Vol. 18 | № 3 | 2024 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. 18 | № 3 | 2024
e-journal
www.cfjournal.hse.ru
ISSN 2073-0438

Contacts:
Higher School
of Economics (HSE),
11 Pokrovsky Boulevard, Building S
Tel.: +7 (495) 621 9192*27188
E-mail: cf@hse.ru

Journal of Corporate Finance Research (JCFR) was established in 2007. It is founded by the National Research University Higher School of Economics (NRU HSE) and **Irina Ivashkovskaya** (chief editor). The journal is included in Web of Science Russian Science Citation Index (RSCI).

Journal of Corporate Finance Research aims to publish high quality and well-written papers that develop theoretical concepts, empirical tests and research by case studies in corporate finance.

The scope of topics that are most interesting to JCFR includes but is not limited to: corporate financial architecture, payout policies, corporate restructuring, mergers and takeovers, corporate governance, international financial management, behavioral finance, implications of asset pricing and microstructure analysis for corporate finance, private equity, venture capital, corporate risk-management, real options, applications of corporate finance concepts to family-owned business, financial intermediation and financial institutions.

JCFR targets scholars from both academia and business community all over the world.

Frequency: 4 times per year

The Journal of Corporate Finance Research is committed to upholding the standards of publication ethics and takes all possible measures against any publication malpractices. Editors of the journal reserve the right to reject the work from publication in case of revealing any such malpractices.

Guidelines for authors:
https://cfjournal.hse.ru/en/for%20authors.html.

Contents

Journal of Corporate Finance Research
Vol. 18 | № 3 | 2024
www.cfjournal.hse.ru

New Research

Reviews

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.5-25
JEL classification: G32, M41

The Wedge between Ownership and Control, Shareholder Identity and Corporate Disclosure: Evidence from Russia

Alexander Muravyev ✉
PhD in Economics, Associate Professor, Department of Economics, HSE University, St. Petersburg Campus, Russia;
Institute of Labor Economics – IZA, Bonn, Germany,
amuravyev@hse.ru, ORCID

Nikolay Telyatnikov
Senior lecturer and postgraduate student, Department of Economics,
HSE University, St. Petersburg Campus, Russia,
ntelyatnikov@hse.ru, ORCID

Abstract

The paper explores a dual-class stock setting to examine the effect of separation of ownership and control on corporate disclosure. Our analysis is based on a unique panel dataset of publicly traded firms in Russia, where dual-class stock companies emerged exogenously during the privatization process. Applying conventional panel data analysis methods and using several robustness checks, we find that the separation of ownership and control through dual-class stock results in lower corporate disclosure. Disclosure is inversely related to the wedge between the control and ownership rights of the largest shareholder (specifically, it increases with her ownership rights but decreases with her control rights). There is also evidence that the effect of the wedge on disclosure depends on the type of controlling shareholder. The negative effect is most pronounced when the largest shareholder is a domestic private person and is virtually non-existent for foreign shareholders from non-offshore jurisdictions. The state and state-related companies as well as foreign entities from offshore jurisdictions occupy an intermediate position in this regard.

Keywords: disclosure, ownership and control, dual-class stock companies, shareholder identity, Russia

For citation: Muravyev A., Telyatnikov N. (2024) The Wedge between Ownership and Control, Shareholder Identity and Corporate Disclosure: Evidence from Russia. *Journal of Corporate Finance Research.* 18(3): 5-25. https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.5-25

Introduction

The implications for corporate disclosure of the separation of ownership and control, which is a key feature and a major governance issue of public companies, have long drawn a lot of attention in the accounting and corporate governance literatures [1–3]. There is considerable theoretical ambiguity on this matter. On the one hand, the separation of ownership and control may lead the parties controlling the firm to opt for low disclosure standards, which helps them conceal their consumption of private benefits (e.g., [4–5]). On the other hand, managers and/or controlling shareholders may use disclosure to reassure investors that their interests will be protected, especially if the company requires additional external financing [6–7]. This theoretical ambiguity ultimately makes the impact of the separation of ownership and control on disclosure an interesting and important empirical question.

To date, most available empirical evidence on this matter comes from studies of ownership concentration and shareholder identity (e.g., [8–10]) In such analyses, ownership concentration is viewed as a key corporate governance mechanism that reduces the gap between ownership and control and the severity of agency conflicts in a widely held firm [11]. Alternatively, the effects of the separation of ownership and control are examined from the perspective of shareholder identity. For example, despite holding significant ownership stakes in a company, institutional investors may forgo exercising control, transferring it to managers [12]. In contrast, families tend to have greater control over companies [13]. Overall, according to H. Khlif et al. [14], the results of such studies are mixed and do not provide a clear picture as ownership concentration and shareholder identity are only indirect indicators of the separation of ownership and control and can be confounded by other factors.

In recent years, additional evidence has started to emerge from analyses of disclosure practices in dual-class stock firms, which are characterized by an intrinsic divergence between voting and cash flow rights. In fact, dual-class shares are one of the most explicit and visible mechanisms for separating ownership and control (e.g., [15–16])[1]. It can therefore be argued that dual-class stock companies provide a much cleaner setting for examining the effects of the divergence between ownership and control on corporate disclosure than the more traditional designs that focus on ownership concentration or shareholder types. The idea of considering dual-class stock firms has been explored by K.W. Lee [17], T. Li and N. Zaiats [18] and R. Palas and D. Solomon [19], among others.

However, this newer approach faces a number of difficulties. The main obstacle is that dual-class stock companies tend to emerge endogenously, particularly due to their founders' desire to retain control of productive assets while obtaining external financing, and thus can be very different from single-class stock firms[2]. In other words, firms' decisions to adopt or abandon a dual-class stock structure are unlikely to be random and are usually determined by certain observable and unobservable characteristics [16; 21; 22][3]. Therefore, relevant empirical studies that emphasize external validity must contend with the difficult selectivity problems associated with company decisions to issue different classes of shares. There are only a handful of studies relying on natural experiments that generate a divergence between ownership and control where sample selection is not a problem (e.g., [25]). Others try to explicitly model the selection process or use propensity score matching techniques [22; 26; 27]. These strategies have their own problems and are often not very convincing. Indeed, the matching strategy cannot handle potential selection on unobservables while the sample selection models often lack instruments for identifying the selection process, which results in a questionable econometric identification based on the non-linearity of the normal distribution.

Furthermore, the sparse literature linking corporate disclosure to the separation of ownership and control in the dual-class stock setting frequently proxies disproportionate control rights with a single dummy variable [18; 28; 29]. Such a simplified approach ignores the strength of incentives of the parties controlling the firm. Only a few studies of corporate disclosure as shown by R. Palas et al. [30], attempt to quantify the wedge between ownership and control that arises from the issue of dual-class stock. The problem here appears to be the lack of detailed data on ownership and control.

Finally, to our best knowledge, little or no attention is paid in the literature to the potential variability in the impact of the wedge on corporate disclosure depending on the identity of the largest shareholder. In fact, both the incentives and the abilities to push for greater disclosure may depend not only on the size of the wedge but also on whether the controller is a founding CEO, a government, a financial institution, an industrial holding company, etc. This seems to be a common gap in the study of dual-class stock companies, as noted by D. Aggarwal et al. [31]. Indeed, these authors emphasize a general lack of knowledge of "the effects of dual-class structures on different outcomes, such as valuation and innovation" and in particular of whether and how "[t]he type of controller and wedge between economic and voting rights may have an effect on various outcomes" [31, p. 150].

[1] Other mechanisms generating the control-ownership wedge include pyramids and cross-holdings, voting coalitions, proxy votes, and loyalty shares that confer additional voting rights to long-term shareholders.

[2] B. Amoako-Adu et al. [20] show that the issue of dual-class stock is more typical of family companies. For example, 83.2% of companies with dual-class stock from the S&P 1500 list are family firms (those marked by the dominance of a family in the ownership structure). Among comparable companies with single-class stock, family firms account for only 29.04%.

[3] Interestingly, R. Adams and D. Ferreira [23] note that there are few studies of the determinants of ownership proportionality. Some recent papers address the issue of dual-class IPOs (e.g., [24]), but the evidence remains thin.

Our paper aims to address the aforementioned gaps in the accounting and corporate governance literatures. We examine the impact of the wedge between ownership and control on corporate disclosure, exploiting an unusually clean setting that resembles a natural experiment and using a rich dataset from an emerging economy – Russia of the first decade of the new century. First, we take advantage of the fact that the overwhelming majority of Russian dual-class stock companies emerged exogenously due to the peculiarities of the privatization process of the early 1990s [32–33][4]. Therefore, the concern that the choice of a dual-class share structure is not exogenous and a sample selection bias exists (e.g., [35]) is of little or no significance in our analysis. Second, we compile detailed data that not only identify dual-class stock companies but also provide us with a direct measure of the size of the wedge between ownership and control of the largest shareholder. Third, we collect and process information about the identities of these largest shareholders. This allows us to study the impact on corporate disclosure of (a) the separation of ownership and control, (b) the magnitude of the control-ownership wedge, and (c) its interactions with the type of controller (i.e., the moderating effects of shareholder identity). These are the central research questions in our analysis.

The data for our study are assembled from multiple sources, the most important being the Standard & Poor's (S&P) Transparency and Disclosure Index and the SKRIN database. We have an unbalanced panel of 125 non-financial companies registered and operating in Russia during the period 2002–2010, with a total of 559 observations. The core of our data, the S&P index, is based on more than 90 individual items and measures the disclosure of (a) ownership structure and investor relations, (b) financial and operational information and (c) board and management structure and process. Therefore, it broadly corresponds to the disclosure of the G dimension of the currently popular ESG. As we explain later in the text, the main strengths of S&P data from Russia are their internationally validated methodology, high level of detail and wide coverage of firms.

Although our data are not very recent and, in particular, do not tell much about the current disclosure practices in Russian firms, they are very well suited to address the research questions of general interest raised in this article. Indeed, these questions refer to the general, fundamental incentives guiding the behavior of individuals and firms that do not vary much over time and across space. Not surprisingly, but S&P data on Russian companies have been recently used by S. Banerjee et al. [36], A. Grosman [37], A. Muravyev [38] and I. Berezinets and A. Muravyev [39] in their articles that tackle general research questions related to corporate governance and disclosure.

Using conventional panel data analysis techniques, we show that disclosure is significantly lower (by approximately 9%) in companies most affected by the separation of ownership and control (i.e., dual-class stock companies) compared to their single-class stock counterparts. It turns out that the level of disclosure is a decreasing function of the wedge between the control and ownership rights of the largest shareholder. More precisely, disclosure increases with her ownership rights but decreases with her control rights. We also find evidence that the type of controlling shareholder moderates the wedge-disclosure relationship. The negative effect of the wedge is most pronounced when the largest shareholder is a Russian private person, be it an individual or a legal entity, and is practically absent in the case of foreign shareholders from non-offshore jurisdictions. The state and state-affiliated companies as well as foreign companies from offshore jurisdictions occupy an intermediate position in this regard. We discuss and interpret these results at the end of the article.

Our analysis has several caveats. First, it focuses on total disclosure as defined by S&P in its Transparency and Disclosure Index, which does not distinguish between mandatory and voluntary disclosure. The drivers of the two may be different, as suggested by C. Arena et al. [40]. Second, our analysis ignores other potential mechanisms of the separation of ownership and control that are distinct from the issue of dual-class shares, such as pyramids and cross-shareholdings. Third, while we emphasize the exogenous creation of dual-class stock companies in Russia during the privatization process, we cannot claim the exogeneity of ownership, including the identity of the largest shareholders in firms. Fourth, we recognize that the two types of shares that can be issued by Russian companies are not absolutely identical in terms of the cash flow rights attached to them. In fact, Russian companies can issue only one type of common (voting) shares and several types of preferred shares, which under normal circumstances do not have voting rights but are usually entitled to a higher dividend. However, previous studies have not found these nuances in cash flow rights to be important, not at least for the voting premium (e.g., [41]).

Despite these limitations, we believe that our analysis represents a noteworthy contribution to the current international literature on corporate governance and corporate disclosure, particularly to the strand that focuses on the effects of the separation of ownership and control and the identity of controlling owners. Here, too, the main strength of our analysis is that it answers previously underexplored questions using an unusually clean setting of exogenously created dual-class stock companies.

[4] In Russia, the key driver of the introduction of dual-class stock was the capital intensity of firms offered for privatization in the early 1990s. Managers and employees of capital-intensive firms were unable to accumulate enough funds to buy 51 percent of shares under Privatization Option 2 and therefore opted for Privatization Option 1 which implied the establishment of a dual-class stock structure with preference (non-voting) shares amounting to up to 25% of the charter capital. These shares were then distributed among managers and employees for free (see the study by P. Hare and A. Muravyev [34] for details).

The rest of the paper is structured as follows. Second section provides a brief review of the relevant literature. Third section describes the data and methods used. Fourth section presents the main empirical results. Finally, conclusions are drawn in fifth section.

Literature review and hypothesis development

In this study, we primarily rely on agency theory, which represents the dominant framework for analyzing both corporate governance [11] and corporate disclosure [42–43]. This theory assumes that the separation of ownership and control – in particular, through the use of dual-class shares – involves agency costs associated with the consumption of perks, excessive compensation, related party transactions, and other private benefits enjoyed by managers and/or controlling owners [11]. This separation can have two opposing effects on corporate disclosure. On the one hand, it may encourage company insiders to reduce the amount and/or quality of disclosure to conceal their consumption of private benefits [5]. Therefore, disclosure is predicted to be lower in companies with potentially high agency costs, such as dual-class stock firms. On the other hand, managers and/or controlling owners can use disclosure as a bonding tool to signal to investors the protection of their interests [6; 44]. As a result, the level and/or quality of disclosure will be higher in companies with potentially high agency costs, including dual-class stock companies. Overall, the connection between corporate disclosure and the separation of ownership and control becomes an empirical matter.

The relevant empirical literature mostly focuses on ownership concentration (typically in the hands of insiders) and shareholder identity (drawing a distinction between families, institutional investors, foreign companies, government, etc.). Both are considered valid indicators of the separation of ownership and control. Indeed, ownership concentration naturally reduces the gap between the two, while the identity of shareholders is normally related to their involvement with the firm (e.g., institutional investors tend to transfer their control rights to managers, while families tend to concentrate control in their own hands). The empirical results based on these proxies are somewhat mixed. In particular, ownership concentration is often found to have a negative impact on disclosure (e.g., [9; 45–46]). However, some studies provide a more nuanced picture. For example, H. Jankensgård [8] uses data from Sweden to show a concave relationship, with disclosure first increasing and then decreasing with ownership concentration. These results could be related to the two different effects of ownership concentration, namely incentive alignment and entrenchment, which are generally difficult to disentangle [47–48]. Another explanation suggests that dominant shareholders may have alternative channels to obtain information about the firm, which may result in less information being passed on to the market [46].

Studies that focus on shareholder identity also provide mixed evidence [14]. For example, regarding government ownership, K.O. Alotaibi and K. Hussainey [49] report that it has a negative effect on disclosure in Saudi Arabia, Y. Lan et al. [50] find a quadratic convex association in China, while A. Amran and S.S. Devi [51] observe a positive link in Malaysia. The difficulty in interpreting these and other results in terms of the separation of ownership and control stems from additional confounding effects, such as the interference of bureaucrats and politicians in state-owned companies in the case of government ownership. Overall, the evidence on whether and how the separation of ownership and control affects corporate disclosure remains ambiguous.

Some researchers attempt to explicitly measure the degree of the separation of ownership and control and assess its effect on corporate disclosure. For example, G. Liu and J. Sun [2] and C. Bona-Sánchez et al. [52] identify the ownership-control wedge for pyramidal structures in China and Spain, respectively. Some studies use instead the dual-class stock setting, which generates an easily identifiable wedge between ownership and control [17; 29; 48; 53].

A common approach in the latter works is to compare disclosure practices in single vs. dual-class stock firms. This is done, e.g., in the studies by T. Li and N. Zaiats [18], R.M. Irani and D. Oesch [28], D. Solomon et al. [29] and S. Tinaikar [44]. The findings are quite mixed. For example, based on US data, S. Tinaikar [44] studies executive compensation disclosure and finds that it is lower in dual-class stock companies compared to single-class stock firms. A cross-country study by T. Li and N. Zaiats [18], based on a sample of 12,672 firms from 19 countries over the period 1994–2010, finds a poorer information environment and increased accrual-based earnings management in dual-class stock firms, suggesting that managers of these firms have incentives to hide the private benefits of control. However, D. Solomon et al. [29], who use data from US listed companies to examine the ability of financial reports of dual vs. single-class stock firms to predict an increase or decrease in earnings, find that financial reports prepared by dual-class public companies are more accurate in predicting changes in earnings, meaning that dual-class companies provide credible and high-quality information to their investors. Likewise, O. Lobanova et al. [54], who rely on the US sample used by P.A. Gompers et al. [16] extended to 2012, find less accruals management among dual-class companies. Finally, based on US data from 2012–2017, R. Palas and D. Solomon [19] report that the earnings of dual-class companies are more persistent and more informative about future cash flows compared to those of single-class stock firms.

The variability of the aforementioned findings is often attributed to the fact that dual-class stock companies tend to emerge endogenously, particularly due to their founders' desire to retain control of productive assets while obtaining external financing, and thus can be very different from single-class stock firms. This highlights the difficult selectivity issues associated with company decisions to issue differ-

ent classes of shares (e.g., [16; 22]), which may invalidate econometric results or complicate their interpretation. This fundamental problem emphasizes the importance of further research, especially in settings that are less sensitive to such selectivity.

Therefore, drawing on the central prediction of agency theory that the separation of ownership and control may incentivize managers and/or controlling owners to opt for low disclosure standards in order to conceal their consumption of private benefits [5] and taking advantage of the quasi-experimental setting of exogenously created dual-class stock firms in Russia [33], we propose our first and most general hypothesis:

H1: The separation of ownership and control through the issue of dual-class stock has a negative impact on corporate disclosure.

Both theoretical and empirical literature furthermore suggest that the magnitude of the wedge may matter for corporate outcomes and performance (e.g., [15]). An extreme example is a company with 100 shares that provide shareholders with equal rights to receive dividends but different voting rights, say 100% of the votes are contained in just one voting share while the remaining 99 shares are non-voting. As a result, a person who holds the voting share and none of the non-voting ones has full (100%) control of the firm but is entitled to only 1% of its cash flow. For such a tremendous wedge between ownership and control, amounting to 99% (control rights minus cash flow rights), one can expect various manifestations of agency costs, from the excessive compensation of managers to related party transactions and asset stripping [11]. Notably, agency theory suggests that disclosure is negatively associated with the aforementioned wedge.

The implications of the wedge for corporate disclosure have been empirically examined by K.W. Lee [17], A. Forst et al. [48], J. Bangert et al. [53] and R. Palas et al. [30], among others. For example, using a data set of 829 firms in eight East Asian countries during the period 2002–2003, K.W. Lee [17] shows that a larger wedge reduces disclosure as measured by the inclusion of specific items in annual reports according to Standard & Poor's transparency and disclosure methodology. Using a sample of US dual-class firms from 2000 to 2012, A. Forst et al. [48] find that disproportionate insider control is negatively associated with financial analysts' forecast accuracy and positively associated with forecast dispersion. This implies that the informativeness of corporate disclosure is a decreasing function of the wedge between ownership and control. Finally, employing data on US publicly traded companies from 2012 to 2019, R. Palas et al. [30] report that a larger wedge is associated with a higher quality of reporting.

Again, the empirical results are not very conclusive and call for further research, preferably in settings that are not plagued by sample selection issues. Therefore, using agency theory predictions, drawing on the above-cited studies and taking advantage of the quasi-experiment of the exogenous establishment of dual-class stock companies in Russia, we formulate our second hypothesis:

H2: Corporate disclosure is a decreasing function of the wedge between the control and ownership rights of the largest shareholder.

It has been recently suggested that the diverse and inconclusive empirical results summarized above may stem from the lack of nuances in measuring the ownership-control wedge. Indeed, the wedge is typically analyzed for insiders, that is managers and board members (e.g., [26; 53]). In particular, V. Baulkaran [26] distinguishes between controlling shareholders who are CEOs, directors or chairmen of the board in a study of US dual-class firms in the period 2001–2007. However, the motivation, abilities, and knowledge to exploit the ownership-control wedge may vary across shareholder types. D. Aggarwal et al. [31] point out the wide diversity among controlling shareholders, who may include founders and their heirs, governments, non-founding directors, and holding companies issuing shares in a subsidiary, and call for calculating the wedge based on the difference in voting and cash flow rights of public shareholders. A few scholars have taken a similar approach in studying ownership effects on company value. For example, K.V. Lins [55] analyzes the effect of the wedge on company value by distinguishing between management and non-management blockholder stock ownership, but his analysis is focused on pyramidal structures in 18 emerging markets. Likewise, C.K. Hoi and A. Robin [56] examine the effect of controller identity (whether the largest shareholder is a top executive, a board member or an outsider) on the value of US dual-class firms.

Similar studies of corporate disclosure are virtually absent. A few papers suggest that the effect of the wedge on disclosure may be moderated by additional aspects of the firm's ownership structure. For example, K.W. Lee [17] reports that the negative effect of the wedge on disclosure is less pronounced in companies that have a large non-management shareholder. Therefore, large non-management shareholders appear to play a role in mitigating agency problems due to separation of ownership and control. Employing a sample of S&P 1500 firms from 1995 through 2015, J. Bangert et al. [53] show that shareholders' ability to predict future earnings decreases with the difference between insider voting and cash flow rights. This relationship is, however, weakened by the presence of large institutional investors, suggesting that the latter can mitigate inherent agency conflicts. K. Cieslak et al. [57] focus on executive compensation disclosure (ECD) using data from Sweden and find that disclosure decreases with ownership concentration and excess voting rights of the largest shareholder. Overpaid CEOs tend to improve ECD quality, but not in the case of excess control rights concentrated in the hands of the controlling owner. This suggests that ECD appears to be part of the agency problem between controlling and non-controlling owners when managers have a bond with controlling shareholders.

Drawing on a study by D. Aggarwal et al. [31] and taking into account the lack of evidence concerning the role of shareholder identity in shaping the relationship between disclosure and the ownership-control wedge, we advance our third hypothesis:

H3: The effect of the wedge between ownership and control on corporate disclosure varies with the type (identity) of the largest shareholder.

Our analysis of Hypothesis H3 should be viewed as exploratory, partly because of the lack of a comprehensive theory linking the wedge, shareholder identity and disclosure and partly due to the limited number and specificity of shareholder identity categories available in our data. We therefore do not advance any explicit hypotheses related to particular types of shareholders, leaving this task for further research.

Data and methodology

Our data are compiled from the Standard & Poor's (S&P) Transparency and Disclosure Index and the SKRIN database. Information from these sources was carefully processed and merged into a unique longitudinal database. The details on the original sources and data aggregation are provided below.

Data and sample

The main data source for our study is the Transparency and Disclosure Database collected by S&P for major Russian companies (e.g., [58]). It was part of the S&P global effort to evaluate the transparency and disclosure of the world's largest publicly traded firms, in particular those included in the S&P Global 1200 and S&P/IFCI 1200 (Emerging Markets) indices.

The methodology of the S&P studies is discussed in detail in the works by S.A. Patel et al. [59], S.A. Patel and G.S. Dallas [60], as well as in the S&P survey [58]. The data include more than 90 distinct disclosure attributes, each coded with a binary score. They are grouped into an overall score, which is based on all individual disclosure items, and three sub-indices characterizing (a) Ownership structure and investor relations, (b) Financial and operational information as well as (c) Board and management structure and process[5]. The focus of the S&P data collection effort is thus on the disclosure of the G dimension of the currently popular ESG. Notably, the overall index and its three sub-indices range between 0 and 100, allowing for easy interpretation in terms of percentages.

The S&P data do not distinguish between mandatory and voluntary disclosure. This is not necessarily a drawback, especially in the context of emerging markets, where enforcement of mandatory disclosure rules is typically poor. As a result, firms have considerable discretion in choosing the type and amount of information to be disclosed, even among the mandatory items. This motivates some scholars such as Y. Liu et al. [61] to focus on total disclosure (which combines voluntary disclosure and compliance with mandatory rules)[6].

The scores for Russian companies are available for nine years from 2002 to 2010 (the Russian survey was discontinued in 2011). Depending on the wave, the data cover between 42 and 90 companies (including banks and firms operating in Russia but registered abroad). Of these, 22 companies are surveyed in all nine waves. Overall, the main strengths of the S&P survey in Russia are an internationally validated methodology, a high level of detail and a good coverage of firms.

The publicly available part of the Russian dataset compiled by S&P has been exploited in the studies of disclosure and corporate governance by B.S. Black et al. [62], R. Enikolopov et al. [63], S. Banerjee et al. [36], A. Grosman [37], I. Berezinets and A. Muravyev [39] and A. Muravyev [38], most of which address research questions of general interest. Unlike most of these studies, we had access to additional waves from 2008 to 2010, which were made available to us by the Moscow office of S&P under conditions of confidentiality.

The original data for our study consisted of all observations in the S&P database, a total of 641 firm-years. We then imposed two key constraints on the original sample. First, we dropped all financial companies, which is common practice in the literature. Second, we omitted a handful of companies that were not listed/traded on the Russian stock exchange, but were only listed/traded abroad (they have most of their operations in Russia but are registered abroad). As a result, our final dataset contains 559 observations on 125 companies.

The distribution of the observations over time is shown in Figure 1. The increase in the number of observations over the study period is due to the wider coverage of Russian companies by S&P in more recent periods. Figure 2 shows the distribution of the sampled firms by region. Firms located in Moscow, the Urals and the Volga region as well as in St. Petersburg dominate the sample. Relative to the population of publicly traded companies (studied by A. Muravyev [64]), the sample is somewhat skewed towards companies based in Moscow. Finally, Figure 3 shows the distribution of observations by industry. Power utilities, telecommunication companies, manufacturing firms, and mining enterprises constitute the bulk of the sample. This is largely characteristic of publicly traded companies in Russia. Overall, the sample appears to be reasonably representative of the country's corporate sector[7].

[5] Here are examples of individual items from each group: (1) "Does the company disclose the way that shareholders nominate directors to board?"; (2) "Does the company disclose a detailed earnings forecast?"; (3) "Does the company disclose the specifics of directors' pay (e.g., the salary levels, etc.)?".

[6] Additional details on the S&P data are available in Appendix/Supplementary Material A1.

[7] Indeed, S. Banerjee et al. [36] formally confirm the external validity of their results, based on the S&P sample over 2003–2007, for the entire population of publicly traded firms in Russia.

Figure 1. The distribution of observations over time

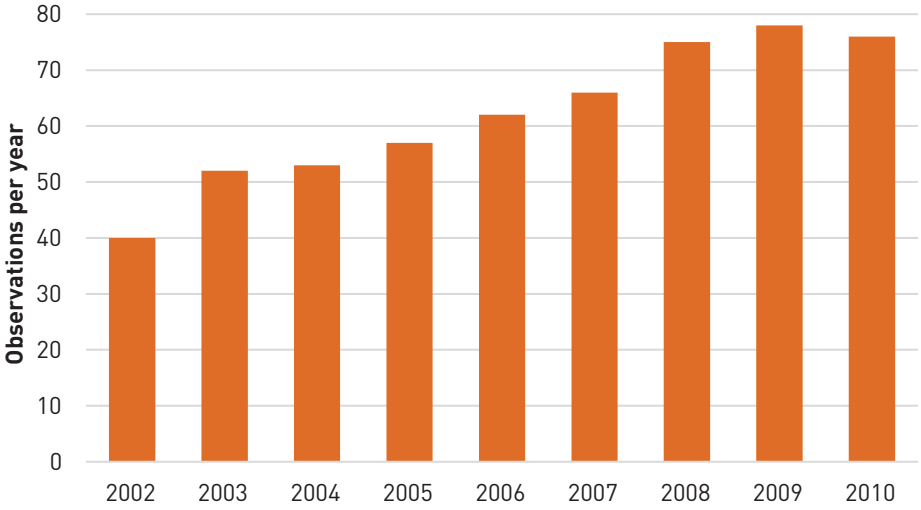


Figure 2. The distribution of observations by macro-region

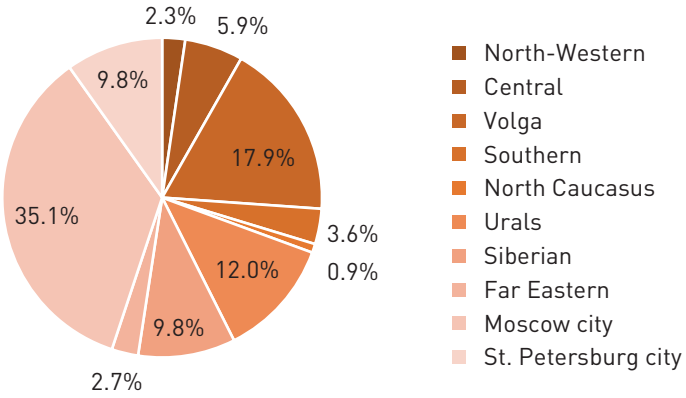
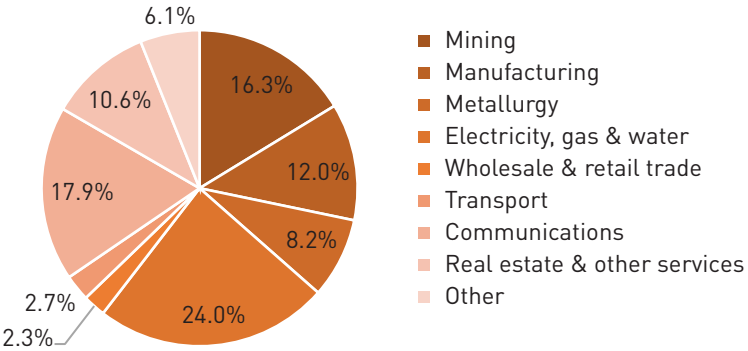


Figure 3. The distribution of observations by industry



The S&P data are supplemented by additional firm-level information obtained from SKRIN, one of the main sources on Russian enterprises whose retrospective coverage goes back to the mid-1990s[8]. It provides a wealth of data on various aspects of companies' operations, such as annual and quarterly financial reports, the distribution of ownership among major shareholders (the reporting threshold in Russia is 5%), and the composition of corporate boards. Although the amount of information provided by SKRIN is huge, only a few variables are available in a ready-to-use format, structured by company and year. Therefore, we manually processed a large portion of the available data to create variables that describe corporate boards and the ownership structure of the companies studied, including the dual-class stock status, the ownership-control wedge and the identity of the largest shareholder.

In particular, the data on cash flow and voting rights come from section 6.5 of the quarterly reports to the regulator (they are available in SKRIN). This section lists, for each owner with at least 5% ownership, their shares of both eq-

[8] The resource is available at http://www.skrin.com/ as accessed on January 20, 2024.

uity and common (voting) stock as recorded at the time of each shareholder meeting. We rely on data from regular meetings, which usually take place between April and June each year. We associate the share of equity with cash flow rights and the share of common stock with voting rights.

The available ownership data allow us to identify three broad categories of owners, namely the state, domestic private shareholders and foreigners. We are also able to distinguish between direct and indirect state ownership and identify foreign owners from offshore jurisdictions (for more details, see Appendix/Supplementary Material A2). As a result, there are five broad ownership categories (shareholder identity variables) in the analysis: direct state ownership, indirect state ownership, domestic private ownership, foreign non-offshore ownership, and foreign offshore ownership. A more detailed breakdown is difficult due to the relatively small number of observations, resulting in thin categories. For example, the division of domestic private owners into natural and legal persons shows that only 5% of observations fall into the category of natural persons.

Descriptive statistics

The descriptive statistics of the key data are presented in Table 1. The total disclosure index is at the top of the table (*Total_disclosure*) followed by the three sub-indices of disclosure (*Ownership_disclosure*, *Financial_disclosure* and *Board_manag_disclosure*) as well as key governance variables that characterize ownership, performance and other aspects of the firms. The descriptive statistics suggest a modest level of transparency and disclosure by Russian companies. The overall index reaches a value of 50, which corresponds to exactly half of the maximum on the S&P scale (0 to 100 points). In terms of disclosure dynamics, there was a clear upward trend until the 2008 financial crisis and stabilization (or even a slight decline) thereafter (see the averages of disclosure scores over time in Figure 4).

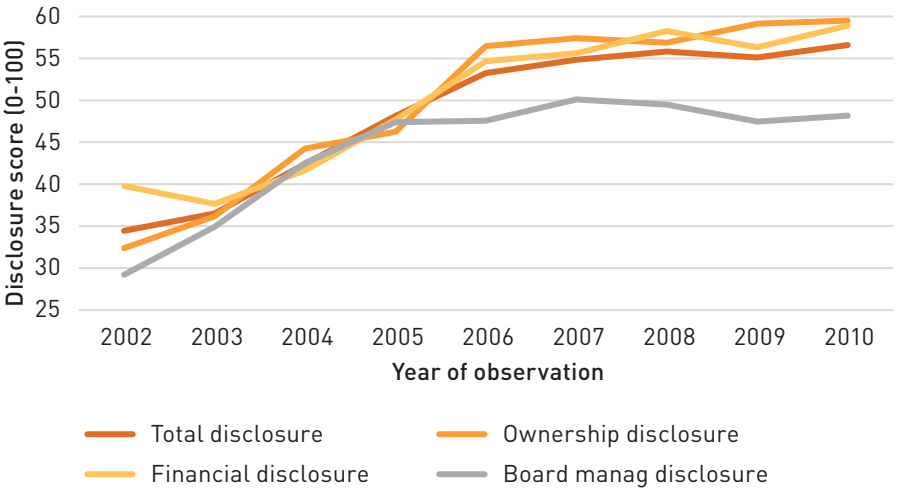
Table 1. Descriptive statistics of the variables

Variable	Definition	Mean	p50	SD	Min	Max
Total_disclosure	S&P T&D disclosure score, 0-100	50.03	52.42	16.73	6.08	85.50
Ownership_disclosure	Ownership structure and investor relations disclosure, 0-100	51.60	53.17	18.53	0	92.86
Financial_disclosure	Financial and operational information disclosure, 0-100	51.47	55.06	19.22	0	89.13
Board_manag_disclosure	Board and management structure and process disclosure, 0-100	45.21	45.07	16.14	0	86.00
DUAL	Dummy for a dual-class stock firm	0.37	0.00	0.48	0.00	1.00
WEDGE	The wedge, VOTING_R- CASH_ FLOW_R	2.74	0.00	4.88	-6.98	16.33
CASH_FLOW_RIGHTS	Cash-flow rights of the largest shareholder	46.99	44.72	18.72	9.52	100.00
VOTING_RIGHTS	Voting rights of the largest shareholder	49.73	50.67	18.89	6.24	100.00
STATE	Dummy for the largest shareholder being the state	0.41	0.00	0.49	0.00	1.00
STATE_DIRECT	Dummy for the largest shareholder being the state (directly)	0.09	0.00	0.29	0.00	1.00
STATE_INDIRECT	Dummy for the largest shareholder being the state (indirectly)	0.32	0.00	0.47	0.00	1.00
DOM_PRIVATE	Dummy for the largest shareholder being a domestic person	0.25	0.00	0.44	0.00	1.00
FOREIGN	Dummy for the largest shareholder being a foreign person	0.33	0.00	0.47	0.00	1.00
FOR_NONOFFSH	Dummy for the largest shareholder being a foreign person (non-offshore)	0.17	0.00	0.37	0.00	1.00

Variable	Definition	Mean	p50	SD	Min	Max
FOR_OFFSHORE	Dummy for the largest shareholder being a foreign person (offshore)	0.17	0.00	0.37	0.00	1.00
FIRM_SIZE	Firm size, log(sales)	11.12	10.84	1.63	1.50	15.24
ROA	Return on assets, profit before taxes/ assets, %	8.54	6.21	9.86	-10.24	34.96
LEVERAGE	Leverage, long-term debt/ (equity+long-term debt), %	22.26	18.02	18.73	0	69.63
TWO_TIER	Dummy for a two-tier board	0.68	1.00	0.47	0.00	1.00
BOARD_SIZE	Size of the board	10.26	11.00	2.16	5.00	17.00
NONEXEC_SHARE	Share of non-executive directors on the board, %	81.09	88.89	18.33	11.11	100.00
AUDIT_COMM	Dummy for an audit committee	0.63	1.00	0.48	0.00	1.00
ADR	Dummy for ADR/GDR	0.67	1.00	0.47	0.00	1.00
BIG-4_AUDITOR	Dummy for a Big-4 auditor	0.67	1.00	0.47	0.00	1.00

Note: The number of observations is 559 for all variables.

Figure 4. Dynamics of S&P transparency and disclosure scores



Dual-class stock companies account for approximately 37% of the sample. The average wedge between ownership and control is 2.74% (calculated for all firms in the sample). Regarding ownership and control, the data show a significant concentration of both, which is consistent with previous studies (e.g., [65–66]). In particular, the ownership stake of the largest shareholder averages 47%, while the control stake is just under 50%. Regarding the identity of the largest owners, state and state-controlled entities are the largest shareholders in 9% and 32% of the companies sampled, respectively. Domestic private shareholders dominate in 25% of the companies, and foreign shareholders in 34%. Interestingly, the percentages of offshore and non-offshore foreign ownership are very similar, at around 17% each.

The financial data suggest that the sampled companies are, on average, profitable and moderately levered. A comparison of the size of sampled companies with that of the universe of publicly traded firms in Russia (e.g., [64]) suggests that the former are slightly larger than the latter. The other variables in Table 1 indicate whether the firm has issued ADRs and appointed a BIG-4 auditor as well as characterizing its corporate board. All these factors have been identified as important determinants of corporate disclosure in previous research (see, e.g., [39]).

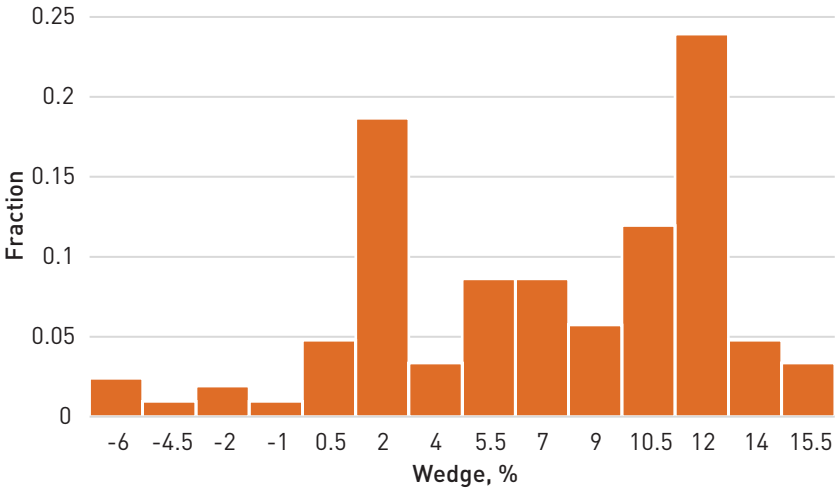
Table 2. Means of key variables by company type

Variable	SINGLE-CLASS	DUAL-CLASS	Difference
Total_disclosure	52.48	46.03	6.45***
Ownership_disclosure	53.42	48.64	4.78***
Financial_disclosure	54.63	46.31	8.32***
Board_manag_disclosure	46.67	42.82	3.85***
DUAL	0.00	1.00	n/a
WEDGE	0.00	7.33	-7.32***
CASH_FLOW_RIGHTS	49.78	42.30	7.48***
VOTING_RIGHTS	49.79	49.63	0.16
STATE	0.32	0.56	-0.24***
STATE_DIRECT	0.11	0.07	0.04
STATE_INDIRECT	0.21	0.50	-0.29***
DOM_PRIVATE	0.27	0.23	0.04
FOREIGN	0.41	0.20	0.21***
FOR_NONOFFSH	0.18	0.15	0.03
FOR_OFFSHORE	0.24	0.05	0.19***
FIRM_SIZE	11.07	11.19	-0.12
ROA	8.52	8.55	-0.03
LEVERAGE	22.23	22.30	-0.07
TWO_TIER	0.69	0.67	0.02
BOARD_SIZE	9.97	10.73	-0.76***
NONEXEC_SHARE	79.95	82.95	-3.00*
AUDIT_COMM	0.77	0.41	0.36***
ADR	0.67	0.68	-0.01
BIG-4_AUDITOR	0.67	0.67	0.00

Note: Asterisks denote significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2 shows the descriptive statistics by company type, i.e., separately for single-class and dual-class companies. The disclosure score for single-class stock companies is significantly higher than for their dual-class stock counterparts, at 52.48 vs. 46.03, providing initial support for Hypothesis H1. This also applies to all disclosure sub-indices. The two types of firms are similar in terms of the voting rights of the largest shareholders, but differ in terms of their ownership rights. The distribution of the wedge between control and ownership in dual-class stock firms is shown in Figure 5. It has two modes, at about 2% and 12%. Interestingly, some companies feature a negative wedge, when the largest shareholder has more ownership rights than control rights.

Figure 5. Distribution of the wedge in dual-class stock firms



There are notable differences in the distribution of the identity of the largest shareholder between the two types of firms. Specifically, the largest shareholder in more than half of the dual-class stock companies is affiliated with the state, while the corresponding share in single-class stock companies is less than a third. However, the data do not suggest dramatic differences in the variables related to corporate governance (e.g., the proportion of non-executive directors, the issue of ADR, and the appointment of a BIG-4 auditor). The only exceptions are larger boards and a lower propensity to establish an audit committee in firms issuing dual-class shares.

Methods

Our empirical framework is similar to that used in most other disclosure studies, for example, those by G. Bueno et al. [67] and A. Gisbert and B. Navallas [68]. The regression analysis takes the disclosure score as the dependent variable and a measure of the separation of ownership and control and other corporate governance and financial attributes of companies as the explanatory ones. In its most general form, our econometric model can be written as follows:

$$Disclosure_{it} = \alpha_i + \boldsymbol{GAP}_{it}\boldsymbol{\beta} + \boldsymbol{X}_{it}\boldsymbol{\varphi} + \upsilon_t + \varepsilon_{it}, \quad (1)$$

where $Disclosure_{it}$ stands for the disclosure score of firm i in year t, α_i is an intercept (which is firm-specific), $\boldsymbol{GAP}_{it}$ describes the wedge between ownership and control (which can be a scalar or a vector), vector $\boldsymbol{X}_{it}$ denotes a set of control variables used in similar analyses (e.g., industry dummies, firm size, and leverage), and υ_t is a time effect. In particular, consistent with Hypotheses H1 and H2, ***GAP*** may be represented by the binary variable *DUAL* indicating dual-class stock companies, the continuous variable *WEDGE* measuring the control-ownership wedge of the largest shareholder or, in a more detailed analysis, two continuous variables characterizing ownership and control of the largest shareholder, *VOTING_RIGHTS* vs. *CASH_FLOW_RIGHTS*. The aforementioned hypotheses are not rejected when the estimated $\boldsymbol{\beta}$ is statistically different from zero.

Next, in order to test Hypothesis H3, we use a scalar measure of the wedge (variable *WEDGE*) interacted with the shareholder identity variables (assembled in vector $\boldsymbol{IDENT}_{it}$) available in the dataset, e.g.:

$$Disclosure_{it} = \alpha_i + WEDGE_{it} \cdot \boldsymbol{IDENT}_{it}\boldsymbol{\beta} + \\ + \boldsymbol{X}_{it}\boldsymbol{\varphi} + \upsilon_t + \varepsilon_{it}. \quad (2)$$

In this setup, Hypothesis H3 finds support in the data when the estimated components of vector $\boldsymbol{\beta}$ are statistically different from each other.

When selecting control variables (vector $\boldsymbol{X}_{it}$), we primarily rely on previous studies of disclosure conducted by G. Michelon et al. [69], M.Glaum et al. [70] and D. Vural [71]. Therefore, we include firm size, leverage, profitability, and industry dummies as key controls[9]. This results in a rather parsimonious specification that excludes potentially endogenous variables and reduces multicollinearity. We also consider an extension of model (2) which incorporates owner identity variables ***IDENT*** as additional control variables. This extension accounts for possible direct effects of shareholder identity, especially given its unequal distribution between single and dual-class stock firms (see Table 2).

We also perform a number of robustness checks by examining the effects of the separation of ownership and control on the three components of *Total_disclosure* (*Ownership_disclosure*, *Financial_disclosure*, and *Board_manag_disclosure*) and by adding additional control variables that have been found important in previous studies of corporate governance and disclosure, including in Russian firms (e.g., [71; 73–74]). These variables include board size, the proportion of non-executive directors (as a measure of board independence), a dummy for the issue of ADRs and a dummy for the appointment of a BIG-4 auditor. We ex-

[9] The selection of the control variables is theoretically grounded. For example, the inclusion of the leverage variable is motivated by the supposition that more levered firms have a lower need for disclosure as leverage helps control the free cash flow problem [72].

pect that these modifications of the main model will have no material effect on our findings.

As regards estimation, we consider pooled OLS, fixed effects (FE), and random effects (RE) estimators. In all cases, we calculate cluster-robust standard errors to account for potential heteroskedasticity and within-firm correlation of the error terms. The pooled OLS model is the most restrictive because it imposes the common intercept $\alpha_i = \alpha \; \forall \; i$ and therefore ignores unobserved heterogeneity across firms. The presence of unobserved effects α_i is checked using the Breusch and Pagan test for random effects (after the RE estimation). When unobserved heterogeneity is detected, the RE estimator is theoretically preferred as the most efficient; however, it is inconsistent if α_i are correlated with the regressors of the model. In this case, one has to rely on the FE estimator, which does not impose any restrictions on the correlation between α_i and the regressors. The main disadvantage of this estimator is that it solely uses the within variation in the variables, which may be small or even absent for many corporate governance attributes. We check the consistency of the RE estimator (and choose between the FE and RE estimators) using the robust version of the Hausman test [75].

Empirical results

Main empirical results

The main empirical results are presented in Table 3. They are organized according to the hypotheses stated in second section. Specifically, we start with the simplest model in which the control-ownership wedge is proxied by a dummy variable taking the value of 1 for dual-class stock companies and 0 otherwise (Column 1). This corresponds to Hypothesis H1. Next, we move on to the continuous wedge variable (Column 2) and, as is commonly done in the literature (e.g., [48]), consider its disaggregation into two variables measuring the ownership and voting rights of the largest shareholder (Column 3). These models are intended to verify Hypothesis H2. Finally, in order to test Hypothesis H3, we consider the interactions of the continuous wedge variable with binary variables for shareholder identity. Here we use either a simple categorization of shareholder identity based on three categories (Column 4) or a more nuanced one based on five categories (Columns 5 and 6). The model in Column 6 is similar to that in Column 5, but includes owner identity variables as additional regressors.

