operations and diversify into nontraditional sectors [17]. The scope of diversification in business seems to be more extensive than its adversaries acknowledge [16].

Deregulation has facilitated institutional expansion, leading to conglomerates that combine banking, securities, and insurance activities in one organization [17]. Diversification in financial institutions is often regarded as promoting financial system stability. However, there is a cost to diversification: while diversification reduces each institution's individual probability of collapse, it increases the likelihood of systemic crises [18]. Bank stability is positively correlated with competition and revenue diversification. Competition enhances stability when banks expand their range of activities that generate both interest and noninterest income internally and externally [19]. Banks that diversify their income sources differentiate themselves from those specializing in a limited set of services, resulting in special treatment based on random assignment [20].

As competition intensifies and the net interest margin (NIM) increases, along with a more extensive banking sector, the incentives for taking risks, such as setting aside funds for nonperforming loans, also increase. Moreover, heightened competition, financial gain, nonperforming loans, and the extent of the banking sector constrain the potential to generate money from many sources [21]. Compared to banks with a greater variety of services, more specialized banks tend to have greater profits, reduced expenses, improved profit efficiency, and enhanced cost efficiency. Risk-taking may increase due to aggressive diversification measures [22]. Diversification in today's competitive landscape is vital for enhancing profitability, market value, and shareholder value, but performance can decline due to instability in return on investment, equity, or liquidity [23]. Due to resource constraints, commercial banks can improve their financial performance through innovation. Financial innovation has produced opportunities for sector participants and established new market actors due to unique financial products[24];[25]. Financial technology has allowed many commercial banks to adopt e-banking services, which save time and effort, promote innovation, and lower costs. These services are available 24/7, allowing banks to expand their customer base [26]. The question of whether technology yields superior financial outcomes and enhances productivity has been a subject of ongoing discussion. In recent years, we have seen remarkable advancements in financial technology.

New information technology business requirements are changing banking. Internet, wireless, and worldwide straight-through processing have made banking virtual [27; 28].

[29] examined the anatomy of diversification and discovered that banking has expanded globally in recent decades, while nonfinancial firms have focused on their core operations. Diversification schemes and control variables affect the results. More focused banks make higher profits due to lower costs, profit efficiency, and cost efficiency. In addition, banks with more foreign ownership may see a decreased diversity discount, a smaller profit decline, or an increase in expenses[22]. [12] investigated how bank portfolio diversification positively impacts performance and competitiveness. Knowledge-based capital is becoming more important, especially in information-driven economies. Creative banking is heavily influenced by intangible assets. Financial liberalization and deregulation have altered conventional banking, increasing competition and decreasing interest earnings. Banks must engage in nontraditional business activities to compensate for revenue loss [12]. The testable research hypotheses in this study are formulated in the alternative hypothesis format as follows. The hypotheses are not specified as positive or negative in direction, because previous authors found inconclusive results regarding the impact of diversification on financial stability and efficiency of commercial banks. Hence the testable hypotheses are supported by the literature in the upcoming section.

Goetz et al. (2012) [30] investigated how a US bank's market valuation is impacted by an increase in the geographic variety of its assets. They utilized the unique, time-dependent trends of interstate bank deregulation to isolate the external factors influencing the geographic variety of bank assets. [31] investigated the inflence of diversity on the financial performance of commercial banks. Geographic diversification is positively correlated with returns on assets and equity, providing support for the resource-based view and market power theories. [32] conducted an empirical investigation to examine the influence of diversity on the financial performance of commercial banks operating in Kenya. [33] used the quantile regression approach to investigate the relationship between geographical diversification, firm size, and profitability in Malaysia. Inconclusive findings have been obtained in different industrialized nations on the relationship between geographical diversification and profitability. [34] showed that diversified banks demonstrate increased loan supply in borrower countries during banking crises. Increased credit availability results in greater investment by firms and a rise in employment. Diversified banks are more stable, because they can secure extra funding in times of trouble. [11] found that geographical and income diversification positively affects the competitiveness of commercial banks in Kenya, whereas asset diversification has a negligibly detrimental influence.

H_1: Geographic diversification has a significant effect on the financial stability and efficiency of commercial banks

[35] analysed the impact of income diversity on risk-adjusted bank performance in the Turkish banking sector using System-GMM estimators. Its results indicate that diversifying income significantly enhances the risk-adjusted financial performance of Turkish deposit banks. [34]; [36] found a strong and statistically significant correlation between competition and stability, particularly when risk-adjusted profits are employed as the outcome variable. They also revealed that revenue diversification contributes to both enhancing risk-adjusted profitability and decreasing the probability of banks becoming insolvent. Income diversification among different income sources other than interest income has a significant positive effect on bank performance, and a liquidity ratio along with financial stability facilitates the relationship between the two variables [37]. The diversification of income and assets significantly enhances the profitability of commercial banks in Bangladesh. Bank profitability is significantly and negatively affected by bank size, credit risk, cost management, and inflation [38].

H_2: Income diversification has a significant effect on the financial stability and efficiency of commercial banks.

[34] examined how the diversity of loan and asset portfolios affects bank performance in transitioning economies. Asset diversity has a positive association with bank performance, while loan diversification has a negative association. [39] analysed how asset diversification impacts bank performance in three Asian Islamic nations with dual banking systems. An analysis of banks in Indonesia, Malaysia, and Pakistan over the period 2006–2012 suggests that asset diversification impacts bank performance. A study of the complete sample shows that diversification negatively impacts conventional banks' profitability and asset quality but not cost efficiency. [40] discovered that in terms of asset diversification, government loans and non-interest-bearing assets significantly reduce bank risk, while mortgage loans and non-classified loans have the reverse effect. [41] investigated the influence of asset diversification on credit risk and market risk. [42] revealed that the influence of asset diversification does not exhibit statistical significance.

H_3: Asset diversification has a significant effect on the financial stability and efficiency of commercial banks.

[43] examined the effect of portfolio diversity on the financial performance of a sample of 40 corporate banks in Kenya. The study showed that several factors, such as investments in insurance, real estate, and government securities, influence the financial performance of commercial banks in Kenya. [15] studied the effects of investment diversification on the financial performance of commercial banks operating in Ethiopia. The findings indicate that financial asset investment, loan portfolio investment, government security investment, insurance investment, and investment size have a statistically significant and positive influence on the financial performance of commercial banks, as measured by return on assets.

H_4: Investment diversification has a significant effect on the financial stability and efficiency of commercial banks.

[44] conducted an empirical study of the impact of specialization vs. diversification on the returns and risks of banks. The key findings of the study indicate that diversifying industrial loans leads to a decrease in bank returns while simultaneously generating riskier loans for all banks in the sample with a stronger impact on high-risk banks. Sectoral loan diversification, on the other hand, only creates an inefficient risk-return trade-off for high-risk banks. [36] explored the connections between loan diversification, performance, and stability. The findings indicate that diversifying loan portfolios improves bank stability, as measured by the Z-score index, and increases profitability. [45] examined the impact of bank portfolio diversification on the financial performance of commercial banks in Kenya. The study revealed that non-lending operations can improve banking performance through internal capital market efficiency, economies of scale, cross-selling, and cross-subsidization.

H_5: Sectoral credit diversification has a significant effect on the financial stability and efficiency of commercial banks.

[22] examined the effects of focus vs. diversity on Chinese banks' performance. The study found that deposit diversification reduces earnings and raises costs. These results hold regardless of diversity and performance measurements. It also found that banks with foreign ownership and conglomerate connections have fewer diversification diseconomies, suggesting that they mitigate diversification diseconomies. [45] examined the impact of deposit diversification on the ROE and ROA of Kenyan banks. The study revealed that the diversification of deposits significantly improved banks' financial performance. The study found a substantial positive correlation between savings, demand, calls, and term deposits and bank performance in Kenya.

H_6: Deposit diversification has a significant effect on the financial stability and efficiency of commercial banks.

[46] studied the impact of intellectual capital on the financial performance and stability of 32 banks in Ghana. The study provides evidence supporting the assertion that VAIC™ has a beneficial and substantial effect on both financial performance and financial stability. [46] analysed the influence of intellectual capital and its sub-components on the efficiency indicators of 38 Indian banks listed on the stock exchange. The research results endorse the need for increased investment in intellectual assets to enhance banking efficiency and value creation in India. Human capital has a substantial positive influence on the performance of banks, highlighting the importance of knowledge-based assets for service-oriented institutions [47]. Diversification has a detrimental effect on cost efficiency, financial stability, and profitability. However, the detrimental impact of diversification is mitigated with increased human capital efficiency [10].

H_7: Intellectual capital has a significant effect on the financial stability and efficiency of commercial banks

Data and Methodology

In this study, a descriptive and explanatory research design with a quantitative research approach was employed to analyse the relationships between the independent variables of bank diversification that affect the financial stability and efficiency of the banking sector in Ethiopia. As of late 2022, the total number of banks in Ethiopia reached 32, comprising 1 central bank, 1 development bank, 1 public commercial bank and 29 privately owned commercial banks[48] its impact on the financial performance of banks remains inconclusive. This paper explores the relationship between financial inclusion and the financial performance of commercial banks in Ethiopia, using a sample of 16 banks. We analyse 10 years of data (2013–2022. Although Ethiopia has a total of 32 operating banks, only 17 banks met the criteria of our sample throughout the study period. The secondary data for this study were obtained from the audited financial accounts of 17 Ethiopian commercial banks. These 17 banks are composed of one public and 16 private commercial banks. There is only one public commercial bank in the country while the rest are privately owned banks. All 12 remaining banks had been operating over a timeframe of less than 10 years (most of them since 2022). These banks were excluded from the sample because their financial performance would create outliers, biasing the regression result. The selected institutions were commercial banks with sufficient data availability to run the regression analysis and at least ten years old.

Description and Measurement of Variables

Independent Variable

Diversification has been defined differently according to the situation and context in which it is used. For this study, the term diversification refers to a strategy that spreads an investment across several assets, geographical locations, income sources, and sectoral and deposit schemes to reduce risk and enhance the financial stability and efficiency of banks [49; 10; 12] diversification for different banking business schemes is measured using the Herfindahl–Hirschman index (HHI). The index is calculated by adding up the squares of individual exposures and dividing this amount by the overall exposure within a specific categorization [9].

