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**Abstract**

This thesis, written by MCF 2nd year student Georgiy Chumachenko under the careful guidance of Associate Professor, Alexander Y. Andrianov , on the topic of “cost of debt and equity in BRICS countries: can better esg performance decrease corporate financing costs” investigates the impact of Environmental, Social, and Governance (ESG) performance on the cost of capital in selected BRICS markets—specifically Russia, Brazil, and South Africa. The primary objective of this research is to elucidate how ESG scores influence the cost of equity and debt and to examine whether these effects differ between top ESG performers and underperformers. Employing comprehensive panel regression models, the study reveals that higher ESG scores are generally associated with increased costs of equity across all three markets. This outcome reflects investors' perceptions of higher initial costs and risks associated with ESG improvements. Conversely, the impact of ESG scores on the cost of debt varies, with significant reductions observed mainly in firms with the highest ESG scores, particularly in Russia and Brazil. The research highlights the varying importance of ESG factors in emerging markets, underscoring the need for country-specific strategies. These findings provide actionable insights for corporate managers, investors, and policymakers aiming to leverage ESG performance for financial and strategic benefits, emphasizing the complex interplay between ESG initiatives and capital costs in diverse regulatory and market environments.

Keywords: ESG score, cost of capital, BRICS markets, cost of debt, cost of equity, panel regression, sustainability, emerging markets.

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# Introduction

The ever-growing interest in Environmental, Social, and Governance (ESG) factors has fundamentally transformed the landscape of corporate finance, influencing investment and corporate strategy globally. This shift towards Corporate Social Responsibility (CSR) marks a significant departure from Milton Friedman's postulates, which emphasized profit maximization as the sole responsibility of business (1975). Today, stakeholders increasingly recognize that sustainable business practices are essential for long-term value creation, leading to a growing integration of ESG criteria in financial decision-making. This thesis aims to elucidate the intricate relationship between ESG performance and the cost of capital within the BRICS markets, specifically focusing on Russia, Brazil, and South Africa. By exploring the distinct economic, regulatory, and market environments of these emerging economies, this research endeavors to bridge the existing gap in literature that predominantly centers on developed markets such as the United States and the European Union. The impetus for this research stems from the growing recognition that ESG factors are not merely concerns of activist investors but integral elements influencing a firm's financial performance and risk profile. Prior studies, such as those by Giese et al. (2019), have demonstrated that firms with superior ESG performance tend to exhibit lower systematic risk, leading to a reduced cost of equity. Similarly, Chen et al. (2023) have shown that enhanced ESG scores in Chinese markets are associated with lower equity costs, further highlighting the risk mitigation benefits of robust ESG practices. These findings underscore the need for a nuanced understanding of how ESG factors interplay with financial metrics in different market contexts.

Despite the wide array of research on developed markets, the BRICS nations present a unique case for examination due to their diverse institutional structures, varying levels of market maturity, and distinct regulatory landscapes. The BRICS economies, characterized by rapid industrial growth and significant environmental and social challenges, offer a fertile ground for investigating the potential of ESG factors to influence corporate financing costs. The limited scholarly focus on these markets, particularly on Russia, Brazil, and South Africa, highlights the substantiality of the research gap.

The primary objective of this thesis is to determine whether ESG disclosures impact the cost of equity and debt in the selected BRICS markets. This study will also explore the differential impact of ESG scores on top ESG performers versus underperformers within these markets. To reach this objective, this study employs a comprehensive dataset spanning multiple years and incorporates panel regression models to analyze the relationship between ESG scores and cost of capital across the selected BRICS nations. By distinguishing between top ESG performers and underperformers and examining country-specific contexts, this research aims to provide valuable insights for both academic inquiry and practical applications in corporate finance and investment strategies.