Table 3. Main regression results, the RE estimator

	(1)	(2)	(3)	(4)	(5)	(6)
DUAL	−9.210***					
	(2.127)					
WEDGE		−0.474**				
		(0.235)				
VOTING_RIGHTS			−0.477**			
			(0.239)			
CASH_FLOW_RIGHTS			0.456*			
			(0.235)			
WEDGE*STATE				−0.307		
				(0.189)		
WEDGE*STATE_DIRECT					−1.410*	−0.465
					(0.746)	(0.894)
WEDGE*STATE_INDIRECT					−0.242	−0.390**
					(0.190)	(0.196)
WEDGE*DOM_PRIVATE				−1.285***	−1.311***	−1.046***
				(0.330)	(0.328)	(0.359)
WEDGE*FOREIGN				0.412		
				(0.359)		
WEDGE*FOR_NONOFFSH					0.768***	0.700*
					(0.291)	(0.425)

	(1)	(2)	(3)	(4)	(5)	(6)
WEDGE*FOR_OFFSHORE					−1.017***	−1.105***
					(0.325)	(0.384)
STATE_INDIRECT						5.507*
						(3.018)
DOM_PRIVATE						1.330
						(2.736)
FOR_NONOFFSH						6.762*
						(3.755)
FOR_OFFSHORE						6.313*
						(3.565)
FIRM_SIZE	3.488***	3.242***	3.258***	3.356***	3.289***	3.454***
	(0.430)	(0.412)	(0.415)	(0.424)	(0.403)	(0.410)
ROA	−0.045	−0.032	−0.032	−0.020	−0.030	−0.041
	(0.077)	(0.076)	(0.076)	(0.074)	(0.074)	(0.081)
LEVERAGE	0.014	0.018	0.018	0.023	0.019	0.015
	(0.035)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Industry dummies	Yes	Yes	Yes	Yes	Yes	
Time dummies	Yes	Yes	Yes	Yes	Yes	
P-values of stat. tests:						
Breusch-Pagan for RE	0.000	0.000	0.000	0.000	0.000	0.000
Hausman test	0.723	0.521	0.731	0.396	0.659	0.527
Equality of coefficients on WEDGE* regressors				0.000	0.000	0.000
R2_overall	0.544	0.507	0.504	0.550	0.556	0.579
No. obs.	559	559	559	559	559	559

Note: The results are obtained using the RE estimator (supported by the Hausman test). The dependent variable is *Total_disclosure* in all models. Cluster-robust standard errors (clustering on firms) are in parentheses. Asterisks denote significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The equality of coefficients tests refer to the test that the coefficients on the interaction of *WEDGE* with shareholder identity variables used in a particular specification (e.g., *STATE*, *DOM_PRIVATE* and *FOREIGN*) are the same.

The table also reports the results of key specification tests – the Breusch and Pagan test for random effects and a robust version of the Hausman test. All the regressions we ran show the presence of unobserved heterogeneity across firms (the Breusch and Pagan test) as well as the consistency of the random-effects estimator (the Hausman test). Given the inefficiency of the fixed-effects estimator, we use the random-effects estimates as our benchmark results[10].

The estimates obtained for the simplest model in Column 1 show that the amount of disclosure is considerably lower in dual-class stock firms compared to their single-class stock counterparts as evidenced by the large and statistically significant coefficient on the variable *DUAL*. Quantitatively, the difference in the disclosure score between these two groups is 9.2% (the percentage interpretation is possible due to the dependent variable ranging from 0 to 100). This result lends strong support to Hypothesis H1.

[10] The fixed-effects estimator relies on the within variation in the variables, which is small or even absent for some corporate governance attributes. In our dataset, the within variance of the disclosure variables is only about half of the between variance; for some other variables, such as *DUAL* and *Firm_size*, it is even smaller. The FE results are available from the authors on request.

Regarding the control variables, it can be seen that larger firms tend to disclose more; this result will hold throughout our analysis. This effect of firm size has been found in most previous studies on disclosure (e.g., [7]). Industry effects are also important, as the respective dummies are jointly statistically significant at the 1% level (not reported). The same is true of the annual dummies. In contrast, neither leverage nor profitability has a significant impact on disclosure. This result will also be corroborated by the subsequent analysis[11].

The results in Column 2 suggest that the amount of disclosure is a decreasing function of the wedge between the voting and cash flow rights of the largest shareholder. Indeed, the negative and statistically significant coefficient on the variable *WEDGE* means that a 10-percentage point increase in the wedge reduces disclosure by approximately 4.7%. To substantiate this result, we split the wedge into two variables measuring the ownership and voting rights of the largest shareholder: *CASH_FLOW_RIGHTS* and *VOTING_RIGHTS* (Column 3). The coefficient on the former variable turns out to be positive, while the coefficient on the latter variable is negative. Therefore, disclosure increases with the ownership rights of the largest shareholder, but decreases with her control rights. Importantly, the absolute values of the two coefficients are similar, which supports the aggregation of variables *CASH_FLOW_RIGHTS* and *VOTING_RIGHTS* into a single variable *WEDGE*. The results reported in Columns 2 and 3 are thus fully consistent with Hypothesis H2.

Column 4 shows the results for the model where the effect of the wedge is allowed to vary with shareholder identity. The latter is represented by three variables – aggregate state ownership, domestic private ownership and aggregate foreign ownership (*STATE*, *DOM_PRIVATE* and *FOREIGN*). In this model, the effect of the wedge on disclosure is negative and statistically significant for domestic private ownership only; the coefficients on the other ownership categories lack statistical significance. From the perspective of Hypothesis H3, it is important to know whether or not the three coefficients are statistically different from each other. The null hypothesis that they are all equal is rejected at the 1% significance level. The pairwise differences are also statistically significant at least at the 10% level. These initial results lend support to Hypothesis H3.

In Column 5, we use a more disaggregated ownership typology (distinguishing between direct and indirect state ownership as well as between foreign offshore and non-offshore ownership) to test Hypotheses H3. The effect of the wedge on disclosure turns out to be negative and statistically significant for direct state ownership (at the 10% level), domestic private ownership (at the 1% level) and foreign offshore ownership (at the 1% level). It is insignificant for indirect ownership by the state and positive and statistically significant (at the 1% level) for foreign non-offshore ownership. The latter result implies that an increase in the wedge between ownership and control for a foreign main shareholder from a non-offshore jurisdiction leads to higher disclosure. This effect is statistically different from the estimated effects for all other groups of owners, at least at the 1% level. Most importantly, the null hypothesis that the five coefficients are equal is rejected at the 1% significance level. This lends support for Hypothesis H3 that emphasizes the role of shareholder identity.

Finally, in Column 6 we perform an additional test by adding shareholder identity dummy variables as separate controls. As already noted, these new variables account for possible direct effects of shareholder identity on corporate disclosure [14]. The key finding here is that the inclusion of additional controls does not change our main results except for those related to state ownership. In the latter case, the new estimates in Column 6 imply a negative effect of the wedge for firms where the largest shareholder is a state-controlled entity (indirect state ownership) rather than the state itself, as in Column 5[12].

An extra insight is provided by the results reported in Column 6. The coefficients on the shareholder identity dummy variables show whether, other things being equal, companies controlled by various types of large shareholders disclose more relative to companies directly controlled by the state (base category). Except for the dummy for domestic private owners, the estimated coefficients are all positive and statistically significant, suggesting that companies whose main shareholder is a state-related company or a foreign offshore/non-offshore company disclose more information compared to companies where the largest shareholder is represented by the state. However, all companies, except for those directly controlled by the state, turn out to be sensitive to the ownership-control wedge. Most interestingly, companies dominated by domestic private owners do not disclose more compared to state-owned companies yet are very sensitive to the wedge. While a similar effect of the wedge is observed for foreign offshore ownership, this category is associated with higher disclosure at the baseline. Finally, companies controlled by the state disclose less than those controlled by other types of owners. However, their disclosure practices are not sensitive to the ownership-control wedge. Overall, the results in Column 6 not only lend support

[11] The leverage and profitability are statistically insignificant and do not affect our key findings. This is true of both contemporaneous and lagged values of these variables. However, we keep them in the regressions to ensure the comparability of our models with those used in similar studies of corporate disclosure.

[12] The results reported above are robust to the inclusion of key corporate governance variables in the models, most importantly variables characterizing corporate boards (e.g., board size, the number of tiers, the share of non-executive directors, and the presence of an audit committee), cross-listing status and the quality of external audit as additional controls, and to the replacement of the dependent variable *Total_disclosure* with its three components, namely *Ownership_disclosure*, *Financial_disclosure* and *Board_manag_disclosure*. These additional results are available from the authors on request.

for Hypothesis H3 but also provide interesting nuances about the effects of various ownership types on corporate disclosure.

Discussion

This study provides strong evidence that corporate disclosure is related to the separation of ownership and control and that this relationship is influenced (moderated) by the identity of the largest shareholder. These results are broadly consistent with agency theory. Indeed, they are in line with the view that the separation of ownership and control induces the parties controlling the firm to opt for low disclosure standards, which helps them mask their consumption of private benefits (e.g., [4–5]). Moreover, the greater the wedge between ownership and control, the greater the incentive not to disclose information. Still, the most interesting results of our study relate to shareholder identity. One of our hypotheses – namely, that the effect of the ownership-control wedge (or, more broadly, of the separation of ownership and control) depends on shareholder identity – finds considerable support in the data, confirming the supposition by D. Aggarwal et al. [31].

Our analysis offers a number of additional insights. First, the negative effect of the wedge on disclosure is most pronounced when the largest shareholder is a domestic person or a foreign entity registered in an offshore jurisdiction. The former result can be linked to the evidence, particularly from the early 2000s, that domestic private ownership was not necessarily associated with better corporate governance and firm performance in Russia (e.g., [76]). The questionable legitimacy of the ownership structures that emerged during the privatization process may have resulted in high incentives for extracting private benefits and, correspondingly, low incentives for disclosure by the new private owners (e.g., [77]). The latter result (for offshore foreign ownership) can be explained by the fact that it simply masks domestic investors.

Second, the moderating effect of state ownership on the link between the wedge and disclosure turns out to be quite small. This result may be explained by more limited opportunities of both bureaucrats and managers to extract private benefits in government-owned firms compared to owners and managers in private firms. Interestingly, our findings for government ownership are at odds with those reported by G. Liu and J. Sun [2]. Indeed, they find lower disclosure quality among firms ultimately controlled by individuals compared to firms ultimately controlled by the state in China. Our results indicate a clear difference in terms of the effect on disclosure of direct and indirect government ownership, which seems to be in line with the argument by A. Cuervo-Cazurra and C. Li [78] stating that companies with indirect government ownership are more likely to behave as private firms.

Third, there is a clear difference between foreign owners from offshore and non-offshore jurisdictions. The former appear to increase the negative effect of the wedge on disclosure while the latter do not. This seems to be a new result in the literature. It may be related to the fact that foreign investor ownership is usually viewed as a factor contributing to better corporate governance in general and improved disclosure in particular (e.g., [79–80]). Such a positive effect on disclosure is especially pronounced for companies domiciled in emerging markets and for foreign investors coming from mature market economies that have better disclosure standards (foreign owners from non-offshore jurisdictions). In contrast, offshore foreign owners may simply mask domestic investors, who, as this study suggests, have lower incentives to disclose information about their companies. Moreover, there is anecdotal evidence suggesting that companies with offshore ownership were often involved in capital flight [81], implying no or low disclosure.

Conclusion

In this article, we studied the effect of the separation of ownership and control on corporate disclosure using a unique setting of exogenously created dual-class stock companies in Russia. We used a rich longitudinal dataset of Russian publicly traded companies compiled from the Standard & Poor's Transparency and Disclosure Index and the SKRIN database. We applied conventional methods of regression analysis – the pooled OLS, RE and FE estimators – to the data collected and used several specification tests and robustness checks to confirm the stability of our empirical results.

We found that the separation of ownership and control due to the issue of dual-class stock results in lower corporate disclosure. Disclosure also decreases with the wedge between the control and ownership rights of the largest shareholder (specifically, it increases with her ownership rights but decreases with her control rights). There is strong evidence that the type of controlling shareholder matters. The negative effect of the wedge is most pronounced when the largest shareholder is a domestic private person, either natural or legal, and is virtually absent for foreign shareholders from non-offshore jurisdictions. The state and state-related companies as well as foreign entities from offshore jurisdictions occupy an intermediate position.

Several caveats are due. First, we rely on data that only measure (a) total disclosure of (b) specific dimensions of company operations selected for the S&P index. While focusing on total disclosure is a sensible approach, especially in the context of emerging markets characterized by poor enforcement of and imperfect compliance with regulations, the bigger picture would still require separating voluntary disclosure from compliance with mandatory regulations. The drivers of the two may be different, as suggested by C. Arena et al. [40]. Moreover, as noted by S. Lim et al. [82], different types of disclosure, such as strategic and forward looking, financial and non-financial, etc., may be determined by different factors. While we provide evidence that our results are reasonably robust for the three components of total disclosure identified by S&P, we obviously cannot extend them to other types of disclosure, for example those related to CSR or ESG.

Second, while the Russian setting is attractive due to the exogenous creation of dual-class stock firms, there are some nuances in the rights attached to voting (common) and non-voting (preferred) shares. In general, they imply a deviation from the clean case where the cash-flow rights are identical across the two classes of stock while the voting rights differ. We assume that these nuances are of little importance and cannot significantly change our results, as suggested by previous studies of the voting premium in Russia (e.g., [41]).

Third, we do not explicitly address endogeneity concerns. Although we control for unobserved heterogeneity across firms using the RE estimator and have sufficient evidence that time-invariant omitted variables do not destroy our estimates (i.e., the Hausman test confirms that the unobserved heterogeneity is not correlated with the regressors so that the RE estimator is consistent and efficient), there are still concerns about the endogeneity of the identity of largest shareholders, which cannot be addressed in the present study (and, to our best knowledge, has not been convincingly addressed in previous studies).

Despite these limitations, we believe that our analysis offers a substantial contribution to the contemporary international literature on corporate governance and corporate disclosure, especially the part that focuses on the separation of ownership and control and the identity of the controlling owners. We also believe that our findings may be of interest not only to academics but also to regulators – for example, for tuning disclosure regulations in dual-class stock companies – as well as to investment professionals and other stock market participants for choosing companies for their investments.

Acknowledgements

Alexander Muravyev is grateful to the Moscow office of S&P and Yulia Kochetygova in particular for kindly providing the data on corporate transparency and disclosure in Russian companies. The usual caveat applies.

References

1. Smith E.D. The effect of the separation of ownership from control on accounting policy decisions. *The Accounting Review*. 1976;51(4):707-723.
2. Liu G., Sun J. Ultimate ownership structure and corporate disclosure quality: Evidence from China. *Managerial Finance*. 2010;36(5):452-467. https://doi.org/10.1108/03074351011039409
3. Ge X., Bilinski P., Kraft A. Institutional blockholders and voluntary disclosure. *European Accounting Review*. 2021;30(5):1013-1042. https://doi.org/10.1080/09638180.2021.1979418
4. Haw I M., Hu B., Hwang L S., et al. Ultimate ownership, income management, and legal and extralegal institutions. *Journal of Accounting Research*. 2004;42(2):423-462. https://doi.org/10.1111/j.1475-679X.2004.00144.x
5. Chen S.-S., Huang C.-W. Silence is not always golden: The effect of private benefits of control on voluntary disclosure. 2023. URL: https://ssrn.com/abstract=4443313 (accessed on 09.02.2024)
6. Jensen M.C., Meckling W.H. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*. 1976;3(4):305-360. https://doi.org/10.1016/0304-405X(76)90026-X
7. Allegrini M., Greco G. Corporate boards, audit committees and voluntary disclosure: Evidence from Italian listed companies. *Journal of Management & Governance*. 2013;17(1):187-216. https://doi.org/10.1007/s10997-011-9168-3
8. Jankensgård H. Between a rock and a hard place: New evidence on the relationship between ownership and voluntary disclosure. *International Review of Financial Analysis*. 2018;56:281-291. https://doi.org/10.1016/j.irfa.2017.09.009
9. Lepore L., Pisano S., Di Vaio A., et al. The myth of the 'good governance code': an analysis of the relationship between ownership structure and the comply-or-explain disclosure. *Corporate Governance: The International Journal of Business in Society*, 2018;18(5):809-838. https://doi.org/10.1108/CG-08-2017-0197
10. Hu Y.Y., Zhu Y., Tucker J. et al. Ownership influence and CSR disclosure in China, *Accounting Research Journal*. 2018;31(1):8-21. https://doi.org/10.1108/ARJ-01-2017-0011
11. Shleifer A., Vishny R.W. A survey of corporate governance. *Journal of Finance*. 1997;52(2):737-783. https://doi.org/10.1111/j.1540-6261.1997.tb04820.x
12. McCahery J.A., Sautner Z., Starks L.T. Behind the scenes: The corporate governance preferences of institutional investors. *The Journal of Finance*. 2016;71(6):2905-2932. https://doi.org/10.1111/jofi.12393
13. Villalonga B., Amit R. How are US family firms controlled? *The Review of Financial Studies*. 2009;*22*(8):3047-3091. https://doi.org/10.1093/rfs/hhn080
14. Khlif H., Ahmed K., Souissi M. Ownership structure and voluntary disclosure: A synthesis of empirical studies. *Australian Journal of Management*. 2017;42(3):376-403. https://doi.org/10.1177/0312896216641475
15. Masulis R.W., Wang C., Xie F. Agency problems at dual-class companies. *The Journal of Finance*. 2009;64(4):1697-1727. https://doi.org/10.1111/j.1540-6261.2009.01477.x
16. Gompers P.A., Ishii J., Metrick A. Extreme governance: An analysis of dual-class firms in

the United States. *Review of Financial Studies*. 2010;23(3):1051-1088. https://doi.org/10.1093/rfs/hhp024

17. Lee K.W. Corporate voluntary disclosure and the separation of cash flow rights from control rights. *Review of Quantitative Finance and Accounting*. 2007;28(4):393-416. https://doi.org/10.1007/s11156-007-0020-4
18. Li T., Zaiats N. Information environment and earnings management of dual-class firms around the world. *Journal of Banking & Finance*. 2017;74:1-23. https://doi.org/10.1016/j.jbankfin.2016.09.009
19. Palas R., Solomon D. The Quality of Earnings Information in Dual-Class Firms: Persistence and Predictability. *Journal of Law, Finance, and Accounting*. 2022;7(1):127-164. https://doi.org/10.1561/108.00000059
20. Amoako-Adu B., Baulkaran V., Smith B.F. Dual-class discount, and the channels of extraction of private benefits. *Advances in Financial Economics*. 2014;16:165-218. https://doi.org/10.1108/S1569-3732(2013)0000016006
21. Nguyen V.T., Xu L. The impact of dual-class structure on earnings management activities. *Journal of Business Finance & Accounting*. 2010;37(3-4):456-485. https://doi.org/10.1111/j.1468-5957.2010.02203.x
22. Cao X., Leng T., Goh J., et al. The innovation effect of dual-class shares: New evidence from US firms. *Economic Modelling*. 2020;91:347-357. https://doi.org/10.1016/j.econmod.2020.06.017
23. Adams R., Ferreira D. One share-one vote: The empirical evidence. *Review of Finance*. 2008;12(1):51-91. https://doi.org/10.1093/rof/rfn003
24. Li X., Jiao Y., Yu M.T., et al. Founders and the decision of Chinese dual-class IPOs in the US. *Pacific-Basin Finance Journal*. 2019;57(C):101017. https://doi.org/10.1016/j.pacfin.2018.04.009
25. Nüesch S. Dual-class shares, external financing needs, and firm performance. *Journal of Management & Governance*. 2016;20:525-551. https://doi.org/10.1007/s10997-015-9313-5
26. Baulkaran V. Management entrenchment and the valuation discount of dual-class firms. *The Quarterly Review of Economics and Finance*. 2014;54(1):70-81. https://doi.org/10.1016/j.qref.2013.08.001
27. McGuire S.T., Wang D., Wilson R.J. Dual-class ownership and tax avoidance. *The Accounting Review*. 2014;89(4):1487-1516. https://doi.org/10.2308/accr-50718
28. Irani R.M., Oesch D. Monitoring and corporate disclosure: Evidence from a natural experiment. *Journal of Financial Economics*. 2013;109(2):398-418. https://doi.org/10.1016/j.jfineco.2013.02.021
29. Solomon D., Palas R., Baranes A. The quality of information provided by dual-class firms. *American Business Law Journal*. 2020;57(3):443-486. https://doi.org/10.1111/ablj.12167
30. Palas R., Solomon D., Gafni D., et al. Does wedge size matter? Financial reporting quality and effective regulation of dual-class firms. *Finance Research Letters*. 2023;54:103774. https://doi.org/10.1016/j.frl.2023.103774
31. Aggarwal D., Eldar O., Hochberg Y.V., et al. The rise of dual-class stock IPOs. *Journal of Financial Economics*. 2022;144(1):122-153. https://doi.org/10.1016/j.jfineco.2021.12.012
32. Muravyev A., Berezinets I., Ilina Y. The structure of corporate boards and private benefits of control: Evidence from the Russian stock exchange. *International Review of Financial Analysis*. 2014;34:247-261. https://doi.org/10.1016/j.irfa.2014.03.008
33. Muravyev A., Telyatnikov N. Dual Class Stock Companies: Global Experience and Russian Practice. *Journal of Applied Economic Research*. 2024; 23(3):801-832. https://doi.org/10.15826/vestnik.2024.23.3.032
34. Hare P., Muravyev A. Privatization in Russia, In: Parker D., Saal D., eds. *International Handbook on Privatization*. Edward Elgar Publishing; 2003. https://doi.org/10.4337/9781781950951
35. Lim L. Dual-class versus single-class firms: information asymmetry. *Review of Quantitative Finance and Accounting*. 2016;46:763-791. https://doi.org/10.1007/s11156-014-0485-x
36. Banerjee S., Estrin S., Pal S. Corporate disclosure, compliance and consequences: evidence from Russia. *European Journal of Finance*. 2022;28(17):1770–1802. https://doi.org/10.1080/1351847X.2021.2007972
37. Grosman A. Mitigating financing constraints on investment: Ownership and transparency in Russia. *Journal of East European Management Studies*. 2022;27(3):434–461. https://doi.org/10.5771/0949-6181-2022-3-434
38. Muravyev A. Board Monitoring and Corporate Disclosure: The Role of the Institutional Environment and Firm-Level Governance. *Journal of Accounting in Emerging Economies*. 2024; forthcoming, https://doi.org/10.1108/JAEE-08-2023-0221
39. Berezinets I., Muravyev A. Disclosure and corporate governance: Evidence from Russian companies. *Russian Management Journal*. 2024; 22(2):193-222. https://doi.org/10.21638/spbu18.2024.203
40. Arena C., Bozzolan S., Imperatore C. The trade-off between mandatory and voluntary disclosure: Evidence from oil companies' risk reporting. *Journal*

Of Accounting, Auditing & Finance. 2021;38(4):986-1008. https://doi.org/10.1177/0148558X211025250

41. Muravyev A. Investor protection and the value of shares: Evidence from statutory rules governing variations of shareholders' class rights in an emerging market. *The Journal of Law, Economics, & Organization*. 2013;29(6):1344-1383. https://doi.org/10.1093/jleo/ews001
42. Cotter J., Lokman N., Najah M.M. Voluntary disclosure research: Which theory is relevant? *Journal of Theoretical Accounting Research.* 2011;6(2):77-95. https://doi.org/10.2139/ssrn.3470466
43. Zamil I.A., Ramakrishnan S., Jamal N.M., et al. Drivers of corporate voluntary disclosure: a systematic review. *Journal of Financial Reporting and Accounting.* 2023;21(2):232-267. https://doi.org/10.1108/JFRA-04-2021-0110
44. Tinaikar S. Voluntary disclosure and ownership structure: An analysis of dual-class firms. *Journal of Management & Governance.* 2014;18:373-417. https://doi.org/10.1007/s10997-012-9229-2
45. Lakhal F. Voluntary earnings disclosures and corporate governance: Evidence from France. *Review of Accounting and Finance*. 2005;4(3):64-85. https://doi.org/10.1108/eb043431
46. Garcia-Meca E., Sanchez-Ballesta J.P. The association of board independence and ownership concentration with voluntary disclosure: A meta-analysis. *European Accounting Review.* 2010;19(3):603-627. https://doi.org/10.1080/09638180.2010.496979
47. Morck R., Shleifer A., Vishny R.W. Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics.* 1988;20:293-315. https://doi.org/10.1016/0304-405X(88)90048-7
48. Forst A., Hettler B., Barniv R.R. Insider ownership and financial analysts' information environment: Evidence from dual-class firms. *Journal of Accounting, Auditing & Finance*. 2019;34(1):30-53. https://doi.org/10.1177/0148558X16670048
49. Alotaibi K.O., Hussainey K. Determinants of CSR disclosure quantity and quality: Evidence from non-financial listed firms in Saudi Arabia. *International Journal of Disclosure and Governance*. 2016;13(4):364-393. https://doi.org/10.1057/jdg.2016.2
50. Lan Y., Wang L., Zhang X. Determinants and features of voluntary disclosure in the Chinese stock market. *China Journal of Accounting Research*. 2013;6(4):265-285. https://doi.org/10.1016/j.cjar.2013.04.001
51. Amran A., Devi S.S. The impact of government and foreign affiliate influence on corporate social reporting: The case of Malaysia. *Managerial Auditing Journal.* 2008; 23(4):386-404. https://doi.org/10.1108/02686900810864327
52. Bona-Sánchez C., Perez-Aleman J., Santana-Martin D.J. Sustainability disclosure, dominant owners and earnings informativeness. *Research in International Business and Finance*. 2017;39(A):625-639. https://doi.org/10.1016/j.ribaf.2016.07.020
53. Bangert J., Myers L.A., Schmardebeck R. Disproportionate insider control and the informativeness of stock returns about future earnings. *SSRN Electronic Journal.* 2021. https://doi.org/10.2139/ssrn.3837651
54. Lobanova O., Barua A., Mishra S., et al. Earnings informativeness in dual-class firms: An empirical investigation of the earnings quality and the information environment. *Review of Accounting and Finance*. 2019;18(3):399-431. https://doi.org/10.1108/RAF-09-2017-0178
55. Lins K.V. Equity ownership and firm value in emerging markets. *Journal of Financial and Quantitative Analysis*. 2003;38(1):159-184. https://doi.org/10.2307/4126768
56. Hoi C.K., Robin A. Agency conflicts, controlling owner proximity, and firm value: An analysis of dual-class firms in the United States. *Corporate Governance: An International Review*. 2010;18(2):124-135. https://doi.org/10.1111/j.1467-8683.2010.00783.x
57. Cieslak K., Hamberg M., Vural D. Executive compensation disclosure, ownership concentration and dual-class firms: An analysis of Swedish data. *Journal of International Accounting, Auditing and Taxation*. 2021;45:100429. https://doi.org/10.1016/j.intaccaudtax.2021.100429
58. Standard & Poor's. Russian Transparency and Disclosure survey 2003: Positive changes in practices of Russian companies. *Standard & Poor's Governance Services*. 2003.
59. Patel S.A., Balic A., Bwakira L. Measuring transparency and disclosure at firm-level in emerging markets. *Emerging markets review*. 2002;3(4):325–337. https://doi.org/10.1016/S1566-0141(02)00040-7
60. Patel S.A., Dallas G.S. Transparency and disclosure: Overview of methodology and study results – United States. *SEIN Corporate Governance & Accountability eJournal*. 2002: 167766282. https://doi.org/10.2139/ssrn.422800
61. Liu Y., Valenti A., Chen Y.J. Corporate governance and information transparency in Taiwan's public firms: The moderating effect of family ownership. *Journal of Management & Organization*. 2016;22(5):662–679. https://doi.org/10.1017/jmo.2015.56
62. Black B.S., Love I., Rachinsky A. Corporate governance indices and firms' market values: Time series evidence from Russia. *Emerging Markets*

Review. 2006;7(4):361-379. https://doi.org/10.1016/j.ememar.2006.09.004

63. Enikolopov R., Petrova M., Stepanov S. Firm value in crisis: Effects of firm-level transparency and country-level institutions. *Journal of Banking & Finance*. 2014;46:72–84. https://doi.org/10.1016/j.jbankfin.2014.04.028
64. Muravyev A. Boards of directors in Russian publicly traded companies in 1998–2014: Structure, dynamics and performance effects. *Economic Systems*. 2017;41(1):5-25. https://doi.org/10.1016/j.ecosys.2016.12.001
65. Chernykh L. Ultimate ownership and control in Russia. *Journal of Financial Economics*. 2008;88(1):169-192. https://doi.org/10.1016/j.jfineco.2007.05.005
66. Iwasaki I., Mizobata S., Muravyev A. Ownership dynamics and firm performance in an emerging economy: a meta-analysis of the Russian literature. *Post-Communist Economies*. 2018;30(3):290-333. https://doi.org/10.1080/14631377.2018.1442036
67. Bueno G., Marcon R., Pruner-da-Silva A.L., et al. The role of the board in voluntary disclosure. *Corporate Governance: The International Journal of Business in Society*. 2018;18(5):886-910. https://doi.org/10.1108/CG-09-2017-0205
68. Gisbert A., Navallas B. The association between voluntary disclosure and corporate governance in the presence of severe agency conflicts. *Advances in Accounting*. 2013; 29(2):286-298. https://doi.org/10.1016/j.adiac.2013.07.001
69. Michelon G., Bozzolan S., Beretta S. Board monitoring and internal control system disclosure in different regulatory environments. *Journal of Applied Accounting Research*. 2015;16(1):138-164. https://doi.org/10.1108/JAAR-03-2012-0018
70. Glaum M., Schmidt P., Street D.L., et al. Compliance with IFRS 3-and IAS 36-required disclosures across 17 European countries: Company-and country-level determinants. *Accounting and Business Research*. 2013;43(3):163-204. https://doi.org/10.1080/00014788.2012.711131
71. Vural D. Disclosure practices by family firms: Evidence from Swedish publicly listed firms. *Accounting in Europe*. 2018;15(3):347-373. https://doi.org/10.1080/17449480.2018.1479531
72. Jensen M.C. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*. 1986;76(2):323-329.
73. Samaha K., Khlif H., Hussainey K. The impact of board and audit committee characteristics on voluntary disclosure: A meta-analysis. *Journal of International Accounting, Auditing and Taxation*. 2015;24:13-28. https://doi.org/10.1016/j.intaccaudtax.2014.11.001
74. Garanina T., Kim O. The relationship between CSR disclosure and accounting conservatism: The role of state ownership. *Journal of International Accounting, Auditing and Taxation*. 2023;50:100522. https://doi.org/10.1016/j.intaccaudtax.2023.100522
75. Kaiser B. RHAUSMAN: Stata module to perform a (cluster-) robust Hausman test. *Statistical Software Components*. 2015:117820761.
76. Estrin S., Hanousek J., Kočenda E., et al. The effects of privatization and ownership in transition economies. *Journal of Economic Literature*. 2009;47(3):699-728. https://doi.org/10.1257/jel.47.3.699
77. Black B., Kraakman R., Tarassova A. Russian privitization and corporate governance: What went wrong. *Stanford Law Review.* 1999;52(6):1731-1808. https://doi.org/10.2307/1229501
78. Cuervo-Cazurra A., Li C. State ownership and internationalization: The advantage and disadvantage of stateness. *Journal of World Business*. 2021;56(1):101112. https://doi.org/10.1016/j.jwb.2020.101112
79. Aggarwal R., Erel I., Ferreira M., et al. Does governance travel around the world? Evidence from institutional investors. *Journal of financial economics*. 2011;100(1):154-181. https://doi.org/10.1016/j.jfineco.2010.10.018
80. Liang J.W., Lin M.F., Chin C.L. Does foreign institutional ownership motivate firms in an emerging market to increase voluntary disclosure? Evidence from Taiwan. *Review of Quantitative Finance and Accounting*. 2012;39:55-76. https://doi.org/10.1007/s11156-011-0245-0
81. Mueller D.C., Peev E. Corporate governance and investment in Central and Eastern Europe. *Journal of Comparative Economics*. 2007;35(2):414-437. https://doi.org/10.1016/j.jce.2007.02.001
82. Lim S., Matolcsy Z., Chow D. The association between board composition and different types of voluntary disclosure. *European Accounting Review*. 2007;16(3):555-583. https://doi.org/10.1080/09638180701507155

Appendix/Supplementary material

A1. The Standard & Poor's Transparency and Disclosure survey in Russia

The Russian transparency and disclosure survey was launched by Standard & Poor's in 2002 to supplement the data on 13 Russian companies that were included in the S&P/IFCI 1200 (Emerging Markets) index. The survey used only publicly available information (from annual reports, corporate websites as well as reports to the regulator) and, therefore, a company's transparency score is different from its corporate governance score and cannot be interpreted as a measure of governance standards. The transparency score is just one of the key factors affecting a firm's attractiveness to investors and an important element of corporate governance.

The survey was run from 2002 to 2010. The number of firms studied varied from 42 in 2002 to 90 in 2010. These were mostly Russian blue-chips from the non-financial sector. The majority of them were traded on the Russian stock market or simultaneously in Russia and abroad. Only a handful of firms were only traded abroad (those registered abroad, but whose operations were predominantly in Russia).

The main criteria used by S&P to select the firms for the study were the size and liquidity of stocks. Some companies with relatively illiquid stocks but fluid markets for corporate bonds were also included in the early waves of the study[13].

S&P compiled an overall transparency and disclosure index as well as three sub-indices based on information about individual disclosures, whose number fluctuated somewhat between the waves due to methodological refinements[14]. The three sub-indices were:

- T&D ownership structure and shareholders rights;
- T&D financial and operational information;
- T&D board and management structure.

The methods of data collection and processing were similar across the waves of the study, albeit a minor change in the methodology occurred in 2004.

Because some of the items were irrelevant for certain companies (for example, single-class stock companies cannot disclose the rights attached to preferred (non-voting) shares), these items were excluded from the calculation of the overall index and its sub-indices for the respective companies with the appropriate adjustment of the weights for the remaining items.

[13] In particular, the 2004 companion book indicates that the survey includes "17 companies in the S&P/IFCG Index, as well as 33 of the other largest companies in Russia (List 1). We also included 10 companies with illiquid or closely held stocks, which have their ruble-denominated bonds first-tier listed on the Moscow Interbank Currency Exchange".

[14] In particular, the 2004 companion to the S&P data specifies, "As noted above, as a result of methodological adjustments, the direct comparison of scores from 2003 and 2004 surveys is not robust in the scientific sense".

A2. Additional information about the identification of key governance variables

1. Direct vs. indirect government ownership

These are identified in several steps. First, we look for matches between government structures and agencies that can have ownership stakes in firms according to Russian law (e.g., the Ministry of State Property, the Russian Federal Property Fund, regional governments and their agencies) and the list of shareholders of the companies sampled. Adding up the stakes of these entities in a given firm produces a measure of direct government ownership. Second, we look for matches between the main state-controlled holdings such as RAO UES, Svyazinvest and Gazprom and the list of shareholders in the companies sampled. Any matches add to our measure of indirect government ownership. Finally, we check the remaining shareholders in the sampled companies for their connection with the state via other firms. A shareholder is considered state-related (and its stake in the firm is added to indirect government ownership) if government structures and agencies have at least a 25% stake in it.

For all intermediate links between the state and the shareholders of the firms sampled, we keep the 25% threshold. However, the measure of indirect government ownership is based on the final link between the shareholder and the company. For example, if the state owns 45% of company A, company A owns 30% of company B, which in turn owns 49% of company C included in our sample, indirect government ownership in company C is estimated at the level of 49%.

2. Offshore vs. non-offshore foreign ownership

Foreign ownership is identified from the names of shareholders and their addresses. In the SKRIN database, the names and addresses of foreign shareholders are normally given in Latin letters, as compared to Cyrillic letters for national shareholders. Foreign legal entities also have specific abbreviations such as Ltd., GmbH, AS, AB, etc. For example, the largest shareholder of company Mechel (MTLR) in 2010 was "Dalewave Limited" registered at "Themistokli Dervi, 3, Julia House, P.C. 1066, Nicosia, Cyprus" – all this is written in Latin letters. We take advantage of this feature of the data to screen foreign shareholders. We additionally check for the country name in the address, which allows us to identify the country of origin for the main shareholders. An interesting fact that emerges from this exercise is that most foreign shareholders are legal entities registered in Cyprus (e.g., among the largest shareholders, 81.3% are Russian legal and physical persons, 10.2% are shareholders with addresses in Cyprus, 1.9% – in the US, 1.7% – in Sweden and 1.3% – in the Netherlands). We identify offshore jurisdictions based on the IMF study "Offshore Financial Centers: IMF Background Paper" (International Monetary Fund. 23 June 2000).

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

The authors declare no conflicts of interests.

The article **was submitted on** 06.06.2024; **approved after reviewing on** 08.07.2024; **accepted for publication on** 30.07.2024.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.26-37
JEL classification: M14, G34, M31

The Threshold Effect of Board Characteristics, Corporate Social Responsibility and Brand Value

Di Ke
Lecturer, School of Economics and Management, Civil Aviation University of China, Tianjin, China, dke@cauc.edu.cn, ORCID

Zhenxuan Liu
Lecturer, School of Economics and Management, Beijing Institute of Petrochemical Technology, Beijing, China, 18652358018@163.com, ORCID

Irina Ivashkovskaya
Professor, School of Finance, National Research University Higher School of Economics, Moscow, Russia, ivashkovskaja@hse.ru, ORCID

Yanfei Wu ✉
PhD student, School of Finance, National Research University Higher School of Economics, Moscow, Russia, yavu@hse.ru, ORCID

Leonid Grigoryev
Professor, School of World Economy, National Research University Higher School of Economics, Moscow, Russia, lgrigor1@yandex.ru, ORCID

Xiaoyu Li
Lecturer, School of Economics and Management,Civil Aviation University of China, Tianjin, China, lixiaoyu5290@163.com, ORCID

Abstract

Brand value remains a crucial element for listed companies striving to sustain competitiveness amid the double-cycle economic context. Using panel data from Chinese A-share listed companies spanning 2017–2021, this study employs a threshold effect model to probe into the boundary conditions of the complex relationship between corporate social responsibility (CSR) and brand value. It empirically investigates the role of board characteristics in shaping the brand value of listed companies through their involvement in CSR, considering the dimensions of board size and board shareholding ratio. The results reveal that a commitment to social responsibility enhances brand value up to a certain point. However, prolonged and extensive resource investment can divert the company's focus, leading to a detrimental impact on brand value. This manifests as a non-strict inverted U-shaped threshold effect between CSR and brand value. Furthermore, the study explores variations in board size and board shareholding ratio, uncovering that board members' perspectives on CSR commitment are subject to distinct constraints. This dynamic results in a non-linear, symmetric U-shaped relationship between CSR and brand value-initially negative and subsequently positive. The study explores whether board characteristics intervene in CSR decision-making and thus contribute to brand value, with a view to guiding listed companies' board governance practices and optimizing the path to brand value enhancement.

Keywords: board characteristics, corporate social responsibility, brand value, threshold effect

For citation: Ke D., Liu Z., Ivashkovskaya I., Wu Y., Grigoryev L., Li X. (2024) The Threshold Effect of Board Characteristics, Corporate Social Responsibility and Brand Value. *Journal of Corporate Finance Research.* 18(3): 26-37. https://doi.org/10.17323/j. jcfr.2073-0438.18.3.2024.26-37

Introduction

With the accelerated development of the new "double-cycle" paradigm, elevating open competition and establishing robust brands has emerged as the optimal strategy for Chinese enterprises to expand internationally and solidify their domestic presence. Brands have garnered significant attention from both corporate and academic spheres due to their potential to generate high value-added outcomes, fostering sustainable competitive advantages [1]. As a distinctive competitive strategy, Corporate Social Responsibility (CSR) holds the power to shape corporate reputation, accumulate ethical resources [2], and serve as a crucial tool for image-building and brand strength [3]. This, in turn, significantly enhances brand competitiveness, ultimately creating elevated brand value.

Nevertheless, the execution of social responsibility entails high costs, uncertain market feedback, and intertemporal benefits, leading companies to adopt a cautious investment approach [4]. Therefore, how the board of directors, as the central decision-making body, navigates the balance between benefits and risks becomes a pivotal factor influencing corporate social responsibility investments.

Despite the theoretical debate, the impact of CSR on brand value lacks a consistent linear or standard U-shaped or inverted U-shaped relationship in practice. Few scholars have delved into the exploration of potentially more intricate relationships. Furthermore, findings on the directional influence of board size and board shareholding, the core variables of board characteristics, on CSR have been inconsistent [5].

Building upon this analysis, this paper aims to unravel the mechanisms of the relationship between CSR and brand value. It further investigates how this relationship evolves with variations in board size and board shareholding. The insights gained from addressing this question are anticipated to offer both theoretical and practical guidance for enterprises seeking to navigate the dynamic interplay between social responsibility investments and brand value enhancement.

Literature review and hypothesis development

Corporate social responsibility and brand value

Studies indicate the potential for two divergent outcomes in the relationship between Corporate Social Responsibility (CSR) and brand value, namely the "facilitating effect" and the "inhibiting effect". Some scholars contend that CSR, as an indicator of corporate strength [6], can effectively enhance corporate reputation [7] and positively influence the enhancement of corporate brand value. Firstly, proactive fulfillment of social responsibility enables enterprises to cultivate unique emotional connections with consumers. This fosters consumer identification, trust-building, and loyalty formation [8], all of which contribute to feedback loops reinforcing brand value. Secondly, CSR aids in establishing, maintaining, and consolidating political affiliations [9], optimizing corporate relationships with governmental entities, and securing additional resources crucial for brand value enhancement. Lastly, by disclosing social responsibility information, enterprises diversify investor risks [10], making it easier to secure financing at a lower cost, thus reducing the cost of capital. This, in turn, enhances brand competitiveness [11] and ultimately contributes to the elevation of brand value. Notably, companies with tarnished reputations may even use robust social responsibility performance to rebuild their corporate image, mitigating consumer boycotts and allowing their brand value to rebound [12].

In contrast, opposing viewpoints suggest that CSR may inhibit brand value growth or even lead to its decline. Firstly, in line with the zero-sum game concept, CSR could consume various limited corporate resources that could otherwise be employed to enhance brand value. This division of focus may hinder the enterprise's ability to concentrate on building an outstanding brand [13]. Secondly, if a company only assumes social responsibility within its immediate business scope, stakeholders may question its commitment to eliminating negative externalities from its primary business activities, potentially causing a detrimental effect on the brand and, consequently, brand value. Similarly, a lack of perceived sincerity and ethical responsibility, viewed instead as hypocritical behavior and a mere show for business gain [14], can lead to a decline in brand value. Moreover, the imperative to balance inputs with returns while meeting external stakeholder expectations of social responsibility fulfillment may drive companies to engage in pseudo-social responsibility behaviors under the guise of genuine commitment [15]. Once exposed, these behaviors can lead to a rapid deterioration of the brand reputation accumulated over time, significantly reducing brand value.

Board characteristics and corporate social responsibility

Board size and board shareholding ratio represent two key dimensions in the examination of board characteristics and stand out as contentious variables in the study of CSR investment impact. Thus, this paper will concentrate on exploring both board size and board shareholding ratio.

Board size and corporate social responsibility

The theories supporting the idea that board size promotes corporate social responsibility (CSR) highlight several key aspects. Firstly, a larger board size facilitates the fulfillment of the board's monitoring function, reducing firm risks by curbing rent-seeking behaviors and potential abuses of power by management [16; 17]. This guidance encourages executives to commit to CSR and make decisions aligned with the company's long-term interests. Secondly, a larger board size, representing diverse stakeholders, fosters inclusive decision-making. This approach aims for "common governance", allowing professionals with varied knowledge to contribute, resulting in more scientifically and reasonably informed de-

cisions [18; 19]. This enhances stakeholder protection and significantly improves CSR efficiency. Finally, a larger board size can prevent large shareholders from manipulating the board, thereby deterring fraudulent behavior of internal managers and promoting better CSR fulfillment [20].

Conversely, opposing views suggest that an excessively large board size may have negative implications for CSR. Firstly, it may lead to inefficient decision-making by reducing the firm's coordination and communication abilities, resulting in losses that outweigh the benefits of increased number of members [21; 22]. This inefficiency is not conducive to the disclosure of socially responsible information [23]. Secondly, a larger board size may encourage "free-riding" and speculative behavior among members, turning the board into a passive entity susceptible to control by majority shareholders or management. This can lead to decisions that prioritize these stakeholders over others, reducing CSR efficiency [22; 24]. Additionally, the increased size of the board brings forth new problems that require time and energy to resolve, diverting resources away from CSR and incurring additional costs [25], thus hindering the enhancement of social responsibility efficiency.

Board shareholding and corporate social responsibility

There is no consensus in previous studies regarding the impact of board shareholding on CSR. Some scholars assert that board shareholding positively contributes to CSR. Firstly, board shareholding can effectively curb opportunistic behavior, conserve corporate resources [26], and incentivize board members to prioritize the overall interests of the enterprise. This, in turn, leads to decisions that enhance the company's long-term performance, such as embracing CSR [27]. Secondly, higher board shareholdings enable effective monitoring and control of management, aligning the interests of the board with those of shareholders [28]. This alignment ensures clear shared goals within the firm, motivating the fulfillment of social responsibilities to safeguard the interests of all parties [29]. Finally, as firms gain competitive advantages through socially responsible actions like charitable donations, effective decision-making requires a higher level of commitment and effort from the company's directors. Increased board shareholding facilitates this process [30].

Conversely, scholars with opposing views argue that board ownership hinders corporate social responsibility. Firstly, based on the "managerial self-interest" hypothesis, a higher board shareholding level may lead to a more risk-averse board that resists engaging in the uncertain and delayed returns associated with CSR [31]. Secondly, a high board shareholding level prompts intensified executive supervision and the development of incentive systems, potentially motivating management to prioritize projects with higher returns over CSR initiatives [32]. Lastly, an excessively high board shareholding level may grant directors greater decision-making control, allowing decisions that favor personal short-term interests over the long-term interests of shareholders. This could lead to reluctance to undertake CSR, as it dilutes directors' interests in favor of other stakeholders [33].

While existing research results offer robust theoretical support for this paper, certain limitations need to be considered. Previous studies have predominantly focused on the relationship between board characteristics and CSR, or CSR and brand value, with limited exploration of the intricate interplay among the three factors. Additionally, the prevailing literature adopts a linear perspective, yet the polarized findings suggest that the relationship between board characteristics, CSR, and brand value is not straightforwardly linear but entails a complex non-linear nature. Consequently, this paper aims to address these gaps by introducing a threshold regression model to delve deeper into the nuanced relationship among board characteristics, CSR, and brand value.

Data and methodology

Sample selection

This study utilizes a sample of listed companies included in the World Brand Lab's list of China's 500 Most Valuable Brands spanning the years 2017 to 2021. The sample selection process is as follows: 1) identification of companies consistently present on the list throughout the five-year period; 2) exclusion of financial and insurance firms; 3) removal of samples with abnormal trading statuses; and 4) elimination of samples with missing values. Following these criteria, 111 listed companies with a total of 555 samples were ultimately included in the study. Financial data and corporate governance-related values were sourced from Cathay Pacific (CSMAR) and WIND databases, while brand value data were obtained from the official website of the World Brand Lab. The measurements and analysis were conducted using Stata 15.0 software.

Definition of variables

The dependent variable in this study is brand value, measured by the absolute value of the brand value data of A-share listed companies as per the rankings released by the World Brand Lab. The independent variable is CSR, defined based on the research findings of H. Shen et al. [34]. Comprehensive CSR performance is calculated through the equal-weighted average of government responsibility performance, employee responsibility performance, supplier responsibility performance, customer responsibility performance, financial institutions' responsibility performance, and social welfare responsibility performance.

The moderating variables encompass board of directors' characteristics, specifically two factors: board size and board shareholding. Board size is measured using the natural logarithm of the total number of board members, while board shareholding is determined by the ratio of the total number of shares held by the board to the overall shares. Control variables include firm size [35], book-to-market ratio [36], equity concentration [37], management shareholding [38], outstanding shareholding [39], leverage ratio [40], and operating income growth rate [41], as detailed in Table 1.