Dependent Variables

The dependent variables in this study are bank financial stability and efficiency. Efficiency is the ability of banks to maximize their returns at a minimum cost of operation. Bank stability refers to the risk-adjusted net of tax returns achieved at the end of each fiscal year [50this research investigates the ID relationship with bank stability. Drawing on the dynamic resource-based view and modern portfolio theory, this research examines the influence of a paramount internal factor i.e. bank life cycle or bank maturity on income diversification (ID; 10].

Table 1. Summary of Variable Descriptions and Measurements

Classification	Notation	Measurement
Bank stability	*RAROA*	$\frac{ROA}{Standard\ Deviation\ of\ ROA}$
	RAROE	$\frac{ROE}{Standard\ Deviation\ of\ ROE}$
	Z-score	$\frac{EQTA + ROA}{Standard\ deviation\ of\ ROA}$
Cost efficiency	*CTIR*	$\frac{Operating\ Expense}{Operating\ Income}$
Geographic diversification	*GD*	Logarithm of the number of branch networks
Income diversification	*ID*	$1-(\frac{Interest\ income}{Total\ Income}+\left(\frac{Non-Interest\ Income}{Total\ \ income}\right)2$
Asset diversification	AD	$1-\left(\frac{Loans}{Total\ Assets}\right)2+\left(\frac{Non-Loan\ assets}{Total\ Assets}\right)2$
Investment diversification	INVD	$1-\left(\frac{Financial\ assets}{Total\ Investments}\right)2+\left(\frac{Other\ investments}{Total\ investments}\right)2$
Sectoral credit diversification	SD	$1-\left(\frac{Mfg.}{Total\ Credit}\right)+\left(\frac{Export}{Total\ Credit}\right)2+\left(\frac{Dom.Trade}{Total\ Credit}\right)2+ +\left(\frac{Build\ \&const.}{Total\ Credit}\right)2+\left(\frac{Others}{Total\ Credit}\right)2$
Deposit diversification	DD	$1-\left(\frac{Saving\ deposit}{Total\ Deposit}\right)2+\left(\frac{Demand\ Deposit}{Total\ Deposit}\right)2+\left(\frac{Fixed\ Deposit}{Total\ Deposit}\right)2$
Intellectual capital efficiency	VAIC	HCE + SCE +CEE
Capital adequacy ratio	CAR	The ratio of owners' capital to total assets
Loan deposit ratio	LDR	The ratio of total loans to total deposits
Nonperforming loan	NPL	The ratio of nonperforming loans to total outstanding loan
Bank size	BS	Log of total assets
Ownership	OW	Dummy: 1=public, 0=private

Source: authors' computations.

Model Specification

This study used a seemingly unrelated regression (SURE) estimation method to examine the effects of bank diversification on Ethiopian commercial banks' financial stability and efficiency, considering intellectual capital efficiency and other control variables, to address endogeneity issues. The data analysis was conducted using STATA Version 15. Three-stage list square estimation is a method that efficiently estimates and addresses endogeneity, heteroskedasticity, and autocorrelation among variables. In addition, where there is endogeneity bias and the structural equation model is correctly specified, the 3SLS method provides more reliable and precise coefficient estimates than the 2SLS method [51]. The rationale for using this estimation method is to consider the endogeneity among diversification, financial stability, and bank efficiency. The literature shows that financial stability, measured by risk-adjusted return on assets (RAROA), risk-adjusted return on equity (RAROE), and banks' Z-scores, has an endogeneity problem with efficiency [19]. In addition, bank-specific variables may not be entirely exogenous to the measures of bank financial stability and efficiency [52]. Year dummies are not incorporated into the econometrics model because no major structural

changes have occurred, particularly during COVID-19. To boost bank liquidity and debt relief, the national bank of Ethiopia injected 15 billion Ethiopian birr into commercial banks to ensure that banks have enough liquidity to provide relief and working capital to businesses and households. Hence, the following simultaneous equation is formulated for the dependent and independent variables:

$$RAROA = \alpha_0 + \alpha_1 CTIR_{it} + \alpha_2 RAROA_{it-1} + \alpha_3 ID_{it} + \alpha_4 GD_{it} + \alpha_5 AD_{it} + \alpha_6 INVD_{it} + \alpha_7 SD_{it} + \alpha_8 DD_{it} + \alpha_9 VAIC_{it} + \alpha_{10} CAR_{it} + \alpha_{11} LDR_{it} + \alpha_{12} NPL_{it} + \alpha_{13} BS_{it} + \alpha_{14} OW_{it} + \mu_i; (1)$$

$$CTIR = \beta_0 + \beta_1 RAROE_{it} + \beta_2 ID_{it} + \beta_3 GD_{it} + \beta_4 AD_{it} + \beta_5 INVD_{it} + \beta_6 SD_{it} + \beta_7 DD_{it} + \beta_8 VAIC_{it} + \beta_9 CAR_{it} + \beta_{10} LDR_{it} + \beta_{11} NPL_{it} + \beta_{12} BS_{it} + \beta_{13} OW_{it} + \varepsilon_i; (2)$$

$$RAROE = \lambda_0 + \lambda_1 RAROE_{it-1} + \lambda_2 ID_{it} + \lambda_3 GD_{it} + \lambda AD_{it} + \lambda_5 INVD_{it} + \lambda_6 SD_{it} + \lambda_7 DD_{it} + \lambda_8 VAIC_{it} + \lambda_9 CAR_{it} + \lambda_{10} LDR_{it} + \lambda_{11} NPL_{it} + \lambda_{12} BS_{it} + \lambda_{13} OW_{it} + \acute{e}_i; (3)$$

$$Z\text{-}score = \delta_0 + \delta_1 ZScoreit\text{-}1 + \delta_2 CTIR_{it} + \delta_3 ID_{it} + \delta_4 GD_{it} + \delta_5 AD_{it} + \delta_6 INVD_{it} + \delta_7 SD_{it} + \delta_8 DD_{it} + \delta_9 VAIC_{it} + \delta_{10} CAR_{it} + \delta_{11} LDR_{it} + \delta_{12} NPL_{it} + \delta_{13} BS_{it} + \delta_{14} OW_{it} + \grave{u}_i, (4)$$

where the risk-adjusted return on assets (*RAROA*), the risk-adjusted return on equity (*RAROE*), and the Z-score are alternative measures of financial stability. The cost-to-income ratio (*CTIR*) is a measure of bank efficiency. α_0, β_0, λ_0, and δ_0 are the intercepts, while α_0– α_{14}, β_1–β_{13}, λ_1–λ_{13}, δ_1–δ_{14} represent coefficients for the independent and control variables. Income diversification (*ID*), geographic diversification (*GD*), asset diversification (*AD*), investment diversification (*INVD*), sectoral credit diversification (*SD*), deposit diversification (*DD*), and value-added intellectual capital (*VAIC*) are predictors of financial stability and efficiency. *CAR, LDR, NPL, BS*, and *OW* are bank-specific controls representing the capital adequacy ratio, loan deposition ratio, nonperforming loan, bank size, and ownership structure. $RAROA_{it-1}$, $RAROE_{it-1}$, and $ZScore_{it-1}$ are the lag of the alternative financial stability proxies. *i* represents a specific bank, while *t* represents time. μ_i, ε_i, $\acute{e}_i$, $\grave{u}_i$ denote the error terms.

Results and Discussion

Descriptive Statistics

Table 2 presents summary statistics for the study's primary variables, including the financial stability proxies *RAROA* and *RAROE* and the Z-score of Ethiopian banks, which have averages of 5.046, 4.77, and 5.059 for the study period, with standard deviations of 1.895, 1.754, and 2.776, respectively. This finding indicates that commercial banks' financial stability proxy variables differ. The cost-to-income ratio (*CTIR*), a proxy for bank efficiency, has an average value of 0.541 and a standard deviation of 0.094. Geographic diversification, income diversification, asset diversification, investment diversification, sectoral credit diversification, and deposit diversification have average values of 4.986, 0.439, 0.472, 0.322, 0.684, and 0.544, respectively, with standard deviations of 1.095, 0.065, 0.032, 0.093, 0.142, and 0.057, respectively.

Table 2. Descriptive Statistics of the Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
RAROA	170	5.046	1.895	2.125	9.759
RAROE	170	4.77	1.754	.821	10.393
CTIR	170	.541	.094	.282	.861
Zscore	170	5.059	2.776	-1.851	12.834
GD	170	4.986	1.095	2.061	7.539
ID	170	.439	.065	.141	.5
AD	170	.472	.032	.365	.5
INVD	170	.322	.093	.056	.479
SD	170	.684	.142	.239	.795
DD	170	.544	.057	.399	.665
VAIC	170	4.14	.68	3.224	6.434
BS	170	7.24	.612	5.58	9.079
CAR	170	.137	.047	.037	.297
LDR	170	.672	.127	.319	1.045
NPL	170	.022	.015	0	.088
OW	170	.059	.236	0	1
RAROAit-1	170	5.953	3.471	.271	17.23
RAROEit-1	170	4.837	2.773	-1.73	13.377
Zscoreit-1	170	5.121	2.752	-1.851	12.834

Source: authors' estimates.

These diversity proxy variables are measured by the Herfindahl – Hirschman index (HHI), except for geographic diversification, which is determined by the log of the number of branches. The HHI ranges from 0.00 (complete concentration), through 0.38 (little diversification) to 0.75 (complete diversification or an equitable split among the portfolio categories). A lower HHI number suggests less diversification and vice versa [10].

Hence, banks' level of diversification in income, assets, sectoral credit, and deposit schemes as per the HH index is low, and there is no diversification in their investment portfolios. Among these variables, sectoral credit diversification has the highest score, followed by deposit diversification, implying that banks diversify their credit facilities for various sectors and provide different deposit services. In addition, intellectual capital efficiency has a mean score of 4.152 and a standard deviation of 0.759, indicating differences among the banks. Among the bank-specific control variables, bank size has a mean value of 7.234 and a standard deviation of 0.62, indicating a difference in size between banks.

Test of Multicollinearity

According to [53], a correlation coefficient between two regressors greater than 0.8 indicates a severe multicollinearity problem. Conversely, if a variable's variance inflation factor (VIF) is greater than 10, the coefficient of determination (R2) is above 0.90, indicating a high level of collinearity for that variable. Nevertheless, the highest correlation between the explanatory factors is lower than the commonly accepted guideline. Furthermore, the variance inflation factor (VIF) test corroborates this finding. Therefore, multicollinearity is not a significant concern for this investigation.