# 1. Literature review

## 1.1. ESG and cost of debt

The debate on whether firm’s ESG risk profile is accounted for by lenders and investors in determining firm’s creditworthiness in the academia is shifting towards nearly universal consensus that it is. For instance Apergis et. al. (2022) stipulate that all pillars of ESG score exert a negative and statistically significant influence on corporate bond yields. Dwelling on the research of the firms from S&P 500 in the period of 2010-2019 authors argue that firms with higher ESG scores exhibit lower bond spreads and higher credit ratings. These findings hold true across aggregate ESG scores and separate pillars alike. Asimakopoulos et. al. (2023) take on a different approach, aiming to determine the relationship between ESG scores, leverage, and debt structure. Their findings suggest that a one standard deviation increase in ESG score will translate into 3,8% increase in bank loanand 6.7% decrease in bond issuing.

Another issue in the topic of ESG scores effect on debt markets and cost of debt is the moderating effect of the country-specific environment. Stellner et. al. (2015) argue that top ESG corporate performers in countries leading the sustainability trend enjoy smaller spreads by approximately 7.7% than their counterparts in markets less preoccupied with the agenda. This is the crucial aspect for our research, as we shall attempt to determine if this rule holds true for Russian market. The research is further continued with the analysis of the mortgage portfolio of firms. Eichholtz et. al. (2019) have analysed a vast dataset of EU firms in the real estate sector. In particular, collateralized assets of such firms were researched, such as asset-backed securities. The findings suggest that assets certified as sustainable by Energy Star enjoyed lower mortgage spreads as compared to non-certified assets. Mortgage spread declines ranged from 24 to 29 basis points. Additionally, Bhuiyan and Nguyen (2020) using multivariate regression analysis to investigate the association between ESG performance and cost of debt for a vast sample of Australian firms, suggest that via enhanced corporate reputation and reduced information asymmetry better ESG performance negatively affects cost of debt, indicating that CSR disclosure reduces financing costs. This supports the risk mitigation perspective that is going to be used in managerial implications of this study.

Furthermore, important mediating factor that conveys better ESG performance into lower cost of debt is the corporate reputation. For instance, Maaloul et al. (2021) uses SPSS PROCESS Macro and AMOS for mediation analysis to examine the relationship between ESG scores, corporate reputation, and cost of debt. The findings indicate that both ESG performance and ESG disclosure positively influence corporate reputation, which in turn reduces the cost of debt. The mediation effect of corporate reputation is more pronounced for ESG performance compared to ESG disclosure. The study highlights the indirect role of corporate reputation in the relationship between ESG factors and cost of debt, showing that better ESG practices lead to lower debt costs through enhanced reputation. Meanwhile, Bae et. al (2022) in their panel regression models across 16 countries (widest country sample to be covered) found robust association between higher ESG performance (upper quartile of the sample) with a lower cost of borrowing in corporate debt markets. Both long-term 10 years Eurobonds and short-term 1 year bonds of the issuers in upper quartile enjoyed lower spreads. The study emphasizes the global applicability of these findings, demonstrating consistent effects across different legal and cultural frameworks.

Lastly, another important moderating variable in the research of the effects of ESG scores and disclosure on the cost of debt is the dominance of stakeholder-oriented countries. Eliwa et. al. (2021), have argued that among EU 27 countries the better ESG scores were most strongly associated with lower costs of borrowing in countries with stronger societal preoccupation with ESG and ethical issues, such as France, Germany, and Nordic Countries. Once again this logic should be put under scrutiny in our research, and will be further discussed in the hypotheses and problem statement section.