Table 1. Definition of variables

Variable category	Variable name	Variable symbol	Description of variables
Dependent Variable	Brand Value	BV	Logarithmic brand value
Independent Variable	Corporate Social Responsibility	CSR	(Government Responsibility Performance + Employee Responsibility Performance + Supplier Responsibility Performance + Customer Responsibility Performance + Financial Institution Responsibility Performance + Social Good Responsibility Performance)/6
Moderator Variables	Board size	BSize	Natural logarithm of total number of board members
	Board of Directors' shareholding	BStock	Ratio of total number of shares held by the Board of Directors to total number of shares
Control Variables	Enterprise size	Lnsize	Natural logarithm of the total number of employees in the enterprise
	Book-to-market ratio	BM	Ratio of total company assets to closing market capitalization
	Shareholding Concentration	CR	Shareholding of the largest shareholder
	Management Shareholding	Mown	Ratio of management's shareholding to total shares
	Percentage of Outstanding Shares	PSO	Total number of issued and outstanding shares of each class of shares of the listed company as a percentage of the company's total share capital on the appointed date
	Leverage Ratio	Lev	Total liabilities divided by total assets
	Revenue Growth Rate	Growth	Ratio of operating income growth to prior period operating income

Modeling

Ordinary panel regression model

This paper employs an ordinary panel regression model as the foundational framework. Taking into account that the influence of CSR on corporate brand value is not instantaneous but rather exhibits a certain time lag, and to mitigate potential endogeneity effects, this study follows the approach of W. Liang and H. Ge (2023) [42] by utilizing lagged one-period data for explanatory variables. The independent variables include corporate social responsibility, board of directors' characteristics (comprising the size of the board of directors and the board of directors' shareholding ratio), along with the interaction term of the two. The specific model is illustrated in equation (1):

$$\begin{aligned} BV_{\text{it}} &= a_0 + a_1 LnSize_{i,t\text{-}1} + a_2 BM_{i,t\text{-}1} + a_3 CR_{i,t\text{-}1} + \\ &+ a_4 \text{Mown}_{i,t\text{-}1} + a_5 PSO_{i,t\text{-}1} + a_6 \text{Lev}_{\text{i,t-1}} + \\ &+ a_7 \text{Growth}_{\text{i,}t\text{-}1} + b_1 CSR_{i,t\text{-}1} + b_2 BSize_{i,t\text{-}1} + \\ &+ b_3 BStock_{i,t\text{-}1} + b_4 CSR_{i,t\text{-}1} \times BSize_{i,t\text{-}1} + \\ &+ b_5 CSR_{i,t\text{-}1} \times BStock_{i,t\text{-}1} + e_{it} \end{aligned} , \quad (1)$$

where i and t denote the company and year respectively, a and b are the coefficients of variables, e_{it} is the random perturbation term, BV_{it} denotes the lagged one-period brand value, CSR denotes board size, $BSize_{i,\text{t-1}}$ denotes board size, $BStock_{i,t\text{-}1}$ denotes board shareholding ratio. $LnSize_{i,\text{t-1}}$ denotes the size of the firm, $BM_{i,\text{t-1}}$ denotes the book-to-market ratio, $CR_{i,t\text{-}1}$ denotes the firm's shareholding concentration, $Mown_{i,\text{t-1}}$ denotes the proportion of management shareholding, $PSO_{i,\text{t-1}}$ denotes the proportion of outstanding shares, $Lev_{i,\text{t-1}}$ denotes leverage, $Growth_{i,\text{t-1}}$ denotes the growth of operating income.

Threshold panel regression model

This paper proposes a hypothesis that, in the presence of differences in board characteristics, namely board size, board shareholding, and *CSR*, the relationship with brand value is not characterized by a simple linear pattern. Instead, it suggests the existence of a complex threshold effect. To investigate this issue, we employ the threshold panel regression model introduced by B. Hansen [43], setting the threshold value as γ. The threshold regression model is expressed in Equations (2)–(4), where all three models

consider *CSR* as the independent variable and brand value as the dependent variable. In Equation (2), *CSR* functions as the threshold variable; in Equation (3), board size serves as the threshold variable; and in Equation (4), the threshold variable is the board of directors' shareholding ratio.

$$BV_{it} = \mu_i + a_1 LnSize_{i,t-1} + a_2 BM_{i,t-1} + a_3 CR_{i,t-1} + a_4 Mown_{i,t-1} + a_5 PSO_{i,t-1} + a_6 Lev_{i,t-1} + a_7 Growth_{i,t-1} + b_1 CSR_{i,t-1} I(CSR_{i,t-1} \le \gamma_1) + b_2 CSR_{i,t-1} I(\gamma_1 < CSR_{i,t-1} \le \gamma_2) + \cdots\cdots + b_n CSR_{i,t-1} I(\gamma_{n-1} < CSR_{i,t-1} \le \gamma_n) + b_{n+1} CSR_{i,t-1} I(CSR_{i,t-1} \ge \gamma_n) + e_{it} \quad ; \quad (2)$$

$$BV_{it} = \mu_i + a_1 LnSize_{i,t-1} + a_2 BM_{i,t-1} + a_3 CR_{i,t-1} + a_4 Mown_{i,t-1} + a_5 PSO_{i,t-1} + a_6 Lev_{i,t-1} + a_7 Growth_{i,t-1} + b_1 CSR_{i,t-1} I(BSize_{i,t-1} \le \gamma_1) + b_2 CSR_{i,t-1} I(\gamma_1 < BSize_{i,t-1} \le \gamma_2) + \cdots\cdots + b_n CSR_{i,t-1} I(\gamma_{n-1} < BSize_{i,t-1} \le \gamma_n) + b_{n+1} CSR_{i,t-1} I(BSize_{i,t-1} \ge \gamma_n) + e_{it} \quad ; \quad (3)$$

$$BV_{it} = \mu_i + a_1 LnSize_{i,t-1} + a_2 BM_{i,t-1} + a_3 CR_{i,t-1} + a_4 Mown_{i,t-1} + a_5 PSO_{i,t-1} + a_6 Lev_{i,t-1} + a_7 Growth_{i,t-1} + b_1 CSR_{i,t-1} I(BStock_{i,t-1} \le \gamma_1) + b_2 CSR_{i,t-1} I(\gamma_1 < BStock_{i,t-1} \le \gamma_2) + \cdots\cdots + b_n CSR_{i,t-1} I(\gamma_{n-1} < BStock_{i,t-1} \le \gamma_n) + b_{n+1} CSR_{i,t-1} I(BStock_{i,t-1} \ge \gamma_n) + e_{it} \quad , \quad (4)$$

where μ_i denotes the firm's individual effect, $I(\cdot)$ denotes the exponential function, γ is the threshold to be estimated, and the rest of the variables are explained as in equation (1).

Empirical results and analysis

Analysis of the results of descriptive statistics

Table 2 provides the results of the descriptive statistical analysis for the main variables. Upon reviewing the table data, it is evident that the mean and standard deviation of CSR are 0.428 and 0.112, respectively. This indicates that the sample firms generally exhibit a low degree of social responsibility fulfillment, aligning with the prevailing perception among Chinese listed companies that view CSR as a costly investment. The mean and median of brand value are 5.684 and 5.681, respectively, with the maximum value reaching 8.428. This suggests substantial variations in brand value across the sample firms.

In regard to board characteristics, the mean and median of board size are 9.083 and 9, respectively, suggesting that the board size tends to hover around 9 persons for the majority of the sample firms. For board shareholding, the mean and median are 0.028 and 0, respectively, indicating that more than half of the sample firms have boards of directors that are not engaged in shareholding. The values of the other control variables fall within reasonable ranges, and there are no instances of extreme values in this study.

Table 2. Descriptive statistics of main variables

Variable	Mean	Median	Std	Min	Max
BV	5.684	5.681	1.058	2.287	8.428
CSR	0.428	0.404	0.112	0.236	1.135
Bsize	9.083	9	2.009	5	17
BStock	0.0280	0	0.0830	0	0.427
Lnsize	9.435	9.282	1.272	6.655	13.11
BM	1.827	1.171	2.236	0.0600	26.49
CR	0.377	0.360	0.158	0.0930	0.826
Mown	0.0110	0	0.0370	0	0.280
PSO	0.921	0.997	0.140	0.127	1
Lev	0.495	0.515	0.192	0.0740	1.290
Growth	0.110	0.0930	0.219	-0.693	1.519

Panel data regression results

Table 3 displays the regression outcomes for board characteristics, CSR, and brand value. In this study, the fixed effects model proves superior to the mixed least squares model. The preference for the fixed effects model is attributed to the mixed least squares method's lack of consideration for the time and cross-section dimensions in data processing. It merely expands the data to augment the sample size. Given the divergent ownership attributes and business scopes of the sample firms, inter-individual differences impact not only their social responsibility fulfillment but also their board characteristics. Primary evidence is found in cross-sectional variations. Initially, the Hausman test was conducted, yielding a p-value of 0.000, rejecting the original hypothesis and substantiating the application of the fixed effect model. Subsequently, a test for heteroskedasticity was executed, producing a p-value of 0.000, indicating the presence of heteroskedasticity. Consequently, the fixed effects model was estimated for heteroskedasticity robustness. The specific results are outlined in Table 3.

A comparison of columns (2) and (3) reveals identical coefficients for the explanatory variables, with the chi-square value escalating from 0.203 to 0.365. This signifies that the heteroskedasticity robust model offers an improved overall fit during estimation, enhancing accuracy compared to the model in column (2). In column (3), the coefficient for CSR is -4.161, significantly and negatively correlated at the 10% level. This implies that, when controlled for certain conditions, brand value decreases by 4.161 units with each unit increase in CSR. The coefficients for board size and board shareholding are both negative, with the former not being significant. Meanwhile, the latter reveals that the firm's brand value diminishes by 4.231 units for every unit increase in board shareholding. The interaction term between board size and CSR yields a coefficient of 1.574, indicating that board size positively moderates the relationship between CSR and brand value. The interaction term between board shareholding and CSR yields a coefficient of -0.948, signifying that higher board shareholding intensifies the negative impact of CSR on brand value. However, the moderating effect of both interactions is not deemed significant.

Table 3. Regression results for board characteristics, CSR and brand value

Variable	(1) Mixed least squares model	(2) Fixed effects model	(3) Heteroskedastic robust
LnSize	0.427*** (16.88)	0.314*** (4.21)	0.314*** (2.97)
BM	0.212** (1.69)	0.791*** (11.32)	0.791*** (8.21)
CR	0.613*** (3.10)	-0.530** (-1.72)	-0.530 (-1.47)
Mown	-8.777 (-1.39)	1.256 (0.39)	1.256 (0.71)
PSO	0.697*** (3.51)	0.395*** (4.16)	0.395*** (3.64)
Lev	0.001 (0.00)	-0.116 (-0.55)	-0.116 (-0.37)
Growth	0.299** (2.05)	0.154*** (2.74)	0.154** (2.47)
CSR	3.089 (1.06)	-4.161** (-2.16)	-4.161*(-1.94)
BSize	0.499 (0.83)	-0.583 (-1.48)	-0.583 (-1.17)
BStock	10.417 (1.41)	-4.231 (-1.08)	-4.231*(-1.69)
CSR_BSize	-1.493 (-1.12)	1.574** (1.78)	1.574 (1.59)
CSR_BStock	-6.608 (-1.07)	-0.948 (-0.22)	-0.948 (-0.28)
_cons	-0.376 (-0.28)	3.766*** (3.35)	3.766** (2.58)
R_squared	0.474	0.378	0.378
Adjusted *R_squared*	0.463	0.203	0.365
N	555	555	555
F-value	41.45***	22.32***	19.72***

Note: *, **, and *** are significant at the 10%, 5%, and 1% levels, respectively, with t-values in parentheses.

Threshold regression results

In this study, we investigate the threshold effect – specifically, the presence and quantity of thresholds – using Bootstrap repeated sampling (300 iterations). We derive the asymptotic distribution, p-value, and critical value of the F-statistic, and present the results in Table 4. Our findings indicate that the single and double thresholds in all three models are statistically significant, with only the triple threshold in Model II demonstrating significance. Consequently, our subsequent analysis focuses on a triple-threshold approach for Model II and a double-threshold model for Models III and IV, respectively. Subsequently, we test the threshold estimates, and the results are detailed in Table 5, showcasing the estimated thresholds alongside their corresponding 95% confidence intervals.

Table 4. Threshold effect test

Model	Dependent Variable	Independent Variable	Threshold Variables	Number of Thresholds	Critical Value				
					F-value	P-value	1%	5%	10%
Model II	*BV*	*CSR*	*CSR*	Single Threshold	17.932***	0.003	16.773	12.392	10.200
				Double Threshold	22.537**	0.013	23.428	18.324	14.479
				Triple Threshold	15.471**	0.030	22.551	14.466	11.586
Model III	*BV*	*CSR*	*BSize*	Single Threshold	12.954***	0.007	12.216	7.252	5.682
				Double Threshold	11.801*	0.090	15.521	13.289	11.467
				Triple Threshold	5.491	0.200	14.953	9.683	7.542
Model IV	*BV*	*CSR*	*BStock*	Single Threshold	20.806**	0.017	21.651	16.391	12.974
				Double Threshold	8.179*	0.100	17.395	9.994	8.165
				Triple Threshold	3.087	0.137	8.370	4.580	3.649

Note: 1) Critical values and p-values are results obtained from repeated self-sampling 300 times using Bootstrap; 2) ***, **, and * represent significant correlation at 1%, 5%, and 10% confidence levels, respectively.

Table 5. Estimated thresholds and confidence intervals

Model	Threshold Value	Estimated Value	95% Confidence Interval
Model II	Threshold I	0.352	(0.345,0.354)
	Threshold II	0.407	(0.404,0.462)
	Threshold III	0.460	(0.437,0.466)
Model III	Threshold I	1.869	(1.869,2.441)
	Threshold II	2.674	(2.602,2.674)
Model IV	Threshold I	0.000	(0.000,0.000)
	Threshold II	0.084	(0.000,0.388)

The results of the threshold panel regression are presented in Table 6, revealing significant interval effects across all three models. These effects are observed within the intervals defined by individual thresholds, indicating a complex and nonlinear relationship. The implications drawn from Table 6 are as follows:

The influence of CSR on brand value initially manifests as a positive and subsequently negative, non-strictly inverted U-shaped nonlinear relationship. Specifically, when CSR is below 0.352, the impact strength is 1.425 and passes the 1% significance level test, signifying a substantial role in enhancing brand value. As CSR increases beyond 0.352 but remains below 0.407, the impact coefficient decreases to 0.750, passing the 5% significance level test. This suggests that within this threshold interval, CSR maintains a positive effect on brand value, albeit displaying an inverted U-shaped non-linear relationship compared to the first threshold interval. The positive effect persists, but with diminishing marginal efficiency compared to the initial threshold interval. Once CSR exceeds 0.407 but remains below 0.460, its positive impact on brand value becomes statistically insignificant. When CSR surpasses 0.460, the impact coefficient becomes -0.011, indicating that CSR's impact on brand value within this fourth threshold interval begins to exhibit an inhibitory effect. However, this inhibitory effect is not statistically significant. This observation implies that the maximization of corporate social responsibility investment does not necessarily lead to optimal outcomes; rather, there exists an inverted U-shaped threshold effect.

Second, under the influence of the board size level, a non-strict U-shaped relationship manifests between CSR and brand value. Specifically, when the board size level drops below 1.869, the impact coefficient registers at -1.135 and successfully passes the 1% significance level test. This result signifies a noteworthy inhibitory effect of CSR on brand value within the initial threshold interval. Within the board size range of 1.869 to 2.674, the impact coefficient becomes -0.746 and passes the 1% significance level test, indicating a reduction in the negative effect of CSR on brand value in the second threshold interval. As the board size level surpasses 2.674, the impact coefficient becomes 0.022, suggesting that in the third threshold interval, CSR begins to exhibit a positive effect on brand value. However, this effect is not statistically significant. Consequently, a larger board size appears to be more favorable to brand value.

Third, influenced by the level of board of directors' shareholding, CSR and brand value demonstrate a non-strict U-shaped non-linear relationship. In the absence of board of directors' shareholding (ratio is 0), the impact coefficient is -1.241, passing the 1% significance level test. This indicates a significant inhibitory effect of CSR on brand value in the first threshold interval. When the board of directors' shareholding ratio ranges from 0 to 0.084, the impact coefficient becomes -0.639, passing the 1% significance level test. This implies a reduction in the negative effect of corporate social responsibility on brand value in the second threshold. The adverse impact of social responsibility on brand value has diminished. As the proportion of board of directors' shareholding exceeds 0.084, the impact coefficient turns positive at 0.360, signifying a positive influence of CSR on brand value within the third threshold interval. However, this effect is not statistically significant. Consequently, board shareholding can effectively contribute to the promotion of brand value.

Table 6. Parameter estimation results of the two-threshold model

Variable	Model II Coefficient Estimate	Model III Coefficient Estimate	Model IV Coefficient Estimate
LnSize	0.290*** (4.06)	0.335*** (4.56)	0.352*** (4.77)
BM	0.772*** (11.70)	0.801*** (11.76)	0.768*** (11.38)
CR	-0.484 (-1.64)	-0.594* (-1.96)	-0.595** (-1.98)
Mown	-3.148*** (-3.65)	-2.690*** (-3.06)	-2.964*** (-3.35)
PSO	0.353*** (3.89)	0.455*** (4.78)	0.340*** (3.65)
Lev	0.035 (0.17)	-0.223 (-1.07)	0.005 (0.03)
Growth	0.148*** (2.80)	0.175*** (3.24)	0.158*** (2.93)

Variable	Model II Coefficient Estimate	Model III Coefficient Estimate	Model IV Coefficient Estimate
CSR_1	1.425*** (3.65)	-1.135*** (-4.79)	-1.241*** (-5.25)
CSR_2	0.750** (2.31)	-0.746*** (-3.58)	-0.639*** (-3.04)
CSR_3	0.318 (1.11)	0.022 (0.07)	0.360 (0.81)
CSR_4	-0.011 (-0.05)		
Intercept Term	2.180*** (3.11)	2.306*** (3.24)	2.236*** (3.14)
F-value	30.14***	29.16***	29.69***
R^2	0.429	0.398	0.402

Note: 1) *, **, *** represent significant correlations at the 10%, 5%, and 1% levels, respectively; 2) t-values of coefficient significance tests under the heteroscedasticity setting are shown in parentheses; 3) p-values are the results of 300 repeated samples using Bootstrap.

Conclusions

This paper constructs a model to investigate the interactive effects of board characteristics and Corporate Social Responsibility (CSR) on brand value. It builds upon a comprehensive review of domestic and international literature, aiming to elucidate the intrinsic mechanism among these variables and elucidate the complex relationship between CSR and brand value.

Initially, the following conclusions are drawn employing three different models – mixed least squares, fixed effects, and heteroskedasticity robustness: CSR significantly inhibits its brand value; regression coefficients for board size and board shareholding exhibit negative trends with brand value, with board size coefficients being insignificant; and the interaction term coefficients for board size and CSR are positive, suggesting that board size positively moderates the relationship between CSR and brand value. Conversely, the interaction term coefficients for board shareholding and CSR are negative, indicating that a higher board shareholding level may result in a crowding-out effect on brand value.

However, results from the threshold panel model estimation reveal a non-linear relationship between board characteristics, CSR, and brand value. Firstly, CSR exhibits a non-strictly inverted U-shaped nonlinear relationship with brand value—initially positive and then negative. This is attributed to companies initially fulfilling social responsibility to enhance their reputation and brand value. Yet, as CSR investment intensifies, it may divert resources and lead to negative consumer perceptions, thus diminishing brand value.

Secondly, concerning board size differences, a non-strictly U-shaped threshold effect emerges between CSR and brand value – initially negative and then positive. Smaller board sizes increase the risk of internal fraud, causing reduced investment in CSR and brand value-related activities. Conversely, larger board sizes provide efficient human resources, fostering cautious decision-making in support of brand value to ensure stakeholder interests.

Lastly, in the context of board shareholding differences, the relationship between CSR and brand value also demonstrates a non-strictly U-shaped threshold effect—initially negative and then positive. Lower board shareholding ratios correlate with weak oversight and low social responsibility, hindering brand value. As board shareholding increases, directors align with shareholder interests, emphasizing long-term enterprise goals and strengthening supervision. This results in increased investment in activities that enhance brand value.

Theoretical contributions

This study makes several significant theoretical contributions. Firstly, we construct a research framework of "Board Characteristics – Corporate Social Responsibility (CSR) – Brand Value". Previous studies have focused on the impact of board characteristics on brand value [44] or the influence of social responsibility on brand value [45], neglecting the interactive effects of board characteristics and corporate social responsibility on brand value. This study not only elucidates the complexity of their interaction but also extends the research paradigm to the relationship between corporate social responsibility and brand value. Secondly, by introducing board characteris-

tics as an internal governance variable, we delineated the boundary conditions of the conflict between board characteristics and corporate social responsibility. Thirdly, this study resolves the contradiction in existing research regarding whether corporate social responsibility "promotes" or "constrains" the enhancement of brand value. For example, M. Salmones et al. (2005) [46] discover that businesses can cultivate public trust and reliance through social responsibility initiatives, providing a promising pathway to bolster their brand value. Conversely, M. Fabrizi et al. (2014) [4] contend that the considerable expenses linked to social responsibility efforts could diminish the resources necessary for brand value development, potentially resulting in its deterioration. This research enriches the literature by investigating the reciprocal relationship between CSR and brand value. The inconsistent conclusions from previous research may stem from the consideration of only linear relationships without accounting for the complex nonlinear relationship between CSR and brand value.

Practical contributions

Practical insights can be summarized as follows: Firstly, when facing resource constraints, enterprises should consider their own circumstances to judiciously allocate resources for social responsibility. This prevents the potential dilution of brand value resulting from excessive investment in corporate social responsibility. Secondly, assuming the total number of board members aligns with the overall scale of the enterprise, a larger board can contribute to more informed decision-making. This increased capacity enables greater attention to activities such as brand building that can yield long-term benefits. Therefore, enterprises should strategically determine the size of the board of directors to optimize overall corporate performance. Thirdly, the alignment of interests between directors and shareholders through board of directors' shareholding is advantageous. This alignment facilitates decision-making aimed at enhancing brand value, driven by a shared objective. Enterprises should establish a well-considered board shareholding plan, enhancing incentives for directors to promote the elevation of brand value. Additionally, this study encourages enterprises to redefine the concept of social responsibility, viewing the fulfillment of social responsibility more as an investment than a cost. This shift in perspective enables enterprises to engage in social responsibility practices more consistently, better safeguarding the interests of stakeholders, and yielding higher social benefits.

Limitations and future research

This study has several limitations. First, the data obtained only reflect results within the selected time period. The generalizability of the conclusions to subsequent years requires validation through empirical tests over a more extended period. Second, the moderating role of only two factors in the board of directors' characteristics – specifically, the size of the board and the proportion of shareholding – has been analyzed in the mechanism of CSR's impact on brand value. Future research should consider the influence of other variables related to board characteristics. Finally, this study is solely based on data from listed companies. To improve the conclusions' reliability, future research could extend to include data from non-listed companies, thus increasing sample diversity. In subsequent studies, it is advisable to explore the impact of additional variables related to board characteristics.

Funding

This project was supported by the Tianjin Municipal Education Commission Research Plan General Humanities and Social Sciences Project (2022SK127), Fundamental Research Funds for the Central Universities Program of Civil Aviation University of China (3122023QD34), Tianjin Philosophy Social Science Planning General Project (No. TJGL20-001) , and the China Scholarship Council.

References

1. Backhaus K., Steiner M., Lügger K. To invest, or not to invest, in brands? Drivers of brand relevance in B2B markets. *Industrial Marketing Management*. 2011;40(7):1082-1092. https://doi.org/10.1016/j.indmarman.2011.09.002
2. Baskentli S., Sen S., Du S., et al. Consumer reactions to corporate social responsibility: The role of CSR domains. *Journal of Business Research*. 2019;95:502-513. https://doi.org/10.1016/j.jbusres.2018.07.046
3. Carlini J., Grace D., France C., et al. The corporate social responsibility (CSR) employer brand process: integrative review and comprehensive model. *Journal of Marketing Management*. 2019;35(1-2):182-205. https://doi.org/10.1080/0267257X.2019.1569549
4. Fabrizi M., Mallin C., Michelon G. The role of CEO's personal incentives in driving corporate social responsibility. *Journal of Business Ethics*. 2014;124:311-326. https://doi.org/10.1007/s10551-013-1864-2
5. Bravo F., Reguera-Alvarado N. The effect of board of directors on R&D intensity: board tenure and multiple directorships. *R&D Management*. 2017;47(5):701-714. https://doi.org/10.1111/radm.12260
6. Ramchander S., Schwebach R.G., Staking K.I.M. The informational relevance of corporate social responsibility: Evidence from DS400 index reconstitutions. *Strategic management journal*. 2012;33(3):303-314. https://doi.org/10.1002/smj.952
7. Rothenhoefer L.M. The impact of CSR on corporate reputation perceptions of the public—A configurational multi-time, multi-source perspective. *Business ethics: A European review*. 2019;28(2):141-155. https://doi.org/10.1111/beer.12207

8. Yoo D., Lee J. The effects of corporate social responsibility (CSR) fit and CSR consistency on company evaluation: The role of CSR support. *Sustainability*. 2018;10(8):2956. https://doi.org/10.3390/su10082956
9. Wright P., Ferris S.P. Agency conflict and corporate strategy: The effect of divestment on corporate value. *Strategic management journal.* 1997;18(1):77-83.
10. Merton R. A Simple Model of Capital Market Equilibrium with Incomplete Information. *Journal of Finance.* 1987;42(3):483-510. https://doi.org/10.1111/j.1540-6261.1987.tb04565.x
11. Wenqi D., Khurshid A., Rauf A., et al. Government subsidies' influence on corporate social responsibility of private firms in a competitive environment. *Journal of Innovation & Knowledge*. 2022;7(2):100189. https://doi.org/10.1016/j.jik.2022.100189
12. Jin C.H., Lee J.Y. The halo effect of CSR activity: Types of CSR activity and negative information effects. *Sustainability.* 2019;11(7):2067. https://doi.org/10.3390/su11072067
13. Duarte Alonso A., Austin I.P. Entrepreneurial CSR, managerial role and firm resources: a case study approach. *Competitiveness Review.* 2018;28(4):368-385. https://doi.org/10.1108/CR-10-2016-0064
14. Christensen L.T., Morsing M., Thyssen O. Timely hypocrisy? Hypocrisy temporalities in CSR communication. *Journal of Business Research*. 2020;114:327-335. https://doi.org/10.1016/j.jbusres.2019.07.020
15. Andersen S.E., Høvring C.M. CSR stakeholder dialogue in disguise: Hypocrisy in story performances. *Journal of business research.* 2020;114:421-435. https://doi.org/10.1016/j.jbusres.2019.08.030
16. Huang Y.S., Wang C.J. Corporate governance and risk-taking of Chinese firms: The role of board size. *International Review of Economics & Finance.* 2015;37:96-113. https://doi.org/10.1016/j.iref.2014.11.016
17. Paniagua J., Rivelles R., Sapena J. Corporate governance and financial performance: The role of ownership and board structure. *Journal of Business Research*. 2018;89:229-234. https://doi.org/10.1016/j.jbusres.2018.01.060
18. Rahman M., Rodríguez-Serrano M.Á, Faroque A.R. Corporate environmentalism and brand value: A natural resource-based perspective. *Journal of Marketing Theory and Practice.* 2021;29(4):463-479. https://doi.org/10.1080/10696679.2021.1872387
19. Upadhyay A. Board size, firm risk, and equity discount. *Journal of Risk and Insurance.* 2015;82(3):571-599. https://doi.org/10.1111/jori.12033
20. Alabdullah T.T.Y., Ahmed E.R., Muneerali M. Effect of Board Size and Duality on Corporate Social Responsibility: What has Improved in Corporate Governance in Asia? *Journal of Accounting Science.* 2019;3(2):121-135. https://doi.org/10.21070/jas.v3i2.2810
21. Gambo E.-M.J., Bello B.A., Rimamshung S.A. Effect of board size, board composition and board meetings on financial performance of listed consumer goods in Nigeria. *International Business Research.* 2018;11(6):1-10. https://doi.org/10.5539/ibr.v11n6p1
22. Jensen M.C. The modern industrial revolution, exit, and the failure of internal control systems. *The Journal of Finance.* 1993;48(3):831-880. https://doi.org/10.1111/j.1540-6261.1993.tb04022.x
23. Yermack D. Higher market valuation of companies with a small board of directors. *Journal of financial economics.* 1996;40(2):185-211. https://doi.org/10.1016/0304-405X(95)00844-5
24. Elsayed K. Board size and corporate performance: The missing role of board leadership structure. *Journal of Management Governance.* 2011;15:415-446. https://doi.org/10.1007/s10997-009-9110-0
25. Mak Y.T., Kusnadi Y. Size really matters: Further evidence on the negative relationship between board size and firm value. *Pacific-Basin finance journal.* 2005;13(3):301-318. https://doi.org/10.1016/j.pacfin.2004.09.002
26. Datta D.K., Musteen M., Basuil D.A. Influence of managerial ownership and compensation structure on establishment mode choice: The moderating role of host country political risk. *Management International Review.* 2015;55(5):593-613. https://doi.org/10.1007/s11575-015-0250-y
27. Naseem T., Shahzad F., Asim G.A., et al. Corporate social responsibility engagement and firm performance in Asia Pacific: The role of enterprise risk management. *Corporate Social Responsibility Environmental Management.* 2020;27(2):501-513. https://doi.org/10.1002/csr.1815
28. Chahine S., Goergen M. Top management ties with board members: How they affect pay–performance sensitivity and IPO performance. *Journal of Corporate Finance.* 2014;27:99-115. https://doi.org/10.1016/j.jcorpfin.2014.04.007
29. Rahman H.U., Zahid M., Khan M. Corporate sustainability practices: a new perspective of linking board with firm performance. *Total Quality Management Business Excellence.* 2022;33(7-8):929-946. https://doi.org/10.1080/14783363.2021.1908826
30. Hayes R.M., Lemmon M., Qiu M. Stock options and managerial incentives for risk taking: Evidence from FAS 123R. *Journal of financial economics.*

2012;105(1):174-190. https://doi.org/10.1016/j.jfineco.2012.01.004

31. García-Sánchez I.-M., Hussain N., Martínez-Ferrero J. An empirical analysis of the complementarities and substitutions between effects of CEO ability and corporate governance on socially responsible performance. *Journal of Cleaner Production.* 2019;215**:**1288-1300. https://doi.org/10.1016/j.jclepro.2019.01.130
32. Peng W. Managerial Myopia and Corporate Social Responsibility Activities. *Frontiers in Business, Economics Management.* 2022;5(3):276-280. https://doi.org/10.54097/fbem.v5i3.2035
33. Ducassy I., Montandrau S. Corporate social performance, ownership structure, and corporate governance in France. *Research in International Business Finance.* 2015;34:383-396. https://doi.org/10.1016/j.ribaf.2015.02.002
34. Shen H., Wang L., Wan T. Can corporate social report and assurance be effective signals. *Audit Research*. 2011;(4):87–93. (in Chinese).
35. Lin R., Xie Z., Hao Y., et al. Improving high-tech enterprise innovation in big data environment: a combinative view of internal and external governance. *International Journal of Information Management.* 2020;50:575-585. https://doi.org/10.1016/j.ijinfomgt.2018.11.009
36. Kerin R.A., Sethuraman R. Exploring the brand value-shareholder value nexus for consumer goods companies. *Journal of the academy of Marketing Science.* 1998;(26):260-273. https://doi.org/10.1177/0092070398264001
37. Chen A.A., Cao H., Zhang D., et al. The impact of shareholding structure on firm investment: Evidence from Chinese listed companies. *Pacific-Basin Finance Journal.* 2013;25:85-100. https://doi.org/10.1016/j.pacfin.2013.08.002
38. Zhang Q., Wang X., Huo C., et al. A study on the optimal shareholding proportion of the controlling shareholders in the competitive mixed-ownership enterprises: Evidence from Chinese listed companies. *International Finance*. 2023;26(2):208-224. https://doi.org/10.1111/infi.12430
39. Liu Q., Tian G. Controlling shareholder, expropriations and firm's leverage decision: Evidence from Chinese Non-tradable share reform. *Journal of Corporate finance.* 2012;18(4):782-803. https://doi.org/10.1016/j.jcorpfin.2012.06.002
40. Nerantzidis M., Tzeremes P., Koutoupis A., et al. Exploring the black box: Board gender diversity and corporate social performance. *Finance Research Letters.* 2022;48:102987. https://doi.org/10.1016/j.frl.2022.102987
41. Zhang X.J. Conservative accounting and equity valuation. *Journal of accounting and economics.* 2000;29(1):125-149. https://doi.org/10.1016/S0165-4101(00)00016-1
42. Liang W., Ge H.H. Research on Corporate Social Responsibility Fulfillment, Growth Cycle and Financial Risk: Based on the Empirical Evidence of Listed Companies in Shanghai and Shenzhen. *Journal of Technical Economics & Management.* 2023;(11):76-81. (In Chinese).
43. Hansen B.E. Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of econometrics*. 1999;93(2):345-368. https://doi.org/10.1016/S0304-4076(99)00025-1
44. Ünlü U, Yagli I. Corporate governance and brand value. *European Journal of Business and Management.* 2016;8(15):65-73.
45. Melo T., Galan J.I. Effects of corporate social responsibility on brand value. *Journal of brand management*. 2011;18:423-437. https://doi.org/10.1057/bm.2010.54
46. Salmones M.M.G., Crespo A.H., Bosque I.R. Influence of corporate social responsibility on loyalty and valuation of services. *Journal of business ethics.* 2005;61:369-385. https://doi.org/10.1007/s10551-005-5841-2

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

The authors declare no conflicts of interests.

The article **was submitted on** 16.06.2024; **approved after reviewing on** 18.07.2024; **accepted for publication on** 12.08.2024.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.38-48
JEL classification: G12, G17, G32

Impact of ESG Rankings on the Credit Spreads of Corporate Bonds in Russia

Alexander Abramov
Candidate of Economic Sciences, Director, Laboratory for Analysis of Institutions and Financial Markets, Institute of Applied Economic Research, Russian Academy of National Economy and Public Administration, Moscow, Russia,
abramov-ae@ranepa.ru, ORCID

Maria Chernova ✉
Candidate of Economic Sciences, Senior Researcher, Laboratory for Analysis of Institutions and Financial Markets, Institute of Applied Economic Research, Russian Academy of National Economy and Public Administration, Moscow, Russia,
chernova-mi@ranepa.ru, ORCID

Anna Shcherbak
Master's in Economics and Finance, Institute of Economics, Mathematics and Information Technologies, Russian Academy of National Economy and Public Administration, Moscow, Russia,
ascherbak-18@edu.ranepa.ru, ORCID

Abstract

The article discusses the impact of corporate ESG activity on the cost of bond issues in the context of the growing interest in sustainable development in Russia. Using panel data models and the ESG rankings of the RAEX rating agency, we demonstrate the significant impact of sustainable performance indicators on credit yield spreads using a sample of 2,646 corporate bond issues of 328 manufacturing companies and 76 financial organizations between the second half of 2019 and the end of 2023. We employ unique data on the dynamics of ESG rankings for each of the components (E - environmental, S - social and G - governance) across a wide range of companies. The explanatory variables include characteristics of bonds and issuers as well as macroeconomic indicators. We show that companies moving up in the ESG ranking in both sectors of the economy reduce their cost of bond issues. ESG components have a uniform impact for manufacturing companies yet show a varying influence for financial organizations. High environmental and social indicators increase a required bond yield, while a high governance component reduces it. Investors value information transparency in both sectors. Real-sector companies place greater importance on environmental and social responsibility, despite the associated costs, while the financial sector often views it as unnecessary. Sustainable bonds enable the Russian economy to adopt the ESG agenda faster. Our findings assist bond issuers in calculating risk premiums more realistically and allow corporate bond investors to consider sustainable development when making investment decisions.

Keywords: ESG ranking, credit spreads, bonds, sustainable development, environmental performance, social performance, management component

For citation: Abramov A., Chernova M., Shcherbak A. (2024) Impact of ESG Rankings on the Credit Spreads of Corporate Bonds in Russia. *Journal of Corporate Finance Research.* 18(3): 38-48. https://doi.org/10.17323/j. jcfr.2073-0438.18.3.2024.38-48

Introduction

Today, companies are paying increasing attention to environmental, social and corporate governance issues. The adoption of the ESG (Environmental, Social, Governance) agenda entails both positive and negative implications for businesses, triggering animated discussions in the academic literature. The indicators and standards for evaluating the conformity of company operations with sustainable development principles, as well as ESG rating and ranking methods, are still often in the development and testing phases. As a result, different agencies can assign different rating scores to the same company. In this paper, we will consider not only whether the RAEX agency has included a corporate bond issuer in its ranking but also the company's position in the ranking based on the aggregated indicator and each individual component (E – environmental, S – social, G – governance).

There is no consensus in the academic literature dedicated to the empirical analysis of rankings and other quantitative indicators of ESG components regarding how compliance with sustainability standards influences companies' performance, measures of profitability, and bond and share risks, which in turn affect the efficiency of investment strategies. Some researchers argue that implementing sustainability practices and principles generally incurs certain costs and investments for companies. However, a wide range of studies indicate that sustainable development, far from being merely an added expense, offers companies numerous opportunities for growth, competitiveness, and long-term success, with the benefits of implementing ESG principles and standards often outweighing the potential additional costs.

The above factors highlight the relevance of empirical studies examining the relationship between companies' ESG compliance ranking and the yields of the financial instruments they issue. The contribution of this research to addressing these problems is as follows. First, we analyzed a large sample of bonds issued by 404 Russian companies from the second half of 2019 to 2023 and were the first to demonstrate that obtaining an ESG ranking from the RAEX agency brings a reduction in the yield premium, considering for issue parameters and liquidity in the stock market. Second, we substantiated the claim that higher ESG ranking for Russian companies correspond to lower credit spreads on corporate bonds, accounting for issuer-specific features and bond issue characteristics. Finally, our research revealed that, in the Russian financial market, the influence of ESG components differs between manufacturing companies and financial organizations.

The paper is structured as follows. First, we review academic papers that analyze the influence of ESG standards on the yield and credit spreads of corporate bonds and formulate hypotheses based on this review. Next, we describe the sample and research methodology. In the third section, we focus on testing the hypotheses regarding the influence of ESG rankings on bond credit spreads and explaining these findings using various samples of corporate bond issuers. The conclusions are presented in the last section.

Describing and Testing Academic Theories

The theoretical literature on the ESG activities of companies offers a variety of opinions about the latter's influence on bond yield spreads, with a lot of theories being advanced on this topic.

The first and most popular approach – *stakeholder theory* [1] – suggests that a company's active fulfillment of its environmental, social and governance obligations to society reduces moral and adverse selection risks by building trust-based relations with interested parties – the government, shareholders, creditors, suppliers, consumers and other stakeholders. According to this theory, the active adherence to ESG principles is in line with investors' ethical interests and leads to a reduction in the bond credit spread.

The hypothesis of a discount of corporate bond yield as a result of responsible financing is also proposed by *resource dependence theory* [2] advanced by J. Pfeffer and G. Salancik. This conception is based on the postulate that any managerial decision is aimed at providing resources for the company, including debt financing. To achieve this goal, companies strive to promote a good image among their investors.

However, alternative theories suggest otherwise. The active implementation of ESG principles by a company limits its access to debt financing and, in particular, bond loans. One such theory is the famous *agency theory (principal-agent problem)* [3], which asserts that company management participates in responsible financing for personal motives, such as concealing negative news about certain company activities, increasing managers' remuneration by getting bonus awards for allegedly finding promising funding targets, and creating a positive corporate image in the eyes of investors. Such behavior compromises the transparency of corporate information, tainting the corporate image in the eyes of investors. As a result, the latter demand an increased risk premium on bonds.

According to the *trade-off theory* [4], investments in ESG projects distract companies from core business activities, decreasing their paying capacity and competitive advantages. This results in an increase in the bond yield required by investors, incrementing the credit spread.

In view of the high cost of obtaining a sustainable development ranking from national rating agencies in Russia, only large companies disposing of the necessary resources tend to get it. In this case, investors have reasons to trust established firms, ignoring the principal-agent problem, which reduces the motivation for increasing the required bond yield. Such trust also negates the compromise effect in investing: investors have reasons to assume that the company makes investments in the ESG agenda without substantial detriment to its core business. Thus, one may conjecture that an active stance on sustainable development issues by Russian companies will decrease the yield spreads of their bond issues.

Empirical literature on the impact of a company's ESG activities on its bond yield spread considers, in particular, the impact on the company's access to financing, separately studying the influence of company environmental, social and governance activities in different papers.

For example, T. Schneider [5] showed that low environmental performance may be indicative of liability risks, which may potentially result in company bankruptcy and higher cost of placing bonds. P. Eichholtz et al. [6] and S. Polbennikov et al. [7] revealed that environmentally certified buildings and high overall ESG ratings are related to lower bond spreads. Thus, these studies show that high environmental performance may decrease the yield spread of corporate bonds.

S. Bhojraj and P. Sengupta [8] emphasized the influence of corporate governance mechanisms, which may be related to the alignment of company activities on the sustainable development approach, issuers' ratings and bond yields. They showed that companies with vast institutional property and strict external control by the board of directors get less expensive bond loans and higher ratings for their new bond issues.

Social projects implemented by issuers may exert a significant impact on their bond yield. In particular, W. Ge and M. Liu [9] and I. Oikonomou et al. [10] found that improved indicators of corporate social responsibility are related to lower yield spreads, which reflects the positive attitude of bond holders about indicators. C. Stellner et al. [11] showed that corporate social indicators are remunerated in the form of a lower bond yield only if they are in line with real environmental, social and country governance indicators. At the same time, H. Huang et al. [12] and K. Menz [13] revealed that the social responsibility of corporations has little influence on the credit spreads of their corporate bonds. This means that other factors, such as financial indicators and market conditions, may have a more significant impact.

International studies show that manufacturing companies and financial institutions invest in ESG in different ways. For example, manufacturing companies in China benefit greatly from investments based on ESG principles, obtaining higher investment returns and a lower credit risk (Lu et al., 2022) [14]. On the other hand, financial institutions, especially in the USA, offer a wide range of investment options related to sustainable development: from efficient investments to ESG-oriented share investment funds (J. Hill, 2020) [15]. There is a widespread belief that sustainable development practices have a positive impact on company effectiveness, including financial performance. Nevertheless, this impact is different in the manufacturing and banking sectors: sustainable development reporting has a positive effect on financial performance in the real economy yet a negative effect in the banking sector (A. Buallay, 2020) [16].

Russian economists are taking a growing interest in the influence of ESG components on corporate performance. For example, I. Ivashkovskaya and A. Mikhaylova [17] demonstrated that, in emerging countries, green bonds provide a discount on the required yield in comparison to non-targeted bonds, which may encourage responsible financing. Moreover, they showed that disclosure of sustainable development activity by Russian corporations makes their market value rise [18]. Russian researchers made similar conclusions for Asian markets [19] and BRICS countries [20] after analyzing the influence of ESG ratings on financial performance in these groups of countries. Nevertheless, in a study of the impact of corporate governance attributes on risk information disclosure in emerging countries, HSE economists found that companies pay less attention to institutional risks, including environmental risks, than to operational risks [21]. I. Ivashkovskaya and I. Frecautan [22] explored the relationship between the governance performance of companies in emerging capital markets and their access to targeted bond loans. They revealed the significant influence of a range of corporate governance indicators on the required yield for green bonds in 16 emerging markets. For example, from the standpoint of the institutional environment, a strong CEO and a smaller board of directors ensure higher yields on green bonds.

Although sustainable development efforts seem to have an indirect impact on bond yield spreads through various channels, further studies are necessary to fully understand the character of this relationship. The diversity of theories and research results makes the present paper particularly relevant in the emerging Russian market, where interest in sustainable development strategies is deepening among both market participants and the government.

The reviewed literature allows us to formulate hypotheses regarding the potential influence of ESG components on corporate bond yield spreads, with a preference for stakeholder theory and resource dependence theory, as these align more closely with the realities of the contemporary Russian securities market.

We shall test the following hypotheses:

Hypothesis 1. The presence of an ESG ranking reduces the credit spread of corporate bonds issued by Russian companies, taking into account issuer-specific features and bond issue characteristics.

Hypothesis 2. Higher ESG ranking of Russian companies correspond to lower corporate bond credit spreads, taking into account issuer-specific features and bond issue characteristics.

Hypothesis 3. The influence of ESG components bonds of the manufacturing companies and financial organizations is different.

Methodology and Data

Our sample included all corporate bonds in the Russian market except for the following issue categories: short-term bonds, structured bonds, bonds intended for qualified investors, and non-market and perpetual bonds according to the Cbonds classification. Illiquid bonds[1] were also eliminated. The resulting sample comprised 2,646 bond issues

[1] Bonds whose bid-ask-spread exceeded 500 b.p. within the considered period.

of 404 companies over the period from the second half of 2019 to the end of 2023. To test our hypotheses, we divided all bonds into the real and financial sectors: 1,191 issues of 328 manufacturing companies and 1,455 issues of 76 financial companies[2].

The potential difference in the impact of ESG activities of manufacturing and financial companies may be related to the fact that financial institutions inflict a relatively smaller damage on the environment. In addition, stakeholders of financial companies may have concerns that the latter chose a wrong investment area or suspect them of greenwashing, which on the contrary produces a negative impact on the cost of debt financing.

We selected the time interval based on RAEX's initiation of monthly ESG rankings for Russian companies in early 2021. For earlier data points, the rankings were recorded at their values as of January 2021. The RAEX rankings for each ESG component are used as a measure of a company's sustainable development efforts, as these rankings are the only ones updated monthly in the Russian market and so enable the tracking of ESG activity dynamics. A higher ESG ranking value indicates lower compliance with ESG principles. The number of companies included in the rankings varies from 68 to 160, depending on the period.

The impact of the presence of an ESG ranking on corporate bond risk was tested by means of a dummy variable indicating a company's presence in the ranking in the considered month. To check the sustainability of results and study the dynamics of each ESG ranking component, we selected two curtailed samples with just 449 issues of 67 manufacturing companies and 1,002 issues of 17 financial companies which are known to have ESG ratings. All companies that have never been assigned rankings were excluded from this sample. The remaining companies accounted for approximately 62.1% of the outstanding bonds in the original sample.

We selected the yield spread of corporate bond issues relative to government bond yields of corresponding duration (G-spread), averaged by month and sourced from the Cbonds database, as the dependent variable. The input data for analysis also included the companies' ESG performance metrics, along with several control variables, forming an unbalanced panel of monthly observations.

The classical factors of bond yield were taken as the control variables to ensure unbiased model estimates. These factors include issue indicators such as volume, liquidity, and the bid-ask spread as well as issuer indicators such as credit rating, size and age proxies. We also used a range of sector-specific factors. We employed ratio of long term debt to corporate assets for manufacturing companies and the ratio of outstanding bonds to assets for financial companies as proxies for debt sustaintability and coefficients of return on equity (ROE) and return on assets (ROA).

This model does not take into account the impact on credit spreads of government participation in the ownership structure of the considered companies. The reason is that, according to available information, the government owns a significant share in most companies with ESG rankings and that issuers have experienced problems in disclosing their ownership structure since 2022 due to anti-sanction measures. So, it is impossible to compile representative samples for each group of ownership structures on the basis of publicly available data and to evaluate this factor correctly in the model.

The complete list of regressors is presented in Table 1.

Table 1. Response variable and regressors

Variable	Value
Response variable	
G-spread	Mean value of the bond's G-spread during the preceding month, b.p.
Regressors (explanatory variables)	
Log(Volume)	Logarithm of the outstanding bond volume, bln rub.
Liquidity	Accrued bond turnover per month, % of the turnover volume
Volatility	Average bond volatility over the last four months, b.p.
BidAsk	Difference between bond quotations for purchase and sale based on the results of a trading session on all trading platforms, b.p.
Maturity	Number of days left to the maturity date, days
Age	Number of days since the date of bond placement, days
dummyESG	Dummy variable: 1 if the company has an ESG ranking by the RAEX rating group and 0 otherwise

[2] The financial sector comprises banking organizations, insurance companies, microfinance providers, development institutions, financial markets and other financial institutions.

Variable	Value
EXRA_E	E-component of the ESG ranking by the RAEX rating group
EXRA_S	S-component of the ESG ranking by the RAEX rating group
EXRA_G	G-component of the ESG ranking by the RAEX rating group
CrRate	Credit rating indicator that ranges from 17 (AAA) to 1 (B-), with 0 corresponding to no credit rating assigned by Russian rating agencies
Arang	Place number on the list of companies ranked by company asset value in ascending order
D/A*	Ratio of long-term debt to corporate assets
Sec/A*	Ratio of issued bonds, expressed as a monetary equivalent, to total assets
ROA*	Return on assets – ratio of net income to assets
ROE*	Return on equity – ratio of net income to shareholders' equity
Rate	Key interest rate of the Central Bank of the Russian Federation averaged over a month, %

Notes: * only for issues of real sector companies; ** only for issues of financial sector companies.