This study uses a seemingly unrelated regression (SURE) estimation method to examine the effects of bank diversification on the financial stability and efficiency of commercial banks in Ethiopia. The model's dependent variables are *RAROA, RAROE*, and the *Z-score*, as well as the cost-to-income ratio (*CTIR*) – a measure of bank efficiency. The model also includes explanatory variables for diversification measures, such as geographic diversification (*GD*), income diversification (*ID*), asset diversification (*AD*), investment diversification (*INVD*), sectoral credit diversity (*SD*), deposit diversification (*DD*), and intellectual capital efficiency. Bank-specific control variables such as bank size, total assets, capital adequacy ratio, and loan deposit ratio are also considered. The variables of financial stability and efficiency are considered endogenous. The parameters are estimated using the coefficients enclosed in brackets. *Statistical significance with a p-value of 0.10. **Statistical significance with a p-value of 0.05. ***Statistical significance with a p-value of 0.01.

Diversification and Financial Stability Nexus

The regression result revealed that geographic diversification (GD), asset diversification (AD), sectoral credit diversification (SD), and intellectual capital efficiency (VAIC), as demonstrated in Table 2, have a significantly positive influence on bank financial stability as measured by the risk-adjusted return on assets (RAROA). This suggests that, as banks' diversification of these schemes and intellectual capital efficiency increase, their financial stability is enhanced, as evaluated by a risk-weighted measure of return on assets. The findings of this study are compatible with those of [19; 38; 54]. However, they contradict those of [10], which found that diversification negatively affects banks' financial stability and efficiency. At the same time, investment diversification (INVD) in financial assets and other investments has a statistically significant negative impact on this variable. While income and deposit diversification positively affect this financial stability indicator, the effect is not statistically significant. The endogenous cost-to-income ratio variable has a major detrimental impact on financial stability. These findings indicate that banks with greater cost-effectiveness tend to have greater financial stability, as assessed by risk-weighted returns on assets.

Their heterogeneous orientation notwithstanding, all bank-specific control factors significantly impact financial stability, as evaluated by risk-adjusted return on assets. The capital adequacy ratio has a notable negative impact, whereas bank size, loan deposit ratio, and ownership structure exhibit statistically significant negative effects. This study leads to the startling finding that nonperforming loans benefit financial stability, although this effect is not statistically significant.

However, most of the explanatory and control factors were determined to be statistically insignificant when considering other indicators of financial stability, the risk-adjusted return on equity (*RAROE*), and the *Z-score* of banks despite exhibiting both positive and negative trends. More precisely, geographic diversification, investment diversification, sectoral credit diversification, and intellectual capital efficiency positively impact financial stability measures. Nonetheless, asset diversification negatively affects both financial stability measures. Income diversification negatively affects the risk-adjusted return on equity yet has a positive effect on bank *Z-scores*. Geographic diversification significantly affects the risk-adjusted return on equity (*RAROE*) and banks' *Z-scores*. On the other hand, asset diversification has a significant negative effect on the return on equity, while investment diversification has a significant positive effect on the *Z-score*.

Furthermore, intellectual capital efficiency significantly and positively impacts the *Z-score* and risk-adjusted return on equity. Similarly, although the bank-specific control variables show mixed results, they do not have a statistically significant effect except for bank size, which significantly and negatively affects risk-adjusted return on equity. Finally, the lagged values of the financial stability indicators, including the risk-adjusted return on assets (*RAROA*), the risk-adjusted return on equity (*RAROE*), and the *Z-score*, demonstrated a notably positive influence.

Table 3. Seemingly Unrelated Regression (SURE) Results for the Full Sample

VARIABLES	(1) RAROA	(2) CTIR	(3) RAROE	(4) Zscore
CTIR	-7.922***			-5.428***
	(0)			(1.14e-06)
$RAROA_{it-1}$	0.308***			
	(0)			
GD	1.305***	0.0242*	0.508*	0.491**
	(4.58e-07)	(0.0864)	(0.0563)	(0.0367)
ID	1.544	-0.105	-0.976	0.825
	(0.306)	(0.206)	(0.538)	(0.546)
AD	13.24***	0.478***	-5.337*	-1.266
	(2.31e-05)	(0.00403)	(0.0931)	(0.655)
INVD	-2.774*	-0.0354	1.789	3.646**
	(0.0974)	(0.687)	(0.283)	(0.0138)
SD	3.127***	0.276***	0.810	0.989
	(0.000170)	(8.21e-11)	(0.315)	(0.188)
DD	2.219	0.179*	2.548	-0.559
	(0.241)	(0.0870)	(0.198)	(0.744)
VAIC	0.529**	-0.0363***	0.636***	0.338*
	(0.0167)	(0.00195)	(0.00361)	(0.0884)
BS	-1.379***	-0.0494**	-0.911**	-0.249
	(0.00213)	(0.0352)	(0.0449)	(0.523)
CAR	9.414***	0.289*	4.500	1.547
	(0.00118)	(0.0742)	(0.147)	(0.566)
LDR	-2.021**	0.0359	1.091	-0.367
	(0.0335)	(0.489)	(0.268)	(0.666)
NPL	8.030	1.532***	3.983	-4.130
	(0.226)	(1.01e-05)	(0.546)	(0.485)
OW	-3.028***	-0.00936	-0.514	-0.703
	(0.000178)	(0.832)	(0.543)	(0.333)
RAROE		-0.0272***		
		(0)		
$RAROE_{it-1}$			0.328***	
			(0)	
$Zscore_{it-1}$				0.747***
				(0)
Constant	-0.524	0.507***	3.644	0.984
	(0.884)	(0.00660)	(0.322)	(0.754)
Observations	170	170	170	170
R-squared	0.647	0.559	0.547	0.861
Chi^2	347.40***	266.83***	196.15***	1111.23***

p-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' estimates.

Diversification and Bank Efficiency

This study used the cost-to-income ratio, which represents the relationship between operating expenses and operating income, as a measure of efficiency. As the value of this ratio increases, banks become less cost-effective. The regression analysis in Table 4 above examines the relationships between the dependent variable, bank efficiency, and the independent variables, which include diversification proxy factors, intellectual capital efficiency, and bank-specific control variables.

This study found that geographic, asset, and sectoral credit diversification positively and significantly impacts the dependent variable of the cost-to-income ratio. An increase in these diversification strategies increases the cost-to-income ratio, implying that banks will become less cost-efficient as their diversity increases through these schemes. These findings are consistent with those of [10] and [55], whose findings are that diversification reduces banks' efficiency. On the other hand, [20] reported that asset and income diversification have mixed effects on the efficiency of US banks.

Deposit diversification improves the cost-to-income ratio in a positive yet statistically insignificant way. In contrast, income diversification and investment diversification negatively affect the dependent variable. This implies that while these variables can potentially improve cost efficiency, their impact is statistically inconsequential. This finding contradicts the results of [56] that revenue and funding source diversification are negatively associated with the efficiency of banks.

On the other hand, intellectual capital efficiency has a significantly positive effect on the dependent variable. Increased intellectual capital efficiency improves the cost efficiency of commercial banks. In this model, the endogenous variable risk-adjusted return on equity (*RAROE*) considerably and positively affects the cost-to-income ratio. Banks' cost efficiency improves when their profitability increases, as measured by the risk-weighted return on equity. The bank-specific control variable bank size has a substantial positive effect on the efficiency of banks. The reverse capital adequacy ratio and nonperforming loans have a significant impact on reducing efficiency. However, the loan deposit ratio and ownership structure do not substantially impact the efficiency of commercial banks in Ethiopia. As a result, hypotheses H_1, H_3, H_4, H_5, and H_7 accepted that geographic, asset, and sectoral diversification and intellectual capital substantially enhance financial stability measured by the risk-adjusted returns on assets, and hypotheses H_2 and H_6 are rejected. While investment diversification significantly negatively affects risk-adjusted returns on assets, it has a positive and significant impact on the Z-score. However, geographic, asset, sectoral, and deposit diversification have negative effects on efficiency. Hence, hypotheses H_1, H_3, H_5, and H_6 are accepted, while H_2 and H_4 are rejected. In contrast intellectual capital has a significantly positive effect on banks' efficiency, and hypothesis H_7 is accepted.

Table 4. Seemingly Unrelated Regression (SURE) Results for Sample Split by Ownership

VARIABLES	(1) RAROA	(2) CTIR	(3) RAROE	(4) Zscore
CTIR	-8.767***			-5.627***
	(0)			(8.62e-07)
$RAROA_{it-1}$	0.316***			
	(0)			
GD	1.470***	0.0296**	0.495*	0.562**
	(1.55e-08)	(0.0395)	(0.0723)	(0.0207)
ID	1.576	-0.0708	-0.882	0.731
	(0.295)	(0.404)	(0.590)	(0.604)
AD	11.80***	0.574***	-2.597	-3.194
	(0.000343)	(0.00131)	(0.454)	(0.303)
INVD	-2.766*	-0.00773	1.885	3.568**
	(0.0985)	(0.931)	(0.271)	(0.0190)
SD	2.975***	0.250***	0.839	1.023
	(0.000399)	(2.01e-08)	(0.327)	(0.192)
DD	2.041	0.142	2.675	-0.299
	(0.277)	(0.181)	(0.189)	(0.865)

VARIABLES	(1) RAROA	(2) CTIR	(3) RAROE	(4) Zscore
VAIC	0.567***	-0.0311***	0.665***	0.372*
	(0.00996)	(0.00959)	(0.00333)	(0.0685)
BS	-1.820***	-0.0715***	-0.797	-0.328
	(0.000136)	(0.00458)	(0.111)	(0.445)
CAR	8.100***	0.112	4.456	1.973
	(0.00908)	(0.523)	(0.197)	(0.509)
LDR	-1.822	0.100	1.203	-0.769
	(0.101)	(0.101)	(0.310)	(0.454)
NPL	5.576	1.308***	4.867	-4.950
	(0.402)	(0.000290)	(0.484)	(0.420)
RAROE		-0.0266***		
		(0)		
RAROEit1			0.305***	
			(0)	
Zscore				
$Zscore_{it-1}$				0.742***
				(0)
Constant	3.050	0.569***	1.337	2.251
	(0.405)	(0.00324)	(0.730)	(0.496)
Observations	160	160	160	160
R-squared	0.661	0.529	0.497	0.858

p-value in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' estimates.

Robustness Tests

In this section, we perform sensitivity analysis to assess the baseline sample result's robustness.