## 1.2. ESG and cost of equity

Cost of equity is a crucial metric determining corporate equity value, as it is universally used as a discount factor for the free cashflow to equity, andis a major component of weighted-average cost of capital.Giese et. al. (2019) give a detailed account of how a favourable ESG risk profile is translated into lower cost of equity and consequently into higher valuation. They argue that top ESG performers are less vulnerable to systematicshocks, giving examples of how those companies were quicker to recover from the march 2020 pandemic slump.As the beta coefficient in the CAPM is a proxy for a systemic risk, lower exposure to the latter translates into lower beta and consequently lower required rate of return. In a DCF valuation this ultimately leads to a higher valuation for the said company. This fact alone underscores the cruciality of the interrelation at hand, as growth of shareholder’s value is the ultimate goal of any enterprise. This logic is further tested in the context of the Chinese capital markets by Chen et.al (2023) who come to a conclusion that ESG score is negatively related to the cost of equity.The study by Chen et al. (2023) examines the impact of ESG performance on the cost of equity for Chinese A-share companies spanning fro 2010 to 2020. Using a comprehensive model that accounts for various controls including heteroscedasticity, sequence, and cross-section correlations, they discover that superior ESG performance significantly lowers the cost of equity capital. The paper finds that better ESG scores can reduce cost of equity not only directly but also indirectly by decreasing market risk and enhancing equity diversification. This line of reasoning is continued in the work of Nga & Rezaee (2015) who have developed a strong negative interrelation between environmental and governance pillars and cost of equity, in other words, the higher is the E and G scores of a respective firm the lower is the required rate of return for its investors. Another surprising finding by Nga & Rezaee is that social pillar (S) of the ESG metric has no significant impact on the cost of equity. This gives ground for our future hypotheses regarding the effect of the separate pillars of ESG on cost of equity. Moving on, El Ghoul et. al. (2011)have come to a similar conclusion dwelling on a vast dataset of the US firms observations from 1992 to 2007. The results are in line with Nga &Rezaee even in regard to weak to no significant effect of social performance of the firm on the cost of equity.

Another important dimension of the implied interrelation is the extent of investor protection in a country of observation. Breuer et. al. (2018) stipulate that ESG score as a proxy for firm’s CSR performance has a potential to reduce cost of equity only in countries with high levels of investor protection. Thus, investor protection takes on a role of a moderating variable in their model. Meanwhile, in countries with low investor protection higher ESG score is found to translate into higher cost of equity. In particular this is due to the social pillar of the said companies and increased spending on the social programs Breuer et. al. (2018) argue. This argument shall be further examined in our study, as the Russia’s country risk premium is notoriously high partly due to perceived lack of investor’s protection.

What is more, executive compensation could be an important moderator in the interaction of the ESG performance and cost of equity. A study by Chouaibi et.al. (2021) investigates the impact of ESG performance and executive compensation on the implicit cost of equity within French firms that adhere to Environmental, Social, and Governance (ESG) standards. This study uses a combination of the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor model to evaluate cost of equity. Conducted over the period 2015–2020 and involving 154 French companies, the research utilizes linear regression analyses on data sourced from Thomson Reuters ASSET4 and Thompson Institutional Brokers Earnings Services (I/B/E/S). The findings indicate a significant negative relationship between ESG score and the cost of equity, suggesting that CSR engagements can lower financing costs and influence investment and financial decisions. Furthermore, the study highlights the role of executive compensation structured around sustainability goals, emphasizing its importance in shareholder value enhancement. This research contributes to understanding how CSR and tailored executive incentives can affect the financial standing of companies committed to sustainability.

Lastlty, it is crucial to cover the mediating and moderating effects of wider investors base, analyst coverage and materiality of the ESG issues. For example, Duarte et al. (2018) investigate how CSR disclosure affects the cost of equity, finding that firms with better CSR disclosure practices enjoy a lower cost of equity. This relationship is mediated by improved analyst coverage and higher investor base. Similarly, Moussa et al. (2022) analyze the relationship between ESG performance and firm risk in European markets, showing that higher ESG scores correlate with reduced firm risk, particularly in the environmental and governance dimensions, leading to a lower cost of equity. They found that environmental performance significantly reduces firm-specific risk, which in turn lowers the cost of equity. Furthermore, Cardoso (2020) explores the link between ESG performance and cost of equity, emphasizing the role of materiality. The study finds that companies with better ESG performance have lower costs of equity, particularly in sectors where ESG issues are highly material. However, top-ranking ESG firms sometimes face higher costs due to potential overinvestment concerns. This nuanced finding suggests that while ESG integration can lead to financial benefits, it must be strategically managed to avoid inefficiencies.Additionally, Fatemi et al. (2018) find that ESG strengths positively impact firm value, while ESG concerns have a negative effect. The study shows that environmental strengths are particularly beneficial, whereas social and governance strengths are less impactful. This differentiation underscores the varying importance of different ESG dimensions in influencing firm value and cost of equity.