We chose the panel data model using the F-test, Hausman's test and the Breusch-Pagan test. After running all these tests on all the samples considered in this paper, we chose the fixed time effects model (within), taking into consideration the variability within each bond issue based on the deviation of the variables' values from their time-mean values.

The descriptive statistics of all the variables are presented in Appendix 1. An analysis of correlations between the variables shows some important specific features of the total sample as well as differences between observations from the real and financial sectors (Figures 1, 2). In this case we used the dummy variable of the presence of a ranking as a characteristic of company ESG activity.

Figure 1. Correlation matrices of variables for the total sample of Russian bonds in the real sector

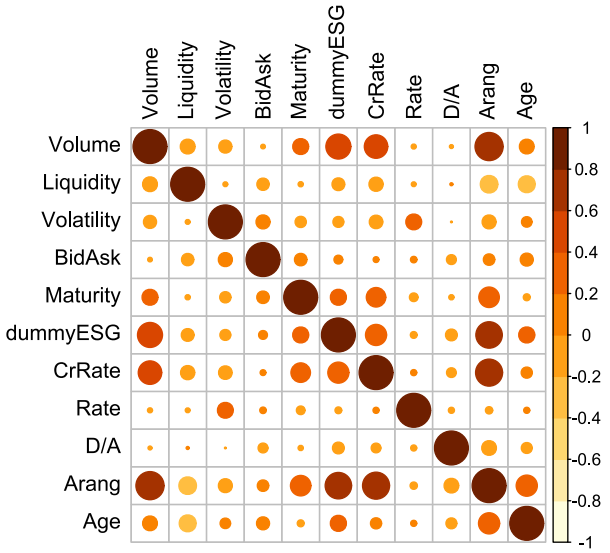
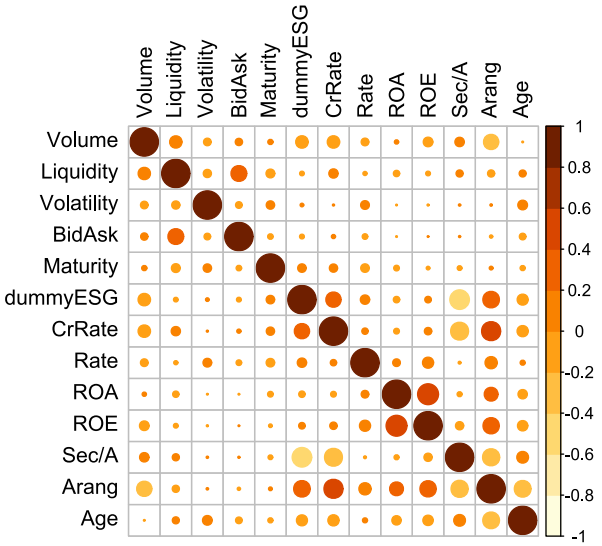


Figure 2. Correlation matrices of variables for the total sample of Russian bonds in the financial sector

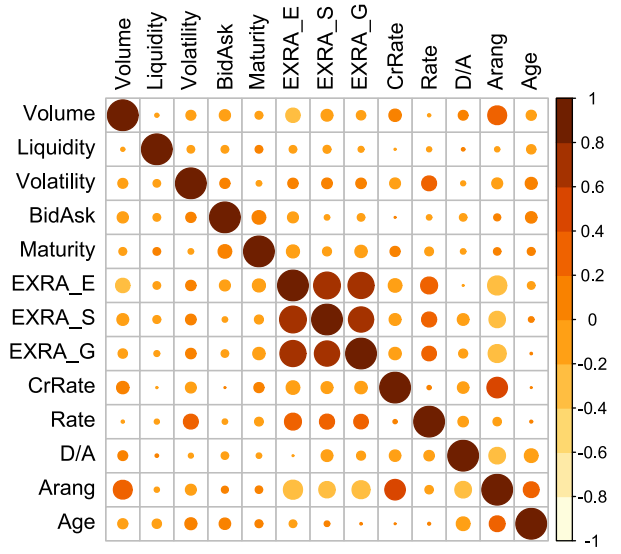


Manufacturing companies have a high correlation between the presence of an ESG ranking and the value of their assets. A possible reason is that large companies often obtain ESG rankings to assure investors of their competitive advantages. Such companies have no problems covering expenses related to their inclusion into the ranking. There is also a high correlation between the presence of an ESG ranking and the issue volume: companies with high issue volumes are interested in obtaining sustainable development rankings as an instrument for building trust-based relations with investors.

Financial companies have a weaker correlation between the presence of an ESG ranking and company size indicators. The reason may be that a substantial part of this sector consists of banks, for which the creation of competitive advantages, including sustainability, is important irrespective

of business size. This is possibly linked to the importance of conformity in the banking sector: the absence of a sustainable development ranking may exert a negative impact on the bank's image, so smaller credit institutions are also forced to follow the current trends of the sector.

Figure 3. Correlation matrices of variables for the sample of Russian bonds of real-sector companies with RAEX ESG rankings



Predictably, we detected a high correlation between the profitability indicators ROA and ROE. The proxy of debt sustainability for financial companies (ratio of corporate outstanding bonds to assets) correlates negatively with the credit rating. At the same time, its high correlation to the presence of an ESG ranking may seem surprising. This implies that companies with a relatively high debt load are less concerned with obtaining an assessment of their activity in the responsible financing area. This may be partially due to the fact that the main volume of issues was formed long before sustainable development trends emerged.

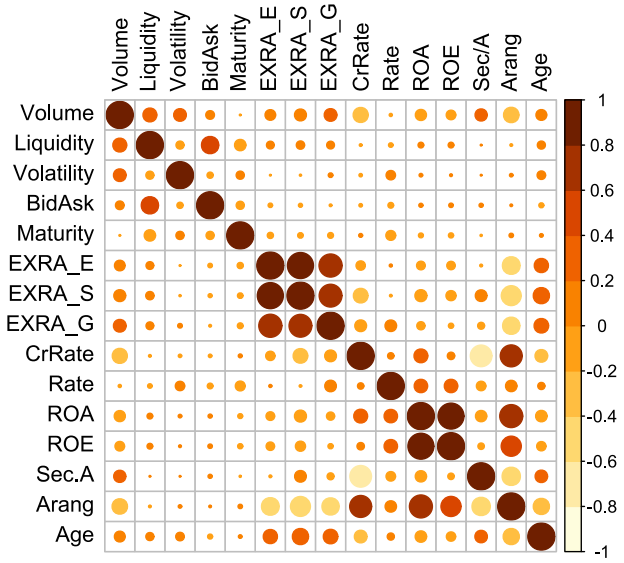
In the preliminary correlation analysis for the curtailed sample of bond issues consisting only of issuers with ESG rankings, ranking dynamics are measured for each component separately (Figures 3, 4).

The results show a number of significant changes in comparison to the total sample. In particular, for manufacturing companies the relationship between size and success in achieving sustainable development goals becomes unobvious. This indicates that small companies are on a par with larger ones in pursuing sustainable activities.

In the financial sector, the correlation between the environmental and social components turns out to be stronger than the correlation between each of these components and governance.

The weaker correlation between issue volume and assets for manufacturing companies makes it possible to include this data in one regression equation, unlike for the financial sector.

Figure 4. Correlation matrices of variables for the sample of Russian bonds of financial companies with RAEX ESG rankings



Results of Hypothesis Testing

The tests conducted to choose the type of panel data model also allowed us to select and evaluate within-models with fixed effects for each sector.

Table 2. Results of regression analysis for the total sample of Russian bonds

	Sample of manufacturing companies		Sample of financial companies	
	I	II	I	II
Volatility	0.877*** (0.011)	0.876*** (0.011)	0.311*** (0.015)	0.313*** (0.015)
BidAsk	0.298*** (0.050)	0.264*** (0.050)	0.504 *** (0.069)	0.525*** (0.069)
Maturity	-0.104*** (0.005)	-0.106*** (0.006)	-0.084*** (0.012)	-0.0859*** (0.011)
Age	-0.005 (0.004)	-0.005 (0.004)	-0.004 (0.005)	-0.004 (0.005)

	Sample of manufacturing companies		Sample of financial companies	
	I	II	I	II
dummyESG	-13.915* (8.070)	-14.067* (8.074)	-186.970*** (9.815)	-176.590*** (9.906)
CrRate	29.358* (16.407)		-1.423 (9.975)	
D/A	79.208*** (14.333)	83.494*** (14.333)		
Arang	-0.002*** (0.0002)	-0.002*** (0.0002)	-0.006* (0.002)	-0.008*** (0.002)
ROE			-483.031 (30.047)	
ROA				-1242.601*** (284.75)
Rate	12.327*** (0.600)	12.263*** (0.601)	-8.712*** (0.992)	-10.724*** (0.997)
R^2	0.2543	0.2534	0.0836	0.0703
Adj. R^2	0.2191	0.2181	0.0784	0.0654

Notes: the standard deviation of coefficient estimates is given in parentheses; coefficient significance levels: * p <0.1, ** p <0.05, *** p <0.01.

The negative sign of the coefficient estimates of the ranking presence dummy shows that both manufacturing and financial companies which have obtained ESG ranking tend to have lower required yields on bond-secured loans; moreover, this influence is stronger for financial companies. This may be due to the aforementioned sustainable development trends that are particularly characteristic of the banking sector where all market participants strive to match the expectations of the unified market of customers.

Obtaining an estimate of a company's sustainable development activities from a rating agency allows investors to grant a "discount" on its bonds, supporting stakeholder theory. This may be attributed to increased transparency in the company's operations. Companies with higher disclosure ratings across different ESG components generally experience lower credit spreads. High-quality ESG rankings help reduce the impact of information asymmetry, in terms of both the volume and the quality of information. This non-financial business metric complements the data provided by financial statements, offering stakeholders a more comprehensive understanding of the company's overall standing.

Furthermore, sustainable development indicators help to mitigate corporate financial risk. A company's interest in obtaining sustainable development ratings indicates its orientation towards addressing social issues alongside profit generation. This focus helps build a positive relations with investors, potentially leading to an "insurance effect" [23]. Even in challenging market conditions or during temporary setbacks, a strong corporate image can help mitigate financial losses, as stakeholders' confidence in the company remains intact.

The results obtained also highlight notable factors influencing bonds in the Russian debt financing market. The model estimates indicate the significance of all control variables, except for the time a bond circulates in the market. The sign of the liquidity indicator, represented by the bid-ask spread, demonstrates that bonds with lower liquidity risk are more popular: domestic investors tend to avoid instruments with low liquidity. The volatility of the yield spread serves as a risk indicator, prompting investors to demand a risk premium due to income uncertainty. Additionally, as the bond's maturity date approaches, the yield spread increases, suggesting that investors in the current Russian securities market prefer shorter-dated bonds due to elevated uncertainty. A positive effect from debt sustainability suggests that investors favor bonds from companies that are more resilient to default risk. The results for credit ratings are mixed, most likely because high-yield bonds were not set apart in this sample. Company size has an inverse relationship with bond yield spreads, confirming that investors favor established companies.

In the financial sector, profitability indicators are clearly important for investors, with return on assets having a stronger impact on bond yield spreads. These metrics provide stakeholders with a deeper understanding of how effectively corporate management generates profits using the company's limited resources.

The conclusions regarding the key interest rate, the main macroeconomic indicator in this model, are particularly interesting. Typically, an increase in the key rate results in a corresponding rise in nominal bond rates. According to classical theory, this should raise credit risks due to higher debt financing costs for credit institutions, thus widening

yield spreads. However, the regression analysis revealed the opposite effect for financial companies. This could be because the key rate increases observed during the study period enabled banks to significantly raise rates for credit products, thereby enhancing their financial stability without substantially increasing credit risks.

The obtained determination coefficients show that the explanatory power of the financial companies' sample is lower than that of manufacturing companies. This may be attributed to non-market factors affecting financial sector bonds, such as reputation, customer loyalty, and popularity. However, excluding Sberbank bonds from the sample (of which they constitute the greater part) improves the model's forecasting ability.

Table 3 provides model estimates to test the hypothesis of a significant relationship between a company's bond yield and its ESG activity, using a sample of companies with an ESG ranking at the time of observation.

Table 3. Results of the regression analysis for the sample of Russian bonds issued by companies with RAEX ESG rankings

	Manufacturing companies			Financial institutions		
	I	II	III	I	II	III
Volatility	0.824*** (0.017)	0.824*** (0.017)	0.823*** (0.017)	0.362*** (0.019)	0.367*** (0.020)	0.366*** (0.019)
BidAsk	0.062** (0.029)	0.059** (0.026)	0.057*** (0.048)	0.503*** (0.084)	0.501*** (0.084)	0.526*** (0.085)
Maturity	-0.049*** (0.006)	-0.049*** (0.006)	-0.048*** (0.006)	-0.194*** (0.014)	-0.138*** (0.014)	-0.138*** (0.014)
EXRA_E	0.381*** (0.110)			-0.810*** (0.262)		
EXRA_S		0.273*** (0.107)			-0.791*** (0.236)	
EXRA_G			0.276*** (0.098)			0.122** (0.061)
Rate	6.447*** (0.616)	6.558*** (0.614)	6.615*** (0.612)	-10.188*** (1.180)	-7.854*** (1.241)	-7.343*** (1.252)
D/A	30.632* (18.589)	27.193* (17.561)	30.198* (18.261)			
Arang	-0.008* (0.003)	-0.009** (0.005)	-0.010** (0.005)			-0.009*** (0.003)
Sec/A				5,938.583*** (620.005)		
ROA					-2,022.501*** (585.121)	-2,288.601*** (599.691)
ROE				-505.373*** (56.053)		
Age	-0.005** (0.002)	-0.005* (0.003)	-0.004 (0.003)	-0.005 (0.005)	-0.005 (0.005)	
R^2	0.2817	0.2811	0.2900	0.1054	0.0962	0.0960
Adj. R^2	0.2437	0.2431	0.2892	0.0814	0.0859	0.0857

Notes: the standard deviation of coefficient estimates is given in parentheses; coefficient significance levels: * p <0.1, ** p <0.05, *** p <0.01.

The regression analysis of the sample of manufacturing companies with RAEX ESG rankings revealed that success in sustainable development significantly influences bond yield spreads. For manufacturing companies, active ESG engagement does indeed lead to lower borrowing costs through bond-secured loans.

The first factor contributing to this "discount" on bond yields is information transparency. Companies with high ESG performance are less likely to hide negative news, resulting in more accurate and reliable disclosure of their operations.

A second reason is the loyalty of consumers who are sensitive to global challenges. By improving their ESG ratings, companies build a positive brand image and social reputation, attracting stakeholders to a relatively new concept in the Russian market. This drives up demand for the company's products and boosts profitability.

The third reason is that strong ESG performance can mitigate the debt agency problem. Shareholders seeking personal gain can take actions detrimental to creditors, such as under-investing, over-distributing dividends, or substituting assets. Companies with high ESG indicators, however, have lower costs associated with the debt agency problem. The governance component of ESG contributes to greater transparency, reducing the principal-agent problem between management and bondholders. Additionally, it is assumed that management in stable, responsible companies adheres to stronger ethical standards.

Thus, the analysis of the impact of ESG rankings on manufacturing companies' bond yields aligns with stakeholder theory. By using non-market mechanisms to enhance their reputation and operational transparency, companies raise investor confidence and encourage investment in their securities.

However, for financial companies, the regression analysis revealed a paradox: higher compliance with environmental and social principles actually increases the required bond yield, making bond-secured loans more expensive. In contrast, the governance component has a positive effect on reducing the cost of debt financing – financial companies with strong governance typically face lower required yields.

Given that 57.14% of bonds in the sample were issued by PJSC Sberbank, an additional regression analysis excluding Sberbank's bonds was performed, and the main conclusions remained consistent.

This paradox is supported by certain economic theories. R. Freeman [1] argued that the primary goal of a company is to increase stakeholder welfare, and so pursuing non-financial objectives may reduce efficiency. Other studies have shown that ESG initiatives can increase costs, leading to negative economic repercussions and reduced company value. A. Buallay [16], focusing on emerging markets, concluded that this phenomenon is particularly evident in the banking sector, where trust-based relationships with investors and improved ESG reporting are still being developed.

Descriptive statistics for RAEX ESG rankings of Russian companies in each sector, presented in Appendix 1, show relative homogeneity within sectors. In particular, the financial sector data does not indicate significant bias, outliers, or large variations in rankings.

However, unlike manufacturing firms, the financial sector demonstrates heterogeneity between ESG components, with the governance component significantly outperforming the others. Judging from the results of model estimation, this component is the key factor reducing bond-secured loan costs. In contrast, the underperforming components increase bond yield spreads, making loans more expensive for financial companies. These results suggest that bond yield reductions primarily benefit ESG leaders, which are mostly manufacturing firms. For companies in the early stages of responsible financing, particularly in the financial sector, ESG compliance may still represent additional costs rather than benefits.

Conclusions

Our quantitative analysis of corporate bond credit spread factors in the Russian market not only showed the expected influence of issuer characteristics, bond features, and macroeconomic indicators but also revealed the specific impact of sustainable development infrastructure on the cost of securing bond-financed loans. The majority of our hypotheses are supported by empirical data and align with theories explaining risk sources for corporate bonds. The impact of sustainable development varies between manufacturing and financial companies. High governance ranking reduce the required bond yield for both groups by mitigating the information asymmetry between businesses and investors. However, the environmental and social components of sustainable development have different effects: manufacturing companies benefit from a "discount" on loan costs for performing these activities, while financial companies, conversely, face a risk premium due to stakeholder skepticism.

The Russian market has seen a decline in information disclosure in recent years, forcing investors to rely on multiple sources when making decisions. Therefore, the finding that investors value enhanced transparency through ESG rankings, particularly regarding the governance component, is significant. Environmental and social responsibilities largely represent additional costs, which are important for high-emission manufacturing firms but are considered unnecessary for the financial sector. This observation aligns with trade-off theory: customers of banks and financial institutions believe ESG investments could be better used to improve customer service or reduce product costs. Supplementing this with agency theory, investors may perceive "green" initiatives in the financial sector as a way to mask underlying business challenges, such as shrinking net interest margins or rising credit risk, rather than genuine ESG commitments. In the realities of modern life banks try to withhold information on the paradoxical negative spread between loans and deposits, which may entail a drop in net interest income and an increase in the credit risk. Instead, they aim at informing stakeholders about the carbon neutrality of offices, which may be unsettling for experienced investors.

In this context, the issue of greenwashing cannot be ignored. Bernd Villhauer, a German scholar and entrepreneur, highlighted the prevalence of greenwashing in banking, noting that society is not yet willing to pay for "green finance". He asserts that "the idea of making pollution a privilege that can be paid for is unacceptable to society" [24].

Despite these challenges, bonds from companies engaged in sustainable development are a promising instrument for the Russian economy, which is in the early stages of ESG development. For investors, these financial instruments may serve as an alternative to charitable environmental programs, offering targeted investment in the most sustainable Russian companies with better returns.

References

1. Freeman R. E. Strategic management: A stakeholder approach. Cambridge university press. 2010.
2. Pfeffer J., Salancik G. External control of organizations – Resource dependence perspective. Organizational behavior 2. 2015;355-370.
3. Jensen M. C., Meckling W. H. Theory of the firm: Managerial behavior, agency costs and ownership structure. Corporate governance. 2019;77-132.
4. Myers S. C. Capital structure. *Journal of Economic perspectives*. 2001; 15(2):81-102.
5. Schneider T.E. Is environmental performance a determinant of bond pricing? Evidence from the US pulp and paper and chemical industries. *Contemporary Accounting Research*. 2011;28(5):1537-1561.
6. Eichholtz P. M. A., Holtermans R., Kok N., Yonder E. Environmental performance and the cost of debt: Evidence from commercial mortgages and REIT bonds. *Journal of Banking & Finance*. 2019;102(19):19-32.
7. Polbennikov S., Desclee A., Dynkin L., Maitra A. ESG ratings and performance of corporate bonds. *The Journal of Fixed Income*. 2016;26(1):21-41.
8. Bhojraj S., Sengupta P. Effect of corporate governance on bond ratings and yields: The role of institutional investors and outside directors. *The Journal of Business*. 2003;76(3):455-475.
9. Ge W., Liu M. Corporate social responsibility and the cost of corporate bonds. *Journal of Accounting and Public Policy*. 2015;34(6):597-624.
10. Oikonomou I., Brooks C., Pavelin S. The effects of corporate social performance on the cost of corporate debt and credit ratings. *Financial Review*. 2014;49(1):49-75.
11. Stellner C., Klein C., Zwergel B. Corporate social responsibility and Eurozone corporate bonds: The moderating role of country sustainability. *Journal of Banking & Finance*. 2015;59:538-549.
12. Huang H. H., Liu C., Sun L. Chemical releases and corporate cash holdings. *International Review of Financial Analysis*. 2019;64:159-173.
13. Menz K. M. Corporate social responsibility: Is it rewarded by the corporate bond market? A critical note. *Journal of business ethics*. 2010;96(1):117-134.
14. Lu. Wenpeng, Ming-Feng Wu, Ze-Jiong Zhou. Analysis of Financial Investment Strategy of Manufacturing Enterprises under ESG System. *Frontiers in Humanities and Social Sciences*. 2022;2(7):1-9.
15. Hill J. Environmental, Social and Governance (ESG) investing: A balanced analysis of the theory and practice of a sustainable portfolio. Academic Press. 2020.
16. Buallay A. Sustainability reporting and firm's performance: Comparative study between manufacturing and banking sectors. *International Journal of Productivity and Performance Management*. 2020;69(3):431-445.
17. Ivashkovskaya I., Mikhaylova A. Do investors pay yield premiums on green bonds? *Journal of Corporate Finance Research*. 2020;14(2):7-21.
18. Makeeva E. Yu., Popov K. A., Dikhtyar A. A., Sudakova A. A. et al. The relationship of board of directors analytics with ESG ratings and the value of Russian companies. *Russian Journal of Management*. 2022;20(4):498-523.
19. Martynova Y., Lukina I. Impact of ESG Ratings on Companies' Financial Performance: Evidence from Asia. *Journal of Corporate Finance Research*. 2023;17(3):116-128.
20. Strekalina A. et al. The Impact of ESG Ratings on Financial Performance of the Companies: Evidence from BRICS Countries. *Journal of Corporate Finance Research*. 2023;17(4):93-113.
21. Musa Uba Adamu. Ivashkovskaya I. Corporate governance and risk disclosure in emerging countries. *Journal of Corporate Finance Research*. 2021;15(4):5-17.
22. Frecautan I., Ivashkovskaya I. Is corporate governance important for green bond performance in emerging capital markets? *Eurasian Economic Review*.2024;1-38.
23. Minor D., Morgan J. CSR as reputation insurance: Primum non nocere. *California Management Review*. 2011;53(3):40-59.
24. Villhauer B. My bank is washing greener: The financial industry's eco-lies. 1 up. Hirzel. Stuttgart. 2023;1:161.

Appendix

Table 1. Descriptive statistics of variables

	Manufacturing companies					Financial companies				
	min	p25	median	p75	max	Min	p25	median	p75	max
G	0	101.1	202.4	444.9	5 719.4	-1112.1	0.01	110.2	707.9	5,890.7
Log (Volume)	7.6	20.7	22.3	23.0	25.9	12.6	19.7	20.9	22.3	25.1
Liquidity	0.00	0.00	0.01	0.03	0.96	0.0	0.00	0.00	0.01	1.00
Volatility	0.1	18.9	36.3	76.7	3,744.0	0.0	23.1	48.1	109.9	6,088.9
BidAsk	0.0	13.9	29.1	78.4	6,254.1	0.0	23.10	230.7	528.7	7,897.0
Maturity	-29.0	579.0	1,056.0	2,076.0	12,717.0	0.0	441.0	886.0	1,426.0	13,886.0
EXRA_E	1.0	15.0	30.0	44.0	158.0	1.0	38.0	46.0	56.0	146.0
EXRA_S	1.0	18.0	27.0	48.0	156.0	1.0	26.0	38.0	51.0	151.0
EXRA_G	1.0	8.0	28.0	48.0	154.0	1.0	19.0	32.0	36.0	159.0
CrRate	0.0	0.0	9.0	14.0	17.0	0.0	15.0	17.0	17.0	17.0
Rate	4.3	5.5	7.5	7.9	20.0	0.0	5.5	7.5	8.0	20.0
D/A	0.0	0.2	0.4	0.5	5.6					
Arang	0.0	8.56	100.3	535.1	26,089.3	0.0	7.5	20,859.0	41,165.5	49,267.1
Age	2.0	341.0	739.0	1,275.0	5,271.0	2.0	306.0	637.0	1,052.0	5,026.0
Sec/A						0.0	0.02	0.02	0.04	1.0
ROA						- 0.2	0.01	0.01	0.02	0.4
ROE						- 4.1	0.1	0.1	0,2	1.2

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

The authors declare no conflicts of interests.

The article **was submitted on** 08.06.2024; **approved after reviewing on** 10.07.2024; **accepted for publication on** 10.08.2024.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.49-61
JEL classification: G34, G39, O33

Do Financing Constraints Moderate the Effect of Digital Transformation on Corporate Cash Holdings? Evidence from China

Tingqian Pu
Lecturer, School of Economics and Finance, Guizhou University of Commerce, China,
tq_pu@outlook.com, ORCID

Abstract

This study examines the impact of digital transformation on corporate cash holdings using panel data from 3,920 Chinese listed companies over the period from 2012 to 2021. By constructing a digital transformation index based on corporate annual reports, we explore how these transformations affect firm-level cash reserves, with a particular focus on the moderating role of financing constraints. The results indicate that digital transformation generally leads to a reduction in corporate cash holdings, although this effect is significantly weakened in the presence of strong financing constraints. Heterogeneity analysis further reveals that the negative impact of digital transformation on cash holdings is more pronounced in firms with lower levels of digital transformation and in non-loss-making companies. These findings provide valuable insights for corporate financial management and policymaking, highlighting the strategic importance of optimizing cash management practices under varying degrees of financial constraints in the context of digital transformation.

Keywords: digital transformation, corporate cash holdings, financing constraints, machine learning, China

For citation: Pu T. (2024) Do Financing Constraints Moderate the Effect of Digital Transformation on Corporate Cash Holdings? Evidence from China. *Journal of Corporate Finance Research.* 18(3): 49-61. https://doi.org/10.17323/j. jcfr.2073-0438.18.3.2024.49-61

Introduction

With the advent of the digital age, enterprises have experienced a fundamental transformation in how they operate, innovate, and compete. Digital transformation, which involves integrating digital technologies into all aspects of business operations, has become a strategic imperative for firms striving to remain competitive and achieve sustainable growth [1]. While this shift has led to substantial research into the macroeconomic impacts of digital transformation [2–3], the microeconomic effects, particularly on corporate cash holdings, remain insufficiently explored. Addressing this gap can generate offer valuable insights for corporate financial management andpolicymakers.

In the context of China, the world's second-largest economy and an emerging hub for technological innovation, digital transformation has become a cornerstone of economic policy [4]. Initiatives such as "Made in China 2025" and the promotion of Industry 4.0 reflect the nation's commitment to fostering a digital economy. These policies aim not only to enhance productivity and innovation but also to drive a structural shift towards a more digital and resilient economic model. According to the "White Paper on China's Digital Economy Development" (2021) by the China Academy of Information and Communications Technology, the scale of China's digital economy has reached 39.2 trillion yuan (approximately 5.4 trillion USD), accounting for 38.6% of China's GDP [5]. The support from national strategies and the wealth of corporate data provide an ideal environment to examine the specific impact of digital transformation on corporate financial behaviors, particularly with regard to cash holdings.

Corporate cash holdings serve as a crucial financial buffer, enabling firms to navigate uncertainties, seize investment opportunities, and mitigate risks associated with external financing constraints [6]. Operating in the largest developing country, Chinese firms often hold substantial cash reserves due to high costs and limited financing channels [7]. Digital transformation, with its potential to enhance operational efficiency and reduce costs, could reduce the need for accumulating large cash reserves to ensure liquidity and financial flexibility. Investigating this dynamic within the Chinese context is of significant relevance to both academic researchers and corporate managers. Moreover, the moderating role of financing constraints adds another layer of complexity. Companies facing stringent financing constraints may encounter greater challenges in accessing capital, which impacts their cash-holding strategies. Understanding how financing constraints interact with digital transformation to impact cash holdings is of significant interest to corporate managers and policymakers.

Despite extensive research on digitalization, there is limited understanding of its financial implications, particularly in terms of how it affects cash management. This study aims to address this underexplored aspect by providing new insights into the financial implications of digital transformation. Utilizing panel data from 3,920 Chinese listed companies between 2012 and 2021, and employing machine learning techniques to extract digital transformation information from annual reports, this study offers empirical evidence on the intricate dynamics between digital transformation, cash holdings, and financial constraints. Our findings reveal that digital transformation generally reduces corporate cash holdings, indicating that the efficiencies and innovations brought about by digital initiatives enable firms to operate with less cash. However, the presence of financing constraints significantly mitigates this effect, suggesting that constrained firms may still hold higher cash reserves to guard against capital challenges. In addition, the heterogeneity test indicates that the negative impact of digital transformation on cash holdings is more pronounced in firms with a lower degree of digital transformation and in non-loss-making companies.

By elucidating these relationships, this paper contributes to the financial literature in two significant ways. First, by examining the relationship between digital transformation and corporate cash holdings through the lens of agency theory, this study enhances the understanding of how digital initiatives impact corporate financial behavior. This adds a new dimension to the agency theory framework, highlighting the role of digital transformation in mitigating agency problems and optimizing cash management strategies. Second, by exploring the moderating effect of financing constraints from the perspective of financial distress theory, our analysis reveals that firms facing greater financing constraints tend to hold higher cash reserves despite undergoing digital transformation, emphasizing the precautionary motive for cash holdings in a constrained financial environment. This insight enriches financial distress theory by integrating the impact of digital transformation on corporate liquidity management practices. At the same time, our findings on the effect of digital transformation on cash holdings provide valuable insights for corporate financial managers. By understanding how digital transformation influences cash reserves, companies can better strategize their financial management, optimize cash allocation, and improve liquidity management, particularly in firms with different levels of digital transformation or financial health. Furthermore, as China rapidly advances its digital transformation agenda, this study expands the literature on factors influencing corporate cash holdings and provides important grounds for developing digital policies and corporate financial strategies in emerging economies.

The remainder of this paper is organized as follows: second section presents the theoretical background and hypothesis development; third section details the research methodology; fourth section discusses the research findings and robustness checks; and the final section concludes the paper.

Theoretical Foundations and Hypothesis Development

Agency Theory

Agency theory provides a framework for understanding the relationship between principals (shareholders) and

agents (managers). Initially proposed by M. Jensen (1996) [8], the theory posits that due to differing objectives, there is often a divergence of interests between the two parties, leading to agency problems. These problems arise when managers do not always act in the best interest of shareholders. As discussed by S. Myers and N. Majluf (1984) [9], information asymmetry exacerbates agency problems by limiting shareholders' ability to monitor and control managerial behavior, a situation commonly referred to as the first-order agency problem.

In corporate finance, one of the central issues addressed by agency theory is the management of corporate resources, particularly cash holdings. Managers, when in control of excess cash, may be incentivized to retain it within the company rather than distribute it to shareholders. This retention enhances managerial discretion and reduces the need to seek external financing, which can be linked to managerial entrenchment. Entrenchment occurs when managers undertake actions that benefit themselves, such as investing in projects that enhance their personal power or job security, often at the expense of shareholder interests [8; 9].

Jensen's (1996) [8] free cash flow hypothesis further elaborates on how excess cash can lead to inefficient capital allocation. Managers may engage in empire-building or pursue personal perks, resulting in suboptimal investment decisions. Such opportunistic behavior not only deviates from the goal of maximizing shareholder wealth but can also lead to significant value destruction within the firm [10].

Moreover, as highlighted by A. Shleifer and R. Vishny (1997) [11], the degree to which these agency problems manifest themselves is influenced by a company's corporate governance structure. Firms with weak governance are more susceptible to managerial opportunism, exacerbating the inefficiencies associated with excess cash holdings [12]. This underscores the importance of aligning managerial incentives with shareholder interests through mechanisms such as performance-based compensation and rigorous oversight.

In summary, agency theory underscores the potential risks associated with excessive cash holdings, particularly in environments characterized by high information asymmetry and weak governance. These risks highlight the need for effective governance mechanisms to mitigate agency problems and ensure that cash management practices align with the goal of maximizing shareholder value.

Financial Distress Theory

Financial distress theory provides a critical perspective for understanding how financial constraints influence corporate behavior, particularly regarding cash holdings. This theory posits that firms facing severe financial distress may hold more cash as a precautionary measure [13]. Financially constrained companies have limited access to external capital markets, making them heavily reliant on internal funds to navigate periods of financial instability [14]. Consequently, these firms maintain higher cash reserves to ensure liquidity and financial flexibility.

In practice, financial distress in companies is a gradual process, typically evolving from a state of financial normalcy to a financial crisis. Many companies with financial distress experience a progressive deterioration in their financial condition, which ultimately leads to financial distress or bankruptcy. Cash flow is a crucial indicator for managers to assess the operational status of a company [13–14]; and the value of a company should be equal to the net present value of its expected cash flows. Previous studies have shown that if a company lacks sufficient cash to meet its debt obligations and cannot secure funds through other means, it will eventually face bankruptcy [15].

Digital Transformation

Recent studies have highlighted the transformative impact of digital technologies on firm performance and strategic operations. Scholars broadly define digital transformation as the integration of digital technologies – such as mobile computing, artificial intelligence, and cloud computing – into business processes to drive significant improvements in value creation and competitiveness [16]. This transformation is characterized by fundamental changes in organizational structures and processes, leading to enhanced productivity and innovative business models.

The process of digital transformation typically unfolds in three stages: digitization of information, the use of digital technologies to optimize existing processes, and strategic shifts in business models to leverage digital advancements [17]. Enterprises that adopt digital transformation strategies gain competitive advantages by improving production processes, reshaping organizational structures, and altering value-creation mechanisms [16–17].

Digital resources, such as big data and advanced technologies, are critical for enhancing firm performance and guiding management practices. These resources enable firms to better understand consumer demand, offer customized services, and strengthen supply chain relationships [18]. Furthermore, digital transformation facilitates business model innovation and efficiency improvements within platforms and ecosystems [19].

Despite these advancements, the impact of digital transformation on corporate finance remains underexplored. Researchers have primarily focused on operational improvements, overlooking how digital transformation influences financial behavior, particularly in areas like cash management and investment strategies. This gap underscores the need for further investigation into the financial consequences of digital transformation within firms.

Financing Constraints

In a perfect capital market, external and internal capital are completely interchangeable, meaning a firm's investment behavior is unaffected by its financial condition and is driven solely by its investment needs [20]. However, the reality of capital markets is far from perfect. Due to issues such as information asymmetry and agency problems, external financing costs are typically higher than internal financing costs, leading a firm's investment decisions to be

endogenous to its financing capacity. Firms generally have three primary channels for raising investment funds: retained earnings, debt financing, and equity financing [21]. Retained earnings are considered internal financing, while debt and equity represent external financing.

In practice, financial markets are not perfectly efficient, and there exists information asymmetry between external investors (such as creditors and shareholders) and corporate managers. Unlike managers, external investors do not have comprehensive knowledge of the firm's investment projects [22]. This information gap can lead to opportunistic behavior by managers, who may prioritize personal gain over the interests of external investors [23]. Although external fund providers can anticipate potential conflicts of interest with managers, the high costs of monitoring and the free-rider problem often prevent them from effectively reducing information asymmetry [24]. To control risks, external investors typically adopt two strategies: raising the interest rate on funds supplied or implementing credit rationing, where only some loan applicants receive funding while others are denied. This situation imposes financing constraints on corporate investment [25].

One challenge faced by empirical research is the measurement of financing constraints. A common approach is to consider a firm's balance sheet information, such as cash holdings or leverage ratios [26]. However, cash holdings, for example, represent an endogenous financial choice, and it is unclear whether this variable always correlates with improved liquidity access. For instance, if a firm cannot secure alternative financing, it might decide to increase its cash holdings. Alternatively, some studies employ survey data or leverage bank-firm relationship data to utilize exogenous shocks from banks and their impact on firms (e.g., K. Bae et al., 2002 [27]).

It is important to note that scholars have varied understandings of financing constraints. To reflect the alignment between a firm's financing capacity and the external financing environment, most existing studies choose to measure financing constraints using indices such as the KZ Index, SA Index, WW Index and FC Index. The SA Index, constructed using only firm size and firm age, primarily analyzes the extent of internal information asymmetry within a firm to assess whether the financing market is affected by incomplete information [28]. T. Whited and G. Wu (2006) [29] developed the WW Index by selecting variables such as the ratio of operating cash flow to total assets, a dummy variable for dividend payments, the ratio of long-term debt to total assets, the logarithm of total assets, industry sales growth, and sales revenue growth. S. Fazzari et al. (1988) [30] used dividend payout ratios and firm size as proxies for financing constraints, focusing on those arising from information asymmetry. Meanwhile, S. Kaplan and L. Zingales (1997) [31] defined financing constraints using financial variables, emphasizing constraints due to financial distress.

The WW Index is considered one of the better metrics for measuring financial constraints. It offers several advantages over other indices, such as the KZ index, the SA index, and the FC index. First, the WW index is based on a structural model of corporate investment, which provides a more robust theoretical foundation compared to the reduced-form models on which the KZ and SA indices rely. This stronger theoretical grounding enables the WW index to align more closely with economic theory when capturing firms' financing constraints. Second, the WW index places a greater emphasis on firm-specific financial frictions, making it more sensitive to variations in financial constraints across firms. It accounts for critical factors such as cash flow sensitivity to investment and corporate leverage, which are key to identifying financial constraints accurately. Third, the WW index is more effective at mitigating potential endogeneity issues, particularly those associated with the KZ index, which may be influenced by variables like leverage and dividend policy that are themselves affected by other firm-specific factors. This reduction in endogeneity is especially beneficial when examining the sensitivity of investment to cash flow.

Corporate Cash Holdings

The study of corporate cash holdings is evolving into a new theoretical framework, with key determinants such as precautionary, agency, and transaction motives shaping firm behavior.

Precautionary Motive. Cash holdings serve as a buffer for firms to seize potential investment opportunities, especially under financial constraints. Actually, internal financing is less costly and more readily available than financing from external sources [9]. Consequently, firms facing significant financing constraints tend to accumulate cash reserves as a precaution [32]. This tendency intensifies in uncertain environments, where increased risks prompt firms to hold more cash.

Agency Motive. Agency problems arise from the separation of ownership and management, where managers may hoard excess cash for personal gain or empire-building activities [8]. Additionally, controlling shareholders can exploit cash holdings to the detriment of minority shareholders [33]. Corporate governance plays a crucial role in mitigating these agency issues. For instance, stronger shareholder rights are associated with lower cash holdings, as firms in countries with better protection hold less cash [34].

Transaction Motive. Cash is essential for daily operations, especially since non-cash assets are less liquid. Firms maintain cash to meet operational needs, with factors such as firm size, wage costs, and transaction costs influencing cash holdings [35]. Moreover, companies with substantial cash reserves often invest more in R&D, leading to higher asset growth [36–37].

While digital transformation is recognized for reshaping business models and organizational structures, its impact on corporate finance, particularly cash holdings, remains underexplored. As digital transformation influences resource allocation, understanding its effect on cash holdings is crucial for enriching the literature on the economic consequences of digital strategies.

Hypothesis Development

Managers' agency motives are often built upon information asymmetry with shareholders, allowing them to engage in personal consumption and empire-building [8]. Digital transformation simplifies and enhances the efficiency of a company's information structure. By improving information processes, digital investments can reduce the costs associated with collecting and disseminating internal information, thus mitigating information asymmetry.

On the one hand, digital transformation provides stakeholders with technological tools to more effectively monitor managerial opportunistic behavior [38]. For example, Z. Riaz et al. (2022) [39] demonstrated that digitalization enhances information transparency and corporate governance levels, thereby curbing financial corruption within companies. On the other hand, digital tools such as enterprise resource planning systems and financial management software enable real-time monitoring and management of cash flows, improving the transparency and accuracy of fund utilization [40]. This helps firms optimize cash flow management, reducing waste due to information asymmetry or mismanagement, consequently lowering cash holdings. Based on the above discussion, we propose the following hypothesis:

H1: Digital transformation has a negative and significant effect on corporate cash holdings.

During digital transformation, firms typically require substantial investments to acquire technologies, train personnel, and upgrade systems. These investments can strain cash flows, particularly in the short term, potentially adversely affecting corporate liquidity [41]. Financial distress theory emphasizes that firms facing financing constraints often struggle to alleviate short-term cash needs through external financing [11]. Consequently, such firms may adopt a more cautious approach to cash management during digital transformation, driven by a precautionary motive to retain cash buffers, thereby mitigating potential financial pressures and risks arising from the transformation. For instance, they may prefer holding more cash reserves to safeguard against operational risks or uncertainties stemming from digital transformation [42]. Thus, we posit the following hypothesis:

H2: Financial constraints play a moderating role in mitigating the negative effect of digital transformation on corporate cash holdings.

Digital transformation, characterized by the integration of advanced technologies into business operations, typically enhances efficiency, reduces operational costs, and optimizes resource allocation [7]. These improvements often lead to a decreased need for large cash reserves, as digitalized processes streamline financial management, enabling firms to better predict cash flows and manage working capital [16]. However, firms with a lower degree of digital transformation may not fully realize these benefits. In such firms, the inefficiencies and uncertainties inherent in a lower level of digitalization can lead to a stronger reliance on cash holdings as a buffer against operational risks and unforeseen contingencies. Therefore, the negative impact of digital transformation on cash holdings is likely to be more pronounced in firms that have not yet fully embraced digitalization, as they still rely on traditional, less efficient cash management practices. Thus, we formulate the following hypothesis:

H3: The effect of digital transformation on cash holdings is more pronounced in firms with a lower degree of digital transformation.

Digital transformation typically enhances operational efficiency, streamlines financial processes, and reduces the need for large cash reserves by enabling better cash flow predictions and more efficient capital management [43]. In firms that are not experiencing losses, the benefits of digital transformation are more fully realized, as these firms already have strong financial positions and stable cash flows [44]. As a result, they are less dependent on holding excess cash as a precautionary measure. Not facing the immediate pressure of covering losses, these firms can confidently invest in digital technologies that further reduce their reliance on cash reserves. Thus, the negative impact of digital transformation on cash holdings is expected to be more pronounced in non-loss-making firms, as they can more aggressively optimize their cash management practices through digitalization, unlike firms with losses that might still need to maintain higher cash levels for financial security. Thus, we propose the following hypothesis:

H4: The effect of digital transformation on cash holdings is more pronounced in firms that are not facing losses.

Methods

Sample and Data

Our sample includes A-share listed companies in China from 2012 to 2021. The digital transformation data is sourced from corporate annual reports, while the WW index and other financial data are taken from the China Stock Market & Accounting Research (CSMAR) database. We conducted the following preprocessing steps on the initial sample: First, due to governance structure differences in the financial industry, companies from this sector were excluded. Second, companies flagged with "ST" by the China Securities Regulatory Commission for two consecutive years of insolvency, indicating severe financial distress, were removed to mitigate their disproportionate impact. Third, companies lacking accounting and related financial data were excluded. The final sample consists of 26,694 annual observations from 3,920 enterprises. Lastly, to mitigate the influence of extreme values, we winsorized all continuous variables at the 1st and 99th percentiles.

Variable Measurement and Estimations Techniques

The dependent variable in this study is corporate cash holdings (CCH). Following T. Opler (1999) [45], we measure CCH using the ratio of cash and cash equivalents divided by total assets.

Digital transformation (DT) serves as the independent variable of interest in this study. Annual reports reflect company strategies and future digital directions, suggesting that textual analysis of annual reports can effectively capture the strategic orientations of firms [46]. Building on W. Tu and J. He (2022) [47], this study employed Python web scraping to construct measures of digital transformation. First, we utilized terms such as "artificial intelligence", "cloud computing", "blockchain", "big data", and "digital technology application" as seed words. Second, the Python modules Jieba and Re were employed for text extraction, cleaning, matching, and frequency counting, including segmentation and stop-word removal to create the study's corpus. Third, the corpus underwent training using a machine-learning word2vec model to generate word vectors and compute semantic similarities among words. This facilitated the identification of words semantically related to the seed words. Fourth, leveraging the generated five-dimensional seed dictionary, the study computed the frequency of occurrence of key digital transformation terms across firms. Given the typical right-skewed nature of such data, frequencies were subsequently natural logarithm transformed, and adjusted by adding 1 (i.e., LN (frequency of keyword occurrence + 1)), to measure the extent of digital transformation among all A-share listed companies in China.

Furthermore, the WW index is constructed using the generalized method of moments (GMM) to estimate the investment Euler equation. Unlike the KZ index, the WW index more accurately reflects firm characteristics associated with external financing constraints. It captures the common movements in returns among constrained firms, indicating the presence of a financial constraints factor. As a result, we employ the WW index obtained from the CSMAR database as a moderating variable to enhance the robustness of our analysis. Generally, a higher WW index indicates more severe financial constraints faced by the company.

Moreover, the study identifies several control factors potentially affecting corporate cash holdings, aligning with prior research. These include Firm Age (natural logarithm of years since establishment plus one), Return on Assets (net income divided by total assets), Financial Leverage (total debts divided by total assets), Board Size (natural logarithm of total board directors), and Ownership Concentration (percentage of shares owned by the largest shareholder). Refer to Table 1 for variable details and measurements.

To test hypothesis H1 to H4, we construct the following empirical models:

$$CCH_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \alpha_2 FA_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 LEV_{i,t} + \\ + \alpha_5 BS_{i,t} + \alpha_6 TOP1_{i,t} + Year + Firm + \varepsilon; \quad (1)$$

$$CCH_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \alpha_2 FC_{i,t} + \alpha_3 FC * DT_{i,t} + \\ + \alpha_4 FA_{i,t} + \alpha_5 ROA_{i,t} + \alpha_6 LEV_{i,t} + \alpha_7 BS_{i,t} + \\ + \alpha_8 TOP1_{i,t} + Year + Firm + \varepsilon, \quad (2)$$

where α_0 denotes the intercept, $\alpha_1 - \alpha_8$ are the coefficients to be estimated. This study added dummy variables that control for year and firm fixed effects (Year and Firm); ε is the error term; i denotes the cross-sectional dimension for firms; and t denotes the time series dimension.

Table 1. Summary of Variable Descriptions and Measurements

	Measurement
Panel A: Dependent Variables	
Corporate Cash Holdings (CCH)	The ratio of cash and cash equivalents divided by total assets
Panel B: Independent Variables	
Digital Transformation (DT)	The natural logarithm of the frequency of keyword occurrence plus one
Panel C: Moderating Variables	
Financing Constraints (FC)	The WW index
Panel D: Control Variables	
Firm Age (FA)	The natural logarithm of the number of years since the firm's establishment plus one
Return on Assets (ROA)	The book value of net income divided by total assets
Financial Leverage (LEV)	The book value of total debts divided by total assets
Board Size (BS)	The natural logarithm of the total number of directors on the firm's board
Ownership Concentration (TOP1)	The percentage of shares owned by the largest shareholder

Source: prepared by the author.

Findings and Discussion

Descriptive Statistics and Correlation Matrix

The descriptive statistics for the key variables in our study are presented in Table 2, including the mean, standard deviation, minimum, and maximum values. For CCH, the mean and standard deviation are 0.049 and 0.067; for DT, 1.417 and 1.389; and, for FC, –1.025 and 0.073, respectively. Regarding control variables, the sample firms exhibit an average FA of 2.922, LEV of 0.422, ROA of 0.041, BS of 2.122, and TOP1 of 34.284.

Table 2. Descriptive Statistics

Variables	N	Mean	Std	Min	Max
CCH	26,694	0.049	0.067	-0.159	0.241
DT	26,694	1.417	1.389	0	5.056
FC	22,494	-1.025	0.073	-1.226	-0.845
FA	26,694	2.922	0.319	1.609	3.496
LEV	26,694	0.422	0.203	0.050	0.893
ROA	26,694	0.041	0.063	-0.239	0.222
BS	26,694	2.122	0.198	1.609	2.708
TOP1	26,694	34.245	14.820	8.630	74.180

Source: prepared by the author.