Initially, we segregated the data into two primary categories according to ownership. Banks are categorized into private-sector banks and public-sector banks. As indicated in Table 4, regression analysis is performed on private banks individually using the three-stage seemingly unrelated regression, which is the same procedure used in the baseline sample. Due to the limited number of observations, we are unable to do regression analysis for a public sector bank. Our sample consists of only one public sector bank, which has a single observation for a period of 10 years. Therefore, as shown in Table 3, a consistent outcome is achieved when private sector banks are utilized as a sub-sample.

Conclusion

The literature explores the conflicting impacts of diversity on commercial banks' financial stability and efficiency. This study examines the effects of bank diversity on financial stability, efficiency, and intellectual capital efficiency while considering other bank-specific control factors. Seemingly unrelated regression (SURE) is employed to address the endogeneity bias in the model, where the variables of financial stability and efficiency are treated as endogenous. The study revealed that geographic diversification, asset diversification, sectoral credit diversification, and intellectual capital efficiency significantly impact the financial stability of banks, as assessed by risk-adjusted return on assets (*RAROA*). Income and deposit diversification have a modest positive impact. In contrast, investment diversification has a significant negative effect on the risk-adjusted return on assets yet a significant positive effect on banks' *Z-scores*. Banks with greater cost-effectiveness tend to have greater financial stability. The control variables of bank size, loan deposit ratio, and ownership structure substantially improve financial stability.

Geographic diversification, asset diversification, sectoral credit, and deposit diversification negatively impact banks' efficiency. In contrast, intellectual capital efficiency has a significant positive effect on the dependent variable. While

income and investment diversification have a slight positive impact, bank size substantially enhances bank efficiency. However, the capital adequacy ratio and nonperforming loans have a significant impact on reducing efficiency. The results of this study provide valuable insights. Bank managers can better understand the impact of diversification on banks' financial stability and efficiency. Policymakers and the top management of respective banks are thus encouraged to pursue strategic geographic, asset, and sectoral credit portfolio diversification to maintain their financial stability and efficiency. To the best of our knowledge, this is one of the rare studies to investigate the effect of diversification on the financial stability and efficiency of commercial banks in Ethiopia. It uses a narrow time frame of ten years and includes control factors particular to banks. This can be regarded as a significant limitation of this study. Future studies could use extended-term yearly observations and include control factors related to macroeconomic conditions and market structure.

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Contribution of the authors: the authors contributed equally to this article.

The authors declare no of interests.

The article **was submitted on** 19.04.2025; **approved after reviewing on** 08.05.2025; **accepted for publication on** 01.06.2025.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.19.2.2025.96-109
JEL classification: G

The Effect of IFRS Adoption on Accounting Quality and Reporting: Evidence from Russia

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Abstract

At present, the question of whether Russian companies should apply International Financial Reporting Standards (IFRS) is quite acute. While in previous years there was a tendency to expand their use, the vector has presently changed. The current situation boils down to the question of whether Russia should strive to use Western standards or develop its own. It is important to note that while there are advantages in ensuring greater transparency and comparability, which increase investor confidence, the implementation of international standards requires significant costs from Russian companies when switching to a new type of reporting. This paper presents research on the effectiveness of the implementation of international standards in Russia in 2010-2020. The data sample is analysed using three regression earnings management models, which are the discretionary accruals model, the abnormal working capital accruals model and the earnings smoothing method, as well as the timely loss recognition approach. Based on the information available in the existing literature and in alignment with the chosen methodology, hypotheses were developed regarding the impact of the implementation of IFRS on the level of earnings management and on the timely loss recognition. The paper examines data for 2010 and 2011, as well as for the period from 2012 to 2020. The final sample includes 40 public non-financial companies from 8 sectors with 440 observations. During the study, the following results are obtained: with the transition to a new accounting system, the degree of profit manipulation decreases; however, after the introduction of international standards, no positive effect on the timeliness of loss recognition is discovered. Thus, the overall analysis provides evidence that formally the adoption of IFRS positively impacts the quality of accounting. Nevertheless, the incomplete implementation of international standards prevents from drawing definitive conclusions regarding the efficiency of such a transition.

This study has the potential to contribute to a deeper understanding of IFRS, to expand the theoretical knowledge base concerning the influence of these standards on accountancy in Russia, and to assist managers in making informed decisions about the advisability of moving towards this system. Future research may incorporate additional analytical methods, including a critical assessment of recognition and measurement principles inherent in IFRS, as well as the extent to which these principles are embedded in the accounting policies of Russian companies.

Keywords: IFRS, earnings management, IFRS adoption, quality of financial statements, Russian companies

For citation: Malofeeva T., Ulyanova N., Dzhioeva A. (2025) The Effect of IFRS Adoption on Accounting Quality and Reporting: Evidence from Russia. *Journal of Corporate Finance Research.* 19. (2): 96-109. https://doi. org/10.17323/j. jcfr.2073-0438.19.2.2025.96-109

Introduction

Since their introduction, International Financial Reporting Standards (IFRS) have had a profound effect on accounting and reporting of companies across the globe. Their adoption was an integral part of globalization and standardization of financial reporting. It allows investors, analysts, company executives and other stakeholders to better assess the companies' financial standing and performance.

Russia also recognized the advantages of IFRS for its practices of accounting and preparation of accounting (financial) statements, and since 1998 has been gradually implementing new standards. After Russia joined the World Trade Organization (WTO) and started integrating into the global economy, it had to bring its standards into compliance with international ones. As a result, IFRS were implemented in the Russian financial market. An official transition stated in Federal Law No. 208-FZ of 27.07.2010 On Consolidated Financial Statements was completed in 2012 when the companies that fall within the scope of this law were obligated to submit their reporting in accordance with these standards.

In view of these events, there arises a serious issue of the influence of IFRS adoption on the quality of accounting and reporting in Russia. The experience of IFRS implementation in Russian practices may give us insights into how the standards influence financial transparency, as well as perception and evaluation of financial information in Russia and beyond it.

At present, the matter of whether IFRS should be applied in Russia is quite acute. Previously there was a trend towards the expansion of their use, yet now the vector has changed. Thus, in 2019 banks with a basic license were exempt from IFRS reporting, and in 2023 the State Duma passed at first reading the bill also exempting non-bank credit institutions from observing these standards. The present situation poses point-blank the question of whether Russia has to work toward applying the Western standards or develop its own. It is important to note that while the implementation of international standards offers the advantages of greater transparency and comparability, which increase investor confidence, it also entails significant costs for Russian companies when switching to a new type of reporting. So, now an analysis of expedience of such a transition is of relevance.

The problem of transition to international standards of financial reporting stirs interest all over the world. However, at present the number of studies that examine the experience of Russian companies is severely limited. Moreover, these papers make almost no use of the methods widely applicable in international practice.

The purpose of this research is to determine the efficiency of use of International Financial Reporting Standards for Russian companies.

The results of the present paper will potentially expand the theoretical research field in terms of IFRS implementation in Russia and may be useful both for company managers who make the decision on the transition to this type of reporting and for supervisory state agencies that develop recommendations and directions regulating the application of these standards.

Literature Review

Numerous studies attempted to determine whether the implementation of IFRS really produced an impact on the audit quality one way or another. While writing this paper, the authors studied international practices in this field. The main conclusions are made in this section. It is structured as follows: all papers are divided into four main groups: first – academic papers that confirm the efficiency of IFRS, second – on the contrary, papers with negative results, third – papers with mixed conclusions. We also placed the studies dedicated to Russia into a separate category.

Positive Effect

This section comprises the papers that confirm a positive effect of the implementation of IFRS on the quality of accounting and reporting.

Research by Malo-Alain et al. [1] showed that the implementation of international standards in Saudi Arabia improved accounting quality. Evaluation was based on three different approaches: qualitative characteristics of financial information, conservatism concept and profit manipulation. Besides, the authors assess the changes in the efficiency of investment decisions within the two years that followed the adoption of IFRS in comparison to the year that preceded this event. They also apply three metrics: cost of capital, liquidity and quality of earnings which, when taken together, brought the authors to the conclusion of a rise in efficiency. Despite the unambiguous results, it should be noted that the paper considers a small time interval, which may imply limitations of research and potential skewing caused by the incomplete integration of new standards that is characteristic of the first years after mandatory implementation. However, in case of Saudi Arabia, positive results in the first years may be due to the fact that preparations for the change in the accounting system started as far back as 2012.

The authors of another research study on Saudi Arabia [2] made similar conclusions and found that IFRS implementation increased transparency and significance of reporting. They believe that one of the reasons is the switch from Arabic to the international English language in the accounting.

In the two papers that considered the introduction of international standards in France, an emphasis was placed on managers' behavior. In particular, Sellami and Fakhfakh [3] confirm that the new type of reporting allows to reduce profit manipulation because it denies managers the opportunity to pursue their own ends under false pretenses. Paper by Hlel and Nafti [4] revealed a positive dependence between the implementation of IFRS and improvement of the quality of earnings prediction.

Some studies are dedicated to the integration of IFRS practices in Africa. Paper by Mensah [5] examined this expe-

rience in Ghana, and another paper written by a group of researchers [6] – in Morocco. Both papers found a reduction in discretionary accruals, which were a way of profit manipulation. Thus, the authors made conclusions about the positive influence of new standards on the quality of accounting and reporting. It is important to note that Mensah uses data for only 11 industrial companies, which may imply a limited nature of conclusions due to the extremely small sample size.

In paper by Key and Kim [7], which studied the implementation of IFRS in South Korea, two hypotheses were used as a basis: the first one assumed that new standards drove a decrease in profit manipulation and the second one admitted timely loss recognition. Four different methods were applied to verify the first hypothesis. Three of them provided an unequivocally positive result and one of them – a contradictory result. In general, the analysis indicated that international reporting standards improved the reporting quality and both hypotheses were confirmed. These conclusions may be substantiated by the fact that South Korea started preparing for a complete transfer to IFRS as far back as 2007. This allowed to analyze the results of a two-year trial period when the implementation of new standards was voluntary, take into consideration the errors and eliminate them. The government also introduced control over the implementation of the new accounting system.

Research by Bertrand et al. [8], which examined European companies, is of particular interest. First, unlike the above papers, which considered the organizations where IFRS implementation was mandatory, this research analyzed a voluntary transition to international standards of the companies not traded in the stock exchange. Second, this paper provides the variables that characterize the institutional features of certain European countries. The authors arrived at the conclusion that the best results of introducing new reporting standards were determined for the companies with the worst transparency, as well as the ones operating in the markets with significant information asymmetry.

Negative Effect

This section comprises the papers that assert that the accounting quality either remained unchanged or decreased after implementation of IFRS.

Research by Abdul-Baki and Haniffa [9] allowed to establish that the introduction of mandatory IFRS in Nigeria in 2012 did not entail improvement of accounting and reporting. This result was obtained on the basis of the following three methods: profit manipulation, which was assessed by two metrics: discretionary accruals and abnormal working capital accruals, timely loss recognition and persistence of profit. The authors explain the conclusions reached by a high level of corruption in the country and weak compliance monitoring authorities. Moreover, even prudent companies, which do not attempt to apply new standards that grant more freedom in using professional judgment, may have lower accounting quality due to lack of experience in applying the new standards during the adaptation period.

The effect of implementation of international standards in India was studied in the paper by Adhikari at al. [10] using six different methods, and all of them unambiguously demonstrated that accounting quality deteriorated as compared to national standards. This may be due to the fact that, on the one hand, India initially had weak institutional regulation mechanisms and, on the other hand, their implementation was expensive. However, as time passed, the revealed quality deterioration was smoothed over, which allows to assume that subsequently it will likely be possible to accumulate the necessary experience. which will assist in the application of new standards and their control. Another research on India by Meshram and Arora [11] comes to similar conclusions. It also revealed no improvement of the accounting quality, however, the authors studied the indicator of reporting comparability and obtained a positive result.

Karapinar and Zaif [12] examined the efficiency of international reporting standards in Turkey. They considered profit manipulation and arrived at the conclusion that there was no quality improvement. Furthermore, the authors revealed a significant increase in discretionary accruals in absolute magnitude, but they took on a negative value. Another reason why the present paper is of interest is that it used the sample of the same companies. which prepared reporting within the studied time interval according to both the previous and new standards. However, one should treat the results of this research with caution because it used a model with just two variables: IFRS and SIZE. It is insufficient for a model because it has no control variables, hence, complex relationships may be underestimated, and this may entail potentially false conclusions.

Research by Fuad [13] considered the changes in reporting when IFRS were introduced in Indonesia on the basis of four indicators: the quality of accruals, timely loss recognition, smoothing of financial results and persistence of profit. Analysis revealed no differences in applying previous and new accounting standards for any of the indicators. The authors presume that it is due to the fact that the research examined the period from 2008 to 2014, while according to official data, the first stage of IFRS implementation was completed in 2012 and it is possible that insufficient time had passed for an unbiased assessment of results.

Mixed Results

This section comprises the papers with ambiguous results or results that cannot be classified as positive or negative.

Mongrut and Winkelried [14] studied South American countries, in particular, Brazil, Peru, Chile, Argentina, Colombia and Mexico, and discovered that although accounting quality generally improved, the results turned out to be controversial. In particular, the reason is that some companies believed that the transition to IFRS alone was enough to make their operations transparent, but such overconfidence led to opposite results.

In the paper by Bryce et al. [15], the efficiency of implementation of international reporting standards in Australia was studied with regard to two aspects: profit manipulation

and quality of accruals. The authors revealed no significant change in accounting quality, however, they think that it may be due to the fact that local reporting standards had coped with the task reasonably before, while the mandatory adoption of IFRS for public companies was just a step towards the improvement of their international market standing. This research is of interest from another viewpoint as well, since the authors also considered how the performance of audit committees changed. In particular, after the implementation of IFRS, the functioning of such committees improves and they can repress profit manipulation provided the meetings are regular, there are accounting specialists among the members of the committees and the committees are sufficiently numerous.

Iatridis and Rouvolis [16] considered how international standards were introduced in Greece and revealed that in the first year after the transition to IFRS, profit manipulation increased, while financial performance deteriorated, however, over the subsequent years the situation changed for the better in both aspects. Probably, this is a result of a complex adaptation period, as well as the high cost of the transition.

The authors of paper [17] dedicated to Great Britain obtained mixed results. They considered changes in accounting quality after IFRS implementation with regard to two aspects: AEM – Accruals Earnings Manipulation and REM – Real Earnings Manipulation through cash flows, expenses and manufacturing costs. Each aspect was measured in three ways and, as a result, the AEM approach showed a decrease in profit manipulation, while REM provided polar opposite results. The authors think that a possible reason for this discrepancy is that the violations related to REM criteria are more difficult to reveal. This provides more freedom for managers to manipulate profit through cash flows and manufacturing costs. Moreover, when assessing the efficiency of IFRS implementation, other researchers virtually never use the REM aspect.

Studies Dedicated to Russia

Despite the fact that international practice possesses vast materials that assess the results of IFRS implementation, the number of papers about the Russian experience is extremely small. The earliest research that evaluates the consequences of voluntary use of international standards showed that application of IFRS does not make financial reporting more valuable than the one prepared on the basis of Russian Accounting Standards (hereinafter referred to as – RAS) [18]. Such results may be caused by use of data for 2006-2009 because within this period the implementation of international standards was not completed, hence, new standards could be less efficient than the use of established norms and regulations. Apart from that, the authors say that compliance with IFRS could be provided only on paper without actual, careful use of these standards, which may also explain their conclusions. Paper by Sorokina [19] also confirms these findings. It discusses separately the problems that arise during the transition to international standards, such as the necessity of professional judgment as a fundamentally different approach to accounting instead of conventional fixed procedures, the absence of a regulatory equivalent for the IFRS concept, which impedes training of specialists and standards application in real practice, and the lack of historical data and estimate formation practices. Research by Kim [20], conducted two years later, focused on the differences between the effects from the implementation of IFRS for the companies that were not obliged to switch to new standards and the companies directly affected by the reform. It showed that for the first group, the positive effect from the integration of international standards was not detected, while for the second group this effect was apparent.

Another research by Dolgikh [21] may be of interest because it is the only paper that examines Russia and also compares it to Canada. It evaluates the effect produced by IFRS implementation on comparability of financial reporting both inside these countries and between them. First of all, Canada was selected because the period of mandatory implementation of IFRS is close to the time of their implementation in Russia. However, institutional variables were not applied and, hence, the influence of differences between the countries, for example, special features of the legal system or cultural experiences was not taken into consideration. It was discovered that after the implementation of standards, comparability of reporting in Russia and between the two countries did not just increase, it dropped, and the results for Canada were mixed. However, companies from the energy sector and the base materials category, which comprises the extractive, chemical and some other industries, showed an opposite effect. Such results may be caused by the fact that in the considered period the proper implementation of standards in reporting preparation has only started, and the industries related to the energy and heavy industry were the first to switch voluntarily to international standards of reporting preparation. This allowed them to accumulate solid experience in this field.

The last paper [22] to be considered in this section evaluated the effect of IFRS implementation using the profit manipulation indicator for 60 companies from 2010 to 2015. The research showed that when international standards were implemented, the difference in the index of return increases, i.e., accounting quality degrades but high audit quality can mitigate this effect. The author believes that these results are due to the fact that Russia has not established strict control over the proper application of international standards and the lack of the institutional component that would ensure regulation of their use and counteraction to possible opportunistic behaviour of managers. The methodological component of this paper should be noted because no other article dedicated to Russia estimates accounting quality based on profit manipulation which, in its turn, is measured by the discretionary accruals indicator in spite of the fact that it is one of the most widely used methods in international practice.

Thus, the section on the experience of Russia has only four relevant sources because the number of papers dedicated to this specific region from the viewpoint of IFRS imple-

mentation is really small. Moreover, the existing literature applies only one approach of drawing conclusions on the results of IFRS implementation in Russia, while in international practice in one research several approaches or different metrics for evaluation of the same efficiency indicator are applied. As for the time period, all papers study intervals prior to 2015, and in the subsequent eight years significant changes could have taken place.

It should be noted that Russia is examined very little in cross-country studies because the period of mandatory implementation does not coincide with that in the majority of countries.

Methodology

In the present paper, the principal method for evaluation of IFRS implementation efficiency is profit manipulation analysis. It is based on two types of models: the discretionary accruals model[1] based on the Jones modification and the abnormal working capital accruals model. Apart from that, the earnings smoothing indicator is applied. Finally, another approach to evaluating efficiency of new standards' implementation is the timely loss recognition model.

Based on the information available in the existing literature and according to the chosen methodology, we advance the following hypotheses:

Hypothesis 1: Implementation of IFRS will entail a decrease in profit manipulation.

Hypothesis 2: Implementation of IFRS will have a positive impact on timely loss recognition.

Thus, if the hypotheses are confirmed, we may make the conclusion that the quality of accounting and reporting improves after the introduction of international standards.

Further, we consider in detail the methodologies behind all the approaches applied in the paper.

The first analysis method is based on the methodology of measuring profit manipulation based on discretionary accruals. There are numerous approaches to their measurement, i.e., the Kothary or Jones models. In this paper we use a modified version of the Jones model [23]. The main concept of this model entails the calculation of discretionary accruals as the difference of total accruals and discretionary accruals. At the same time, non-discretionary accruals are standard, while discretionary accruals are an anomaly and, as expected, are indicative of the fact of profit manipulation. Thus, the following equation was used to obtain the dependent variable DA:

$$\frac{\mathrm{TA}_{\mathrm{it}}}{A_{\mathrm{it-1}}} = \beta_1 \frac{1}{A_{\mathrm{it-1}}} + \beta_2 \left(\frac{\Delta \mathrm{Rev}_{\mathrm{it}}}{A_{\mathrm{it-1}}} - \frac{\Delta \mathrm{AR}_{\mathrm{it}}}{A_{\mathrm{it-1}}} \right) + \beta_3 \frac{\mathrm{PPE}_{\mathrm{it}}}{A_{\mathrm{it-1}}} + \varepsilon_{\mathrm{it}}, \quad (1)$$

where $\mathrm{TA}_{\mathrm{it}}$ – total accruals for period t;

$\Delta \mathrm{Rev}_{\mathrm{it}}$ – change in company's revenue for period t as compared to the previous period;

$\Delta \mathrm{AR}_{\mathrm{it}}$ – change in company's accounts receivable for enterprise t as compared to the previous period;

$\mathrm{PPE}_{\mathrm{it}}$ – gross value of fixed assets by the end of period t;

$A_{\mathrm{it-1}}$ – total assets for period t-1.

Besides, total accruals may be calculated by means of a direct approach, i.e., using the data from the statement of cash flows, in particular, cash flows from operating activities or applying an indirect approach, which uses only the information from the balance-sheet.

As long as SPARK does not offer data from the statements of cash flows of organizations in the sample of this research, in order to calculate discretionary accruals, it is necessary to subtract non-discretionary accruals from total accruals, i.e., apply the indirect method to calculate discretionary accruals.