Table 3. Pearson Correlation

	CCH	DT	FC	FA	LEV	ROA	BS	TOP1	VIF
CCH	1.000								-
DT	-0.027***	1.000							1.03
FC	-0.223***	-0.006	1.000						1.49
FA	0.006	0.019***	-0.081***	1.000					1.06
LEV	-0.170***	-0.070***	-0.322***	0.163***	1.000				1.52
ROA	0.413***	0.016***	-0.266***	-0.081***	-0.359***	1.000			1.44
BS	0.041***	-0.082***	-0.230***	0.053***	0.154***	-0.005	1.000		1.07
TOP1	0.099***	-0.116***	-0.243***	-0.090***	0.059***	0.127***	0.027***	1.000	1.10

Note: this table shows the correlation coefficients for the main variables defined in Table 1. The lower triangle in this table shows the Pearson correlation coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, respectively.

Source: prepared by the author.

Table 3 presents the results of the Pearson correlation matrix, used to evaluate potential multicollinearity among independent variables. The coefficients range from –0.359 to 0.413, and the highest variance inflation factor (VIF) value is only 1.52, which is well below the critical threshold. These results indicate that multicollinearity is not a significant concern in this study. Moreover, preliminary findings suggest a negative impact of DT on CCH, aligning with our hypothesis H1. However, further validation is warranted.

Baseline Results

To assess the impact of digital transformation (DT) on corporate cash holdings (CCH), this study investigates the relationship between DT and CCH in column (1) of Table 4. The results indicate that DT significantly reduces CCH, with a coefficient of –0.002 at the 1% significance level ($\alpha_1 = -0.002$, $p < 0.01$). Additionally, five control variables were included in the panel data model to further empirically test this relationship. The estimation results in column (2) show that the coefficient for the key explanatory variable DT remains significantly negative ($\alpha_1 = -0.002$, $p < 0.01$). Economically, this effect is substantial, as a one standard deviation increase in DT is associated with a 4.15% decrease in the standard deviation of CCH. These findings support Hypothesis 1 and align with X. Qu and B. Zhu (2023) [48]'s perspective, which posits that digital technology adoption reduces the strategic aggressiveness of companies, thereby lowering their cash holdings.

Regarding the control variables, firm age (FA) positively impacts cash flow, suggesting that older firms possess more operational experience and tend to hold more cash to manage uncertainties and potential risks. Furthermore, there is a positive relationship between return on assets (ROA) and CCH, implying that firms with higher ROA may retain cash for future high-return investment opportunities, enhancing profitability. Overall, these control variable results are consistent with prior studies, such as C. Hadlock and J. Pierce (2010) [28].

Table 4. Baseline Regression Results

	(1) CCH	(2) CCH
DT	-0.002***	-0.002***
	(-2.663)	(-2.997)
FA		0.018**
		(1.990)
LEV		-0.007
		(-1.314)
ROA		0.256***
		(20.792)
BS		-0.003
		(-0.764)
TOP1		-0.000
		(-0.965)
Cons	0.049***	0.002
	(35.596)	(0.086)
Year FE	Yes	Yes
Firm FE	Yes	Yes
N	26694	26694
Adj. R^2	0.016	0.070

Note: statistical significance is denoted by ***, **, and *, representing levels of significance at the 1%, 5%, and 10% thresholds, respectively. T-statistics (shown in parentheses) are calculated using standard errors adjusted for firm-level clustering. All variables are defined in Table 1.

Source: prepared by the author.

Robustness Check

So far, the baseline results reveal a negative relationship between digital transformation and corporate cash holdings. In this section, we employ additional methodologies to ensure the robustness of our findings.

First, adjusting cluster-robust standard errors to the industry level. Standard errors play a pivotal role in statistical inference, directly impacting the significance of coefficients, confidence intervals, and ultimately hypothesis testing conclusions. Therefore, accurately estimating standard errors is paramount in empirical analysis. Expanding robust standard errors to the industry level allows for a more comprehensive consideration of shared characteristics and market influences among firms within the same industry. This approach further mitigates biases introduced by data structure or sampling methods. The results in columns (1) of Table 5 demonstrate that after clustering robust standard errors at the industry level, the negative coefficient of DT is statistically significant at the 1% level, confirming the robustness of our findings.

Second, adding province and city fixed effects. Considering the potential specific characteristics and environmental influences across different provinces and cities, we introduce these fixed effects to further reduce biases introduced by geographic or administrative differences. By incorporating these fixed effects, we ensure that the statistical inferences of our results are robust across different geographic and urban contexts, thereby enhancing the credibility and generalizability of our findings. We assign dummy variables based on the registered locations of the sample firms at the province and city levels. Columns (2) of Table 5 present results that exhibit consistent coefficient signs and significance levels with the baseline regressions, confirming that geographic or administrative differences do not affect the robustness of our conclusions.

Third, using propensity score matching (PSM) method. In empirical research, sample selection bias can lead to biased estimates. PSM addresses this by matching individuals in the treatment group with those in the control group based on the similarity of observed characteristics, thereby creating a more balanced sample. This approach better simulates the conditions of a randomized experiment, reducing the impact of confounding variables and ensuring more reliable and valid estimates of the treatment effect. Specifically, we aim to ensure that firms with DT (treatment group) and without DT (control group) are comparable in other respects. To achieve this, we use control variables consistent with the baseline regression as covariates and implement 1:1 nearest neighbor matching. Columns (3) of Table 5 report the re-estimated results using the propensity score matching methods. The results show that the impact of DT on CCH remains significantly negative, indicating that the results are robust even after applying PSM.

Fourth, using generalized method of moments (GMM) approach. GMM estimation technique is employed to address endogeneity issues. When an explanatory variable is correlated with the error term, conventional estimation methods such as OLS may yield biased results. GMM overcomes this by introducing instrumental variables that are correlated with the explanatory variables but uncorrelated with the error term, providing consistent estimates. Specifically, we utilize the two-step system GMM estimation technique to eliminate time-invariant omitted variables (i.e., fixed effects) and to mitigate estimation bias stemming from reverse causality.

In GMM models, serial correlation in the error term can lead to biased estimates. The AR(1) test is applied to examine whether the error term exhibits first-order autocorrelation. If AR(1) is present and highly significant, this suggests the existence of first-order autocorrelation, which is acceptable, as the differenced error term should exhibit autocorrelation. However, the AR(2) test is used to detect the presence of second-order autocorrelation. The presence of second-order autocorrelation would indicate that the instrumental variables might be correlated with

the error term, leading to biased estimates. For GMM, it is crucial that the AR(2) test results are not significant (i.e., the null hypothesis of no second-order autocorrelation cannot be rejected) to ensure the validity of the instrumental variables. Finally, the Hansen test (also known as the Hansen J test) is conducted to assess the overall validity of the instrumental variables used in the model. The null hypothesis of the Hansen test is that the instruments are exogenous, meaning they are uncorrelated with the error term. If the test results are not significant (i.e., the null hypothesis cannot be rejected), it indicates that the choice of instruments is appropriate, and the model does not suffer from over-identification. Upon passing these three tests, columns (4) of Table 5 report the re-estimated results using GMM. The findings reveal that the coefficient for DT remains significantly negative at the 5% level, suggesting that the results remain robust even after applying GMM.

Table 5. Robustness Check

	Clustering Level (Industry)	Additional FE	PSM	GMM
	(1)	(2)	(3)	(4)
	CCH	CCH	CCH	CCH
DT	-0.002***	-0.002***	-0.002***	-0.003**
	(-3.001)	(-2.743)	(-3.073)	(-2.025)
L.CCH				0.309***
				(3.960)
Control Variables	Yes	Yes	Yes	Yes
Additional FE	No	Yes	No	No
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
AR(1)				0.000
AR(2)				0.162
Hansen J				0.197
No. of Firm				3439
No. of IV				33
N	26150	26149	26602	22048
Adj. R^2	0.374	0.368	0.069	

Note: statistical significance is denoted by ***, **, and *, representing levels of significance at the 1%, 5%, and 10% thresholds, respectively. T-statistics (shown in parentheses) are calculated using standard errors adjusted for firm-level clustering. All variables are defined in Table 1.
Source: calculated by the author.

The Moderating Role of Financing Constraints

This study incorporates financing constraints (FC) as a moderating variable to examine its role in the relationship between digital transformation (DT) and corporate cash holdings (CCH). Columns (1) and (2) of Table 6 illustrate the moderating effect of FC on the DT-CCH relationship. The results show that the interaction term between DT and FC (DT#FC) is positive and significant, both in column (1), where no additional variables are controlled, and in column (2), where additional controls are included. This indicates that under severe financing constraints, firms face greater difficulties and higher costs in obtaining financing, leading them to adopt a more cautious approach to digital transformation. Specifically, they prioritize internal cash management and retention, mitigating the negative impact of DT on CCH. These findings provide support for Hypothesis 2.

Table 6. Moderating Effect

	(1) CCH	(2) CCH
DT#FC	0.013**	0.016***
	(2.051)	(2.615)
DT	-0.003***	-0.002***
	(-4.014)	(-3.569)
FC	-0.264***	-0.178***
	(-17.627)	(-11.744)
Control Variables	No	Yes
Year FE	Yes	Yes
Firm FE	Yes	Yes
N	22 494	22 494
Adj. R^2	0.047	0.078

Note: statistical significance is denoted by ***, **, and *, representing levels of significance at the 1%, 5%, and 10% thresholds, respectively. T-statistics (shown in parentheses) are calculated using standard errors adjusted for firm-level clustering. All variables are defined in Table 1.

Source: calculated by the author.

Heterogeneity Test

Firms with high digital transformation level. vs. firms with low digital transformation level. To test the hypothesis that the impact of digital transformation (DT) on corporate cash holdings (CCH) is more pronounced in firms with a lower degree of digital transformation, we ranked the sample firms based on the level of digital transformation in their respective cities. Firms ranked in the top quartile were classified as having a high degree of digital transformation, while the others were categorized as having a low degree of digital transformation. We then conducted a subsample regression analysis on model (1). The results, presented in Table 7, show the regression outcomes for firms with high (Column 1) and low (Column 2) levels of digital transformation. The findings indicate that the impact of DT on CCH is significantly negative only in the group of firms with low digital transformation, suggesting that digital transformation has a more substantial effect on cash holdings in firms with a higher degree of transformation. These results support hypothesis H3.

Firms facing losses vs. firms not facing losses. To examine whether firm profitability influences the heterogeneity of the regression results, we conducted subsample regressions based on model (1). Firms were classified as firms facing losses if their total revenues were insufficient to cover total expenses during the sample period, dividing the sample was divided into "firms facing losses" and "firms not facing losses" subsamples. The regression results are presented in Table 7, with column (3) showing the results for firms facing losses and column (4) for firms not facing losses. The findings indicate that the impact of DT on CCH is significantly negative only for firms not facing losses, thereby supporting hypothesis H4.

Table 7. Heterogeneity Test

	H-DT=1 (1)	H-DT=0 (2)	Loss=1 (3)	Loss=0 (4)
	CCH			
DT	-0.002	-0.002**	-0.005	-0.001**
	(-0.930)	(-1.975)	(-1.517)	(-1.994)
Control Variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N	6749	19 945	2787	23 907
Adj. R^2	0.060	0.076	0.009	0.089

Note: statistical significance is denoted by ***, **, and *, representing levels of significance at the 1%, 5%, and 10% thresholds, respectively. T-statistics (shown in parentheses) are calculated using standard errors adjusted for firm-level clustering. All variables are defined in Table 1.

Source: calculated by the author.

Discussion and Conclusion

Utilizing data from Chinese firms between 2012 and 2021, this study offers significant insights into the relationship between digital transformation and corporate cash holdings, particularly within the context of financing constraints. Our findings demonstrate a notable negative impact of digital transformation on corporate cash holdings, indicating that firms undergoing digital transformation tend to hold less cash. This can be attributed to the efficiency improvements and enhanced liquidity management typically associated with digital initiatives. By employing advanced technologies and streamlined processes, firms can reduce the asymmetry of information, thereby mitigating managerial motives to hoard excessive cash. Previous studies have identified digital transformation as a strategic component of leadership agendas, shaping internal organizational structures, operational processes, and value creation models [22; 49]. However, its impact on corporate cash holdings has not been thoroughly investigated in prior literature. From a microeconomic perspective of firms, our paper supplements existing evidence on the microeconomic consequences of digitalization.

Indeed, firms facing financing constraints often struggle to secure adequate external funding, potentially leading to inefficient resource allocation. For instance, such firms may face challenges in investing in high-return projects, which can affect their long-term growth and competitiveness [23; 50]. Focusing on financially constrained firms can assist policymakers in understanding how difficulties in accessing funds influence corporate investment decisions and

operational efficiency, thereby facilitating the development of effective financial policies and support measures. Our study also aligns with financial distress theory, showing how financial distress constraints inhibit corporate operations and development, thereby increasing precautionary motives for cash holdings. This conclusion holds particular relevance in China, where high corporate debt levels are prevalent, highlighting the importance for policymakers to consider corporate financial conditions when devising national digitalization strategies to promote healthy digital transformation and rational fund allocation.

Additionally, the heterogeneity tests reveal that the impact of digital transformation on corporate cash holdings is more pronounced in firms with lower levels of digital transformation and in those not facing losses. This result suggests that firms with less advanced digital capabilities may experience greater operational inefficiencies and uncertainties, leading them to hold onto cash. As digital transformation progresses, these firms are likely to reduce cash holdings as they become more confident in leveraging digital technologies to optimize cash flow management, reduce transaction costs, and mitigate risks. In contrast, non-loss-making firms, which typically have stronger financial health and operational stability, might have the flexibility to strategically reduce cash reserves as they pursue digital initiatives. These firms can more effectively deploy cash towards value-enhancing investments, such as technology upgrades and innovation, without the immediate pressure of financial distress. This behavior aligns with the notion that financially stable firms are better positioned to capitalize on the efficiencies and opportunities brought about by digital transformation, thereby justifying a lower cash cushion.

This study makes several theoretical contributions. On the one hand, from the perspective of agency theory, it reveals that digital transformation diminishes the motives offirms holding cash for agency reasons. Empirical analysis supports the view that digital transformation reduces the tendency of management to hold excessive cash due to self-interest motives, thereby lowering agency costs. This validation broadensthe application of agency theory in the digital age, offering a new perspective on how technological advancements influence corporate governance. On the other hand, the study explores financing constraints as a manifestation of financial distress and how they moderate the relationship between digital transformation and corporate cash holdings. Our findings support the cash precautionary motive posited by financial distress theory, indicating that firms facing higher financing constraints tend to maintain greater cash reserves during digital transformation to mitigate potential risks and uncertainties. This discovery deepens our understanding of financial distress theory, illustrating firms' cash management strategies under financial pressure and enriching the theoretical framework.

Our study offers insights for stakeholders and policymakers. The findings demonstrate that digital transformation reduces corporate cash holdings, albeit financing constraints may influence this process. Therefore, as firms advance in their digital transformation, managers should concurrently assess their financing conditions and implement measures to ensure stable cash flows, such as optimizing internal fund management and diversifying financing channels. For policymakers, governments and regulatory bodies can facilitate digital transformation and overall economic development by providing easier access to financing and financial support, thereby helping firms overcome financing challenges.

However, our study has limitations. Our data sample is exclusively confined to Chinese listed companies, which restricts the basis for developing cross-national comparative research. Future studies could compare financial behaviors under digital transformation and financing constraints across different countries and regions to reveal the influences of culture, institutions, and economic environments on corporate behavior, thereby providing broader evidence to support theoretical research. Additionally, future research could explore the impact of other moderating variables on the relationship between digital transformation and corporate cash holdings, such as corporate governance structures and market competitiveness, to further deepen the understanding of this relationship.

References

1. Butt, A., Imran, F., Helo, P., & Kantola, J. Strategic design of culture for digital transformation. *Long Range Planning*, 2024;57(2), 102415. https://doi.org/10.1016/j.lrp.2024.102415
2. Chen, Y., Wang, Y., & Zhao, C. From riches to digitalization: The role of AMC in overcoming challenges of digital transformation in resource-rich regions. *Technological Forecasting & Social Change*, 2024;200, 123153. https://doi.org/10.1016/j.techfore.2023.123153
3. Zhang, C., Fang, J., Ge, S., & Sun, G. Research on the impact of enterprise digital transformation on carbon emissions in the manufacturing industry. *International Review of Economics & Finance*, 2024;92, 211–227. https://doi.org/10.1016/j.iref.2024.02.009
4. Xu, X., Wang, Q., & Zhang, M. The complementary effects of 'Made in China 2025' industrial policy and trade liberalisation on China's export of relevant products. *Asian Journal of Technology Innovation*, 2024;1–30. https://doi.org/10.1080/19761597.2024.2358307
5. Tian, G., Li, B., & Cheng, Y. Does digital transformation matter for corporate risk-taking? *Finance Research Letters,* 2022;49, 103107. https://doi.org/10.1016/j.frl.2022.103107
6. Chen, Y., Ho, K., & Yeh, C. CEO overconfidence and corporate cash holdings. *Journal of Corporate Finance*, 2020;62, 101577. https://doi.org/10.1016/j.jcorpfin.2020.101577

7. Chen, H., & Yoon, S. S. Does technology innovation in finance alleviate financing constraints and reduce debt-financing costs? Evidence from China. *Asia Pacific Business Review*, 2021;28(4), 467–492. https://doi.org/10.1080/13602381.2021.1874665
8. Jensen, M. C. (1996). Agency costs of free cash flow, corporate finance, and takeovers. In *Cambridge University Press eBooks* (pp. 11–16). https://doi.org/10.1017/cbo9780511609435.005
9. Myers, S. C., & Majluf, N. S. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 1984;*13*(2), 187–221. https://doi.org/10.1016/0304-405x(84)90023-0
10. Stulz, R. Managerial discretion and optimal financing policies. Journal of Financial Economics, 1990; 26(1), 3–27. https://doi.org/10.1016/0304-405x(90)90011-n
11. Shleifer, A., & Vishny, R. W. A survey of Corporate Governance. *The Journal of Finance*, 1997; *52*(2), 737–783. https://doi.org/10.1111/j.1540-6261.1997.tb04820.x
12. Harford, J., Mansi, S. A., & Maxwell, W. F. Corporate governance and firm cash holdings in the US. *Journal of Financial Economics*, 2008;87(3), 535–555. https://doi.org/10.1016/j.jfineco.2007.04.002
13. Gordon, M. J. Towards a theory of financial distress. *The Journal of Finance*, 1971;26(2), 347. https://doi.org/10.2307/2326050
14. Purnanandam, A. Financial distress and corporate risk management: Theory and evidence. *Journal of Financial Economics*, 2008;87(3), 706–739. https://doi.org/10.1016/j.jfineco.2007.04.003
15. Isayas, Y. N. Financial distress and its determinants: Evidence from insurance companies in Ethiopia. *Cogent Business & Management*, 2021;8(1). https://doi.org/10.1080/23311975.2021.1951110
16. Vial, G. Understanding digital transformation. In *Routledge eBooks*, 2021; (pp. 13–66). https://doi.org/10.4324/9781003008637-4
17. Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 2021; *122*, 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022
18. Zeng, H., Ran, H., Zhou, Q., Jin, Y., & Cheng, X. The financial effect of firm digitalization: Evidence from China. *Technological Forecasting and Social Change*, 2022; *183*, 121951. https://doi.org/10.1016/j.techfore.2022.121951
19. Cusumano, M. A., Gawer, A., & Yoffie, D. B. Can self-regulation save digital platforms? *Industrial and Corporate Change*, 2021; *30*(5), 1259–1285. https://doi.org/10.1093/icc/dtab052
20. Modigliani, F., & Miller, M. H. The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, 1958; *48*(3), 261–297. http://www.jstor.org/stable/1809766
21. Zou, H., & Xiao, J. Z. The financing behaviour of listed Chinese firms. *The British Accounting Review*, 2006; *38*(3), 239–258. https://doi.org/10.1016/j.bar.2006.04.008
22. Pu, T., & Zulkafli, A. H. State Ownership Heterogeneity and Corporate Innovation: New Evidence from a Hierarchical Perspective. *Journal of Corporate Finance Research.* 2024; *18*(1), 20-36.
23. Muttakin, M. B., Khan, A., & Azim, M. I. Corporate social responsibility disclosures and earnings quality. *Managerial Auditing Journal*, 2015; *30*(3), 277–298. https://doi.org/10.1108/maj-02-2014-0997
24. Pu, T., & Zulkafli, A. H. Managerial ownership and corporate innovation: evidence of patenting activity from Chinese listed manufacturing firms. *Cogent Business & Management*, 2024; *11*(1). https://doi.org/10.1080/23311975.2023.2289202
25. Fazzari, S., Hubbard, R. G., & Petersen, B. *Financing constraints and corporate investment*. 1987; https://doi.org/10.3386/w2387
26. Chen, M., & Guariglia, A. Internal financial constraints and firm productivity in China: Do liquidity and export behavior make a difference? *Journal of Comparative Economics*, 2013;*41*(4), 1123–1140. https://doi.org/10.1016/j.jce.2013.05.003
27. Bae, K., Kang, J., & Lim, C. The value of durable bank relationships: evidence from Korean banking shocks. *Journal of Financial Economics*, 2002; *64*(2), 181–214. https://doi.org/10.1016/s0304-405x(02)00075-2
28. Hadlock, C. J., & Pierce, J. R. New evidence on measuring financial constraints: Moving beyond the KZ index. *The Review of Financial Studies*, 2010;23(5), 1909–1940. https://doi.org/10.1093/rfs/hhq009
29. Whited, T. M., & Wu, G. Financial constraints risk. *Review of Financial Studies*, 2006;*19*(2), 531–559. https://doi.org/10.1093/rfs/hhj012
30. Fazzari, S., Hubbard, R. G., & Petersen, B. Investment, Financing Decisions, and Tax Policy. *The American Economic Review*, 1988; *78*(2), 200–205. http://www.jstor.org/stable/1818123
31. Kaplan, S. N., & Zingales, L. Do Investment-Cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics*, 1997;*112*(1), 169–215. https://doi.org/10.1162/003355397555163

32. Almeida, H., Campello, M., & Weisbach, M. S. The cash flow sensitivity of cash. *The Journal of Finance*, 2004; *59*(4), 1777–1804. https://doi.org/10.1111/j.1540-6261.2004.00679.x

33. Johnson, S., La Porta, R., Lopez-De-Silanes, F., & Shleifer, A. Tunneling. *American Economic Review*, 2000;*90*(2), 22–27. https://doi.org/10.1257/aer.90.2.22

34. Dittmar, A., Mahrt-Smith, J., & Servaes, H. International Corporate Governance and corporate cash holdings. *Journal of Financial and Quantitative Analysis*, 2003; *38*(1), 111. https://doi.org/10.2307/4126766

35. Mulligan, C. B. Scale Economies, the Value of Time, and the Demand for Money: Longitudinal Evidence from Firms. *Journal of Political Economy*, 1997;*105*(5), 1061–1079. https://doi.org/10.1086/262105

36. Mikkelson, W. H., & Partch, M. M. Do persistent large cash reserves hinder performance? *Journal of Financial and Quantitative Analysis*, 2003;*38*(2), 275. https://doi.org/10.2307/4126751

37. Pu, T., & Zulkafli, A. H. Global minds, local impact: exploring the effect of foreign directors on corporate R&D expenditure. [Preprint]. May 17, 2024 [cited 2024 August 5]. Available from: https://doi.org/10.5937/StraMan2400007P

38. Kimani, D., Adams, K., Attah-Boakye, R., Ullah, S., Frecknall-Hughes, J., & Kim, J. (2020). Blockchain, business and the fourth industrial revolution: Whence, whither, wherefore and how? *Technological Forecasting & Social Change*, 161, 120254. https://doi.org/10.1016/j.techfore.2020.120254

39. Riaz, Z., Ray, P., & Ray, S. The impact of digitalisation on corporate governance in Australia. *Journal of Business Research*, 2022;152, 410–424. https://doi.org/10.1016/j.jbusres.2022.07.006

40. Yu, Y., Zhang, J. Z., Cao, Y., & Kazancoglu, Y. Intelligent transformation of the manufacturing industry for Industry 4.0: Seizing financial benefits from supply chain relationship capital through enterprise green management. *Technological Forecasting & Social Change*, 2021;172, 120999. https://doi.org/10.1016/j.techfore.2021.120999

41. Zhang, X., Xu, Y. Y., & Ma, L. Information technology investment and digital transformation: the roles of digital transformation strategy and top management. *Business Process Management Journal*, 2023;29(2), 528–549. https://doi.org/10.1108/bpmj-06-2022-0254

42. Xu, G., Li, G., Sun, P., & Peng, D. Inefficient investment and digital transformation: What is the role of financing constraints? *Finance Research Letters*, 2023;51, 103429. https://doi.org/10.1016/j.frl.2022.103429

43. Scardovi, C. Digital transformation in financial services. In *Springer eBooks*. 2017; https://doi.org/10.1007/978-3-319-66945-8

44. Drobetz, W., Haller, R., & Meier, I. Cash flow sensitivities during normal and crisis times: Evidence from shipping. *Transportation Research Part a Policy and Practice*, 2016; *90*, 26–49. https://doi.org/10.1016/j.tra.2016.04.015

45. Opler, T. The determinants and implications of corporate cash holdings. *Journal of Financial Economics*, 1999;52(1), 3–46. https://doi.org/10.1016/s0304-405x(99)00003-3

46. Kindermann, B., Beutel, S., De Lomana, G. G., Strese, S., Bendig, D., & Brettel, M. Digital orientation: Conceptualization and operationalization of a new strategic orientation. *European Management Journal*, 2021;39(5), 645–657. https://doi.org/10.1016/j.emj.2020.10.009

47. Tu, W., & He, J. Can Digital Transformation Facilitate Firms' M&A: Empirical Discovery Based on Machine Learning. *Emerging Markets Finance & Trade*, 2022;59(1), 113–128. https://doi.org/10.1080/1540496x.2022.2093105

48. Qu, X., & Zhu, B. Digital Finance and Corporate Cash-Holding Strategy: Organizational Heterogeneity and Strategic Transmission Channels. *Sustainability*, 2023;*15*(3), 2361. https://doi.org/10.3390/su15032361

49. Matt, C., Hess, T., & Benlian, A. Digital Transformation Strategies. *Business & Information Systems Engineering*, 2015;57(5), 339–343. https://doi.org/10.1007/s12599-015-0401-5

50. García, C. J., & Herrero, B. Female directors, capital structure, and financial distress. *Journal of Business Research*, 2021;136, 592–601. https://doi.org/10.1016/j.jbusres.2021.07.061

The article **was submitted on** 14.06.2024; **approved after reviewing on** 15.07.2024; **accepted for publication on** 14.08.2024.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.62-81
JEL classification: G11, G32, C5

IPO Underpricing in the Russian Stock Market

Sergey Kondratev ✉
Financial Analyst, Sberbank, Moscow, Russia,
sergeiko999@mail.ru, ORCID

Elizaveta Batalova
Expert, Industrial Development Fund, Moscow, Russia,
lizabatalova99@mail.ru, ORCID

Olga Frolova
Financial Analyst, Yandex, Moscow, Russia,
oolyafrolova@yandex-team.ru, ORCID

Abstract

This paper investigates stock underpricing in the Russian capital market during initial public offerings in the present-day situation. The econometric study of initial public offerings in the Russian market for 2006–2024 shows that such factors as dividend policy, technological profile of the company, and the difference between the actual and expected offering price increase IPO underpricing. Additionally a positive correlation between the capital raised by the company and the reduction of the underpricing IPO effect is revealed: large companies have more stable financial indicators, which brings their valuation closer to the real value in the market.

Keywords: IPO underpricing, stock underpricing, initial public offerings, IPO, Russian capital markets, technological companies, capital raised, expected IPO price

For citation: Kondratev S., Batalova E., Frolova O. (2024) IPO Underpricing in the Russian Stock Market. *Journal of Corporate Finance Research.* 18(3): 62-81. https://doi.org/10.17323/j. jcfr.2073-0438.18.3.2024.62-81

Introduction

In today's world, companies seeking to expand their business attract additional financing in several main ways, including bank lending, venture capital funding, bond issue, and public stock offering. Another method of raising additional capital is for a private company to go public. Initial public offerings (IPO) provide unparalleled advantages such as reducing the debt burden, increasing share liquidity, and attracting market attention to the company.

However, IPOs also have some disadvantages, including considerable expenditures of time and money before the offering, the possibility of an unsuccessful offering, etc. Nevertheless, the demand for public offerings remains. According to ExpertRA [1], there is a currently a renaissance in the IPO market in Russia as the country is adapting to foreign sanctions. At year-end 2023, the funds raised from IPOs exceeded RUB 40 billion in seven transactions. This amount is lower than the market peak result achieved in 2021 when approximately RUB 300 billion were raised. At the same time, according to the forecasts of Aigenis Investment Company [2], the funds raised from IPOs will double in 2024, amounting to RUB 83 billion.

In this research, we focus on IPO underpricing. IPO underpricing is a phenomenon when company stock prices in an initial public offering (IPO) are below their real value, which often leads to a significant price escalation on the first trading day. As a result, the company and its investors may lose a significant part of their potential capital or, on the contrary, investors may derive greater revenue. Thus, the purpose of the present paper is to identify the main factors that influence the underpricing of corporate stocks during initial public offerings in the Russian market. To this end, we use statistical analysis with multiple OLS regressions.

Theoretical aspects of the IPO underpricing phenomenon

Scholars have taken great interest in the IPO underpricing phenomenon, studying the factors that influence the extent of company underpricing during an IPO. F. Reilly and K. Hatfield (1969) [3], D. Logue (1973) [4], R. Ibbotson (1975) [5] and others were among the first fundamental studies to analyse the underpricing of companies holding IPOs in the USA in 1960–1969. Subsequently, studies conducted in the 1980s and 1990s proposed four basic groups of theories about the factors that influence the extent of IPO underpricing. Behavioural theory posits that IPOs are accompanied by situations in which investors or issuers are driven by behavioural factors to manipulate stock prices without consideration for their actual value [6–8]. Institutional theory, in turn, analyses the influence of legal proceedings, the activity of banks aimed at price stabilization after the start of trading, and taxes on the market [6; 9]. According to control theory, a reduction in stock prices contributes to the creation of a shareholder structure which limits the influence of external investors when a company issues an IPO [10–13]. However, the most popular approach is information asymmetry theory, which is used in the present paper to formulate the research hypotheses.

Information asymmetry theory presupposes that one of the IPO participants, whether an underwriting bank, issuer or investor, is more informed than the other participants. This leads to an uncertainty in the market and a benefit/loss for one of the three parties as a result of IPO underpricing. Information asymmetry may be inherent in any of the three parties. Therefore, such models as the winner's curse [14], information revelation [15; 16], principal agent [6; 17] and the signalling model [6] are widespread. Papers studying the information asymmetry problem on the part of investors have made the following key conclusions:

1) The higher the uncertainty about the company, the greater the extent of IPO underpricing [18; 19].
2) The extent of IPO underpricing may be reduced by a decrease in information asymmetry between informed and uninformed participants [6].

Authors mostly make use of company characteristics, characteristics of the offer made when holding the IPO, and information about the secondary market as uncertainty factors [6]. For example, J. Ritter (1984) [18] and W. Megginson and K. Wiess (1991) came to the conclusion that, as a company grows more mature, the amount of information about it in the market increases, and thus the extent of uncertainty and IPO underpricing lessens [20]. Empirical studies confirm the negative dependence of the company age on the extent of IPO underpricing [21].

Various authors also studied industry affiliation. The problem of IPO underpricing was particularly acute for the technology industry when the dot-com bubble emerged in the US market. Such authors as A. Ljungvist and W. Wilhelm (2003) explained this distinctive feature by the hypothesis that technology companies tend to be young, rapidly growing firms whose age and business activities give reasons for greater uncertainty and information asymmetry in the market [22]. This conclusion has also been confirmed by more recent studies [23; 24].

The amount of capital raised by an IPO is often taken as a characteristic feature of the offering itself. As studies show, the larger the capital, the more advantageous it is for underwriting banks to sell it due to commission payments and the lower the issue's underpricing. According to D. Logue (1973), this is due to a greater competition among underwriting banks, which provides the issuer with greater bargaining power in relation to the offering price [4]. Another prevalent theory is that larger capital raised in an IPO is indicative of lower uncertainty concerning the issue and a lower extent of underpricing [19]. A recent study by N. Watanabel et al. (2022) for the Japanese market for 2009–2016 shows a negative dependence between the offering amount and the underpricing extent [25]. This relationship is confirmed by a large-scale study by L. He et al. (2022) on a sample of 20 countries in 2005–2016 [26].

The partial adjustment phenomenon models proposed by L. Benveniste and P. Spindt (1989) [15] and K. Hanley

(1993) [16] are among the most popular information disclosure models. The conclusions made in these papers boil down to the idea that the more positive information investors provide about a company, the higher the final offering price as compared to the average price. Ultimately this results in greater IPO underpricing. These conclusions are confirmed by I. Ivashkovskaya and L. Kharlamov (2007), who use data from the Russian market for 1996–2007 [27]. However, a more recent study of the Russian market by V. Nazarova and D. Anisina (2021) for 1996–2021 points to the insignificance of this factor for underpricing [28].

According to the signalling model that implies information asymmetry on the part of the issuer, the reputation of the organizing bank at the time of an IPO [29], the venture capital [20] and the composition of directors [30] are some of the available factors that can act as signals to the market during the IPO. For example, J. Wang et al. (2023) examined the factor of dividend payments by the company in the year preceding the IPO for a sample of Chinese companies from 2006 to 2019 to confirm the hypothesis that companies use dividend payments in the year preceding the IPO as a positive signal to attract investors yet afterwards often decrease the extent of stock underpricing in the IPO to cover the dividend expenses. This is confirmed by a negative relationship between dividend payments in the year preceding the IPO and the extent of company underpricing [31].

Determinants of IPO Underpricing and hypothesis

The systematization of previous academic papers and available relevant information led us to advance five main hypotheses for the Russian IPO market.

1) The first hypothesis states that, the greater the raised capital, the lower the IPO underpricing. Apart from the reduction in underpricing detected when comparing mean values and weighted average values in the previous section, this assumption aligns with the literature: underwriters may perceive a large amount of capital raised in an IPO as a more gainful transaction, leading to quasi-competition among investment bankers, so a company interested in an IPO at a higher price has a wider choice of partners and a greater relative strength in negotiations [4; 25; 26]. For these reasons, we expect a negative relationship between the raised capital and IPO underpricing.
2) The second hypothesis asserts that, the larger the dividends distributed during the preceding period, the lower the expected IPO underpricing. According to recent studies [31], such dividends are a signal of the quality of companies and their willingness to make payments from revenue as an investor attraction strategy. Later on, they may well raise the IPO price threshold to cover the expenses for previous and future dividend payments. As a result, investors will estimate stocks higher, leading to lower underpricing.
3) The third hypothesis posits that technology companies are more often underpriced in IPOs than companies from other industries. This observation has already been noted in the previous section when comparing IPO underpricing. For the most part, technology companies are young, rapidly growing firms, whose age and business activities, which many investors do not understand, lead to greater uncertainty and information asymmetry in the market [22]. Furthermore, due to the higher possible volatility of tech company shares in general, underwriters are unwilling to establish stock prices which the market is ready to pay, because they anticipate a drop in quotations shortly after the listing. This also explains their involvement in reputational and legal suits [32].
4) The fourth hypothesis is related to the partial adjustment theory advanced in IPO underpricing studies [16; 27; 28]: the wider the spread between the actual and expected offering price, the greater the IPO underpricing. This is effect is due to the fact that preliminary information that potentially increases the stock price strengthens investors' willingness to participate in the issue. It is impossible to transfer completely the effect produced by such information into stock price growth due to the risks of losing the planned shareholding structure, because such news attracts new investors.
5) The fifth hypothesis states that the more mature the company, the smaller the IPO underpricing. In the case of companies with a short history, uninformed investors face uncertainty (adverse selection problem [18]) as well as a serious asymmetry of information about the company. This eventually leads issuers to reduce the offering price for external investors [20]. Nevertheless, several papers dedicated to related topics present statistical evidence for the insignificance of the age parameter [26].

Empirical research

Data and Descriptive Statistics

The present paper presents the results of an empirical study of the Russian IPO market for 2006–2024 (until April 2024). The sample consists of companies whose business (or its main part) was located in Russia at the time of the IPO. The data used in the research was collected by the authors manually from publicly available Internet sources: the Moscow Exchange [33], official websites of companies and their consolidated IFRS statements, online versions of popular Russian newspapers [34–41], and open databases of issues [42–48].

The sample for the aforementioned time interval comprises 80 observations related to separate public offerings of non-financial organizations. Financial organizations such as banks, funds, insurance enterprises and other companies rendering financial services were removed from the sample.

Industries and Raised Capital

The 80 observations represent 9 non-financial industries (Figure 1). Companies were assigned to a single industry on the basis of their principal source of revenue.

The following industries are present in the sample:

- Mining – extraction of natural resources except for oil and gas;
- Technology – development of technological products, in particular software, or delivery of technological services;
- Retail – sales of consumer goods and services;
- Real estate – construction and renovation of immovable property;
- Food – food production and sales;
- Health – healthcare, pharmaceuticals, manufacturing and development of medication and medical technologies;
- Oil – extraction or sales of liquid hydrocarbons and/or natural gas;
- Transport – transportation services and logistics;
- Power – generation of electricity.

A dummy variable is introduced for each industry, taking the value "1" if a company is affiliated to the industry and "0" otherwise.

Figure 2 presents the size of IPO offerings (IPO volumes) in Russia. The raised capital was calculated as the product of the stock offer price (in roubles) and the number of issued stocks (*cap*).

We may compare leaps in amounts of raised funds to economic phenomena in modern Russia such as the significant market activity in 2006 and 2007 caused by the oil price surge and economic ramp-up, or the minimal IPO volumes in 2009, 2014 and 2022 as a result of economic and foreign-policy crises. These indicators are contained in the *cap* variable, which reflects the IPO volume and gives an indirect estimate of the company size.

Figure 1. Number of IPOs by industry in 2006–2024

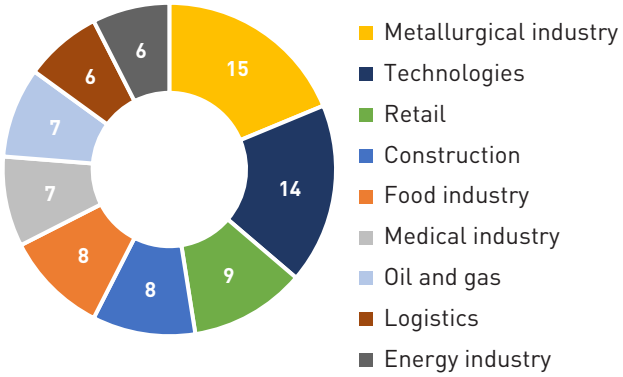


Figure 2. Funds raised through IPOs by industry, RUB mln

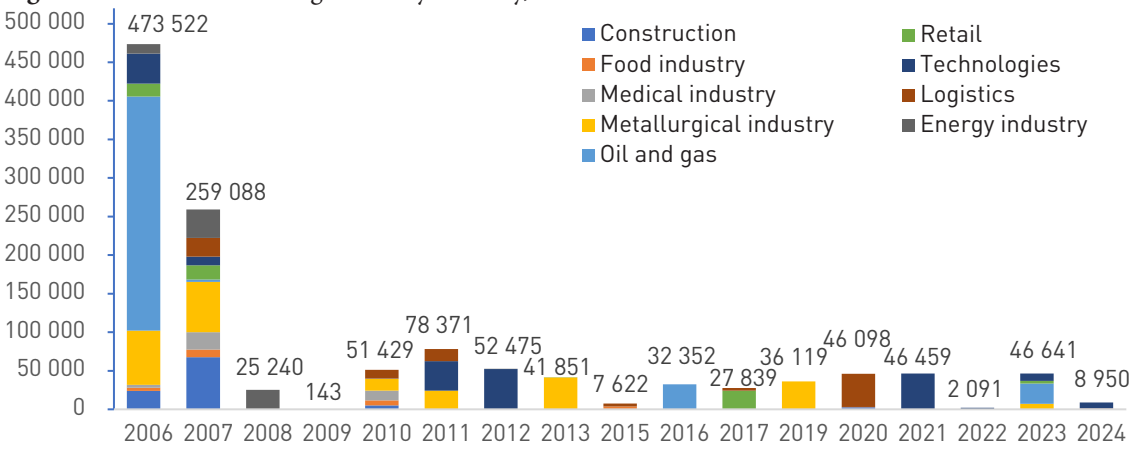
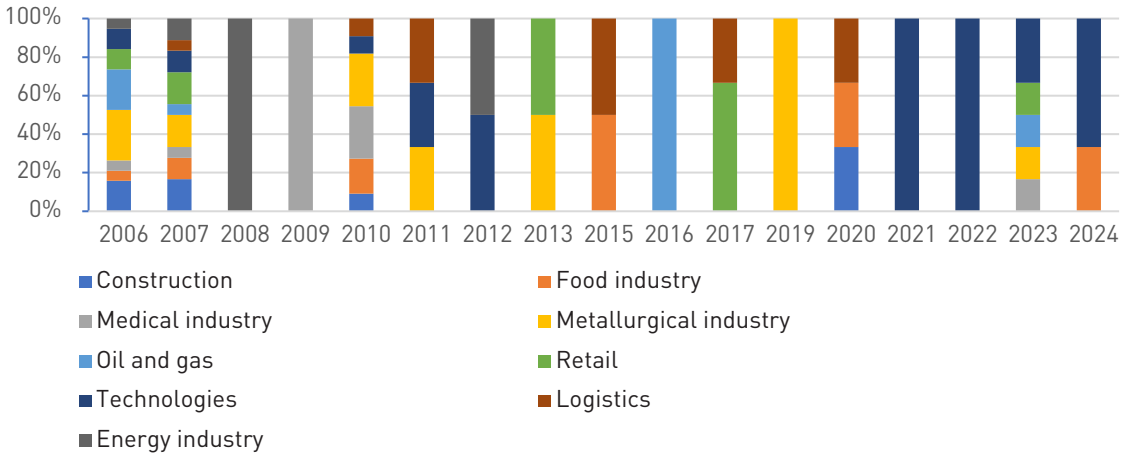


Figure 3. IPOs by industry, normalized by the number of IPOs



The dependence between the amount of raised funds and industries within the considered time interval (Figure 2) is ambiguous: when an industry shows peak IPO volumes in a certain year, further fund raising in subsequent years may differ, which is indicative of the absence of an obvious relationship between the IPO volume in a given year and the IPO volume in the subsequent year.

Figure 3 shows a normalized diagram indicating the percentage of IPOs by industry. It is remarkable that there is no single industry that has the same share of IPOs consistently from year to year: there is always an interval of 1–3 years. It is also notable that IPOs of technology companies predominate for several years in a row (2010–2013 and 2021–2024), which is related to the surge of investor interest in technology solutions, including domestic ones.

IPO underpricing

To study IPO underpricing, we collected the stock quotations of companies whose IPOs were included in the sample. To calculate the IPO underpricing variable, we used the initial public offering price and further stock quotations at the closing of the exchange:

$$l\_und\_id\ (underpricing\ on\ nth\text{-}day) = \ln \frac{P_n}{P_0}, \quad (1)$$

where P_n – closing price on trading day n;

P_o – initial public offering price.

For further research it is important to obtain a statistical confirmation that underpricing is statistically significant. According to the t-test presented in Table 1 for the hypothesis which states that this variable is insignificant, underpricing turned out to be significant for the intervals of 1 day, 7 days and 30 days at the 5% significance level.

Table 1. Significance of IPO Underpricing

und_1d	und_7d	und_30d	und_180d
	t-stat		
2.999	2.784	2.186	0.383
	5%-conf. Level		
	1I: und < 0	H1: und ≠ 0	H1: und > 0
und_1d	0.998	0.004	0.002
und_7d	0.997	0.007	0.003
und_30d	0.984	0.032	0.016
und_180d	0.649	0.703	0.351

Generally speaking, IPO underpricing refers to the prices on the *days immediately following* the offering. A measurement of the extent of underpricing on later dates may involve more "noise" which impairs the effectiveness of the estimation. In this research, we use the most popular time intervals: the 1st trading day, the 7th trading day, and the 30th trading day. The 180th day was included as a comparison with the primary underpricing detected at shorter, less "noisy" and statistically more significant intervals.

As long as the amount of company listing in our sample ranges from RUB 143 million to RUB 281 billion, it makes sense to calculate the IPO underpricing using the amount of raised funds. In Table 2 we recalculated the IPO underpricing values for several time intervals according to the amount of the funds raised by a company in a particular year: the IPO underpricing values within the interval were multiplied by the weights which were obtained as the ratio of the volume of a particular IPO to the total amount of funds raised in that year.

Table 2. Weighted average values of IPO underpricing (%)

	1 day	7 days	30 days	180 days
2006	1.6	2.9	1.5	18.0
2007	5.4	5.9	5.6	25.6
2008	-11.0	-10.6	-15.2	-84.7
2009	30.5	110.5	88.4	16.8
2010	-1.8	-2.5	-2.1	-8.0
2011	18.1	13.7	4.3	-15.6
2012	-0.7	11.1	18.4	71.5
2013	-0.6	2.4	-0.2	1.7

	1 day	7 days	30 days	180 days
2015	-2.5	-2.1	-14.0	-18.1
2016	1.5	1.7	1.7	6.7
2017	0.3	-0.7	-1.1	2.6
2019	3.5	4.0	7.8	17.0
2020	-3.7	-3.8	-6.7	-9.4
2021	42.2	25.4	15.2	37.3
2022	0.2	-13.8	-12.5	15.6
2023	-0.6	8.0	5.2	9.8
2024	16.8	12.2	15.9	–
Weighted average values, total	4.2	4.8	3.2	14.4

We see that weighted average values indicate the underpricing of stocks across the whole sample at the 3–4% level. This may be indicative of the impact of IPO volume on a decrease in IPO underpricing [4; 25; 26]. The diminishing correlation of the weighted average underpricing in Table 3 gives additional relevance to calculations.

Table 3. Correlation of weighted average values of IPO underpricing

	1–7 days	1–30 days	1–180 days
Correlation	0.6884	0.6557	0.3839

Technology companies

Another factor which may impact the extent of underpricing is the industry where the company operates – for example, a technology firm providing technological solutions, products or services to the market. Table 4 presents the results of weighted average values of IPO underpricing for technology companies calculated as the product of underpricing and the share of the funds raised by the technology company in the total amount of the funds raised by the companies of this industry in a given year.

Table 4. Weighted average values of IPO underpricing for technology companies (%)

	1 day	7 days	30 days	180 days
2006	0.61	-0.14	0.40	1.92
2007	-4.51	-7.08	-10.65	-40.46
2010	3.19	1.84	-1.44	-8.54
2011	37.80	34.08	26.20	-9.65
2012	-0.75	11.17	18.40	71.56
2021	42.16	25.40	15.25	37.27
2022	0.22	-13.84	-12.45	15.63
2023	23.60	41.13	36.85	38.44
2024	22.10	15.90	19.94	–
Weighted average values, total	18.1	16.8	14.8	24.7

Values for technology companies are indicative of much higher initial underpricing than across the sample as a whole: on the first day – 18.1% versus 4.2%, in 7 days – 16.8% versus 4.8%, in 30 days – 14.8% versus 3.2%. This confirms the assumption that technology companies experience greater asymmetry in the offering price of the company [24].

Financial indicators

In our research we used the financial indicators of a company which describe various aspects of financial standing, including total assets and revenue (TA, rev) [18], profitability (EBITDA margin, ROA) [28], debt burden (TD/E) [24], and dividend policy (div, div_ni_return) [31].