To apply this method, first, we present the calculation of total accruals as follows:

$$\mathrm{TA}_{it} = \Delta \mathrm{CA}_t - \Delta \mathrm{Cash}_t - \left(\Delta \mathrm{CL}_t - \Delta \mathrm{CD}_t \right), \quad (2)$$

where $\mathrm{TA}_{\mathrm{it}}$ – total accruals for the period t;

$\Delta \mathrm{CA}_t$ – change in current assets for period t as compared to the previous period;

$\Delta \mathrm{Cash}_t$ – change in cash and cash equivalents for period t as compared to the previous period;

$\Delta \mathrm{CL}_t$ – change in short-term liabilities for period t as compared to the previous period;

$\Delta \mathrm{CD}_t$ – change in current debt included in current liabilities for period t as compared to the previous period.

Formula (2) above implies that total accruals in current assets resulting from the use of the accrual method and recalculation of the exchange rate differences as of the date of the reporting are not taken into consideration. Therefore, total accruals in current assets are "cleared off" those changes.

Subsequently, the obtained TA_t is inserted in formula (1) and regression coefficients β_1 β_2 β_3 are calculated. They describe the existence of the relatio $\mathrm{CA}_{\mathrm{it}}$ – nship between the value of assets and fixed assets and the value of assets and revenue adjusted for accounts receivable determined using the accrual method. Within the meaning of the model, total accruals for current assets should take into account the operational effect of change in the scope through the change in revenue and depreciation. Such accruals are standard, i.e., non-discretionary.

Therefore, at the next stage of model construction, the value of non-discretionary accruals is calculated based on the obtained coefficients. The following formula may be used to calculate them:

$$\mathrm{NDA}_{\mathrm{it}} = \beta_1 \frac{1}{A_{\mathrm{it-1}}} + \beta_2 \left(\frac{\Delta \mathrm{Rev}_{\mathrm{it}}}{A_{\mathrm{it-1}}} - \frac{\Delta \mathrm{AR}_{\mathrm{it}}}{A_{\mathrm{it-1}}} \right) + \beta_3 \frac{\mathrm{PPE}_{\mathrm{it}}}{A_{\mathrm{it-1}}}, \quad (3)$$

[1] Discretionary accruals are a part of total accruals for the reporting period that has no direct relation to corporate operations and arise when managers use their professional judgement in accounting of business transactions.

where NDA_{it} – non-discretionary accruals for period t;

$\beta_1, \beta_2, \beta_3$ – coefficients obtained when constructing the model at the previous stage of the method;

Finally, non-discretionary accruals resulting from the change in the operational scope are subtracted from total accruals of formula (2), i.e., discretionary accruals may be calculated as the forecast error of the original model:

$$DA_t = TA_t - NDA_t. \quad (4)$$

After all preliminary calculations, the general model for the first method appears as follows:

$$DA_t = \alpha_0 + \beta_1 IFRS_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \\ + \beta_4 LOSS_{it} + \beta_5 GROWTH_{it} + \beta_6 BIG4_{it} + \\ + \beta_7 ROA_{it} + \varepsilon_{it}, \quad (5)$$

where DA_{it} – discretionary accruals for company i in period t;

$IFRS_{it}$ – a binary variable measured as 1 for the periods following the adoption of international standards and 0 – otherwise;

$SIZE_{it}$ – company size measured as a logarithm of the total asset value;

LEV_{it} – leverage measured as a ratio of total debt to the total asset value;

$LOSS_{it}$ – a binary variable measured as 1 if within period t-1 the net profit takes on a negative value and 0 – otherwise;

$GROWTH_{it}$ – percentage change of income for period t;

$BIG4_{it}$ – quality of the audit measured as 1 if the reporting was verified by a Big Four company and 0 – otherwise;

ROA_{it} – return on assets measured as a ratio of profit to the total asset value;

Thus, according to the first hypothesis, we should expect to get a negative coefficient of the IFRS variable.

The second method for the evaluation of profit manipulation is based on the indicator of abnormal working capital accruals [24], which is given by the following equation:

$$AWCA_{it} = WC_t \left[\left(\frac{WC_{it-1}}{T_{it-1}} \right) \bullet T_{it} \right], \quad (6)$$

where $AWCA_{it}$ – abnormal working capital accruals for period t;

WC_{it} – working capital without cash funds for year t;

WC_{it-1} – working capital without cash funds for year t–1;

T_{it} – revenue for year t;

T_{it-1} – revenue for year t–1.

Working capital without cash funds is calculated as follows:

$$WC_{it} = (CA_{it} - Cash_{it} - CI_{it}) - (CL_{it} - CD_{it}), \quad (7)$$

where current asset for period t;

$Cash_{it}$ – cash and cash equivalents for period t;

CI_{it} – short-term financial investment for period t;

CL_{it} – short-term liabilities for period t;

CD_{it} – current debt included current liabilities for period t.

As in the previous model, in this case it is assumed that a change in working capital by the accrual method and a change in the scope of working capital as a result of change in revenue is normal (non-discretionary). However, this model also clears working capital from short-term financial investments, which are not related in any way to the change in revenue from operating activity.

Thus, after calculating the dependent variable $AWCA_{it}$ by formula (6), the general model for the alternative method of evaluation of profit manipulation appears as follows:

$$AWCA_{it} = \alpha_0 + \beta_1 IFRS_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \\ + \beta_4 LOSS_{it} + \beta_5 GROWTH_{it} + \beta_6 BIG4_{it} + \\ + \beta_7 ROA_{it} + \varepsilon_{it}. \quad (8)$$

Therefore, as for the first model, it is logical to assume that the value of the IFRS indicator coefficient is negative.

The third approach differs from the ones considered previously. The principle of assessment of the variance of the Barth earnings smoothing metric lies at the root of this approach [25]. At the first stage, two regressions are constructed and evaluated for the periods before and after the introduction of international standards, which are generally presented as follows:

$$\Delta NI_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 LEV_{it} + \beta_3 LOSS_{it} + \\ + \beta_4 GROWTH_{it} + \beta_5 BIG4_{it} + \beta_6 ROA_{it} + \varepsilon_{it}, \quad (9)$$

where ΔNI_{it} – change in net profit scaled by total assets for period t.

At the second stage, residuals are calculated for both regressions, variances of these residuals are computed, and their values lead us to a conclusion on profit manipulation.

Thus, according to the first hypothesis, the variance of the model residuals after the adoption of IFRS should be greater to enable us to make a conclusion on the improvement of accounting quality.

The fourth method is based on a fundamentally different idea, that is, timely loss recognition by Barth [25] and Klish [26]. Unlike discretionary accruals, more timely loss recognition is indicative of more efficient accounting and high quality of reporting. Thus, the model is presented as follows:

$$IFRS_{it} = \alpha_0 + \beta_1 LL_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \\ + \beta_4 LOSS_{it} + \beta_5 GROWTH_{it} + \beta_6 BIG4_{it} + \\ + \beta_7 ROA_{it} + \varepsilon_{it}, \quad (10)$$

where LL_{it} – severe losses for company i in period t.

Thus, according to the second hypothesis, the coefficient of the LL variable should be positive because it indicates that the companies that have switched to IFRS, recognize serious losses more often, which is an indicator of higher accounting quality.

Sample and Descriptive Statistics of Variables

In order to achieve the objectives of the present research, we compiled a sample by analyzing the financial operations

of Russian companies before and after the implementation of international standards. The paper studies data for 2010 and 2011, as well as the period from 2012 to 2020. The final sample comprised public non-financial companies that published reporting according to RAS and IFRS.

The final sample encompassed a total of 40 companies from 8 sectors: telecommunications, automobile and spare parts manufacture, oil and gas extraction, food and beverage production, manufacture of industrial products and rendering services, extraction and production of basic resources, retail, as well as construction and building materials manufacture. The sample was limited rather significantly because it did not comprise the companies that started publishing IFRS reporting after the end of the official transition period, or the companies that did not provide in their reporting all the data required to calculate the necessary variables. Thus, 440 observations for 11 years were obtained. They are conventionally divided into two subsamples according to adoption or non-adoption of international standards. It should be noted that this sample size imposes some limitations, such as the applicability of the conclusions to only a part of the corporate sector because the results for the companies operating in certain industries, in particular banking and insurance, may differ significantly, as well as the use of a limited number of control variables in order to avoid overcomplication of the models.

We also conduct statistical analysis of variables in this paper (Table 1). Descriptive statistics are presented for two subsamples separately in order to trace the changes in the two periods. Besides, the t-test was applied to evaluate the statistical significance of differences in the mean values in both groups.

It is obvious that there are differences between the two periods. Besides, these differences are statistically significant for several control variables. The mean value for discretionary accruals is lower after the implementation of international standards, although the difference in the value is statistically insignificant. Meanwhile, the mean value of the AWCA variable remained virtually unchanged, increasing only slightly in the second considered period. As for serious losses, on the basis of mean values we may put forward an assumption that after the transition to IFRS they are recognized more often. As for control variables, an increase in the mean values is apparent for the variables responsible for company size and its leverage. A statistically significant decrease of the Growth and ROA variables is also observed. As long as the variables describing the audit quality and losses are binary, their mean values are equivalent to the sample percentage, which takes on the value of 1. Thus, the differences in these variables are statistically significant and indicative of lower losses and more extensive use of audit services of the Big Four companies after 2012.

Table 1. Descriptive statistics

	Before IFRS		After IFRS			
Variable	**Mean value**	**St. deviation**	**Mean value**	**St. deviation**	**T-test**	**p-value**
DA	-0.2564	4.0597	-0.096	0.7879	-0.695	0.4874
AWCA	-0.093	0.9962	-0.0978	1.1129	0.0354	0.9718
LL	0.125	0.3328	0.2167	0.4125	-1.857	0.0640
Size	24.4268	2.62433	25.4129	2.4146	-3.251	0.0012
Lev	0.4247	0.2549	0.7732	2.1797	-1.427	0.1544
Growth	0.6736	1.9067	0.1623	0.889	3.6235	0.0003
ROA	0.0818	0.1145	0.023	0.2335	2.1929	0.0288
Loss	0.125	0.3328	0.2083	0.4067	-1.709	0.0881
Big4	0.3	0.4611	0.6917	0.4624	-6.856	0

Source: Authors' calculations, Stata.