It is impossible to use such financial indicators for financial organizations such as banks, funds, and insurance enterprises, because their financial structure is different. Although financial organizations have a relatively high share of capitalization, they are far less represented in the IPO market, so modernizing the existing indicators would be unreasonable for our purposes and is left for future study by the authors.

Offering and shareholding indicators

To give a complete picture of company listings on the stock exchange, non-financial indicators were added to the database. In particular, we took the number of shares in the offering (*shares_n*), the amount of funds raised at IPO (*l_cap*) and free float shares (*ff_share*) [23] which are related to liquidity and may potentially influence the share price. We also used the company age at the time of IPO (*age*), the government's share in the company before the IPO (*gov_share*) [49] and a dummy variable related to listing on the Russian stock exchange (*rus_floor*). Additionally, we took the variable which presents the declared range of the IPO price – the width of the price range (*WRP*), calculated as follows [16; 27; 28]:

$$WRP\ (width\ of\ price\ range) = \frac{(Ph - Pl)}{Pe}, \quad (2)$$

where WRP – width of price range;

P_h – upper limit of price range;

P_l – lower limit of price range;

P_e – middle of price range.

We also calculated the change of the actual closing price in comparison to the expected offering price (*l_PRI*) as follows [16; 27]:

$$l\_PRI\ (price\ revision\ index) = \ln \frac{P_0}{Pe}, \quad (3)$$

where PRI – price revision index;

$P_e = \frac{(Ph + Pl)}{2}$ – expected offering price;

P_o – initial public offering price.

The list of variables with their descriptions and abbreviations is given in Appendix 1. In Table 5, we present the descriptive statistics of the aforementioned explanatory variables.

Table 5. Descriptive statistics of variables

Variables[1]		N	Mean	St. deviation	Min.	Max.
Categorial	food	80	0.100	0.302	0	1
	tech	80	0.163	0.371	0	1
	mining	80	0.163	0.371	0	1
	oil	80	0.113	0.318	0	1
	retail	80	0.113	0.318	0	1
	health	80	0.088	0.284	0	1
	estate	80	0.100	0.302	0	1
	transport	80	0.088	0.284	0	1
	utilities	80	0.075	0.265	0	1
	rus_floor	80	0.762	0.428	0	1
Organizational	gov_share	80	8.7%	20.8%	0.0%	100%
	age	80	12	7.382	0	33
Offering	ff_share	80	0.212	0.110	5.0%	51.0%
	shares_n	80	15,215	92,186	0.110	603,925
	WRP	80	0.180	0.110	0,0001	0.500
	PRI	80	0.974	0.080	0,697	1.191
	cap	80	15,454	32,713	7	280,899

[1] See the detailed description of variable values in Appendix 1.

Variables		N	Mean	St. deviation	Min.	Max.
Financial	rev	80	42,970	112,590	0.01	915,960
	EBITDA_margin	80	16.8%	50.9%	-131%	67.0%
	ta	80	82,561	205,002	6.97	1,282,702
	TD/E	80	1.674	2.348	0	8.375
	ROA	80	7.8%	19.0%	-27.6%	62.2%
	div	80	1,973	10,101	0	88,200
	div_ni_return	80	13.1%	22.5%	-9.35%	86.3%

The range of financial variable values reveals private data on particularly prominent offerings. For example, Norilsk Nickel attains its maximum value in assets and paid dividends, while Rosneft is the leader in terms of capitalization (281 billion roubles) and has the largest offering in Russia. Due to the limited number of observations, we expanded the sample with newly formed companies which did not derive steady revenues at the time of the IPO.

Research Methodology

To verify the hypotheses, we used a series of multiple OLS regressions with IPO underpricing as the dependent variable for several time intervals to test significance of the target exogenous variables. As the sample consists of various companies over different years, we applied logarithmic equations to stabilize estimates. We also used robust standard errors to minimize statistical outliers.

The regression models have the following form[2]:

$$ln\ (Underpricing\ on\ nth\ day)_j =$$
$$= cons + \sum Categorial\ parameter_j +$$
$$+ \sum Organizational\ parameterj +$$
$$+ \sum Offering\ parameter_j +$$
$$+ \sum Financial\ parameter\ p_j, \quad (4)$$

where n – number of days since the start of the IPO;

j – company from the sample.

After evaluating the OLS regressions, we performed tests and corrections for heteroscedasticity, multicollinearity and endogeneity by building an additional model using the two-stage least squares method (2SLS) with instrumental variables.

For building the regression models and conducting additional tests, we used the statistical package Stata 12.0 (http://www.stata.com).

The collected data allowed us to describe each observation with 24 parameters. The rational algorithm of enumeration was applied to make sets of regressors:

1) Amount of capital raised at the IPO and tech industry. These variables are used in most papers (A. Ljungvist and W. Wilhelm (2003); L. He et al. (2022); V. Nazarova and D. Anisina (2021) [22; 26; 28]), especially when a relationship with underpricing is suspected in the sample. This makes them the key parameters of the regression.
2) Other industries and time (categorial) variables. We focused our approach by taking the possible significance of industries and time into consideration.
3) Financial parameters. We added financial parameters to take the probable correlation into account.
4) Organizational and offering parameters. We studied the influence of the parameters of issue, age, and shareholding to get the final regression.
5) Additional verification. We added categorial variables to verify the significance and stability of estimates.

Selection of Parameters for the Empirical Model

Tables 6–10 in Appendix 2 show the results of the selection of regressors for evaluating the influence on the dependent variable of IPO underpricing on the 1st day.

Due to the high correlation of the parameters with each other, estimates for 1, 7 and 30 days will demonstrate similar results. Moreover, information about the issue, namely the full list of considered variables from Table 5, remains unchanged after 7, 30, and 180 days. Thus, the effects detected within the one-day interval will not strengthen in 7 or 30 days, nor will any new significant effects emerge. Intuitively this thesis is confirmed by the fact that investors and traders will not bide their time to implement a strategy if they receive no new information concerning the variables (from Table 5) when this period is over. Nevertheless, it is expedient to analyse longer time intervals for (1) testing the adequacy of the collected data and (2) verifying the durability of the effect.

It is useless to study the parameters which influence IPO underpricing beyond the horizon of 180 days due to "noise" and the limited publication of financial data in the course of a year. Nevertheless, using the dummy variable in the OLS regression, one should test the influence of these parameters on the years with the highest number of IPOs,

[2] The parameters mentioned in this equation are divided into subgroups in Table 5.

that is 2006 and 2007. The results show that their effect is insignificant (Table 7, Appendix 2). Although the sample is asymmetric from year to year, the inclusion of years with significant fluctuations in underpricing (2008, 2009, and 2013) is of no statistical significance, because these years have only 1 or 2 observations each.

The tech dummy variable demonstrated high significance in all versions (Tables 6–8, Appendix 2). The coefficients of other industries showed much weaker results.

The obtained estimates show that the variables of revenue (*l_rev*), total assets (*l_ta*) and capitalization (*l_cap*) give similar results (Tables 6–8, Appendix 2). *l_cap* was chosen as the final version of the company size variable, because this variable has a slightly higher R^2 and a better confirmed statistical significance in the literature than *l_rev* or *l_assets*. When the dividend variable (*l_div*) is added, the significance of *l_cap* grows.

After adding the variable *pri,* which shows the change in the actual offering price in comparison to the expected offering price, the significance of both the model and the individual regressors, including the constant, increase (Table 9, Appendix 2), which has not been observed up to now.

The reverification of earlier versions of the models with the addition of the variable *PRI* (Table 10, Appendix 2) showed that neither *age* nor *gov_share* are significant in different combinations with *PRI*. The dummy variables of 2006 and 2007 with a positive coefficient remain insignificant as before. As the capitalization of the IPO market for the sample was at the maximum point during these years, the addition of these variables draws off part of the effect from the capitalization variable (*cap*), which has been and remains significant. Similarly, while the industry variables could drive the estimates of other regressors up or down, they did not impact their own significance or that of others. After the addition of other dummy variables, the previously insignificant constant did not change its positive sign or lose its statistical significance, which confirms the consistent underpricing in the Russian IPO market.

Research Results

The final regression for IPO underpricing for 1 day, 7 days and 30 days (Model 2, same as Model 1.16 from Appendix 2) is presented in Table 11.

Table 11. Regression

Variable	Model 2		
	1 day	7 days	30 days
l_div	0.00297**	0.00193	0.00279
	(0.00132)	(0.00198)	(0.00243)
l_cap	-0.0223**	-0.0281	-0.0296
	(0.00959)	(0.0170)	(0.0183)
tech	0.134***	0.141***	0.151***
	(0.0373)	(0.0490)	(0.0522)
l_PRI	0.644***	0.868***	0.870***
	(0.199)	(0.243)	(0.327)
constant	0.205**	0.279*	0.266
	(0.0893)	(0.156)	(0.166)
Observations	80	80	80
R-squared	0.339	0.268	0.206
R-adjusted	0.304	0.229	0.162

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

As we can see, the significance of these variables and the regression as a whole (R^2) decreases as the time interval of underpricing increases. Generally speaking, this is not surprising, because the same explanatory data are used for different dependent variables which come under the influence of the new parameters over time.

All variables turned out to be significant at the 5% level and within the one-day interval. However, the significance of *l_div*, *l_cap* and the constant decreased as the time lag grew. The coefficient of the dividend payment variable (*l_div*) was estimated as 0.2–0.3%, which means that, when dividend payments grow by 1% in the year preceding the IPO, the initial underpricing increases by 0.2–0.3%. An inverse dependence was detected for the raised capital variable in the IPO period (*l_cap*), which is related to the company size. So, when the raised capital grows by 1%, the extent of underpricing decreases by 2.2%. Another variable – the deviation of the actual offering price from the expected one (*l_PRI*) – showed high significance for the estimate and the effect on underpricing. When the prices deviate by 1%, underpricing can grow from 0.64 to 0.87% within a month. A company from the technology sector statistically influences the basic level of IPO underpricing, increasing it by 14–16%. Also, the initial level of underpricing[3] of any Russian company is 23% on the first trading day and can rise as high as 32% subsequently, confirming the significant positive constant. This result aligns with all previous studies on the existence of IPO underpricing in the capital market as well as being additionally confirmed in our study by the t-test for significance (Table 1) and our data sample (Table 2), which shows IPO underpricing.

The evaluation results confirm the first hypothesis about a negative relationship between company size and IPO underpricing, the third hypothesis about the higher underpricing of technology companies, and the fourth hypothesis about a positive relationship between underpric-

[3] Disregarding the effects of other parameters – in particular, the diminishing effect of the amount of raised funds on underpricing (l_cap).

ing and the deviation of the actual offering price from the expected one. The second hypothesis about an inverse relationship between paid dividends and underpricing is rejected by our results, which show a positive influence of dividends on underpricing in the Russian market. The fifth hypothesis, which already showed statistical insignificance in some studies [25; 26], is also rejected, because the company age variable at the time of IPO (*age*) turned out to be insignificant.

The fact that we obtained similar results in three different time intervals is indicative of the reliability of the empirical study (robustness check).

Model Testing

To verify that the results of OLS regression are correct from the econometric point of view, we performed a series of classical tests for detecting errors in the evaluation of parameters. Table 12 presents the results.

Table 12. Testing the regression

F-test for the general significance of the regression			
F-stat (4, 75)	7.60	8.60	5.61
Prob > F	0.000	0.000	0.001
Ramsey Reset test for the correctness of the functional form			
F-stat (3, 72)	1.18	0.09	0.16
Prob > F	0.325	0.964	0.921
Breusch-Pagan test for heteroscedasticity			
Chi-squared (1)	0.18	9.29	1.34
Prob > Chi-squared	0.668	0.002	0.248
VIF-test for multicollinearity			
VIF	1 day	7 days	30 days
l_cap	1.12	1.12	1.12
l_div	1.11	1.11	1.11
l_PRI	1.08	1.08	1.08
tech	1.08	1.08	1.08
Average	1.08	1.08	1.08

First, F-tests for the significance of the regression showed that the regression as a whole is significant. Furthermore, the chosen logarithmic type of model suited the research, which is confirmed by the Ramsey test. The estimates were not exaggerated by a multicollinearity effect, as shown by the calculated Variance Inflation Factor (VIF) and the absence of highly correlated regressors in the same equation (Table 3). As the sample is heterogeneous and the evaluated residuals may have different dispersions, we applied robust standard errors of the regressors characterized by robustness to outliers. According to the Breusch-Pagan test for heteroscedasticity with non-robust estimates, this precaution was necessary, as significant heteroscedasticity was indeed detected in the model for underpricing for 7 days.

Endogeneity

Estimates may be distorted by omitted variables, although the F-tests confirmed the significance of the regression: in other words, the endogeneity of regressors is possible. In more formal terms, omitted variables cause a correlation between the regressor and an error, making the estimate exaggerated and inconsistent. One of the most common solutions is the use of instrumental variables (IV) in the two-stage least squares model (2SLS).

Instrumental variables should have the two following characteristics: no correlation with errors in the basic model and a correlation with the target regressor.

Although almost all the variables in this study may be suspected of endogeneity, we focused on paid dividends (*l_div*) and capital (*l_cap*). It is extremely difficult to run an endogeneity test on the variable of deviation from the expected price (*l_PRI*), as it relates to investors' expectations. There is no standard list of factors which influence investors' expectations, and any hypothetical list would most likely be different for each case. From the mathematical point of view, the deviation is calculated as the average of the upper and lower limits of the range, yet in the case of investors' expectations these limits have no clear or readily available formula, and this issue is furthermore not raised in the reviewed literature [16; 27; 28]. As for technology companies, the dummy variable format is often applied in studies [22; 32], yet the present study additionally verified the effects of other industries and years, which turned out to be insignificant. Therefore, there are reasons to believe that use of the *tech* dummy variable is quite exogenous enough.

To select relevant instrumental variables, we calculated separately the residuals of Model 2 for the 1, 7 and 30 days (*res1, res7, res30*) and verified the absence of a correlation between the residuals and the errors and the presence of a correlation with *l_div* and *l_cap* (see Appendix 3).Table 13 presents the results of the 2SLS model with robust errors.

Table 13. 2SLS Regression

	2SLS c IV (*l_div*)			2SLS c IV (*l_cap*)		
Variable	1st day Model 2	7 days Model 2	30 days Model 2	1st day Model 2	7 days Model 2	30 days Model 2
l_div	0.00377**	0.00325	0.00175	0.00307**	0.00179	0.00265
	(0.00190)	(0.00306)	(0.00398)	(0.00133)	(0.00216)	(0.00260)
Tech	0.134***	0.141***	0.151***	0.134***	0.141***	0.151***
	(0.0354)	(0.0470)	(0.0511)	(0.0360)	(0.0477)	(0.0507)
l_PRI	0.629***	0.842***	0.890***	0.652***	0.857***	0.859***
	(0.191)	(0.235)	(0.308)	(0.191)	(0.226)	(0.310)
L_cap	-0.0234**	-0.0299*	-0.0281	-0.0245**	-0.0249	-0.0263
	(0.00940)	(0.0173)	(0.0190)	(0.0104)	(0.0210)	(0.0225)
Constant	0.207**	0.283*	0.263	0.224**	0.253	0.239
	(0.0858)	(0.152)	(0.164)	(0.0940)	(0.183)	(0.193)
Observations	80	80	80	80	80	80
R-squared	0.336	0.264	0.204	0.338	0.267	0.205
R-adjusted	0.301	0.224	0.161	0.303	0.228	0.163
Endogeneity tests						
Chi-squared (1)	0.415	0.649	0.186	0.164	0.113	0.075
Prob > Chi-squared	0.520	0.421	0.666	0.685	0.737	0.785
F-stat (1,74)	0.367	0.588	0.176	0.155	0.102	0.067
Prob > F	0.546	0.446	0.676	0.700	0.750	0.796
J-test for endogeneity IV / overidentifying restrictions						
Chi-squared (6)	2.042	2.649	2.574	0.638	0.671	1.198
Prob > Chi-squared	0.916	0.851	0.860	0.888	0.880	0.754

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

Note that the coefficients of all variables and R^2 remained the same as in the standard OLS regression (Table 13). The tests show that the assumptions of the significance of endogeneity of *l_div* and *l_cap* are erroneous (the zero hypothesis about exogeneity is not rejected) and that the selected set of instrumental variables is also exogenous (J-test).

The results of all the aforementioned tests allow us to assert that Model 2 shows the estimated results for our data sample correctly.

In view of the endogeneity problem, we should pay attention to the significant positive constant, which was formed after identifying the price deviation variable *l_PRI* and which may provide indirect evidence of factors increasing IPO underpricing that were not taken into account in the model. Most likely, many parameters which influence underpricing are not represented in the model due to the limited information at our disposal, which is a problem for all econometric studies. Nevertheless, the significant constant is balanced by another significant but negative variable – raised capital (*l_cap*) – which mitigates the effect of inserting an average raised capital of 15.5 billion into the sample.

Conclusion

The Russian IPO market is relatively young, having emerged at the end of 1996 when the first Russian company OJSC VimpelCom was listed on the New York Stock Exchange. Nevertheless, the phenomenon of IPO underpricing during foreign offerings is also characteristic of the Russian market.

We reviewed the main theories which explain this phenomenon, including behavioural theory, institutional theory, control theory and information asymmetry theory, taking the latter as the basis for our research hypotheses. We used these theories to select the individual parameters that influence underpricing during an initial public offering. Running multiple OLS regressions on data from Russian companies relating to both IPO characteristics and company indicators, we obtained a statistical estimate of the impact of different company parameters.

First, we confirmed statistically the fact of stock underpricing in an average IPO. Second, testing the advanced hypotheses, we confirmed the positive effect of capital raised by a company on the decrease of company underpricing in a public offering, which was also noted in earlier papers (D. Logue,1973; N. Watanabel et al., 2022; L. He et al., 2022) [4; 25; 26]. We also revealed that previously paid dividends, company affiliation to the technology industry (A. Ljungqvist and W. Wilhelm, 2003; T. Loughran and J. Ritter, 2004; J. Kim et al., 2008) [22; 24; 32] and a positive deviation of the actual offering price from the expected offering price (partial adjustment phenomenon) increase IPO underpricing (K. Hanley, 1993; I. Ivashkovskaya and K. Kharlamov, 2007; V. Nazarova and D. Anisina, 2021) [16; 27; 28].

For the qualitative improvement of the estimates, one can increase the number of explanatory variables related to market expectations – for example, by introducing a variable describing the news coverage of the IPO or conducting in-depth studies of individual cases accompanied by an analysis of the opinions of investment banks along with an analysis of multipliers. Be that as it may, the obtained results will be useful as indicative values to determine underpricing at initial public offerings of shares – for example, to external investors for adjusting potential revenues and to issuers for regulating underpricing when taking decisions on launching an IPO.

References

1. Andreev R., Galieva G., Soloviev D. Russia's IPO Boom: Impact on Capital Markets. *Expert: Rating Agency.* 27.03.2024. URL: https://raexpert.ru/researches/ua/debt_market_2024/?ysclid=lw6k3uebyo545194672 (Accessed on 28.06.2024)
2. Analytics by the Investment Company Aigenis. *Aigenis.* 2024. (Accessed on 28.06.2024) URL: https://www.aigenis.ru/analytics
3. Reilly F.K., Hatfield K. Investor Experience with New Stock Issues. *Financial Analysts Journal.* 1969;25(5):73–80.
4. Logue D.E. On the Pricing of Unseasoned Equity Issues: 1965-1969. *The Journal of Financial and Quantitative Analysis.* 1973;8(1):91–103. https://doi.org/10.2307/2329751
5. Ibbotson R.G. Price Performance of Common Stock New Issues. *Journal of Financial Economics.* 1975;2(3):235–272. https://doi.org/10.1016/0304-405X(75)90015-X
6. Ljungqvist A. IPO Underpricing. *Handbook of Corporate Finance*. 2007;1:375–422. https://doi.org/10.1016/B978-0-444-53265-7.50021-4
7. Welch I. Sequential Sales, Learning and Cascades. *The Journal of Finance*. 1992;47(2):695–732. https://doi.org/10.2307/2329120
8. Loughran T., Ritter J.R. Why Don't Issuers Get Upset about Leaving Money on The Table in IPOs? *The Review of Financial Studies*. 2002;15(2):413–443. https://doi.org/10.1093/rfs/15.2.413
9. Benvenistea L.M., Busabah W.Y., Wilhelm W.J. Price Stabilization as a Bonding Mechanism in New Equity Issues. *Journal or Financial Economics.* 1996;42(2):223–255. https://doi.org/10.1016/0304-405X(96)00880-X
10. Shleifer A., Vishny R. Large Shareholders and Corporate Control. *Journal of Political Economy*. 1986;94(3 Part 1):461–488.
11. Thomsen S., Conyon M. *Corporate Governance: Mechanisms and Systems.* McGraw-Hill; 2012.
12. Zingales L. Insider Ownership and the Decision to Go Public. *The Review of Economic Studies.* 1995;62(3):425–448. https://doi.org/10.2307/2298036
13. Stoughton N.M., Zechner J. IPO-mechanisms, Monitoring and Ownership Structure. *Journal of Financial Economics*. 1998;49(1):45–77. https://doi.org/10.1016/S0304-405X(98)00017-8
14. Rock K. Why New Issues are Underpriced. *Journal of Financial Economics.* 1986;15(1-2):187–212. https://doi.org/10.1016/0304-405X(86)90054-1
15. Benveniste L.M., Spindt P.A. How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics.* 1989;24(2):343–361. https://doi.org/10.1016/0304-405X(89)90051-2
16. Hanley K.W. The underpricing of initial public offerings and the partial adjustment phenomenon. *Journal of Financial Economics.* 1993;34(2):231–250. https://doi.org/10.1016/0304-405X(93)90019-8
17. Baron D.P. A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues. *The Journal of Finance.* 1982;37(4):955–976. https://doi.org/10.1111/j.1540-6261.1982.tb03591.x
18. Ritter J.R. The «Hot Issue» Market of 1980. *The Journal of Business.* 1984;57(2):215–240.

19. Beatty R.P., Ritter J.R. Investment Banking, Reputation, and The Underpricing of Initial Public Offerings. *Journal of Financial Economics.* 1986;15(1-2):213–232. https://doi.org/10.1016/0304-405X(86)90055-3
20. Megginson W.L., Weiss K.A. Venture Capitalist Certification in Initial Public Offerings. *The Journal of Finance.* 1991;46(3):879–903. https://doi.org/10.1111/j.1540-6261.1991.tb03770.x
21. Chambers D., Dimson E. IPO Underpricing Over the Very Long Run. *The Journal of Finance.* 2009;64(3):1407–1443. https://doi.org/10.1111/j.1540-6261.2009.01468.x
22. Ljungqvist A., Wilhelm W.J. IPO Pricing in the Dot-Com Bubble. *The Journal of Finance.* 2003;58(2):723–752. https://doi.org/10.1111/1540-6261.00543
23. Kennedy D.B., Sivakumar R., Vetzal K.R. The implications of IPO underpricing for the firm and insiders: Tests of asymmetric information theories. *Journal of Empirical Finance.* 2006;13(1):49–78. https://doi.org/10.1016/j.jempfin.2004.10.003
24. Kim J., Pukthuanthong-Le K., Walker T. Leverage and IPO under-pricing: High-tech versus low-tech IPOs. *Management Decision.* 2008;46(1):106–130. https://doi.org/10.1108/00251740810846770
25. Watanabel N., Yamauchi S., Sakawa H. The Board Structure and Performance in IPO Firms: Evidence from Stakeholder-Oriented Corporate Governance. *Sustainability (Switzerland).* 2022;14(13):8078. https://doi.org/10.3390/su14138078
26. He L., Hsin-han Shen C., Shiu C. Y. Is fair value information fairly priced? Evidence from IPOs in global capital markets. *Journal of Banking and Finance.* 2022;135:106368. https://doi.org/10.1016/j.jbankfin.2021.106368
27. Ivashkovskaya I.V., Kharlamov L.S. Russian IPOs Pricing Efficiency. *Korporativnye Finansy = Journal of Corporate Finance Research.* 2007;3(3):53–63. (In Russ.) https://doi.org/10.17323/j.jcfr.2073-0438.1.3.2007.53-63
28. Nazarova V.V., Anisina D.V. Identifying the reasons for understimation of Russian companies at primary placement of shares. *Vestnik Moskovskogo universiteta. Seriâ 6, Èkonomika = Moscow University Economics Bulletin.* 2021;(3):240-270. (In Russ.) https://doi.org/10.38050/013001052021311
29. Booth J.R., Smith R.L. Capital raising, underwriting and the certification hypothesis. *Journal of Financial Economics.* 1986;15(1-2):261–281. https://doi.org/10.1016/0304-405X(86)90057-7
30. Hughes P.J. Signalling by Direct Disclosure under Asymmetric Information. *Journal of Accounting and Economics.* 1986;8(2):119–142. https://doi.org/10.1016/0165-4101(86)90014-5
31. Wang J., Cheng R., Huang Y. et al. The pre-IPO dividend and IPO underpricing: Evidence from China. *Pacific Basin Finance Journal.* 2023;(82):102195. https://doi.org/10.1016/j.pacfin.2023.102195
32. Loughran T., Ritter J. Why Has IPO Underpricing Changed over Time? *Financial Management.* 2004;33(3):5–37.
33. Moscow Exchange. IPO Guide. URL: https://ipoguide.moex.com/ru/section-2-1.html (Accessed on 28.06.2024)
34. Russian newspaper Kommersant. 2024. URL: https://www.kommersant.ru/ (Accessed on 28.06.2024) (In Russ.)
35. Russian broker Finam. 2024. URL: https://www.finam.ru/ (Accessed on 28.06.2024) (In Russ.)
36. Investment Company BCS. 2024. URL: https://bcs-express.ru/ (Accessed on 28.06.2024) (In Russ.)
37. Newsportal Russian Immovable Property. 2024. URL: https://rn.ru/ (Accessed on 28.06.2024) (In Russ.)
38. Russian newspaper RBC. 2024. URL: https://www.rbc.ru/ (Accessed on 28.06.2024) (In Russ.)
39. Data portal InfraNews. 2024. URL: https://www.infranews.ru/ (Accessed on 28.06.2024) (In Russ.)
40. Russian newspaper Finmarket. 2024. URL: https://www.finmarket.ru/ (Accessed on 28.06.2024) (In Russ.)
41. Federal News Agency TASS. 2024. URL: https://tass.ru/ekonomika/ (Accessed on 28.06.2024) (In Russ.)
42. Preqveca database. 2024. URL: http://preqveca.ru/placements/ (Accessed on 28.06.2024) (In Russ.)
43. Financial portal Investing. 2024. URL: https://ru.investing.com/ (Accessed on 28.06.2024) (In Russ.)
44. Financial portal TradingView. 2024. URL: https://ru.tradingview.com/symbols/ (Accessed on 28.06.2024) (In Russ.)
45. Russian broker Finam. Quotes. 2024. URL: https://www.finam.ru/quote/ (Accessed on 28.06.2024) (In Russ.)
46. Financial portal Investfunds. 2024. URL: https://investfunds.ru/stocks/ (Accessed on 28.06.2024) (In Russ.)
47. Financial portal YahooFinance, 2024. URL: https://finance.yahoo.com/quote/ (Accessed on 28.06.2024)
48. Financial portal MFD. 2024. URL: https://mfd.ru/marketdata/ (Accessed on 28.06.2024) (In Russ.)
49. Dewenter K.L., Malatesta P.M. Public Offerings of State-Owned and Privately-Owned Enterprises: An International Comparison. *The Journal of Finance.* 1997;52(4):1659–1679. https://doi.org/10.1111/j.1540-6261.1997.tb01125.x

Appendix 1. Description of variables

Designation of the variable in the model	Variable	Variable description
l_und_1d l_und_7d l_und_30d l_und_180d	IPO underpricing for 1, 7, 30, 180 days	Logarithm of the dependent variable that indicates the difference between the price over a time period and the offering price $l\_und\_id\ (\text{underpricing on ith day}) = \ln\frac{P_i}{P_0}$, where P_i – closing price on trading day i; P_o – initial offering price
tech	Technology company	Dummy variables which identify company affiliation to some industry
food	Food company	
mining	Mining company	
oil	Oil and/or gas extraction company	
retail	Retail company	
health	Medical or pharmaceutical company	
estate	Real estate developer	
transport	Transport and/or logistics company	
utilities	Power company	
rus_floor	Listing in Russia	Issue's affiliation with MICEX and/or RTS, among others
year_ipo	IPO year	Year when the company held the IPO, during the period 2006–2024
l_shares_n	Number of shares	Logarithm of the number of shares issued for the IPO
l_rev	Revenue	Logarithm of revenue during the last full year preceding the IPO
EBITDA_margin	EBITDA margin	EBITDA margin during the last full year preceding the IPO

l_ta	Total assets (company size)	Logarithm of all assets during the last full year preceding the IPO
age	Company age	Company age in years at the time of the IPO
TD/E	Debt burden	Total debt to capital during the last full year preceding the IPO
l_cap	Capitalization/company size	Logarithm of the product of the offering price and the number of shares
ROA	Return on assets	Return on assets during the last full year preceding the IPO
div_l	Paid dividends	Logarithm of all the paid dividends during the last full year preceding the IPO
div_ni_return	Return on dividends	Ratio of paid dividends to capital during the last full year preceding the IPO
ff_share	Free-float	Free float shares immediately after the IPO in % of all company shares
gov_share	Government share	Government share in company capital before the IPO
l_WRP	Width of price range	$WRP\ (\text{width of price range}) = \frac{(Ph - Pl)}{Pe}$, where WRP – width of price range; P_h – upper limit of price range; P_l – lower limit of price range; P_e – middle of price range.
l_PRI	Deviation of the offering price from the expected one	$l\_PRI\ (\text{price revision index}) = \ln\frac{P_0}{Pe}$, where PRI – price revision index; $P_e = \frac{(Ph + Pl)}{2}$ – expected offering price; P_o – initial offering price. P_h – upper limit of price range; P_l – lower limit of price range
2006_y	IPO of 2006	Dummy variable indicating that the IPO was held in 2006
2007_y	IPO of 2007	Dummy variable indicating that the IPO was held in 2007

Appendix 2

Table 6. Regression. Selection of Parameters (1/5)4

Variables	(1) Model 1.1	(2) Model 1.2.	(3) Model 1.3.	(4) Model 1.4.	(5) Model 1.5.	(6) Model 1.6
Tech	0.148***	0.144***	0.145***	0.144***	0.143***	0.139***
	(0.0480)	(0.0474)	(0.0484)	(0.0481)	(0.0418)	(0.0415)
l_rev	-0.00446					
	(0.00331)					
l_ta		-0.00772		-0.00368		
		(0.00623)		(0.00594)		
l_cap			-0.0110	-0.00786	-0.0171*	-0.0122
			(0.00969)	(0.0108)	(0.00968)	(0.00915)
l_div					0.00386**	
					(0.00147)	
div_ni_return						0.147**
						(0.0683)
Constant	0.0550	0.0904	0.112	0.120	0.132	0.104
	(0.0344)	(0.0679)	(0.0912)	(0.0930)	(0.0876)	(0.0864)
Observations	80	80	80	80	80	80
R-squared	0.145	0.148	0.151	0.153	0.216	0.201
R-adj	0.123	0.130	0.130	0.121	0.185	0.170

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

Table 7. Regression. Selection of Parameters (2/5)

Variables	(1) Model 1.5.	(2) Model 1.7.	(3) Model 1.8.	(4) Model 1.9.	(5) Model 1.10.	(6) Model 1.11.
l_div	0.00386**	0.00399***	0.00412***	0.00422**	0.00455**	0.00466**
	(0.00147)	(0.00150)	(0.00151)	(0.00181)	(0.00175)	(0.00176)
l_cap	-0.0171*	-0.0178*	-0.0187*	-0.0148	-0.0149	-0.0152
	(0.00968)	(0.00989)	(0.00956)	(0.00934)	(0.00916)	(0.00937)
food				-0.115	-0.00263	-0.00103
				(0.0958)	(0.102)	(0.102)

[4] Colouring is used in the regression models to single out logical subgroups.

Variables	(1) Model 1.5.	(2) Model 1.7.	(3) Model 1.8.	(4) Model 1.9.	(5) Model 1.10.	(6) Model 1.11.
mining				-0.119***	-0.00862	-0.0120
				(0.0436)	(0.0529)	(0.0535)
Oil				-0.103**	0.00873	-0.000479
				(0.0477)	(0.0572)	(0.0603)
retail				-0.105**	0.00820	0.00749
				(0.0499)	(0.0608)	(0.0613)
health				-0.0111	0.102	0.103
				(0.0678)	(0.0776)	(0.0792)
estate				-0.0403	0.0733	0.0691
				(0.0492)	(0.0611)	(0.0598)
transport				-0.107**	0.00210	0.00590
				(0.0499)	(0.0567)	(0.0582)
tech	0.143***	0.145***	0.146***		0.162**	0.163**
	(0.0418)	(0.0432)	(0.0441)		(0.0626)	(0.0641)
y_2006		0.0219				0.0250
		(0.0305)				(0.0320)
y_2007			0.0410			
			(0.0303)			
Constant	0.132	0.131	0.134	0.201**	0.0876	0.0841
	(0.0876)	(0.0905)	(0.0872)	(0.0768)	(0.0862)	(0.0903)
Observations	80	80	80	80	80	80
R-squared	0.216	0.220	0.227	0.202	0.265	0.270
R-adj	0.185	0.178	0.175	0.100	0.159	0.152

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

Table 8. Regression. Selection of Parameters (3/5)

Variables	(1) Model 1.5	(2) Model 1.12	(3) Model 1.13	(4) Model 1.14	(5) Model 1.15
tech	0.143***	0.140***	0.139***	0.139***	0.131***
	(0.0418)	(0.0425)	(0.0422)	(0.0438)	(0.0449)
l_div	0.00386**	0.00362**	0.00370**	0.00364**	0.00322**
	(0.00147)	(0.00153)	(0.00143)	(0.00158)	(0.00156)
l_cap	-0.0171*	-0.0173*	-0.0155	-0.0172*	-0.0157
	(0.00968)	(0.00975)	(0.00977)	(0.00973)	(0.00988)
ROA				0.0340	0.0358
				(0.0606)	(0.0593)

Variables	(1) Model 1.5	(2) Model 1.12	(3) Model 1.13	(4) Model 1.14	(5) Model 1.15
TD/E			-0.00639		-0.00682
			(0.00676)		(0.00688)
EBITDA_margin		0.0163*			0.0167*
		(0.00947)			(0.00897)
Constant	0.132	0.133	0.131	0.133	0.133
	(0.0876)	(0.0883)	(0.0880)	(0.0880)	(0.0892)
Observations	80	80	80	80	80
R-squared	0.216	0.219	0.226	0.217	0.231
R-adjusted	0.185	0.177	0.184	0.176	0.168

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

Table 9. Regression. Selection of Parameters (4/5)

Variables	(1) Model 1.16	(2) Model 1.17	(3) Model 1.18	(4) Model 1.19	(5) Model 1.20	(6) Model 1.21
l_div	0.00297**	0.00378**	0.00389**	0.00385**	0.00367**	0.00428***
	(0.00132)	(0.00151)	(0.00149)	(0.00147)	(0.00153)	(0.00156)
l_cap	-0.0223**	-0.0168*	-0.0162*	-0.0175*	-0.0165*	-0.0162
	(0.00959)	(0.00961)	(0.00952)	(0.00976)	(0.00959)	(0.00980)
tech	0.134***	0.139***	0.141***	0.144***	0.138***	0.139***
	(0.0373)	(0.0427)	(0.0426)	(0.0421)	(0.0446)	(0.0409)
l_PRI	0.644***					
	(0.199)					
l_wrp		0.00465				
		(0.00792)				
age			0.000611			
			(0.00200)			
shares_n				0.001		
				(0.006)		
ff_share					-0.0663	
					(0.113)	
gov_share						-0.0614
						(0.0497)
Constant	0.205**	0.142	-1.097	0.134	0.144	0.126
	(0.0893)	(0.0883)	(4.016)	(0.0881)	(0.0948)	(0.0883)
Observations	80	80	80	80	80	80
R-squared	0.339	0.220	0.217	0.216	0.218	0.222
R-adjusted	0.304	0.179	0.175	0.174	0.176	0.181

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

Table 10. Regression. Selection of Parameters (5/5)

Variables	(1) Model 1.16	(2) Model 1.23	(3) Model 1.24	(4) Model 1.25	(5) Model 1.26	(6) Model 1.27
l_div	0.00297**	0.00298**	0.00326**	0.00326**	0.00326**	0.00363**
	(0.00132)	(0.00132)	(0.00138)	(0.00139)	(0.00144)	(0.00160)
l_cap	-0.0223**	-0.0220**	-0.0216**	-0.0215**	-0.0239**	-0.0219**
	(0.00959)	(0.00928)	(0.00975)	(0.00943)	(0.00959)	(0.00968)
tech	0.134***	0.134***	0.131***	0.131***	0.138***	0.162***
	(0.0373)	(0.0382)	(0.0367)	(0.0376)	(0.0420)	(0.0609)
l_PRI	0.644***	0.643***	0.637***	0.637***	0.644***	0.664***
	(0.199)	(0.197)	(0.202)	(0.200)	(0.212)	(0.245)
food						-0.0133
						(0.107)
mining						0.00764
						(0.0547)
oil						0.00824
						(0.0556)
retail						0.0496
						(0.0616)
health						0.0711
						(0.0729)
estate						0.0909
						(0.0572)
transport						0.0219
						(0.0550)
age		0.000178		0.0003		
		(0.00194)		(0.00200)		
gov_share			-0.0398	-0.0396		
			(0.0502)	(0.0525)		
y_2006					0.00157	
					(0.0359)	
y_2007					0.0425	
					(0.0333)	
Constant	0.205**	-0.154	0.200**	0.150	0.206**	0.169*
	(0.0893)	(3.884)	(0.0904)	(3.990)	(0.0921)	(0.0947)
Observations	80	80	80	80	80	80
R-squared	0.339	0.339	0.342	0.342	0.353	0.381
R-adjusted	0.304	0.295	0.297	0.288	0.300	0.281

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

Appendix 3. Correlation matrices with residuals of Model 2

Variables	res1	res7	res30	l_cap	l_div	l_ta	EBITDA_ margin	TD/E	div_ni_ return	ROA
res1	1.00									
res7	0.80***	1.00								
res30	0.80***	0.87***	1.00							
l_cap	0.00	0.00	0.00	1.00						
l_div	0.00	0.00	0.00	0.28**	1.00					
l_ta	-0.01	-0.01	0.01	0.66***	0.29***	1.00				
EBITDA_ Margin	0.06	0.03	0.02	0.11	0.30***	0.11	1.000			
TD/E	-0.06	-0.05	-0.13	0.16	-0.05	0.28**	0.032	1.00		
div_ni_return	0.06	0.05	-0.06	0.07	0.70***	0.03	0.232**	-0.01	1.00	
ROA	0.02	0.02	-0.01	0.12	0.35***	0.31***	0.241**	0.03	0.31***	1.00

Variables	res1	res7	res30	l_cap	l_div	rus_floor	l_shares_n	age	gov_share	ff_share	l_WRP
res1	1.00										
res7	0.78***	1.00									
res30	0.80***	0.87***	1.00								
l_cap	0.00	0.00	0.00	1.00							
l_div	0.00	0.00	0.00	0.28**	1.00						
rus_floor	-0.08	0.05	0.02	0.04	0.12	1.00					
l_shares_n	-0.03	0.07	0.07	0.47***	0.18*	-0.09	1.00				
age	0.01	-0.04	0.05	-0.34***	-0.15	-0.06	-0.22**	1.00			
gov_share	-0.06	0.06	0.05	0.23**	0.38***	0.20*	0.29***	-0.25**	1.00		
ff_share	-0.05	-0.10	-0.08	0.07	-0.22*	-0.19*	-0.11	-0.03	-0.12	1.00	
l_WRP	0.08	0.11	0.11	-0.03	0.07	0.03	-0.20*	-0.01	0.04	-0.21*	1.00

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

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

The authors declare no conflicts of interests.

The article **was submitted on** 26.06.2024; **approved after reviewing on** 28.07.2024; **accepted for publication on** 15.08.2024

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.82-96
JEL classification: C23, E02, G28, M41, N27

Economic Freedom and Bank Stability in the Rich African Economies

Abdulai Agbaje Salami ✉
PhD, Senior Lecturer, Al-Hikmah University, Ilorin, Nigeria,
abdagbaje1@gmail.com, ORCID

Ahmad Bukola Uthman
PhD, Senior Lecturer,
Nile University of Nigeria, Abuja, Nigeria,
ahmad.uthman@nileuniversity.edu.ng, ORCID

Asiyat Titilope Bello
Accountant, Kwara State Civil Service Commission, Ministry of Finance, Ilorin, Nigeria,
belloasiyat09@gmail.com, ORCID

Abstract

This study empirically examines the nexus between economic freedom and bank stability in rich African economies, seeking to uncover the underlying causes of the recent wave of bank failures in these countries. It employs the Heritage Foundation's Economic Freedom Index, utilizing its four main pillars to offer a more holistic approach compared to existing studies on the continent. Static panel regression analysis is applied to bank-level, economic freedom, and macroeconomic data from ten countries over the period 2013–2022 to test the hypotheses. The results largely support a positive relationship between bank stability and economic freedom, though at a lower intensity, as indicated by the insignificant positive coefficients of the overall economic freedom index. Specifically, the findings show insignificant positive coefficients for the rule of law (RLW) and government size (GVSZ), alongside significantly positive and negative coefficients for regulatory efficiency (REGE) and the open market system (OPM), respectively. These results highlight weaknesses in the OPM's components, including trade, investment, and financial freedom, despite their average level. The study also points to a need for improving the components of RLW, given its low mean score, which signals insufficient judicial effectiveness, government integrity, and property rights protection – factors essential for attracting business and fostering banking sector growth. While regulatory efficiency is seen as a key factor in enhancing bank solvency in the future, the study emphasizes that significant behavioural and policy changes are needed for other pillars to contribute meaningfully to bank stability in the rich African economies. The findings provide insights into how banks, especially those from wealthier African nations, can maintain global recognition and financial viability through economic liberalisation. At the same time, the study's limited access to bank-specific data presents an opportunity for future research to further build on these findings.

Keywords: bank stability, economic freedom, economic openness, regulatory efficiency, rich African countries, rule of law

For citation: Salami A.A., Uthman A.B., Bello A.T. (2024) Economic Freedom and Bank Stability in the Rich African Economies. *Journal of Corporate Finance Research.* 18(3): 82-96. https://doi.org/10.17323/j. jcfr.2073-0438.18.3.2024.82-96

Introduction

While an efficient banking system is considered to be a potent tool for driving the economy [1], the economy can also be a source of strength for the banking sector [2]. Economic freedom is often related to the seamless actualisation of the economic goals of individuals and corporate entities thanks to the absence of economic restrictions [3]. Bolstered by free competition, protection of individual and corporate property, and a greater volume of voluntary exchange [2], among other factors, economic freedom may be defined as an overall quality of political cum economic institutions [4] that provides for greater economic opportunities. This suggests that economic progress lies in the freedom to choose and supply factors of production, compete favourably in business and financial transactions, exchange goods and services with others and protect individual and corporate property rights.

The empirical link between economic freedom and bank soundness can be explained by several key factors. The ability of banks to provide more credit depends on the presence of multiple competing firms seeking funding through bank loans, which contributes to higher interest margins for banks [5]. Additionally, a greater national level of economic freedom encourages the entry of new domestic and foreign companies offering diverse products, leading to more diversified loan portfolios that enhance bank profitability and efficiency [6]. The increase in real income associated with a higher economic freedom index drives greater demand for banking services [7].

According to institutional theory, sound institutions – characterised by open markets, secure property rights, and minimal trade restrictions – create a favourable policy environment [8], which fosters national economic growth [9] and positively impacts banking sector efficiency [5]. This is further supported by new growth theory, which argues that robust institutions and policies are essential for sustained economic progress [10], with a stable and efficient banking sector being a natural outcome of such progress.

The construction of an economic freedom index, as reflected in the literature, is typically associated with the Heritage Foundation and the Fraser Institute [5; 11]. The Fraser Institute's index of economic freedom is built on five pillars: government size, legal systems and property rights, freedom to trade internationally, regulation, and sound money. In contrast, the Heritage Foundation's index is based on 12 factors across four pillars, each comprising three factors. The "rule of law" pillar includes judicial effectiveness, property rights, and government integrity, while the "open market system" pillar encompasses trade, financial, and investment freedom. The "regulatory efficiency" pillar is composed of business, monetary, and labour freedom, and, finally, the "government size" pillar is defined by government spending, fiscal health, and tax burden.

The connection between the four pillars of the economic freedom index, as defined by the Heritage Foundation, and banks' financial stability is particularly evident in the African context. In Kenya, despite an expanded regulatory framework, bank collapses have persisted over time. A key factor in the recurrence of banking crises is the abuse of insider lending practices to bank directors and major shareholders, which undermines the rule of law [12]. A similar situation has occurred in Nigeria, notably with First Bank of Nigeria Limited's loan facility to Honeywell Flour Mills Plc. The acquisition of Union Bank of Nigeria by Titan Trust Bank, facilitated by regulators according to a special investigation, has raised questions about government integrity in Nigeria [13].

South Africa has also faced a series of bank failures [14]. The placement of African Bank Limited and VBS Mutual Bank under curatorship is a typical example [14; 15]. The VBS Mutual Bank case, as revealed by the South African Reserve Bank, involved the misuse of short-term municipal deposits to fund long-term lending, clearly violating the rule of law [15]. Furthermore, the granting of substantial personal loans, amounting to R7.8 million, to President Jacob Zuma while he was still in office [16] casts doubt on both government integrity and regulatory efficiency in the country.

The persistence of bank failures in Ghana, despite government intervention [17], is also a cause for concern. Recently, Fitch, a globally-recognised credit rating agency, downgraded four systemically important Egyptian banks following a sharp increase in the net foreign asset deficit of Egypt's banking sector [18], despite Egypt's prominent position in the African economy [19]. This downgrade may increase the vulnerability of Egypt's banking sector [18]. Both Ghana and Egypt are known for having robust regulatory and supervisory frameworks [12; 14].

However, it is unclear if these banking crises are unique to these nations, as several catalysts of banking efficiency, such as trade, investment, and financial openness – key elements of greater economic freedom – are present in these countries [20], which are considered among the wealthier economies in Africa. These factors underscore the need for an empirical study examining the relationship between economic freedom and bank stability in rich African countries.

Several empirical studies have explored the nexus between economic freedom and bank performance within sub-Saharan Africa [21–23]. However, our study is unique in that it singles out Africa's wealthier economies. Since the challenges and opportunities organisations face differ across societies with varying levels of economic freedom [2], a more accurate reflection of the relationship between economic freedom and bank stability is achieved when studying a sample of banks operating in societies with relatively similar economic potential. By focusing on Africa's richer countries, this study strengthens its argument and contributes to the existing literature.

Our study is also the first of its kind, as far as we can tell from the available literature, to examine the empirical nexus of the major pillars of economic freedom (as developed by the Heritage Foundation) with bank stability in an African context. Previous studies have either adopted

the overall economic freedom index or focused on only a few selected factors [22–24]. As an empirical fact-finding study, this paper addresses the reality that nations with higher levels of economic freedom – according to the Heritage Foundation's economic freedom index – tend to have robust and profitable banking sectors. Thus, it produces a paradigm shift in the literature by determining whether the relatively high levels of economic freedom in rich African countries are reflected in their banks' financial standing.

Additionally, this study serves as a call to action for governments of Africa's wealthier countries to pursue greater economic openness. Such openness will enable those of their banks that aim to expand globally to compete favourably with leading international banks.

This paper also includes a literature review section integrated with hypotheses development, as well as a research methods section detailing the research design and model specification. Additionally, there are two sections focusing on data analysis, which is accompanied by a discussion of findings, and concluding remarks incorporating policy implications.

Empirical Literature and Hypotheses Development

The financial condition of banks, as an outcome variable in the economic freedom literature, is often considered in terms of bank performance and/or risk-taking. For bank performance, which reflects profitability, solvency, and/or stability, there is predominant evidence of a direct relationship: a higher economic freedom index, along with its components such as business, monetary, and financial freedom, as well as the index of freedom from corruption, has been found to positively impact the profitability of Malaysian banks [25]. Similar evidence, particularly for the overall economic freedom index, has been established by F. Sufian and M.K. Hassan [26] and F. Sufian [27], who used the bank interest margin and bank efficiency as outcome variables for banks in ASEAN-5 countries and Indonesia, respectively.

However, contrary evidence has been reported by F. Sufian and M.S. Habibullah for Malaysian banks [28] and by F. Sufian for banks in the MENA region [29]. Greater economic freedom and its components, including financial freedom, property rights, freedom from corruption, and business freedom but excluding government spending, are seen as ingredients of bank efficiency, as found by G.E. Chortareas et al. for banks in 27 European countries [3]. The positive impact of economic freedom on bank profitability was also highlighted by A. Shahabadi and H. Samari, with positive coefficients observed for most measures of economic freedom – such as government size, secured property rights, legal structure, access to sound money and financial, trade, and labour freedom – across developed and developing countries [30].

Using the Fraser economic freedom index, E. Mamatzakis et al. [31] found that neither the overall economic freedom index nor its five pillars (with the exception of the protection of legal rights) had a positive impact on bank efficiency for banks in 10 Central and Eastern European countries, showing the directional relationship of economic freedom to bank performance.

Banks' return on assets is influenced by the level of economic freedom within a U.S. state [32]. Similar findings were reported by E. Sarpong-Kumankoma et al. [22] for sub-Saharan African banks over the period 2006–2012. The relationship between greater financial freedom and higher bank interest margins is highlighted in [33], though the opposite effect is observed for bank stability according to [23], using the same dataset as [22]. In Arab countries, bank profitability, as indicated by return on assets, is positively correlated with the quality of economic freedom based on the Fraser Institute's conceptualization [11]. In the European context, greater economic freedom is more strongly linked to improved bank interest margins than to other bank performance indicators [34]. Bank stability, however, is reflected in lower non-performing loans, higher Z-scores, and improved capital adequacy levels [34].

For 19 Eurozone countries, higher economic freedom, as measured by the Heritage Foundation's overall and pillar indexes and by the Fraser Institute's index, is causally linked to better profitability and stability of financial institutions [5]. Conversely, in the United Kingdom, higher economic freedom is found to be inversely related to bank solvency based on data from the 10 largest depository institutions [35]. In Africa, the Heritage Foundation's indexes of economic, business, monetary, and financial freedom positively explain bank interest margins, return on assets, and return on equity [24]. Indonesian evidence from all types of commercial banks shows that the overall index of the Heritage Foundation's four-pillar economic freedom model is positively associated with financial stability, as measured by the Z-score [36]. Additionally, economic freedom not only positively moderates the relationship between risk-based capital and U.S. banks' profitability, but also has a direct positive impact as a standalone explanatory variable on bank profitability [37].

B.M. Adam et al., using country-level data for the period 2008–2019, found a positive nexus between economic freedom and bank stability through increased economic efficiency, although greater financial, trade, business, and investment freedom could not be linked to substantial improvements in bank solvency [21]. However, in the MENA region, an increase in bank stability was attributed to higher indexes of economic, investment, financial, and business freedom [38]. The positive impact of economic freedom was reflected in the positive coefficients of government effectiveness, voice and accountability, regulatory quality, and control of corruption, yet not the rule of law, as noted by [39].

As to bank risk-taking, an inverse relationship between economic freedom and bank risk-taking – indicating a positive link between economic freedom and bank stability – was reported by S. Ghosh for the monetary and business freedom sub-components [40], F. Defung and R. Yadaruddin for Indonesian private, government, and

large commercial banks [36], R. Harkati et al. for both Islamic and commercial banks in Malaysia [41], S. Ali et al. and F. Abbas et al. for U.S. banking [2; 42], and F. Abbas et al. for the rule of law and open market systems in Japan [43].

In contrast, a direct link between economic freedom and bank risk-taking was found for MENA banks by S. Ghosh [40], for GCC countries by T. Akhter et al. [44], and for the overall economic freedom index and its sub-components of government size and regulatory efficiency by F. Abbas et al. [43].

As we see from our review of empirical literature, the majority of evidence supports a positive nexus between economic freedom and bank financial standing. The positive coefficients found for all four pillars of the Heritage Foundation index [5] and the individual pillars of government size [30; 31] and regulatory efficiency [31; 39] lead us to make the following hypotheses:

Hypothesis 1 (H1): Effective rule of law leads to increased bank stability in rich African countries.

Hypothesis 2 (H2): The open market system has a significantly positive impact on the stability of banks in rich African countries.

Hypothesis 3 (H3). Regulatory efficiency has a significantly positive influence on the stability of banks in rich African countries.

Hypothesis 4 (H4): The size of government in rich African countries is positively related to the stability of their banks.

These hypotheses have been previously emphasized as shown above. The empirical findings of D. Asteriou et al. indicate that effective rule of law, an open market system, regulatory efficiency, and government size are instrumental in improving bank performance and stability in Eurozone countries [5]. While these findings are comprehensive, other studies partially support our hypotheses, particularly regarding government size [30], government size and regulation [31], regulatory quality [39; 40], and the rule of law and open market systems [43]. In contrast, a direct relationship of bank risk-taking with government size and regulatory efficiency has been found in the Japanese context [43]. Additionally, negative coefficients for the rule of law [39] and all dimensions of the open market system [21] in relation to bank stability, as reported for MENA and sub-Saharan African banks, provide contradictory evidence to our hypotheses.

Methodology

To establish the relationship between economic freedom and bank stability, this study focuses on all depository financial institutions in all rich African countries. According to the World Population Review, as presented in Table A1 in the Appendix, there are twenty-one rich countries in Africa. This classification is based on the "Top-10 richest African countries" in terms of overall gross domestic product (GDP), GDP per capita, GDP by purchasing power parity (PPP), and gross national income (GNI) per capita (Atlas method). However, as shown in Table A2 in the Appendix, there are over 400 banks in the identified countries, according to information from each country's central bank and *Global Brands Magazine*. Despite the number of banks in these wealthy African economies, access to bank-level data from annual reports is limited to ten countries. As presented in Table 1, there are 264 banks in the sampled countries, of which 54 banks were selected based on the availability of their annual audited financial statements.

Table 1. Study Sample

S/N	Country	Population of banks	Sampled banks	% Population	% Sample
1	Nigeria	27	16	10.2	29.6
2	Ghana	23	11	8.7	20.4
3	South Africa	28	4	10.6	7.4
4	Egypt	32	3	12.1	5.6
5	Sudan	14	3	5.3	5.6
6	Seychelles	6	2	2.3	3.7
7	Kenya	39	9	14.8	16.7
8	Tanzania	35	2	13.3	3.7
9	Mauritius	18	2	6.8	3.7
10	Botswana	9	2	3.4	3.7
	Total	264	54	100	100

Source: Authors' compilation.

The study's bank-level data related to the dependent variable and some control variables were manually extracted from the annual reports of the sample banks. In contrast, data for the economic freedom index (independent variable) and certain macroeconomic variables are sourced from the Heritage Foundation and World Development Indicators. The data cover a ten-year period from 2013 to 2022, reflecting changes in the presentation of economic freedom data by the Heritage Foundation starting in 2013. By that year, the definitions of the components of economic freedom were standardized by the Heritage Foundation. Although the Fraser Institute also provides data on economic freedom, a comparative analysis cannot be made with the Heritage Foundation due to the unavailability of Fraser Institute data up to 2022 as of the third quarter of 2023, when data compilation was completed.

Since data are obtained at both the time series and cross-sectional levels, a panel data model is adopted for analysis. While the basic static panel model is considered, the selection of other static panel models is also suggested based on the statistical significance of various diagnostic tests. The basic static panel model requires the choice of a fixed-effects model (FEP) over a random-effects model (REP) when the Hausman statistic (HST) is significant at a confidence level greater than 95%. It also necessitates opting for REP over pooled ordinary least squares regression (POLS) when the Breusch-Pagan Lagrangian multiplier test (LMT) is statistically significant at a p-value of less than 5%.

However, in the presence of concurrent statistical significance in tests for heteroscedasticity, serial correlation, and cross-sectional dependence, the panel corrected standard errors model (PCSE) is preferred. If the error structures in the panel model exhibit heteroscedasticity, serial autocorrelation, and cross-sectional dependence, choosing PCSE is advisable [45; 46]. This explains our application of three diagnostic tests: the likelihood ratio test for heteroscedasticity (HTR), the Breusch-Pagan Lagrangian multiplier test of independence in the panel model (LMTI), and the first-order serial correlation test (ACOR) for autocorrelation. The results of these tests are presented below the regression estimates in the relevant tables.

In addition to regression analysis for hypothesis testing, we use descriptive statistics for data summarization as well as correlation and variance inflation factor analysis to identify multicollinearity issues.

To test the study's four hypotheses, bank stability is modelled as a function of each pillar of the Heritage Foundation economic freedom index. As previously established [5; 23], bank stability is indicated by the Z-score. The Z-score summarises the number of standard deviations by which a bank's profitability must fall before eroding its capitalisation [47]. A higher Z-score value indicates greater bank stability/solvency/soundness [47] or a lower risk of insolvency or probability of failure [34]. Previous studies commonly measured the Z-score as follows:

$$Z-score_{it}=\frac{EYT_{it}+ETA_{it}}{\sigma EYT_{iT}}, \quad (1)$$

where EYT_{it} – earnings for the year; ETA_{it} – total equities of bank i for year t, both scaled by total assets; σEYT_{iT} – standard deviation of EYT of each bank over the entire sampled period.

After deriving the Z-score to measure bank stability, the following econometric models are specified to test each of the study's hypotheses:

$$Z-score_{it}=\propto_0+\propto_1 RLW_{it}+\propto_2 CCAP_{it}+ +\propto_3 TCAP_{it}+\propto_4 LVR_{it}+\propto_5 DIVF_{it}+ +\propto_6 NPL_{it}+\propto_7 DEP_{it}+\propto_8 CIR_{it}+ +\propto_9 RGDP_{it}+\propto_{10} IFL_{it}+\propto_{11} UEMP_{it}+E_{it}; \quad (2)$$

$$Z-score_{it}=\propto_0+\propto_1 OPM_{it}+\propto_2 CCAP_{it}+ +\propto_3 TCAP_{it}+\propto_4 LVR_{it}+\propto_5 DIVF_{it}+ +\propto_6 NPL_{it}+\propto_7 DEP_{it}+\propto_8 CIR_{it}+ +\propto_9 RGDP_{it}+\propto_{10} IFL_{it}+\propto_{11} UEMP_{it}+E_{it}; \quad (3)$$

$$Z-score_{it}=\propto_0+\propto_1 REGE_{it}+\propto_2 CCAP_{it}+ +\propto_3 TCAP_{it}+\propto_4 LVR_{it}+\propto_5 DIVF_{it}+ +\propto_6 NPL_{it}+\propto_7 DEP_{it}+\propto_8 CIR_{it}+ +\propto_9 RGDP_{it}+\propto_{10} IFL_{it}+\propto_{11} UEMP_{it}+E_{it}; \quad (4)$$

$$Z-score_{it}=\propto_0+\propto_1 GVSZ_{it}+\propto_2 CCAP_{it}+ +\propto_3 TCAP_{it}+\propto_4 LVR_{it}+\propto_5 DIVF_{it}+ +\propto_6 NPL_{it}+\propto_7 DEP_{it}+\propto_8 CIR_{it}+ +\propto_9 RGDP_{it}+\propto_{10} IFL_{it}+\propto_{11} UEMP_{it}+E_{it}. \quad (5)$$

Upon establishing the behaviour of each pillar in relation to bank stability, further analysis is performed using the overall economic freedom index (EFD) to ensure consistency. This is specified as:

$$Z-score_{it}=\propto_0+\propto_1 EFD_{it}+\propto_2 CCAP_{it}+ +\propto_3 TCAP_{it}+\propto_4 LVR_{it}+\propto_5 DIVF_{it}+ +\propto_6 NPL_{it}+\propto_7 DEP_{it}+\propto_8 CIR_{it}+ +\propto_9 RGDP_{it}+\propto_{10} IFL_{it}+\propto_{11} UEMP_{it}+E_{it}. \quad (6)$$

The inclusion of control variables, both bank-specific and macroeconomic, is based on findings from previous studies. At the bank level, capitalisation, diversification, and leverage ratio are considered among the factors that explain bank solvency in the relevant literature, though the statistical signs are mixed [23; 34]. Similarly, third-party funds or customer deposits, the cost-income ratio [36], and the ratio of non-performing loans to gross loans – an indicator of credit risk [47] – also feature in econometric models examining bank stability and economic freedom.

The rationale for including real GDP growth rate (RGDP), inflation rate (IFL), and unemployment rate (UEMP) in the relevant models is supported by the argument for a favourable relationship between economic growth and financial sector performance. This is complemented by the similar dynamics of high inflation rates and bank loan interest rates, which lead to higher interest margins, as well as the inverse relationship between unemployment and bank profitability due to low economic activity [5; 34; 42].

The variables used in equations 2–6 are described in Table 2.

Table 2. Definitions and Measurements of Variables

S/N	Variable	Variable Name	Definition/Measurements
1	Z-score	Bank stability	As defined in equation 1
2	RLW	Rule of law	A simple average of Heritage Foundation indexes of the three factors constituting the rule of law pillar of economic freedom
3	OPM	Open market system	A simple average of Heritage Foundation indexes of the three factors constituting the open market system pillar of economic freedom
4	REGE	Regulatory efficiency	A simple average of Heritage Foundation indexes of the three factors constituting the regulatory efficiency pillar of economic freedom
5	GVSZ	Government size	A simple average of Heritage Foundation indexes of the three factors constituting the government size pillar of economic freedom
6	EFD	Economic Freedom Index	Heritage Foundation annual overall economic freedom index measured in percent
7	CCAP	Bank core capital	Tier 1 capital scaled by total risk-weighted assets
8	TCAP	Total capital	$\frac{Tier\,1 + Tier\,2\,capital}{Total\,risk\,weighted\,assets}$
9	LVR	Leverage ratio	Ratio of gross loans to total assets
10	DIVF	Diversification	Non-interest income to gross income
11	NPL	Non-performing loans ratio	Non-performing loans to gross loans
12	DEP	Deposit ratio	Customer deposits to total assets
13	CIR	Cost-income ratio	Operating cost to operating income
14	RGDP	Real Gross Domestic Product rate	Annual GDP growth rate
15	IFL	Inflation	Consumer price index growth rate on an annual basis
16	UEMP	Unemployment	Annual unemployment rate

Source: Authors' compilation.

Results and Discussion

This section presents the results of data analysis. It consists of three sub-sections: summary statistics, correlation and multi-collinearity diagnostic analyses, and regression analysis for testing the study's hypotheses.

Summary Statistics

The descriptive statistics displaying the mean, standard deviation, and range of the study's variables are presented in Table 3. The Z-score summary statistics provide insight into the stability of banks in the sampled rich African economies, using both the mean and maximum values. However, the negative minimum value suggests that not all of these banks are solvent. This finding is also reflected in the capitalisation summary statistics. Although the average capital ratios – 15.7% for Tier 1 capital (CCAP) and 18.4% for total regulatory capital (TCAP) – exceed global benchmarks, the negative minimum values raise regulatory concerns.

The higher interest margin for the sampled banks is likely attributable to the proportion of their gross loans relative to total assets (LVR), which shows elevated maximum and mean values. However, this may also explain the high maximum value of non-performing loans (NPL) at 31%, indicating a significant level of customer default. Nevertheless, the mean NPL value of 5.2% remains within the global regulatory benchmark.

Since many of the sampled banks are parent companies in financial holding groups, the average value of 19% for the proportion of non-interest income to gross income (DIVF) indicates a reasonable level of income diversification. However, high operating costs relative to operating income, as reflected in the cost-income ratio (CIR), may account for the low profitability observed in these banks.

The higher deposit ratio, with a mean value of 0.65 (DEP), is favourable for depository institutions. However, a maximum value of 1.6 – indicating deposits exceeding total assets – poses a threat to bank stability, suggesting a scenario where total equity is negative.

In terms of economic freedom, while the maximum values for all four pillars exceed 70, which is encouraging, the low mean values cast doubt on the economic strength of the sampled countries, except for the government size pillar. A similar pattern is observed for the overall economic freedom index, which, in light of institutional theory, could have an inverse relationship with the stability of these banks.

The high inflation rate (IFL), with a mean (maximum) value of 14% (359%), could result in higher loan interest rates and potentially increased profitability. However, banks' failure to adjust their interest rates promptly due to unanticipated inflation may undermine this effect. Additionally, the higher unemployment rate (UEMP) and low real GDP growth rate (RGDP), as shown in Table 3, could further weaken bank stability.

Table 3. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Z-score	532	25.9740	19.4857	-43.9423	122.7871
CCAP	532	0.1569	0.2032	-2.0159	1.0343
TCAP	532	0.1838	0.1879	-1.9856	1.0306
LVR	532	0.4815	0.1528	0.0556	0.7995
NPL	532	0.0521	0.0419	0.0002	0.3108
DIVF	532	0.1932	0.1382	0.0001	0.7569
DEP	532	0.6847	0.1544	0.0006	1.6121
CIR	532	0.5966	0.2353	0.1649	2.8436
RLW	532	38.0572	12.3779	4.8824	74.5881
GVSZ	532	73.4119	11.7025	44.9500	90.6000
REGE	532	63.9106	5.0841	27.8186	78.5667
OPM	532	55.5154	11.4656	5.0000	82.6333
EFD	532	56.9803	10.3100	0.0000	77.0000
RGDP	532	0.0325	0.0323	-0.1460	0.1187
IFL	532	0.1420	0.3058	-0.0102	3.5909
UEMP	532	0.0746	0.0677	0.0000	0.2981

Source: Authors' calculations using STATA version 15 outputs.

Correlation and Multi-Collinearity Analysis

Table 4 depicts the results of Pearson correlation analysis, while Table 5 shows the results of variance inflation factor and related diagnostics. As revealed in Table 4, two of the four components of economic freedom (GVSZ & REGE) have a positive relationship with the Z-score, while the remaining two (RLW & OPM) have a negative relationship. Only GVSZ is not significant.

Table 4. Correlation Matrix

Variable		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Z-score	**1**	1.00															
CCAP	**2**	0.22*	1.00														
		(0.00)															
TCAP	**3**	0.22*	0.97*	1.00													
		(0.00)	(0.00)														
LVR	**4**	0.22*	-0.05	-0.04	1.00												
		(0.00)	(0.25)	(0.31)													
NPL	**5**	-0.13*	0.05	0.05	-0.12*	1.00											
		(0.00)	(0.23)	(0.30)	(0.01)												
DIVF	**6**	0.08	0.06	0.07	-0.08	-0.15*	1.00										
		(0.07)	(0.18)	(0.12)	(0.06)	(0.00)											
DEP	**7**	0.05	-0.28*	-0.30*	0.12*	0.02	-0.33*	1.00									
		(0.22)	(0.00)	(0.00)	(0.00)	(0.62)	(0.00)										
CIR	**8**	-0.04	-0.37*	-0.37*	-0.07	0.07	0.05	0.09*	1.00								
		(0.36)	(0.00)	(0.00)	(0.12)	(0.13)	(0.29)	(0.03)									
RLW	**9**	-0.11*	0.01	0.01	0.08	0.17*	-0.16*	0.40*	-0.03	1.00							
		(0.01)	(0.90)	(0.78)	(0.06)	(0.00)	(0.00)	(0.00)	(0.50)								
GVSZ	**10**	0.03	-0.10*	-0.10*	-0.03	-0.26*	0.19*	-0.20*	0.16*	-0.37*	1.00						
		(0.43)	(0.03)	(0.03)	(0.46)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)							
REGE	**11**	0.15*	-0.08	-0.07	0.07*	-0.07	0.13	0.19	0.1	0.51*	0.14*	1.00					
		(0.00)	(0.05)	(0.10)	(0.13)	(0.13)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)						
OPM	**12**	-0.09*	-0.01	-0.01	-0.04	0.17*	-0.24*	0.44*	0.00	0.75*	-0.18*	0.20*	1.00				
		(0.04)	(0.85)	(0.81)	(0.42)	(0.00)	(0.00)	(0.00)	(0.95)	(0.00)	(0.00)	(0.00)					
EFD	**13**	0.03	-0.08	-0.07	-0.07	0.07	-0.02	0.37*	0.11*	0.68*	0.09*	0.30*	0.78*	1.00			
		(0.48)	(0.06)	(0.09)	(0.12)	(0.13)	(0.66)	(0.00)	(0.01)	(0.00)	(0.03)	(0.00)	(0.00)				
RGDP	**14**	-0.05	0.05	0.04	-0.03	0.05	-0.22*	0.17*	-0.01	0.06	-0.30*	-0.07	0.25*	0.00	1.00		
		(0.27)	(0.22)	(0.30)	(0.46)	(0.28)	(0.00)	(0.00)	(0.82)	(0.19)	(0.00)	(0.10)	(0.00)	(0.95)			
IFL	**15**	-0.13*	-0.01	0.01	-0.04	-0.08	0.16*	-0.20*	-0.14*	-0.22*	-0.07	-0.22*	-0.42*	-0.29*	-0.24*	1.00	
		(0.00)	(0.88)	(0.82)	(0.42)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)	(0.10)	(0.00)	(0.00)	(0.00)	(0.00)		
UEMP	**16**	0.02	0.03	0.04	0.31*	-0.09*	0.33*	-0.03	-0.13*	0.18*	-0.13*	0.02	-0.11*	-0.13*	-0.30*	0.20*	1.00
		(0.58)	(0.52)	(0.32)	(0.00)	(0.04)	(0.00)	(0.42)	(0.00)	(0.00)	(0.00)	(0.71)	(0.01)	(0.00)	(0.00)	(0.00)	

Note: Correlation coefficients are presented with the p-value in parentheses while * stands for statistical significance at the 95% confidence level.
Source: Authors' calculations.

Among the control variables, CCAP, TCAP and LVR have a significantly positive relationship with the Z-score, while the coefficients of NPL and IFL are significantly negative. For multi-collinearity analysis, there is no evidence of the multi-collinearity problem among any pair of variables except for CCAP and TCAP: only CCAP and TCAP have a correlation coefficient exceeding 0.8. The multi-collinearity problem between CCAP and TCAP is also confirmed by the VIF, tolerance and R-squared analyses: as Table 5 shows, only TCAP and CCAP have a VIF greater than 10, a tolerance of less 0.1 and R-squared over 0.9. This explains the separate specification of TCAP and CCAP in the study's regression models.

Table 5. Variance Inflation Factor

Variable	VIF	$\sqrt{VIF}$	Tolerance	R-Squared
RLW	4.56	2.14	0.2191	0.7809
GVSZ	1.95	1.40	0.5120	0.4880
REGE	2.28	1.51	0.4381	0.5619
OPM	5.07	2.25	0.1972	0.8028
EFD	5.34	2.31	0.1871	0.8129
CCAP	18.01	4.24	0.0555	0.9445
TCAP	18.10	4.25	0.0552	0.9448
LVR	1.23	1.11	0.8160	0.1840
NPL	1.18	1.09	0.8468	0.1532
DIVF	1.61	1.27	0.6227	0.3773
DEP	1.61	1.27	0.6202	0.3798
CIR	1.27	1.13	0.7881	0.2119
RGDP	1.48	1.22	0.6752	0.3248
IFL	1.59	1.26	0.6290	0.3710
UEMP	1.88	1.37	0.5326	0.4674
Mean VIF	4.48			

Source: Authors' calculations using STATA version 15 outputs.

Regression Results and Discussion

The baseline results of the study's hypothesis tests are presented in Table 6, with further analysis and overall conclusions in Table 7. The findings show that the economic freedom index generally supports bank stability in the sampled banks, as all four pillars' regression coefficients exhibit a positive impact, except for the open market system (OPM), which has a negative coefficient. However, only the coefficient of the regulatory efficiency (REGE) pillar is statistically significant among the positive pillars. The OPM coefficient, which is negative, is also statistically significant. Although the rule of law (RLW) coefficient is positive, its lack of statistical significance prevents full acceptance of the first hypothesis. The insignificantly positive coefficient may be due to weak property rights protection, government integrity, and judicial effectiveness, as reflected by the low mean RLW score of 38, as shown in Table 3.

The significantly negative OPM coefficients suggest that increased economic openness correlates with reduced bank stability in the sampled countries. This indicates that the current levels of investment, trade, and financial freedom in these countries have yet to positively impact the stability of their banks. Potential reasons include a low OPM index, underdeveloped capital and financial markets, and substantial government intervention.

Table 6. Regression Results for the Four Pillars of the Economic Freedom Index

Var.	RLW	RLW	OPM	OPM	REGE	REGE	GVSZ	GVSZ
	1	2	3	4	5	6	7	8
RLW	0.02	0.02						
	(0.41)	(0.34)						
OPM			-0.23***	-0.23***				
			(-2.79)	(-2.88)				
REGE					0.22***	0.19**		
					(2.71)	(2.37)		
GVSZ							0.01	0.01
							(0.34)	(0.34)
CCAP	15.43***		15.82***		24.63***		16.05***	
	(7.02)		(7.21)		(9.75)		(7.28)	

Var.	RLW	RLW	OPM	OPM	REGE	REGE	GVSZ	GVSZ
	1	2	3	4	5	6	7	8
TCAP		17.26***		17.79***		27.46***		17.98***
		(7.04)		(7.28)		(8.96)		(7.32)
LVR	11.27***	11.38***	12.99***	13.05***	18.22***	17.67***	12.58***	12.66***
	(3.85)	(3.89)	(4.46)	(4.50)	(6.47)	(5.83)	(4.20)	(4.24)
DIVF	3.35 2.95 4.71 4.30				5.09**	4.55**	4.17	3.75
	(0.93)	(0.82)	(1.31)	(1.20)	(2.30)	(2.03)	(1.14)	(1.03)
NPL	8.12	8.59	7.07	7.39	-21.02**	-24.04***	6.69	7.07
	(0.95)	(1.01)	(0.84)	(0.88)	(-2.54)	(-2.76)	(0.78)	(0.82)
DEP	-5.92**	-5.52**	-4.70*	-4.26	5.36*	6.47**	-5.09*	-4.68*
	(-2.14)	(-1.98)	(-1.70)	(-1.53)	(1.85)	(1.99)	(-1.83)	(-1.67)
CIR	-2.97**	-2.57*	-2.92*	-2.52*	-4.01***	-3.85**	-2.86*	-2.46*
	(-1.97)	(-1.71)	(-1.93)	(-1.67)	(-3.22)	(-2.36)	(-1.89)	(-1.68)
RGDP	2.05	1.97	2.91	2.80	5.48	5.54	3.84	3.78
	(0.25)	(0.24)	(0.36)	(0.34)	(0.76)	(0.76)	(0.44)	(0.44)
IFL	0.61	0.47	0.56	0.41	-2.90*	-2.83*	0.48	0.32
	(0.59)	(0.45)	(0.55)	(0.40)	(-1.95)	(-1.89)	(0.45)	(0.30)
UEMP	-130.01***	-129.46***	-109.47***	-109.10***	-12.47**	-12.57**	-99.02***	-99.11***
	(-6.71)	(-6.69)	(-6.34)	(-6.38)	(-2.41)	(-2.41)	(-5.84)	(-5.85)
_cons	31.73***	30.57***	41.28***	40.44***	-3.59	-3.51	27.74***	26.47***
	(9.50)	(9.05)	(6.91)	(6.75)	(-0.60)	(-0.58)	(6.33)	(5.99)
R^2	0.2939	0.2943	0.304	0.3053	0.6943	0.6902	0.2903	0.2908
F-Test	19.48***	19.52***						
Wald			190.34***	192.03***	295.16***	193.11***	181.61***	182.49***
HST	30.25***	30.14***	11.70	11.29	33.83***	33.35***	5.71	4.05
LMT			1657.07***	1663.10***			1746.04***	1753.88***
HTR	24155.4***	18264.5***	23045.9***	17965.2***	2477.59***	18414.84***	24613.7***	17876.6***
ACOR	0.86	0.95	1.17	0.99	38.18***	22.95***	1.23	1.18
LMTI	3.41	3.88	3.65	3.69	3013.07***	3021.87***	3.97	3.98
Model	FEP	FEP	REP	REP	PCSE	PCSE	REP	REP

Note: Regression estimates are presented with the t or z-statistic in parentheses. Only the statistics of the diagnostic tests are presented. *, ** and *** denote statistical significance at the 90%, 95% and 99% confidence levels, respectively.

Source: Authors' calculations using STATA version 15 outputs.

Contrary to the coefficients of OPM, those of REGE are positive and significant, confirming the third hypothesis that regulatory efficiency has a significantly positive influence on the stability of banks in rich African economies. The significantly positive REGE coefficients highlight how efficient regulation has improved the solvency of the sampled banks, reflected in greater business, labour, and monetary freedom. Notably, second only to GVSZ in terms of mean score (see Table 3), REGE has a substantial positive impact. This suggests that the regulatory and infrastructure environments in the sampled countries, measured by factors such as regulatory quality and women's economic participation (business freedom), labour productivity, associational rights, and labour force participation (labour freedom), and some degree of price stability despite government intervention (monetary freedom), have supported bank stability.

While the GVSZ coefficients are positive, they are more akin to RLW than to REGE in terms of statistical significance. This limits the full acceptance of the fourth hypothesis. The issue of a higher tax burden in African economies is debatable, but the adverse effects of excessive government spending and budget deficits cannot be ignored. Many African countries face weak fiscal health, evidenced by a high ratio of deficits and debt to GDP. Therefore, GVSZ's limited ability to enhance bank stability in the sampled rich African countries can be attributed to the low economic freedom score, especially in terms of fiscal health.

The findings of this study related to the linkage of each pillar of economic freedom to bank stability, as presented in Table 6, are comparable to the results of [5], showing positive coefficients for RLW (Rule of Law), REGE (Regulatory Efficiency), and GVSZ (Government Size), but not for OPM (Open Market System). However, the coefficients for RLW and GVSZ are not statistically significant. Our results align with the conclusion of F. Abbas et al. regarding the inverse relationship between bank risk-taking and effective rule of law, though not with its relationship to the open market system, government size, and efficient regulation [43]. Some agreements are observed with the coefficients for government size found by A. Shahabadi and H. Samari [30] and E. Mamatzakis [31], as well as regulatory quality noted by E. Mamatzakis [31], S. Ullah et al. [39], and S. Ghosh [40]. Our findings also bear similarities to the empirical results of N. Djebali regarding the coefficients for government effectiveness and regulatory quality [38] yet not for rule of law. The inverse relationships found by S. Ullah et al. [39] and B. M. Adam et al. [21] for RLW and all components of OPM with bank stability are in disagreement and agreement, respectively, with the findings of this study.

As shown in Table 7, the overall economic freedom index (EFD) is positively related to bank stability in the rich African economies. The coefficients of EFD in both regression estimates for the CCAP (Core Capital Adequacy) and TCAP (Total Capital Adequacy) models are positive. However, the lack of statistical significance for two of the three positive pillars and the significantly negative coefficient for one pillar (OPM) contribute to the overall insignificance of the EFD coefficient. This could be due to the relatively low mean value of the EFD score, as shown in Table 3. Despite the statistical insignificance of EFD in this study, its positive coefficient aligns with several previous studies, including recent ones [5; 21; 36; 38], while contradicting others [23; 35].

Table 7. Regressions with the Overall Economic Freedom Index

Variable	EFD	EFD
	9	10
EFD	0.013	0.003
	(0.29)	(0.07)
CCAP	16.09***	
	(7.26)	
TCAP		18.01***
		(7.29)
LVR	12.88***	13.01***
	(4.30)	(4.42)
DIVF	4.31	3.96
	(1.18)	(1.08)
NPL	5.86	6.23
	(0.69)	(0.74)
DEP	-5.08*	-4.63*
	(-1.81)	(-1.67)
CIR	-2.85*	-2.44*
	(-1.87)	(-1.75)
RGDP	3.54	3.00
	(0.42)	(0.35)
IFL	0.25	0.17
	(0.23)	(0.15)
UEMP	-96.41***	-96.76***
	(-5.72)	(-5.74)
_cons	27.46***	26.71***
	6.24	6.04
R^2	0.2893	0.2897
Wald	178.37***	179.24***
HST	7.62	1.40
LMT	1728.53***	1733.38***
HTR	23143.7***	18234.6***
ACOR	1.82	1.96
LMTI	3.83	3.85
Model	REP	REP

Note: Regression estimates are presented with the z-statistic in parentheses. Only the statistics of the diagnostic tests are presented. *, ** and *** denote statistical significance at the 90%, 95% and 99% confidence levels, respectively.

Source: Authors' calculations using STATA version 15 outputs.

For control variables, the coefficients of CCAP (Core Capital Adequacy), TCAP (Total Capital Adequacy), LVR (Loan-to-Value Ratio), DEP (Deposit-Asset Ratio), CIR (Cost-to-Income Ratio), and UEMP (Unemployment Rate) are statistically significant across all models in both Tables 6 and 7. This highlights the importance of stronger capitalisation (indicated by positive coefficients of CCAP and TCAP), credit growth (reflected by positive coefficients of LVR), and operating efficiency (shown by negative coefficients of CIR) in enhancing bank stability. The significantly negative coefficients of DEP across all models, except for REGE models, could be attributed to higher interest payments compared to those received on loans, given that the mean value of DEP is higher than that of LVR. The negative coefficients of UEMP align with the literature, which suggests an inverse relationship between bank performance and unemployment rate [5]. The positive coefficients of income diversification (DIVF), though statistically significant only in REGE models, underscore its relevance. Additionally, low non-performing assets (NPL) and inflation rates (IFL), indicated by significantly negative coefficients in REGE models, demonstrate their potential to strengthen bank stability.

Conclusions

This study investigates how the fundamental indices of economic liberalisation, specifically economic freedom, influence bank stability in the rich African economies. These key components, referred to as pillars, are examined in relation to bank stability, which is measured using the Z-score. Ten countries classified as "rich" by the World Population Review are sampled, based on the availability of bank-level data from annual audited financial statements. As revealed by panel fixed-effects, panel random-effects, and/or panel corrected standard errors regression analyses, three of the pillars – rule of law (RLW), regulatory efficiency (REGE), and government size (GVSZ) – show a positive relationship with bank stability, while the open market system (OPM) exhibits an inverse relationship. The estimates for REGE and OPM are statistically significant.

Overall, the economic freedom index (EFD) contributes to increased bank stability, although its effect is not strongly pronounced due to the statistical insignificance of EFD coefficients. This underscores that improved bank soundness is dependent on a country's EFD level, as the mean score of the sampled countries is relatively low. The findings also suggest that trade restrictions, investment capital limitations, and government interference in the financial sector – which hinder the effectiveness of the open market system – are detrimental to bank stability. Furthermore, the low mean value of RLW and its insignificant coefficients highlight concerns about judicial independence, government integrity, and property rights in the sampled countries, which are essential before business opportunities that drive demand for bank funding can be fully realised.

The study's results emphasize the need for substantial improvements across all indices of regulatory efficiency (REGE), the only EFD pillar that strongly correlates with bank stability in the sampled countries. To bring the components of the other pillars in line with REGE, comprehensive institutional reforms, along with attitudinal changes among policymakers and enforcement agencies, are essential in the rich African economies.

This study makes a valuable contribution to the literature on the nexus between bank stability and economic freedom by focusing on the basic pillars of the Economic Freedom Index (EFD), rather than selecting only a few components, as seen in previous regional studies. As a result, the evidence provided in this research is more comprehensive and representative. By concentrating on rich economies, the study aligns with the primary goal of the economic freedom score – serving as a benchmark for economic success and viability. This highlights that research on economic freedom and bank performance in cross-country studies yields more accurate results when banks in societies with similar economic potential are compared.

Furthermore, the study offers empirical insights for policymakers in rich African economies, encouraging them to enhance economic freedom to improve the ability of their banks to access cross-border funding, including global depository receipts, thereby strengthening their financial position.

Despite its value, the study is somewhat limited by its restricted access to bank-level data. Out of over 260 banks, data were available for only 54, highlighting that future research with broader access to data could expand upon the present findings and offer even more robust conclusions.

References

1. Sanni M, Salami AA, Uthman AB. Determinants of Bank Performance in Nigeria: Do they Behave Differently with Risk-Adjusted Returns? *Studia Universitatis Vasile Goldiș Arad, Seria Științe Economice*. 2020;30(3):1-34. https://doi.org/10.2478/sues-2020-0015
2. Ali S, Abbas F, Umar M. Nexus between Economic Freedom and Bank Risk-taking: Evidence from US commercial banks. *Panoeconomicus*. 2024: 1-24. https://doi.org/10.2298/PAN200731005A
3. Chortareas GE, Girardone C, Ventouri A. Financial freedom and bank efficiency: Evidence from the European Union. *Journal of Banking & Finance*. 2013;37(4):1223-31. https://doi.org/10.1016/j.jbankfin.2012.11.015
4. D'Agostino E, De Benedetto MA, Sobbrio G. Does the economic freedom hinder the underground economy? Evidence from a cross-country analysis. *Economia Politica*. 2023;40(1):319-341.https://doi.org/10.1007/s40888-022-00288-2
5. Asteriou D, Pilbeam K, Tomuleasa I. The impact of corruption, economic freedom, regulation and transparency on bank profitability and bank stability:

Evidence from the Eurozone area. Journal of Economic Behavior & Organization. 2021;184:150-77.https://doi.org/10.1016/j.jebo.2020.08.023

6. Claessens S, Laeven L. What drives bank competition? Some international evidence. *Journal of Money, Credit and Banking.* 2004; 36:563-583.
7. Holmes KR., Feulner,EJ., O'Grady M.A. 2008 Index of Economic Freedom. Heritage Foundation. 2008. https://www.epf.um.si/fileadmin/user_upload/Knjiznica/2008_Index_of_Economic_Freedom.pdf
8. Pu T, Zulkafli AH. State ownership heterogeneity and corporate innovation: New evidence from a hierarchical perspective. *Journal of Corporate Finance Research.*2024;18(1):20-36. https://doi.org/10.17323/j.jcfr.2073-0438.18.1.2024.20-36
9. Gwartney J. Institutions, economic freedom, and cross-country differences in performance. *Southern Economic Journal.* 2009;75(4):937-956. https://doi.org/10.1002/j.2325-8012.2009.tb00941.x
10. Gwartney J, Lawson R. The concept and measurement of economic freedom. *European Journal of Political Economy*. 2003;19(3):405-430. https://doi.org/10.1016/S0176-2680(03)00007-7
11. Aziz OG, Knutsen J. The banks profitability and economic freedom quality: Empirical evidence from Arab economies. *Journal of Banking and Financial Economics*. 2019;(1 (11):96-110. https://doi.org/10.7172/2353-6845.jbfe.2019.1.4
12. Nyambura W. J. Banking Regulations and Financial Crisis: An investigation into recent Banking Crisis in Kenya between 1980 and 2018 [Doctoral dissertation on the internet]., United States International University-Africa; 2019. http://erepo.usiu.ac.ke/11732/6906
13. Adepegba, A. How Emefiele used proxies to acquire banks – CBN investigator. Punch[internet]. 2023 December 23. https://punchng.com/how-emefiele-used-proxies-to-acquire-banks-cbn-investigator/
14. Sanderson LB, De Jongh DC, Maré E. Banking regulations: An examination of the failure of African Bank using Merton's structural model. *South African Journal of Science*. 2017;113(7-8):15-21. http://dx.doi.org/10.17159/sajs.2017/a0216
15. BusinessTech. All the South African banks that have failed in the last 30 years. 2018 March 12. https://businesstech.co.za/news/banking/231009/all-the-south-african-banks-that-have-failed-in-the-past-30-years/
16. BusinessTech. What happens to Zuma's loan now that VBS is under. 2018 March 12. https://businesstech.co.za/news/banking/230843/what-happens-to-zumas-loan-now-that-vbs-is-under-curatorship/
17. Kapotwe M. How Ghana is working to improve the banking sector. World Economic Forum. 2018 December 6. https://www.weforum.org/agenda/2018/12/ghana-working-to-improve-bank-regulation/
18. Mandour M. Egypt's banking system is getting closer to the edge. Fair Observer. 2023, June 15. https://www.fairobserver.com/business/egypts-banking-system-is-getting-closer-to-the-edge/#
19. African Development Bank. Egypt economic outlook. 2023. https://www.afdb.org/en/countries/north-africa/egypt/egypt-economic-outlook
20. U.S. Department of State. 2020 investment climate statements: Ghana. 2020. https://www.state.gov/reports/2020-investment-climate-statements/ghana__trashed/
21. Adam BM, Sarpong-Kumankoma E, Fiador V. Economic freedom, corruption and bank stability: evidence from sub-Saharan Africa. *Journal of Financial Crime*. 2024;31(4):781-794. https://doi.org/10.1108/JFC-04-2023-0087
22. Sarpong-Kumankoma E, Abor J, Aboagye AQ, Amidu M. Freedom, competition and bank profitability in Sub-Saharan Africa. *Journal of Financial Regulation and Compliance*. 2018;26(4):462-481.https://doi.org/10.1108/JFRC-12-2017-0107
23. Sarpong-Kumankoma E, Abor JY, Aboagye AQ, Amidu M. Economic freedom, competition and bank stability in Sub-Saharan Africa. *International Journal of Productivity and Performance* Management. 2021;70(7):1510-1527. https://doi.org/10.1108/IJPPM-06-2019-0310
24. Oladele TC. Economic freedom, institutional quality and financial performance of banks in selected African countries [Doctoral dissertation]. Kwara State University, Nigeria; 2021.
25. Sufian F, Habibullah MS. Does economic freedom fosters banks' performance? Panel evidence from Malaysia. *Journal of Contemporary Accounting & Economics*. 2010;6(2):77-91. https://doi.org/10.1016/j.jcae.2010.09.003
26. Sufian F, & Hassan MK. Economic freedom, development and bank intermediation spreads. *Southwestern Economic Review*. 2012; 39: 1-35.
27. Sufian F. Economic freedom and bank efficiency nexus. *International Journal of Monetary Economics and Finance*. 2013;6(2-3):150-185. https://dx.doi.org/10.1504/IJMEF.2013.056395
28. Sufian F, Habibullah MS. Economic freedom and bank efficiency: does ownership and origins matter? *Journal of Financial Regulation and Compliance*. 2014;22(3):174-207. https://doi.org/10.1108/JFRC-01-2013-0001
29. Sufian F. The nexus between economic freedom and Islamic bank performance: Empirical evidence from

the MENA banking sectors. *Contemporary Review of the Middle East*. 2014;1(4):411-439. https://doi.org/10.1177/0972150915601256

30. Shahabadi A, Samari H. The effect of economic freedom on bank performance. *Iranian Journal of Economic Studies*. 2013;2(1): 123-142.
31. Mamatzakis E. Regulations, economic freedom and bank performance: Evidence from the EU-10 economies. *MPRA Paper*. 2013; No. 51878. https://mpra.ub.uni-muenchen.de/51878/
32. Gropper DM, Jahera Jr JS, Park JC. Political power, economic freedom and Congress: Effects on bank performance. *Journal of Banking & Finance*. 2015;60:76-92. http://dx.doi.org/10.1016/j.jbankfin.2015.08.005
33. Sarpong-Kumankoma E, Abor J, Aboagye AQ, Amidu M. Financial freedom, market power and bank margins in sub-Saharan Africa. *Journal of Financial Regulation and Compliance*. 2020;28(2):283-299.https://doi.org/10.1108/JFRC-05-2019-0066
34. Mavrakana C, Psillaki M. Do economic freedom and board structure matter for bank stability and bank performance? *MPRA Paper*. 2019;No. 95709. https://mpra.ub.uni-muenchen.de/51878/
35. Oino I. Bank solvency: The role of credit and liquidity risks, regulatory capital and economic stability. *Banks and Bank Systems*. 2021;16(4):84-100. https://doi.org/10.21511/bbs.16(4).2021.08
36. Defung F, Yudaruddin R. Economic freedom on bank stability and risk-taking in emerging economy: Indonesian case study. *Cogent Business & Management*. 2022;9(1):2112816. https://doi.org/10.1080/23311975.2022.2112816
37. Abbas F, Ali S. Is economic freedom a moderator of the relationship between bank capital and profitability? *Scientific Annals of Economics and Business*. 2022;69(2):273-292. https://doi.org/10.47743/saeb-2022-0016
38. Djebali N. Assessing the determinants of banking stability in the MENA region: what role for economic and financial freedom? *Journal of Banking Regulation*. 2024;25(2):127-144. https://doi.org/10.1057/s41261-023-00220-z
39. Ullah S, Ullah A, Zaman M. Nexus of governance, macroeconomic conditions, and financial stability of banks: a comparison of developed and emerging countries. *Financial Innovation*. 2024;10(1):Article30. https://doi.org/10.1186/s40854-023-00542-x
40. Ghosh S. Does economic freedom matter for risk-taking? Evidence from MENA banks. *Review of Behavioral Finance*. 2016;8(2):114-136. http://dx.doi.org/10.1108/RBF-01-2015-0002
41. Harkati R, Alhabshi SM, Kassim S. Influence of economic freedom and its subcomponents on risk-taking behavior: evidence from dual banking system of Malaysia. *Review of Behavioral Finance*. 2020;12(4):335-356. https://doi.org/10.1108/RBF-09-2019-0119
42. Abbas F, Ali S, Wong WK. Impact of economic freedom and its subcomponents on commercial banks'risk-taking. *Annals of Financial Economics*. 2022;17(03):2250022. https://doi.org/10.1142/S2010495222500221
43. Abbas F, Ali S, Suleman MT. Economic freedom and banks' risk-taking in Japan: a tale of two sides. *The Journal of Risk Finance*. 2024;25(3):537-554. https://doi.org/10.1108/JRF-03-2023-0061
44. Akhter T, Abdul Halim Z, Mehzabin S, Shahriar A, Azad MA. Do national culture and economic freedom affect bank risk-taking behavior? Evidence from GCC countries. *International Journal of Islamic and Middle Eastern Finance and Management*. 2023;16(6):1159-1180. https://doi.org/10.1108/IMEFM-07-2022-0283
45. Salami AA. Bank-specific decisions and banks' provisioning behaviour in Nigeria: The role of IFRSs adoption and banks' riskiness. *Russian Management Journal*. 2024;*22*(1): 51-85. https://doi.org/10.21638/spbu18.2024.103
46. Salami AA, Uthman AB. Bank capital, earnings smoothing and provisioning practices in Nigeria: IFRS and risk evidence. *Asian Journal of Economics and Banking*. 2023 Aug 29. https://doi.org/10.1108/AJEB-05-2022-0058
47. Salami AA. Determining a better predictor of bank's solvency in Nigeria: Risk-based capital or risk-independent capital? *Acta Universitatis Danubius. Œconomica*. 2018;14(6): 522-546.

Appendix

Table A1. Rich African economies ranked by World Population Review Indices

Rank	Overall GDP	GDP(Current PPP INT$)	GDP per capital	GNI per capital (Atlas method)
1	Nigeria	Egypt	Seychelles	Seychelles
2	South Africa	Nigeria	Mauritius	Mauritius
3	Egypt	South Africa	Gabon	Libya
4	Algeria	Algeria	Equatorial Guinea	South Africa
5	Morocco	Morocco	South Africa	Gabon
6	Ethiopia	Ethiopia	Botswana	Botswana
7	Kenya	Kenya	Libya	Equatorial Guinea
8	Ghana	Angola	Namibia	Namibia
9	Ivory Coast	Ghana	Eswatini	Algeria
10	Tanzania	Sudan	Tunisia	Eswatini

Source: Authors' compilation.

Table A2. Number of banks in the rich African economies

S/N	Country	Number of Banks
1	Nigeria	27
2	South Africa	28
3	Egypt	32
4	Algeria	21
5	Morocco	32
6	Ethiopia	26
7	Kenya	39
8	Ghana	23
9	Ivory Coast	16
10	Tanzania	35
11	Angola	22
12	Sudan	14
13	Seychelles	6
14	Mauritius	18
15	Gabon	17
16	Equatorial Guinea	4
17	Libya	20
18	Botswana	9
19	Namibia	8
20	Eswatini	7
21	Tunisia	22
	TOTAL	426

Source: Authors' compilation using *Global Brands Magazine* and data from the countries' central banks.