We also analyzed the relationship between the main variables used for modelling because multicollinearity may bias the estimates of the model coefficients and make some regressors insignificant. For this purpose, a correlation matrix is used (Table 2). As we can see, in general all correlations do not have high values, and the strongest relationship is detected between the ROA and Lev variables. However, since no correlations exceeding 0.8 in absolute magnitude were found, we may assume that there are no strongly correlated features. Thus, no variables were eliminated from the models.

Table 2. Correlation matrix

	DA	AWCA	LL	Size	Lev	Gr.	ROA	Loss	Big4	IFRS
DA	1									
AWCA	0.35	1								
LL	-0.04	-0.13	1							
Size	0.22	0.28	-0.18	1						
Lev	-0.2	-0.5	0.19	-0.2	1					
Gr.	-0.3	-0.51	0.05	-0.3	0.03	1				
ROA	0.14	0.57	-0.5	0.29	-0.7	-0.15	1			
Loss	-0.04	-0.12	0.44	-0.2	0.18	0.1	-0.33	1		
Big4	0.05	0.097	0.004	0.49	-0.04	-0.15	0.08	-0.03	1	
IFRS	0.03	-0.002	0.09	0.15	0.06	-0.17	-0.1	0.08	0.31	1

Source: Authors' calculations, Stata.

Further, modelling according to the methodology presented above is described. This section is structured as follows: there are four main parts corresponding to the main approaches presented in the methodology.

Discretionary Accruals Model

First of all, a modified Jones model was applied (equation (5)). Since panel data is used, it was necessary to define the best model to obtain the most unbiased results. Since the fixed effects (FE), random effects (RE) or pooled models are used in most cases for panel data, these models have been applied in this paper. The obtained models are compared to each other by means of both quality characteristics of the models and independent tests.

The FE model was considered to be the best, and the relevant modeling results are presented in Tables 3 and 4. In the general form, this model appears as follows:

$$DA_t = 0.693 - 0.736 \cdot IFRS_{it} + 1.997 \cdot SIZE_{it} - \\ - 0.164 \cdot LEV_{it} + 0.05 \cdot LOSS_{it} - 0.08 \cdot GROWTH_{it} - \\ - 0.161 \cdot BIG4_{it} - 0.29 \cdot ROA_{it}.$$

Table 3. Results of the FE model of discretionary accruals

Variable	Coefficient	St. deviation	t-statistics	p-value	
IFRS	-0.7356	0.1536	-4.79	0	***
Size	1.9974	0.2043	9.78	0	***
Lev	-0.1644	0.0878	-1.87	0.062	*
Loss	0.0478	0.1258	0.38	0.704	
Growth	-0.0845	0.0531	-1.59	0.112	
Big4	-0.1613	0.1797	-0.90	0.370	
ROA	-0.2902	0.0906	-3.20	0.001	***
Const	0.6927	0.1287	5.38	0	***

Note (hereinafter):

* – the coefficient is significant at the 10% significance level;

** – the coefficient is significant at the 5% significance level;

*** – the coefficient is significant at the 1% significance level.

Source: Authors' calculations, Stata.

Table 4. Quality characteristics of the FE model of discretionary accruals

Standard error	0.8699	F-statistics	21.11
R^2_{within}	0.2732	p-value (F)	0
$R^2_{between}$	0.1657	AIC	2.66
R^2_{overal}	0.055	ρ	0.81

Source: Authors' calculations, Stata.

Based on the obtained results, we may make the following conclusions about the quality of the model of discretionary accruals: the model is significant and a substantial role of effects is observed, however, its explanatory power is rather low. The model quality is also described by the tests verifying the model suppositions that state that model residuals are normally distributed and there is no first-order correlation.

Moreover, to confirm the reliability of the obtained results, tests verifying the stability of the model were carried out. Although the FE model was considered to be the best among the panel models, the random effects model may be used to check the stability of the result irrespective of the assessment method. In the general form, it appears as follows:

$$DA_t = 0.106 - 0.053 \cdot IFRS_{it} + 0.161 \cdot SIZE_{it} -$$
$$- 0.374 \cdot LEV_{it} + ., 009 \cdot LOSS_{it} - 0.255 \cdot GROWTH_{it} -$$
$$- 0.104 \cdot BIG4_{it} - 0.252 \cdot ROA_{it.}$$

The RE model demonstrates that the effect for the IFRS variable has the same direction and is statistically significant, which confirms sustainability of the result.

Apart from this model, a range of additional specifications of the fixed effects model was considered separately. First, we tested the specification without the Loss variable, which showed the lowest correlation with the dependent variable and was statistically insignificant in the main model. The results remained sustainable: the coefficient of IFRS preserved its sign and statistical significance. We also assessed the model without the Loss, Growth и Big4 variables, which did not achieve statistical significance, thus making it possible to verify whether they influence the main effect indirectly via a relationship with other variables. The coefficient of the IFRS indicator amounted to -0.81 and remained significant, thus, confirming sustainability of the conclusions. In view of a strong correlation between the ROA and Lev variables, two separate specifications were presented: without ROA and without Lev. In both cases, the IFRS variable retained its direction and significance, indicating that the multicollinearity between these variables does not skew the estimate of the main effect. Finally, we evaluated the model without the Growth variable, which showed the strongest correlation with the dependent variable but, at the same time, was statistically insignificant. Elimination of this indicator did not impact the result, confirming sustainability of the estimate. Consequently, as long as the IFRS variable preserves statistical significance and direction in all alternative specifications, we may conclude that the model results are highly resistant to changes in the set of control variables.

As for the interpretation of model coefficients, it can be observed that the coefficient of the IFRS variable is statistically significant and negative, hence, the adoption of IFRS indeed formally improves the quality of accounting and reporting because it decreases the degree of profit manipulation. Thus, hypothesis 1 is not rejected.

The coefficient of the company size variable is also statistically significant and positive. This implies that large companies are more prone to profit manipulation as compared to small firms. The reason for this result may be the fact that large companies are exposed to greater pressure due to their market standing and their managers may potentially have more chances for opportunistic behaviour.

The ROA indicator coefficient is also statistically significant, and at the same time shows a negative impact on the degree of profit manipulation. As long as higher values of return on assets are indicative of the high efficiency of corporate resources use, it is rather logical that such companies are less prone to profit manipulation.

The leverage is statistically significant only at the 10% level and at the same time exerts a negative impact on the dependent variable. It would be more reasonable to expect the opposite result because with increasing debt and, consequently, the growth of this indicator companies may gain an impetus for profit manipulation. However, the modeling results do not confirm this assumption, which may be due to stricter creditors' control when debt is at high levels. Apart from that, such a negative relationship between the leverage and degree of earnings management is also confirmed by other studies [27].

Coefficients of the rest of variables are statistically insignificant, however, they will be interpreted below.

The sign of the audit quality variable is negative, which may be due to the fact that the Big Four companies provide a higher quality audit, which has a restraining effect on profit manipulation.

The coefficient of the Loss variable is positive, i.e., if companies suffered losses in the previous period, they are more exposed to profit manipulation. The reason for such behavior may be that organizations that have not shown positive net profit before are more likely to gravitate towards data tampering in order to match the stakeholders' expectations within this period or to compensate for the financial results of prior periods.

The Growth variable is negatively related to the dependent variable, which implies that rapidly growing companies are less prone to profit manipulation. Potentially, these results may be caused by such companies' greater focus on a long-term development strategy and no counting upon short-term manipulations, or by their concern to lose stakeholders' confidence.

In general, the application of this accounting quality assessment model requires consideration of the following subtle methodological aspects of financial accounting and reporting in Russia. The amount of discretionary accruals increases as companies transition to fair value of assets and liabilities and apply the effective interest rate instead of the nominal interest rate for assessment. However, these most significant changes are introduced into accounting of Russian companies at an extremely slow rate. Thus, applying fair value to fixed assets and capital assets in financial reporting has been permitted in Russia only since 2022, and to intangible assets – since 2024. The effective interest rate and depreciable cost for evaluation of long-term liabilities are not yet provided for in the Russian standards. The subsequent vector of development of the methods for evaluation of financial investments in associated and subsidiary companies, which are usually aimed at a long term and may entail a significant increase in discretionary accruals, is not clear either. Therefore, the majority of Russian organizations, despite declaring their transition to IFRS in the past 10 years, still prepare reporting under the principle of maximum convergence of traditional Russian and international financial accounting, avoiding significant revaluations and adjustments. A conceptual analysis of changes in accounting policies of Russian companies as they switch to the ideology of international financial reporting provides a confirmation of the above. However, this is a topic for another research publication.

Consequently, the idea of verifying the quality of discretionary accruals at present is not substantiated by a solid information foundation. In case of formal confirmation of hypothesis 1, it appears that we have to discuss the relationship between discrete accruals and certain financial indicators, rather than the improvement of accounting quality related to the transition to IFRS. In our opinion, it is too early to discuss decreasing profit manipulation in the case of transition to IFRS because the transition is extremely protracted. This, indeed, invites the assumption that financial reporting as such cannot be the sole purpose of accounting as an information system; development of accounting should be targeted not just at financial markets, but also at the national interests of the state.

Abnormal Working Capital Accruals Model

The next model constructed in this research was the abnormal working capital accruals model (equation (8)). As in the case of the discretionary accruals model, three types of models are used, and they are compared to each other using the characteristics of the models' quality and independent tests. The FE model turned out to be the best one; relevant modelling results are provided in Tables 5 and 6. In the general form, this model appears as follows:

$$AWCA_t = 0.228 - 0.318 \cdot IFRS_{it} + 0.666 \cdot SIZE_{it} +$$
$$+ 0.0004 \cdot LEV_{it} + 0{,}172 \cdot LOSS_{it} - 0.363 \cdot GROWTH_{it} -$$
$$+ 0.002 \cdot BIG4_{it} - 0.465 \cdot ROA_{it}.$$

Table 5. Results of the FE model of abnormal working capital accruals

Variable	Coefficient	St. error	t-statistics	p-value	
IFRS	-0.3177	0.1194	-2.66	0.008	***
Size	0.6663	0.1588	4.20	0	***
Lev	0.0004	0.0682	0.01	0.995	
Loss	0.1719	0.0978	1.76	0.079	*
Growth	-0.3629	0.0413	-8.80	0	***
Big4	-0.0021	0.1397	-0.01	0.988	
ROA	0.465	0.0704	6.61	0	***
Const	0.228	0.1	2.28	0.023	**

Source: Authors' calculations, Stata.