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

The authors declare no conflicts of interests.

The article **was submitted on** 10.06.2024; **approved after reviewing on** 12.07.2024; **accepted for publication on** 10.08.2024.

DOI: https://doi.org/10.17323/j.jcfr.2073-0438.18.3.2024.97-109
JEL classification: G28, G30, G32, G38, O32

Financing and Management of Innovation in India: New Paths for Green Innovation

Galina Besstremyannaya ✉
PhD, Senior research fellow at the International Laboratory for Macroeconomic Analysis, Professor at the Department of Applied Economics, National Research University Higher School of Economics, Moscow, Russia,
gbesstremyannaya@hse.ru, ORCID

Richard Dasher
PhD, Director of US-Asia Technology Management Center, Stanford University, Stanford, US,
rdasher@stanford.edu

Abstract

India is a fascinating example of an emerging economy which adapts the concept of innovation-based growth to its own specific economic and cultural context. Innovation in India has attracted growing interest among researchers, with a steady increase in the number of published works on the subject and in the number of their citations. The present paper provides a meta-review of the literature on the financing and management of innovation and green innovation in India. The novelty of the analysis is severalfold. Firstly, we highlight the coexistence of universal and India-specific features in the types of innovation and the practices of financing and management of innovation in the country. Secondly, the paper not only summarizes a range of bibliometric surveys and a large number of methodological and empirical papers on innovation in India, but also reviews a unique series of papers associated with the World Management Survey, which compare and contrast managerial practices in India with those in a large number of developed and emerging economies. Our analysis shows that India follows a number of universal approaches to the financing and management of innovation, and that parallels can be established between innovative IT companies in India and Japan. However, India uses many practices that are deemed inefficient in developed countries: the government, not the private sector, is the major supplier of R&D expenditure and green investment; family ownership is a driver of (not an obstacle to) innovation; there is a focus on low-income consumers; and cost-cutting rather than quality competition is the primary innovation technique. In conclusion, we link the India-specific innovation path to various opportunities for fostering green growth in the country.

Keywords: R&D, green innovation, green financing, ESG, BRICS

For citation: Besstremyannaya G., Dasher R. (2024) Financing and Management of Innovation in India: New Paths for Green Innovation. *Journal of Corporate Finance Research.* 18(3): 97-109. https://doi.org/10.17323/j. jcfr.2073-0438.18.3.2024.97-109

Introduction

India is a fast-growing middle-income country with strong regulation by government. Growth of real GDP in India has been the fastest in emerging and developing Asia since 2021, achieving rates of 7–8% per year [1, p. 7]. India is also the world's third largest emitter of greenhouse gases (GHG) [2].

India obtained its political independence in 1947 and has been implementing market reforms since 1991. Despite 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 government in 1999 and it has taken one or two decades to put in place essential legislation for the functioning of a new economic system[1].

India has followed the modern paradigm of fostering economic growth through innovation [4], a paradigm that is particularly emphasized in the BRICS countries [5]. According to the OECD and Eurostat [6]: "an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, work place organization or external relations" [6, paragraph 146]; and "a new or improved product is implemented when it is introduced on the market. New processes, marketing methods or organisational methods are implemented when they are brought into actual use in the firm's operations" [6, paragraph 150].

Green innovation stands apart from other innovation and may be broadly considered as "the adoption and development of technologies for the mitigation of environmental degradation" [7]. According to the OECD, green innovation (eco-innovation) is "the development of products (goods and services), processes, marketing methods, organizational structure, and new or improved institutional arrangements which, intentionally or not, contribute to a reduction of environmental impact in comparison with alternative practices" [8, p. 67–68]. Green investment (or green financing) implies "investment…venture or commitment made for the alleviation or avoidance of ecological debasement" [7].

The government of India stated its commitment to innovation in 1999 and several policy reforms have attempted to create stimuli for innovation through better protection of intellectual property rights (IPRs)[2]. Types of innovation and the drivers of successful innovation in middle-income countries in transition commonly differ from what is usual in developed countries [9]. Accordingly, a large body of literature focuses on the specific features of innovation in emerging countries and on national systems of innovation[3]. It has been noted that the model of large projects with substantial budgets financed by government or corporations, which is prevalent in the US, EU, and Japan, is not observed in India [10]. In the absence of such generous sources of financing, innovation in India tends to be "resource-constrained" [11; 12]. Moreover, lack of competition and inadequate market mechanisms in the Indian economy explain an emphasis by companies on incremental (non-radical, often imitative) innovation and the existence of domestic industries with very modest innovation potential [4].

Innovation undoubtedly requires R&D expenditure [13], and this highlights the importance of the financial context of national systems of innovation [5]. R&D expenditure must be properly managed in order to produce innovation outcomes [14–16]. It is generally agreed that a combination of appropriate economic and financial institutional environment at macro level and effective managerial practices at company level are prerequisites for successful innovation [17–19]. On the one hand, forms of entrepreneurship in general and management of innovation in particular display a number of unique features in India [11; 12; 20]. On the other hand, a large amount of research on India highlights the country's use of universal building blocks of successful innovation, which have proved effective in developed countries. It is plausible to claim that financing and management of innovation in India is most accurately described as a synthesis of universal and India-specific approaches.

The purpose of this paper is to provide an up-to-date meta-review of literature on the financing and management of innovation in India. The meta-review is novel because it highlights the co-existence of two types of practices in the country: universal practices that are well-established worldwide; and approaches that are India-specific. We studied a range of bibliometric surveys on the subject and selected a large number of papers that offer qualitative and quantitative analysis of innovation and the financing and management of innovation in India (Table 1). Additionally, we used a unique series of papers associated with the World Management Survey that contrast various managerial practices in India with those used in developed and other developing countries [21–23]. Finally, the analysis in this paper reviews policy evaluation papers [24; 25] which assess a field experiment that introduced several internationally well-established managerial techniques to Indian firms.

[1] According to [3], the Competition Act, Right to Information Act, and Land Acquisition Act required, respectively, 11, 15 and 17 years for their pre-legislative stages alone (see Tables 2.3 and 2.4 in [3, p. 46, 64].

[2] Examples include signing of the Trade Related Property Rights Agreement in 2005 when joining the WTO and adoption of the Intellectual Property Rights Policy in 2016.

[3] According to [5, p. XXX]: "Systems of innovation, defined as a set of different institutions that contribute to the development of the innovation and learning capacity of a country, region, economic sector, or locality, comprise a series of elements and relations that relate production, assimilation, use, and diffusion of knowledge".

Table 1. Studies analyzed in this paper on innovation and the financing and management of innovation in India

Type of study	Details
Bibliometric reviews	A. Nair et al. (2015): a review of innovation in India [4]. D. Chatterjee and S. Sahasranamam (2018): a comparative review of technological innovation in China and India in 1991–2015 [32]. G. Sharma (2019): a review of innovation and entrepreneurship in India in 2000–2018 [31]. S. Khan et al. (2021): a systematic review of green process innovations worldwide, including India [69]. S. Tomer and G. Rana (2020): green human resource management worldwide, including India [70]. Y. Gaajar (2021): green investment in the coal sector worldwide, including India [7]. S. Bhatnagar and D. Sharma (2021): potential for financial innovation through green financing in India [45]. U. Chaturvedi et al. (2017): green innovation in the pharmaceutical industry in India [71]. H. Diwan and B. Sreeraman (2024): ESG reporting worldwide, including India [44].
Case studies	N. Sharma (2016): management of innovation at 3 IT and 3 pharmaceutical firms [29]. P. Ray and S. Ray (2010): case study of resource-constrained innovation at telecom company C-DoT [11]. P. Ray and S. Ray (2011): resource-constrained innovation by Tata Motors (the Nano car) [12]. J. Prabhu and S. Jain (2015): frugal innovation ("jugaad") in India [10]. S. Jain (2022): frugal innovation and its evolution in India [9]. A. Motwani and R. Gupta (2023): content analysis of ESG reports by 9 large Indian companies in the energy sector [43]
Statistical analyses: surveys of managers and employees, company-level surveys, data analysis in the World Management Survey	P. Malaviya and S. Wadhwa (2005): innovation management in a software firm as viewed by its 45 employees [27]. J. Bhatnagar (2012): innovation management and people management, survey of 291 managers from five innovative firms [26]. R. Singh et al. (2005): innovation as a strategy at Indian electronics firms, 44 SMEs, mailed questionnaire [63]. V. Gupta and B. Gupta (2014): management of innovation at 88 SMEs, face-to-face interviews [65]. A. Chakraborty (2024): quality management at 52 manufacturing SMEs in Southern India, mailed questionnaire [3]. S. Sahoo (2019): quality management and innovation at 34 manufacturing SMEs, face-to-face interviews [28]. N. Bloom et al. (2010), N. Bloom and Van Reenen (2010): management scores of 620 manufacturing firms in India contrasted with scores of 100–700 firms in other countries [21; 22]. M. Singh et al. (2021): ESG disclosure by 203 SMEs listed on the Bombay Stock Exchange [42]

Type of study	Details
Econometric analysis	S. Ray and P. Ray (2021): 961 pharmaceutical firms in 1994–2012, policy evaluation of tightening IPR protection and its impact on exploratory innovation [20]. N. Bloom et al. (2013): 28 plants in 17 firms in 2008–2011, weekly data, policy evaluation of the effect on firm production of introduction of 38 modern management practices [24]. N. Bloom et al. (2020): 28 plants in 17 firms in 2008–2017, a study of whether newly introduced management practices were maintained by firms; analysis of impact of the new practices on the firms in the long run [25]. M. Nazir et al. (2021): macro-level analysis for China, India and Pakistan; interrelation between financial innovation and economic growth [72]. P. Mishra and M. Yadaw (2021): determinants of green innovation at 221 large firms in the manufacturing and service sectors in India [2]. G. Rana and V. Arya (2024): green human resource management as a predictor of green innovation according to a survey of 579 employees in India's manufacturing sector [55]. P. Sharma et al. (2020): ESG reporting and financial performance of 82 companies listed on the Bombay Stock Exchange [56]

The remainder of the paper is organized as follows. Second section overviews main topics relating to the financing and management of innovation in India. Universal drivers of innovation and building blocks of financing and management of innovation in India are outlined in third section. Fourth section provides a list of unique features of innovation strategies as well as India-specific approaches to financing and managing innovation. A contrast between innovation practices at companies in India and firms worldwide is given in Fifth section. The final section of the paper gives a summary of the regularities highlighted by the preceding analysis and their application to new developments in the sphere of green innovation in India.

Overview of innovation research in India

Bibliometric reviews and searches of scientific databases using the keywords "finance of innovation in India" and "management of innovation in India" found the following aspects to be of most interest to international researchers writing in English:

a) Incentives of Indian entrepreneurs [26].
b) Innovation in the Indian telecom and automobile industries [11; 12].
c) India-specific forms of innovation [9; 10].
d) Innovation in Indian small and medium-sized enterprises [27; 28].
e) Innovation in Indian pharmaceuticals, IT and renewable energy [12; 29].
f) Green innovation and green innovation financing in India [8; 26; 30].

The prevailing research areas in Indian innovation are associated with key words "business, management, and accounting" [31] and "policy, economics, and governance" [32], while in China the focus would be placed on "IP and technology diffusion" [32].

The Indian economy is marked by high levels of inequality and regional disparity, high share of the agricultural sector (especially as regards the labor force [30]), relative cheapness of labor and high returns to labor [4; 25]. Accordingly, a large share of innovation research consists of case studies on innovation strategies in companies in selected geographic areas and industries. Most of the research emphasizes personnel management and many papers focus on production in the agricultural sector, as well as innovations targeted at the rural population. Only a few papers analyze large samples of data, but even those are often limited to statistical analysis of a hundred or fewer observations.

Universal building-blocks of innovation and the financing and management of innovation in India

India follows the classic example of modern innovative economies, where companies innovate to increase their profits by entering markets for new products or by expanding markets for their existing products [33–35]. Such innovation is generally agreed to be an important factor in economic growth: the paradigm of endogenous growth

models with technological change has received ample empirical support on the macro level for developed countries, such as the US, Japan, and the Netherlands [35–37]. Growth through innovation is also on the agenda of the BRICS countries. Specifically, there is "a close articulation of innovation policy with the countries' development strategy in China and India" [38, p. 15].

Similarly to other BRICS countries, the state plays the most important role in the innovation system in India [38, p. 15]. The public sector is the major source of R&D financing in India [39] in contrast with most other countries where the private sector bears most of the burden of R&D expenditure [40, Figure 5]. However, India stands out by the emphasis which the government places on creating incentives that are inseparable from free-market organization of the economy, such as the provision of R&D tax credits [38, p. 15; 39].

Other important instruments of R&D financing in many countries are research grants and venture capital [39]. The latter is still very small in India: the total amount of venture capital in the country is less than 40% of what it is in China and less than 10% of its value in the US [1, p. 26]. It is also notable that, despite the large share of public sources in total national R&D expenditure in India, the ratio of Indian R&D expenditure to GDP is less than 0.007. Moreover, the ratio has been declining over the past two decades (from over 0.08 in 2005-2009 to 0.064 in 2020–2021 [41]). This is low both by international standards (the international figure for the ratio is 0.02) and by the standards of other BRICS countries [38].

As regards green innovation financing in India, the government has carried out direct investment in green innovation as well as offering various policy measures to stimulate green investment by the private sector. Regulatory measures include:

1) Mandatory publication of business responsibility (ESG performance) reports by the top 100 listed companies, established by the Securities and Exchange Board of India in 2012 [42]. Mandatory reporting has been extended to the top 1000 listed companies since 2022–2023 [43].
2) ESG disclosure at the National Stock Exchange of India on a "comply-or-explain basis" since 2015 [44].
3) The policy of the Reserve Bank of India since 2015 prioritizes lending to the energy sector and the agricultural sector, where most of green innovation is accumulated.
4) Introduction in 2015 of green bonds as a capital market instrument and establishment by the Securities and Exchange Board of India of the requirement that large companies raise 25% of their debt through bonds [30; 45] (green bonds were first employed in the EU in 2007 and have been gaining popularity in the BRICS countries as a green financing tool [46–48]).
5) Adoption of the National Action Plan for Climate Change in 2010 and creation of the Ministry of New and Renewable Energy [45].

Government support for innovation is essential in all countries due to various market failures. Firstly, innovation is closely linked to the disclosure of knowledge, so new products are vulnerable to imitation. To prevent the loss of novelty through imitation governments design policies for the protection of IPRs. Governments address other causes of under-provision of innovation by improving an appropriate institutional climate and governance as well as by offering various types of financial, organizational and other support to companies in order to stimulate innovation. The higher the per capita GDP of the economy, the greater the ability of government to maintain the quality of its institutions [49] and hence to stimulate innovation.

The above-mentioned economic and policy regularities are well observed in India. It is therefore possible to outline a number of universal building blocks of innovation in India on the *macro-economic level* related to regulation, institutional climate and governance. They can be summarized as follows:

a) Regional variation in outcomes of innovation due to differing governance practices between Indian states [4; 31; 32].
b) Interrelation between IPR protection and incentives of firms to innovate [4; 20].
c) Links between firms, government and R&D universities, although such links remain weak in India due to poor governance of innovation and inadequate institutional incentives.
d) Use of traditional instruments by government to promote overall R&D investment and green investment by firms: liberalization, protection of IPR, R&D tax incentives, coal tax and research subsidies, ESG disclosure practice and green bonds [5,; 38; 39; 50].
e) Strengthening the national banking system by encouraging banks to avoid bad debts and to develop microfinance practices as a source of private R&D investment [7; 8; 50].
f) Introduction of green bonds as a long-term financing instrument with the ability to "relieve pressure on bank balance sheets" [50].

India has low per capita GDP, which, as cross-country evidence shows, is associated with low management scores of firms in various sectors [23]. This goes in line with a well-established inverse relationship between per capita GDP and quality of management. Low per capita GDP may be caused by deficiencies of the institutional climate (insufficient stimuli for non-predatory and innovative behavior [49]), which would also be a cause of ineffective management.

At the *company-level* (*micro level*) a number of empirical regularities concerning innovation and innovation finance and management at Indian firms may be noted. These regularities as regards innovation techniques and preferred tools for effective management of innovation, including green innovation, in India correspond to findings in the

empirical literature for the US, Japan, and other countries. Such managerial practices include effective leadership, firm organizational structure and capability, and collaboration in research, as well as people management and management of diversity [2; 14; 51; 52].

Universal (internationally observed) features of innovation that are observed in Indian firms include the following:

a) Innovation is driven by growth opportunities [29], diversification and the search for new product markets [9]. There are spillover effects among Indian firms as regards innovation and managerial practices [25; 32].

b) M&As and innovation are complementary strategies. Indian companies use M&As to compensate for lack of in-house R&D, and the same department of a company often deals with both R&D and acquisitions [4][4].

c) The will to implement green innovation is positively linked to financial performance of firms [2; 54]. Drivers of green innovation are organizational and technological capabilities, as well as corporate social responsibility [54, Appendix].

The quality of innovation management enhances performance of Indian firms [28; 54], which is in line with evidence for the US, EU and Japan (see our review in [53]). Specifically, there is a positive association between personnel management and successful innovation, including green innovation [9; 27; 28; 55]. ESG disclosure is positively related to financial and market performance of firms [56].

Examples of universal approaches to personnel management in order to pursue innovations at Indian firms are as follows.

Firstly, personnel management for innovation involves creating a favorable work climate [28], promoting collaborative culture at work and incentivizing research by providing workspace for the exchange of ideas (see a survey of 45 employees at a software firm in [27]), providing research grants to employees and promoting staff based on their performance [9], and advocating "participatory leadership culture" [28][5]. The importance of these factors is confirmed by the methodological analysis of X. Song and M. Parry (1993) which lists organizational structure, attitude of senior management and employee participation as key elements of marketing R&D [58].

Secondly, a widespread method of personnel management consists in training personnel for in-house R&D with an emphasis on interdisciplinary expertise and collaboration: "a month of training in each type of research activity" [6, p. 1]; "organization-wide" employee training [28]; and a 3–4 month training program that covers diverse fields [9]. This corresponds to practices in Japanese firms [53]. For instance, Sony pays attention to social interactions within the company and educates R&D personnel as generalists [59–62]. True to this logic, newly hired R&D researchers at Sony receive a one-month training in production and a three-month training in sales and marketing [59].

Thirdly, management of innovation personnel involves hiring competent engineers and networking [29], as well as collecting customer feedback on innovation.

As regards other universal forms of innovation management (including green innovation management) practiced in India, innovation in IT and pharmaceutical firms is associated with discovering new fields that offer growth opportunities [29] and exploring the possibilities of new technologies [63] as well as using "time" as a first-mover advantage [28]. According to the study of 44 SMEs in the electronics sector in India, introduction of new technologies ranks as the top strategy for company development over a 3-year horizon (Table 4 in [63]). It may be noted that the launch of new products and new product areas is also regarded as the most effective R&D strategy in the Japanese electronics industry [58].

Finally, "psychological empowerment" is an important part of innovation management and is used by companies in several Indian industries [26].

Unique features of innovation, innovation finance and innovation management in India

1. Unique instruments of innovation finance.

The Indian government and the public sector are the major sources of domestic R&D financing in general and of green financing in particular [5; 8; 38; 39; 41]. The government seeks to compensate for a lack of private investment in R&D, which is noticeable in industries as varied as fuels and higher education [41]. Venture capital is of minor importance in India in comparison to the BRICS countries [1].

It is important to note that green foreign direct investment in India is very large, exceeding the figure in China by almost 4 times [8, Table 2].

2. Indigenous forms of innovation

A unique feature of innovation in India is concentration of domestic firms on frugal, low-cost innovation under resource constraints [4; 10–12; 32]. In this regard, Indian firms show more resourcefulness and creative capacity than Chinese firms [32]. In the Indian context, frugal innovation (described by the Hindi word, "jugaad") can be defined as "the art of overcoming harsh constraints by improvising an effective solution using limited resources" [10, p. 847]. Indian R&D tends to focus on specific markets with low-income consumers, cost-cutting

[4] The strategy is similar to that observed at Japanese firms [53].

[5] In line with established management practices in the US [57].

[4; 29], and use of local materials. Below we list examples of cost-cutting innovation in various sectors of the Indian economy:

a) In the agricultural sector: milk powder made from buffalo milk; composite feed for cattle made from local nutrients and grains [9].

b) In the IT sector: innovation targeted at rural areas with hot climate and absence of air-conditioning (lower-powered microprocessors to reduce heat and longer circuitry [12]).

c) In the automobile industry: a low-cost car, the Nano by Tata Motors, priced at USD 2500, with small tires and wheel, 3 instead of 4 lug nuts, a 2-cylinder engine in the rear of the car to save space and only 1 windshield wiper [11].

Frugal innovation and cost-cutting have become major drivers of green innovation in India. For example, an innovative business model has been developed by a non-profit NGO, SELCO, to supply solar panels and batteries to poor Indians in rural areas in such a way that this renewable energy source is cheaper than kerosene, which has been used previously [10]. In another example, a fully biodegradable clay refrigerator that costs less than USD 50 and uses no electricity was introduced by Mitticool social ventures [10]

3. Unique innovation strategies

A number of unique innovation strategies are observed in India. Firstly, there is an emphasis on immaterial motivation for innovation, particularly as regards ecological innovation. Grass-root innovation, based on "links between traditional knowledge and ecological sustainability" is popular [32, p. 202].

Secondly, innovative firms in India often use forms of personnel management that are not commonly observed in other countries. Work engagement in India is the highest in the world [26]. Accordingly, personnel management in India aims at creating the most favorable climate for innovative workers. Companies focus on the technical proficiency and motivation of a newly hired job candidate, not on the ranking of his college [9]. For example, the Indian Space Research Organization, a public-sector research institute, does not seek to attract personnel by salary levels, which are lower than in the private sector, but by transparency of career paths and promotion according to merit [9]. Another example is the telecom company C-Dot, set up by Satyen Pitroda, which encouraged innovation by young engineers through "an open, non-hierarchical, and egalitarian organizational culture which promoted creativity" [5, p. 147].

4. Unique firm-level drivers of innovation

Unique innovation strategies and special features of the Indian economy explain unique forms of innovation management in the country.

a) Family ownership, which impedes innovation in the West, fosters innovation in the Indian context [57]. This is because in India family ownership provides innovation benefits through diversification [32]. Family ties are also an essential part of Indian business [4; 64].

b) Indian firms use an "ambidextrous strategy of innovation" combining explorative and exploitative forms of innovation [4; 29; 32], especially in response to changes in IPR policy [32].

c) SMEs in India are more open to innovation than large companies [14]. "Small team projects" are therefore the prevalent form of innovation [3].

d) SMEs often pursue several types of incremental innovation, e.g. "four or more types" ([65, p. 514], a study of 88 SMEs).

Innovation and management in India according to the World Management Survey

The World Management Survey is a tool developed in the early 2000s by a team headed by Professors Nicholas Bloom and John van Reenen [57]. It was an unprecedented standardized survey which could quantify management practices at firms in different industries and different countries. The seminal work by Bloom and van Reenen "Measuring and explaining management practices across firms and countries" appeared as an NBER working paper in 2006 and as an article in the Quarterly Journal of Economics in 2007. As of July 2024, the work has reviewed over 4500 citations in Google scholar and close to 2000 citations in the Web of Science, which marks it as one of the most influential papers in economics. The concept of management as part of a firm's technology was highlighted in Bloom and van Reenen [57] and in a series of subsequent works by the same authors as well as by many other researchers worldwide[6].

The World Management Survey examined 18 management practices at manufacturing firms and 19 at retail firms [57][7], including several practices particularly related to management of innovation (see in [21, Table 1, p. 206, Categories 1, 2, 17 and 18]). The practices investigated by the Survey included:

1) Introduction of modern manufacturing techniques.

2) Rationale for introduction of modern manufacturing techniques.

3) Attracting talented human capital.

4) Retaining talented human capital.

Answers to the Survey questionnaire were used to prepare a composite management score for each company which could shed light on the relationship between management

[6] See our research applying the concepts of Bloom and van Reenen [57] to measuring production at Japanese local public enterprises in [66; 67].

[7] The Survey also looked at 21 management practices in hospitals and 23 in schools [23].

and the firm's productivity and profitability. Just as institutional climate is regarded as a production factor at the macro-economic level [49], management can be viewed as a technology tool at the firm level [22; 57][8].

The scores of Indian firms in the first rounds of the Survey were among the lowest on average across all of the surveyed countries: Indian firms scored less than 2.7 points out of a possible 5, while US firms had an average score close to 3.4 (see in [21, Figure 1; 24]). Moreover, India was placed lower than any other country, including Brazil and China, as regards performance monitoring by management, scoring only 2.62 (see in [7] in [7, Table 2]).

The distribution of management scores is very skewed to the left in India, implying that very few firms have high scores. Moreover, the distribution is not compressed, meaning that the variation in management scores within India is high (see in [21, Table 2]).

The data from several rounds of the World Management Survey (2004–2014) reveal a positive association between management scores and GDP per capita (see in [23, Figures 2, 4]; and in [68, Figure 16]). This tallies with India's worse performance in the Survey compared with Brazil and China since India is poorer in per capita terms than these other two BRICS countries.

One striking finding of the Survey is that India is a rare example of a country which places more emphasis on people management than on operations, monitoring, and targets: the average scores for people management at Indian manufacturing firms are higher than for other areas of management (see in [21, Table 2] and in [23, Figure 3]). Similarly, people management was found to be an important productivity factor in Indian schools [68].

As regards the relation between management and firm performance (measured as firm production, profitability, and survival), a series of papers by the Survey designers, Bloom and van Reenen, support the theory that differences in management practices across firms in different countries lead to variation in productivity and firm performance [21; 57].

A special study by one of the authors of the Survey and other researchers (N. Bloom et al., 2013 [24]) examined impact from the introduction of modern manufacturing practices at Indian textile firms. Consulting on the new practices, which concerned operations, quality control, inventory, human resource management, sales and other management, was offered to firms free of charge as a field experiment for the purposes of the study [24]. The firms were keen to make use of the practices (see in [24, Figure 5]), which led to rises in output and total factor productivity (see in [24, Table 2]). The list of practices included garbage disposal, removing old stock and cleaning the machines [24, p. 11, 45–47], which all relate directly to environmental protection and green investment. Indeed, "waste management" is one of the items covered by ESG reports, which are now compulsory for publication by top listed firms in India [43].

A follow-up study by N. Bloom et al. (2020) investigated whether the new managerial practices were still in use by the firms 9 years after their adoption [25]. The adoption rate fell from over 0.6 to about 0.45 at treatment plants, but rose from 0.4 to 0.45 in other plants owned by the firms [19, Figure 1, p. 206]. The main causes for abandonment of the new managerial practices were managerial turnover (employment of new managers) and reduced director time, while the drivers for greater use of the practices were spillover from other plants in the same firm or other firms [19, Table 3, p. 210]. The practices that were dropped were those that created a burden on managers by increasing their routine duties due to the need for daily monitoring. The practices that remained rooted in the firms were associated with systematic quality management, disposing of old stock and preventive maintenance [19, p. 213].

Discussion and conclusion

India is a fascinating example of an emerging economy which adapts the concept of innovation-based growth to its own specific economic and cultural context. Innovation in India has attracted growing interest among researchers, with a steady increase in the number of published papers on the subject and in the number of their citations [31].

Research into efficient practice for the financing and management of innovation is important for assuring successful outcomes from the implementation and commercialization of innovation[9]. However, the experience of developed countries is often inapplicable to emerging economies. Hence the importance of studying both universal and unique forms of innovation in a major emerging economy such as India in order to identify the most effective practices for management of innovation there and in other emerging economies.

The present paper first carried out a meta-review of literature on innovation in India, focusing on the universal and unique features of innovation practices in that country. The paper then proceeded to summarize universal and India-specific methods of innovation finance and management (Table 2).

[8] The large-scale data of the World Management Survey confirmed the hypothesis that management is an important production factor in various countries, including India.

[9] In Western countries as many as six generations of R&D management practices have been formulated since WWII [15].

Table 2. Innovation, and the financing and management of innovation in India: universal and unique features

	Universal features	Unique features
Innovation	Drivers of innovation are growth opportunities, diversification, search for new products and possibilities offered by new technologies. M&As and innovation are complementary strategies. Institutional climate, governance and IPR protection foster innovation.	Ambidextrous strategy of combining exploration and exploitation innovation, as well as product and process innovation. Indigenous forms of resource-constrained innovation, targeted at domestic markets with low-income consumers.
Financing of innovation	As the major regulating body in the national innovation system, government has been employing standard policies to promote innovation. Overall R&D investment and green investment by firms. Liberalization, protection of IPR, R&D tax incentives, coal tax and research subsidies, regulations on ESG reporting.	Government is the major source of R&D financing and of green investment. Green bonds have been used in India only since 2015. Venture capital is of minor importance in India. The share of R&D expenditure in GDP is very low and has been decreasing in the past 15-20 years. There is no general agreement about the effectiveness of government policies as regards R&D expenditure growth. Green foreign direct investment in India is large.
Management of innovation	Ineffective management may be explained by low per capita GPD and high firm centralization. Effective human resource management is associated with successful innovation including green innovation. Examples of modern managerial practices are: collaborative culture at work, diversified training of personnel for in-house R&D, and psychological empowerment. There are spillovers across firms as regards innovation and modern managerial practices	Cost-cutting and use of local materials, especially for resource-constrained innovation, including green innovation. Immaterial motivation for innovation, including green innovation and grass-root innovation. Innovation is generally caused by the competitive environment rather than by customer demand. Family ownership fosters innovation. Unique examples of human resource management at Indian innovative firms: focus on technical proficiency and motivation of an employee, attracting personnel by promotion based on merit and transparency of career plans

A number of universal innovative practices are implemented in India, accompanied by internationally established practices for regulating the financing and management of innovation. There are clear parallels between companies in India and in Japan as regards the use of diversified training for in-house R&D and the creation of a collaborative culture in the workplace.

However, a number of innovation practices are specific to India and are accompanied by specific approaches to innovation. In particular, Indian firms prefer labor-intensive rather than capital-intensive technologies and focus on (green) human resources. The same phenomenon is observed in other low- and middle-income countries [23]. Accordingly, India uses various approaches that would be deemed inefficient by a Western analyst: government, not the private sector, as the major supplier of R&D and green R&D expenditure; family ownership drives innovation instead of impeding it; innovation may be encouraged by non-material motivations; there is a focus on low-income consumers and cost-cutting as key determinants for innovation; and preference is often given to indigenous forms of innovation and green innovation.

The above-mentioned combinations of universal and country-specific features of the national innovation system are well pronounced in green innovation in India. Regarded as "a fruitful research area" but lacking sufficient coverage in academic literature as of 2015 [32], by 2023 issues of sustainability, green innovation and green financing in India have entered the arena of discussion by international academic analysts [44], and there is much interest in the potential of green innovation to assist in "moving from growth to development" [50].

The universal features of green innovation and green financing that are observed in India include: reliance on regulatory measures, such as priority lending to the energy sector; requirements for ESG reporting; use of green bonds; and discouraging carbon emissions through coal tax. Specifically, ESG reporting is an important driver of green innovation in the pharmaceutical sector [71].

There are still a number of impediments to expansion of green innovation in India. But the studies that were summarized in this paper offer various approaches to overcome these impediments, and the proposed solutions leverage the opportunities offered by the strong role of government in India's economy. Firstly, an effective public-private partnership could be realized by helping private companies to conduct long-term investment in green technologies that often require large capital inputs (e.g. carbon capture and storage technology in the carbon sector [7]). Secondly, there is a need to strengthen the banking system and, particularly, to develop banking in rural areas. This could be accomplished by: reducing the non-performing asset ratio, which is among the highest in large economies [45]; providing micro-finance on a longer-term basis [50] in order to involve rural individuals who have collateral but are currently outside the bank system [10]; increasing the volume of deals and aggregating smaller assets to attract investment though green bonds [50]. It will also be important to develop capital markets using a range of financial instruments such as loans and bonds, to enhance institutional engagement at the international, national and grass-roots level, and to treat green innovation as a prime example of public-private partnership [45].

In conclusion we note that existing bibliometric reviews find that economics literature is increasingly interested in the contrast between universal and unique features of innovation financing and management in India – the contrast which has been the subject of the present paper. Specifically, N. Sharma (2016) stresses an increasing interest of the international scholarly audience in "India-specific innovations" [29], p. 258[. A. Nair et al. (2015) discuss whether it is possible to "develop a uniquely Indian perspective on innovation" [3, p. 948]. Finally, D. Chatterjee and S. Sahasranamam (2018) point to the existence of an "India-specific innovation paradigm" [32, Table 4, p. 219].

Acknowledgement

We are grateful to the Editor, Irina V. Ivashkovskaya, for 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).

References

1. Dasher R. *Asia Entrepreneurship Update – 2024.* 2024. URL: https://drive.google.com/file/d/11YrpBt1BTo3cYOZbJ3x2aHWXhTb6YELw/view (accessed on 17.06.2024)
2. Mishra P., Yadav M. Environmental capabilities, proactive environmental strategy and competitive advantage: A natural-resource-based view of firms operating in India. *Journal of Cleaner Production.* 2021;291:125249. https://doi.org/10.1016/j.jclepro.2020.125249
3. Chakraborty A. Quality management practices in Indian SMEs. In: Pereira P., Xavier S., eds. *Quality Management and Quality Control: New Trends and Developments.* IntechOpen; 2024. https://doi.org/10.5772/intechopen.83550
4. Nair A., Guldiken O., Fainshmidt S., et al. Innovation in India: A review of past research and future directions. *Asia Pacific Journal of Management.* 2015;32:925–958. https://doi.org/10.1007/s10490-015-9442-z
5. Cassiolato J.E., Couto Soares M.C. Introduction. BRICS National System of Innovation. In: *Financing Innovation: BRICS National Systems of Innovation.* Taylor&Francis; 2020.
6. OECD. *Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition.* 2005. https://doi.org/10.1787/9789264013100-en
7. Gajjar Y. Exploring the scope of green investment in the coal sector of India and its efficacy on Indian economy. *Environmental Claims Journal.* 2020;33(4):279–303. https://doi.org/10.1080/10406026.2020.1851489
8. Tolliver C., Fujii H., Keeley A.R., et al. Green innovation and finance in Asia. *Asian Economic Policy Review.* 2021;16(1):67–87. https://doi.org/10.1111/aepr.12320
9. Jain S. From jugaad to jugalbandi: Understanding the changing nature of Indian innovation. *Asia Pacific Journal of Management.* 2022;39(1):1–26. https://doi.org/10.1007/s10490-020-09728-8
10. Prabhu J., Jain S. Innovation and entrepreneurship in India: Understanding jugaad. *Asia Pacific Journal of Management.* 2015;32:843–868. https://doi.org/10.1007/s10490-015-9445-9
11. Ray P.K., Ray S. Resource-constrained innovation for emerging economies: The case of the Indian telecommunications industry. *IEEE Transactions*

on Engineering Management. 2010;57(1):144–156. https://doi.org/10.1109/TEM.2009.2033044

12. Ray S., Ray P.K. Product innovation for the people's car in an emerging economy. *Technovation*. 2011;31(5–6):216–227. https://doi.org/10.1016/j.technovation.2011.01.004
13. Klette T.J., Kortum S. Innovating Firms and Aggregate Innovation. *Journal of Political Economy*. 2004;112(5):986–1018. https://doi.org/10.1086/422563
14. Gupta A.K., Wilemon D. Changing patterns in industrial R&D management. *Journal of Product Innovation Management*. 1996;13(6):497–511. https://doi.org/10.1016/S0737-6782(96)00051-3
15. Nobelius D. Towards the sixth generation of R&D management. *International Journal of project management*. 2004;22(5):369–375. https://doi.org/10.1016/j.ijproman.2003.10.002
16. Coad A. Firm Growth: a Survey. *Papers on Economics and Evolution*. 2007:07032007.
17. Iino T., Inoue H., Saito Y.U., et al. How does the global network of research collaboration affect the quality of innovation? *The Japanese Economic Review*. 2021;72:5–48. https://doi.org/10.1007/s42973-020-00042-y
18. Demirag I.S., Doi N. R&D management under short term pressures: a comparative study of the UK and Japan. *International Journal of Technology Management*. 2007;40(4):249–277. https://doi.org/10.1504/IJTM.2007.015752
19. Coad A., Rao R. Innovation and firm growth in high-tech sectors: A quantile regression approach. *Research policy*. 2008;37(4):633–648. https://doi.org/10.1016/j.respol.2008.01.003
20. Ray S., Ray P.K. Innovation strategy of latecomer firms under tight appropriability regimes: The Indian pharmaceuticals industry. *Journal of International Management*. 2021;27(1):100820. https://doi.org/10.1016/j.intman.2020.100820
21. Bloom N., Van Reenen J. Why do management practices differ across firms and countries? *Journal of Economic Perspectives*. 2010;24(1):203–224. https://doi.org/10.1257/jep.24.1.203
22. Bloom N., Sadun R., Van Reenen J. Recent Advances in the Empirics of Organizational Economics. *Annual Review of Economics*. 2010;2:105–137. https://doi.org/10.1146/annurev.economics.050708.143328
23. Scur D., Sadun R., van Reenen J., et al. World Management Survey at 18: lessons and the way forward. *CEPR Discussion Papers*. 2021: 28524. https://doi.org/10.3386/w28524
24. Bloom N., Eifert B., Mahajan A., et al. Does Management Matter? Evidence from India. *The Quarterly Journal of Economics*. 2013;128(1):1–51. https://doi.org/10.1093/qje/qjs044
25. Bloom N., Mahajan A., McKenzie D., et al. Do management interventions last? Evidence from India. *American Economic Journal: Applied Economics*. 2020;12(2):198–219. https://doi.org/10.1257/app.20180369
26. Bhatnagar J. Management of innovation: Role of psychological empowerment, work engagement and turnover intention in the Indian context. *The International Journal of Human Resource Management*. 2012;23(5):928–951. https://doi.org/10.1080/09585192.2012.651313
27. Malaviya P., Wadhwa S. Innovation management in organizational context: an empirical study. *Global Journal of Flexible Systems Management*. 2005;6(2):1–14.
28. Sahoo S. Quality management, innovation capability and firm performance: Empirical insights from Indian manufacturing SMEs. *The TQM Journal*. 2019;31(6):1003–1027. https://doi.org/10.1108/TQM-04-2019-0092
29. Sharma N. Management of innovation in small and medium enterprises in India: Comparison of IT and pharmaceutical firms. *The IUP Journal of Knowledge Management*. 2016;14(2). https://doi.org/10.2139/ssrn.2664235
30. Saran S. *Financing Green Transitions*. Observer Research Foundation. 2019. (Accessed on 27.05.2024) URL: https://samirsaran.com/2019/01/24/financing-green-transitions/
31. Sharma G. Innovation and entrepreneurship research in India from 2000 to 2018: a bibliometric survey. *Journal of Management Development*. 2019;38(4):250–272. https://doi.org/10.1108/JMD-11-2018-0316
32. Chatterjee D., Sahasranamam S. Technological innovation research in China and India: A bibliometric analysis for the period 1991–2015. *Management and Organization Review*. 2018;14(1):179–221. https://doi.org/10.1017/mor.2017.46
33. Schumpeter J. *Capitalism, socialism and democracy*. Routledge; 1942.
34. Romer P.M. Endogenous technological change. *Journal of political Economy*. 1990;98(5, Part 2):S71–S102.
35. Grossman G.M., Helpman E. Trade, knowledge spillovers, and growth. *European economic review*. 1991;35(2–3):517–526. https://doi.org/10.1016/0014-2921(91)90153-A

36. Akcigit U., Kerr W.R. Growth through heterogeneous innovations. *Journal of Political Economy*. 2018;126(4):1374–1443. https://doi.org/10.1086/697901

37. Lentz R., Mortensen D.T. An empirical model of growth through product innovation. *Econometrica*. 2008;76(6):1317–1373. https://doi.org/10.3982/ECTA5997

38. Kahn M., de Melo L.M., de Matos M.G.P. *Financing Innovation: BRICS National Systems of Innovation*. Taylor & Francis; 2020.

39. Sunil M. India. In: *Financing Innovation: BRICS National Systems of Innovation.* Taylor & Francis; 2020.

40. Eurostat. *R&D expenditure*. 2024 (accessed on 27.07.2024). URL: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=R%26D_expenditure&oldid=551418#R.26D_expenditure_by_source_of_funds

41. Department of Science and Technology Government of India. *R&D Statistics at a Glance, 2022-23*. 2023. (accessed on 27.07.2024). URL: https://dst.gov.in/sites/default/files/R%26D%20Statistics%20at%20a%20Glance%2C%202022-23.pdf

42. Singh M.P., Chakraborty A., Roy M., et al. Developing SME sustainability disclosure index for Bombay Stock Exchange (BSE) listed manufacturing SMEs in India. *Environment, Development and Sustainability*. 2021;23:399–422. https://doi.org/10.1007/s10668-019-00586-z

43. Motwani A., Gupta R. ESG reporting: Environmental dimension disclosures by large energy sector companies in India. *European Journal of Theoretical and Applied Sciences.* 2023;1(2):108–118. https://doi.org/10.59324/ejtas.2023.1(2).11

44. Diwan H., Amarayil Sreeraman B. From financial reporting to ESG reporting: a bibliometric analysis of the evolution in corporate sustainability disclosures. *Environment, development and sustainability.* 2024;26(6):13769–13805. https://doi.org/10.1007/s10668-023-03249-2

45. Bhatnagar S., Sharma D. Green financing in India: identifying future scope for innovation in financial system. *International Journal of Green Economics.* 2021;15(3):185–212. https://doi.org/10.1504/IJGE.2021.120875

46. Ivashkovskaya I., Shcherbakov D., Yakovenko P. Corporate International Diversification and Performance: An Economic Profit Viewpoint—Evidence from BRIC Companies. In: *Strategic Deals in Emerging Capital Markets: Are There Efficiency Gains for Firms in BRIC Countries?* Springer Cham; 2020. https://doi.org/10.1007/978-3-030-23850-6

47. 4Frecautan I., Ivashkovskaya I. Is corporate governance important for green bond performance in emerging capital markets? *Eurasian Economic Review.* 2024;14(1):175–212. https://doi.org/10.1007/s40822-023-00249-5

48. Frecautan I. Is the Russian Green Bond Market Strong Enough to Hedge in the Crisis Times? *Journal of Corporate Finance Research = Korporativnye Finansy.* 2024;18(2):26–41. https://doi.org/10.17323/j.jcfr.2073-0438.18.2.2024.26-41

49. Hall RE, Jones CI. Why do Some Countries Produce So Much More Output Per Worker than Others? *The Quarterly Journal of Economics.* 1999;114(1):83–116.

50. Kumar N., Vaze P., Kidney S.. Moving from growth to development: Financing green investment in India. *ORF Special Report.* 2019:85.

51. Suzuki S., Takemura K. The effects of diversity in innovation: the moderating role of universal-diverse leaders. *Research Institute of Economy, Trade and Industry (RIETI). Discussion papers.* 2016;16086.

52. Haneda S., Ikeda Y. Determinants of Staged Project Management and Success in Innovation: Empirical Analysis Based on the Japanese National Innovation Survey. *Research Institute of Economy, Trade and Industry (RIETI). Discussion papers*. 2019:19094.

53. Besstremyannaya G., Dasher R., Golovan S. Quantifying heterogeneity in the relationship between R&D intensity and growth at innovative Japanese firms: A quantile regression approach. *Applied Econometrics.* 2022;67:27–45.

54. Singh M.P., Chakraborty A., Roy M. The link among innovation drivers, green innovation and business performance: empirical evidence from a developing economy. *World Review of Science, Technology and Sustainable Development.* 2016;12(4):316–334. https://doi.org/10.1504/WRSTSD.2016.082191

55. Rana G., Arya V. Green human resource management and environmental performance: mediating role of green innovation – a study from an emerging country. *Foresight*. 2024;26(1):35–58. https://doi.org/10.1108/FS-04-2021-0094

56. Sharma P., Panday P., Dangwal R. Determinants of environmental, social and corporate governance (ESG) disclosure: a study of Indian companies. *International Journal of Disclosure and Governance.* 2020;17(4):208–217. https://doi.org/10.1057/s41310-020-00085-y

57. Bloom N., Van Reenen J. Measuring and explaining management practices across firms and countries. *The Quarterly Journal of Economics.* 2007;122(4):1351–1408. https://doi.org/10.1162/qjec.2007.122.4.1351

58. Song X.M., Parry M.E. How the Japanese manage the R&D–marketing interface. *Research-Technology Management.* 1993;36(4):32–38. https://doi.org/10.1080/08956308.1993.11670913

59. Harryson S.J. From experience How Canon and Sony drive product innovation through networking and application-focused R&D. *Journal of Product Innovation Management*. 1997;14(4):288–295. https://doi.org/10.1016/S0737-6782(97)00011-8

60. Arimura S. How Matsushita electric and Sony manage global R&D. *Research-Technology Management.* 1999;42(2):41–52. https://doi.org/10.1080/08956308.1999.11671272

61. Reger G. How R&D is coordinated in Japanese and European multinationals. *R&D Management.* 1999;29(1):71–88. https://doi.org/10.1111/1467-9310.00118

62. Wu F.S., Haak R. Innovation Mechanisms and Knowledge Communities for Corporate Central R&D. *Creativity and Innovation Management.* 2013;22(1):37–52. https://doi.org/10.1111/caim.12015

63. Singh R.K., Garg S.K., Deshmukh S. Development of flexible strategies by Indian SMEs in electronics sector in emerging economy. *Global Journal of Flexible Systems Management.* 2005;6(2):15–26.

64. Chakrabarti R., Sanyal K. *Shaping policy in India: Alliance, advocacy, activism.* Oxford University Press; 2017.

65. Gupta V., Gupta B. Flexible strategic framework for managing innovation from perspective of continuity and change: A study of SMEs in India. *Business Process Management Journal.* 2014;20(3):817–825. https://doi.org/10.1108/BPMJ-05-2013-0061

66. Besstremyannaya G. Managerial performance and cost efficiency of Japanese local public hospitals: A latent class stochastic frontier model. *Health Economics.* 2011;20(S1):19–34. https://doi.org/10.1002/hec.1769

67. Besstremyannaya G., Golovan S. Measuring heterogeneity in hospital productivity: a quantile regression approach. *Journal of Productivity Analysis.* 2023;59(1):15–43. https://doi.org/10.1007/s11123-022-00650-3

68. Lemos R., Muralidharan K., Scur D. Personnel Management and School Productivity: Evidence from India. *The Economic Journal.* 2024;134(661):2071–2100. https://doi.org/10.1093/ej/uead112

69. Khan S.J., Kaur P., Jabeen F., et al. Green process innovation: Where we are and where we are going. *Business Strategy and the Environment.* 2021;30(7):3273–3296. https://doi.org/10.1002/bse.2802

70. Tomer S., Rana G. Green Human Resource Management: A Conceptual Study. In: Agarwal S., Burrell D.N., Solanki V.K., eds. *Proceedings of the 2020 International Conference on Research in Management & Technovation,* 2020;24:147–150. https://doi.org/10.15439/2020KM10

71. Chaturvedi U., Sharma M., Dangayach G.S., et al. Evolution and adoption of sustainable practices in the pharmaceutical industry: An overview with an Indian perspective. *Journal of Cleaner Production.* 2017;168:1358–1369. https://doi.org/10.1016/j.jclepro.2017.08.184

72. Nazir M.R., Tan Y., Nazir M.I. Financial innovation and economic growth: Empirical evidence from China, India and Pakistan. *International Journal of Finance & Economics.* 2021;26(4):6036–6059. https://doi.org/10.1002/ijfe.2107

The authors declare no conflicts of interests.

The article **was submitted on** 06.06.2024; **approved after reviewing on** 08.07.2024; **accepted for publication on** 30.07.2024.