Table 6. Quality characteristics of the FE model of abnormal working capital accruals

St.error	0.6761	F-statistics	43.42
R^2_{within}	0.4361	p-value (F)	0
$R^2_{between}$	0.4478	AIC	2.16
R^2_{overal}	0.356	ρ	0.5

Source: Authors' calculations, Stata.

Based on the quality characteristics of the abnormal working capital accruals model, we may assert that the model is significant, has a reasonably good explanatory power and the effects play a rather serious role in this model. Together, the above is indicative of a rather high quality of the model. These conclusions regarding the model quality confirm a normal distribution of residuals and absence of first-order correlation.

The model was also verified for sustainability using several methods. The first method was an alternative model evaluation method, i.e., applying the RE model where the coefficient of the IFRS variable equals -0.101 and is statistically significant. This confirms the result sustainability.

Another method of verification consists in changing the specification of the fixed effects model. First, the model was assessed without the insignificant Lev and Big4 variables. The coefficient of the IFRS indicator amounted to -0.318 and remained significant. This is indicative of the effect sustainability. The specification without the Loss variable is also of interest. Although it was considered to be significant at the 10% level in the main FE model, it had the lowest correlation with the dependent variable. Elimination of this indicator did not cause changes in the result. The IFRS variable retained its direction and statistical significance. As with the discretionary accruals model, separate specifications without ROA and Lev, which verify absence of biases related to multicollinearity, were the last to be tested. In both cases the IFRS variable has a negative relationship with the dependent variable and is significant, thus, confirming the evaluation sustainability. So, both verification methods may be indicative of sustainability of the initial model's results.

The obtained modelling results enable us to make the formal conclusion that the first hypothesis is not rejected for this model either, because the coefficient for the IFRS variable is negative. In other words, when the new accounting system is introduced, the degree of profit manipulation reduces.

A comparison of this model with the previous one demonstrates that the coefficients of the variables responsible for such indicators as company size, percentage change in earnings, losses and audit quality coincide in terms of direction. Thus, their interpretations are identical, which is why we made the decision not to repeat them.

The Leverage indicator is related positively to the dependent variable, hence, organizations with higher leverage values are inclined to tamper with data. This may be due to the fact that when debt increases, companies may gain an impetus for profit manipulation in an attempt not to violate their loan agreement and to retain the trust of creditors and investors.

The coefficient of the ROA indicator shows a positive influence on the degree of profit manipulation. Companies with high ROA may strive to maintain a high market-based valuation of their shares, and consequently, profit may be manipulated in order to create an illusion of financial stability and efficiency. Eventually, this may result in an increase in the stock value.

It is worth noting individually that only such variables as IFRS, Size, Growth, ROA and Loss are significant (at the 10% level of significance).

However, as in the previous case, when applying this model, it's important to realize that fair value reporting for current assets was introduced only in 2021 and applies to a comparatively small number of organizations that either perform non-cash settlements or have goods on their balance sheet that are traded officially. The standard for revenue recognition and assessment, which will also allow to apply professional judgment in order to evaluate revenue and will actually "destroy" the equality between accounts receivable and cash and revenue, has not been adopted in Russia. Therefore, in the financial reporting the adjustments related to current assets and revenue also remain minimal. This model will probably be representative only for the evaluation of accounting quality in agricultural, forestry and fishery companies which are obliged to use fair value. However, such organizations should be examined in a separate academic study because many of them have the right to use the simplified accounting system and do not publish their financial reports.

Thus, despite a formal confirmation of hypothesis 1, the changes in recognition of current assets for this sample were minimal. Therefore, this model also cannot unambiguously confirm a decrease in profit manipulation when transitioning to IFRS.

Earnings Smoothing Model

The last approach verifying the first hypothesis is the evaluation of the earnings smoothing metric. For this purpose, auxiliary regressions were built for both considered periods (equation (9)) in order to assess the residuals' variations. The obtained values were also tested for statistical significance of the differences in the obtained values (Table 7).

Table 7. Results of the earnings smoothing model

	Before IFRS	After IFRS	F	p-value
$VAR\,\Delta NI^{*}$	0.0039	1.0863	281.0662	0

Source: Authors' calculations, Stata.

So, the variance of ΔNI^* before IFRS adoption amounted to 0.004, and after 2012 – to 1.09. Since the variance value has obviously increased and the difference is statistically significant, we may formally conclude that the degree of profit manipulation was reduced. Thus, hypothesis 1 is not rejected.

However, we should also take into consideration that in case of use of fair value, the international financial reporting concept allows to designate revaluations both as profit and revaluations that pertain to the proprietary equity section on the balance sheet. Revaluation creates competitive advantages for the company. When equity grows, the leverage increases and there emerges an opportunity to attract additional financial resources by placing a bond-secured loan or raising credit funds. Therefore, when distributing the assessment methods permitted by IFRS, an analysis of this model should comprise not only the change in net profit but also the change in revaluation items that pertain to equity. For example, according to IFRS, other comprehensive income is classified as either reclassified or non-reclassified. The result of revaluation of fixed assets is non-reclassified other comprehensive income, i.e., in case of retirement of a non-current asset, the revaluation reserve is not included in the financial result of the reporting year stated in the profit and loss statement. At the same time, the revaluation of some financial assets is reclassified other comprehensive income, i.e., the accumulated revaluation result is recorded as other comprehensive income, but when a financial asset is disposed of, the accumulated revaluation is added to the financial result of the reporting period, i.e., it is included in the profit and loss statement. Up to the present time, such division of other comprehensive income has not been utilized in Russian standards. Moreover, they do not contain the concept of "other comprehensive income". In our country, these are operations left out of profit and loss, but included in the cumulative financial result. At present, there are only two regulated items that fall under this category: revaluation of non-current assets and exchange rate differences related to foreign operations. IFRS has far more such items, for example, revaluation of financial assets or accumulated actuarial gains and losses related to a pension program.

Thereby, we believe that in the present research the results of the model rather indicate that in most of the companies there were no significant changes in revaluations included in profit and loss within the research period, therefore, the variance increased.

Timely Loss Recognition Model

The last model constructed in this paper is the timely loss recognition model (equation (10)). All in all, three types of models were built in this section of the paper: the logistic fixed effects model (FE), the logistic random effects model (RE) and the common logistic model built on the basis of a generalized sample (pooled). The obtained models are compared to each other using both their quality characteristics and independent tests.

The FE model is the best, and the relevant modelling results are reported in Tables 8 and 9. In its general form, this model appears as follows:

$$IFRS_t = -0.916 \cdot LL_{it} + 12.27 \cdot SIZE_{it} + 5.193 \cdot LEV_{it} + \\ + 0.459 \cdot LOSS_{it} - 0.6 \cdot GROWTH_{it} + 4.543 \cdot BIG4_{it} - \\ - 0.837 \cdot ROA_{it}.$$

Table 8. Results of the FE model of timely loss recognition

Variable	Coefficient	St. error	t-statistics	p-value	
LL	-0.9163	1.0155	-0.90	0.367	
Size	12.2698	2.1236	5.78	0	***
Lev	5.1926	3.33	1.56	0.119	
Loss	0.4593	0.877	0.52	0.6	
Growth	-0.6006	0.5149	-1.17	0.243	
Big4	4.5429	1.2097	3.76	0	***
ROA	-0.837	0.6707	-1.25	0.212	

Source: Authors' calculations, Stata.

Table 9. Quality characteristics of the FE model of timely loss recognition

χ^2-stat.	236.55
p-value	0
AIC	0.223

Source: Authors calculations, Stata.

It is important to note that the coefficient of the LL variable is negative, consequently, IFRS implementation does entail a better timely loss recognition, hence, we cannot make the conclusion that the quality of accounting and reporting improved. Thus, hypothesis 2 is rejected. However, it should be noted that the coefficient of this variable is insignificant, which is quite understandable. If the purpose of preparing financial reporting according to IFRS is to attract external investors, recognition of significant losses stands in direct conflict with this goal. Therefore, the model itself and the conclusion that hypothesis 2 is rejected should be treated with caution.

Conclusion

The present research is dedicated to the analysis of influence of international standards adoption on the quality of accounting and reporting. In this context, we have studied data on Russian public companies from the beginning of 2010 to the end of 2020. In the paper, we advanced two main hypotheses that evaluate the efficiency of IFRS implementation on the degree of profit manipulation and timely loss recognition.

In order to verify the first hypothesis, we applied three key methodologies: the discretionary accruals model, the abnormal working capital accruals model and the earnings smoothing model. Formally, all three methods demonstrated that the degree of profit manipulation decreased after the transition to the new accounting system; and we may conclude that the hypothesis is accepted. Such results are in line with existing literature since a lot of papers describe the positive effect of IFRS implementation. To verify the second hypothesis, the timely loss recognition model was applied. Based on it, we may draw the conclusion that no positive influence on timely loss recognition is observed after introducing international standards.

Thus, the whole conducted analysis indicates that formally IFRS indeed produces a positive effect on the quality of accounting and reporting.

However, in our opinion, there is currently no proper information base to evaluate the quality of accounting according to IFRS. Up until 2021, Russian standards had almost no regulations on fair value and effective interest rate. Therefore, even when organizations applied IFRS, they chose the accounting methods that were consistent with Russian standards and provided an opportunity to avoid serious adjustments when preparing financial reporting according to IFRS. So, in IFRS fair value is the key assessment value intended to ensure the realistic appraisal of financial standing and company performance, and essentially increases the degree of correspondence of financial reporting indicators with the business's market value. At the same time, estimated calculated values in particular are most affected by professional judgment when the reliability criterion is met, which implies a clear, accurate description and explanation.

Therefore, it seems that at present the analysis of accounting quality should be conducted through the analysis of accounting methodology, accounting policies and achievement of indicators associated with reporting but not directly related to it, rather than through the analysis of financial reporting itself. For example, high accounting quality may ensure concessionary loans and/or high accuracy in predicting income receivable. This conclusion indicates that application of mathematical methods in the analysis of the accounting quality requires their critical reevaluation and the development of proprietary models that taking into consideration distinctive national features of accounting.

The present research was limited by certain branches of economy. This prevented us from making conclusions on Russia's entire corporate sector. Other branches of the national economy, such as the electric-power industry, agriculture, transport, and extractive industry should be added as a basis in further promising studies.

This research will potentially contribute to the understanding of IFRS, expand the theoretical knowledge base on the influence of these standards in such an understudied region as Russia (from the viewpoint of this topic), enable company managers to make decisions on the expediency of transition to this accounting system, and also serve as the basis for further academic papers.

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