## 1.3. ESG and cost of capital in emerging markets

Aside from necessary investor protection legislation and functioning enforcement mechanisms in place there are certain characteristics and nuances to ESG performance effect on cost of equity and debt in developing markets. While the research existing in the academia is still in nascent stage, there are certain developments in examination of how ESG scores affect cost of capital in emerging markets.

The literature on the effects of ESG scores on the cost of capital in emerging markets underscores the multidimensional role of sustainability for financial performance and financing costs optimization. Several new studies, focusing on Latin America and BRICS countries, have observed that the transparency and governance aspects of ESG can substantially influence elements of firm’s cost of capital. Whereas a research focusing on ESG score effects on WACC in Malaysia suggests that aggregate ESG scores only affect firms in the financial sector.

Firstly, Ramirez et al. (2022) figured out an inverse relationship between ESG scores and the cost of capital within Latin American firms. Their research, covering over 600 firm-year observations from 202 firms between 2017 and 2019, reveals that while Environmental and Social Pillar scores did not show a significant effect on the cost of capital, the Governance Pillar displayed a strong negative correlation. The idea behind this is clear - governance plays a crucial role, where increased transparency and better governance practices correlate with reduced cost of capital. What is especially crucial for our research is the ESG scores breakdown conducted in Ramirez et al. (2022), they have subdivided the firms according the quatiles of theior respective ESG scores. Findings suggest that the observed relationship is stronger for firms in lowest first quartile (lowest 25% of the ESG performers), highlighting that even modest improvements in governance may lead to significant cost of capital reductions for firms that just start their path on improving their ESG record.

Furthermore, an important factor to consider is the industry-specific effects of the ESG scores on cost of capital in developing markets. For instance, Mohammad et al. (2023) have scrutinized the effect of corporate governance and ESG scores on the aggregate cost of capital (WACC) across 800 firm-year observations in emerging markets. Their findings through panel-corrected standard errors regressions suggest that in the financial sector of these markets, there’s a negative association between ESG scores and the cost of capital. However, this relationship is not observed in the non-financial sector, hence our suggestion to include dummy variable for industry in our model.

Lastly, Fandella et. al (2022) research ESG score effect on separate elements of the cost of capital, namely the cost of debt and the cost of equity in BRICS countries from a new angle..Their dataset spans from spans 2014 to 2019 and employs panel regressions to figure out the significance of the relationship between CSR performance, measured through ESG scores, and corporate financing costs. The researchers provide a new angle by differentiating between the mere inclusion in an ESG ranking (meaning the presence of ESG reporting) and the level of the ESG score itself. Their findings suggest the following - while the presence in the ESG ranking correlates with lower required rate of return and average cost of capital, the ESG score level itself does not significantly impact the cost of capital among the sampled firms. This suggests that, in BRICS markets, differentiation in ESG scores is not able to influence the cost of capital.

Across these studies there is no consensus as to whether ESG combined score are influencing the cost of capital. While Ramirez et. al (2022) suggest that only Governance pillar is decreasing the cost of capital in Latam region, Fandella et. al (2022) found no such relationship in BRICS countries. Mohammad et al. (2023) on the other hand argues about industry-specific effects. While the ongoing debate is fruitful for our research gap it is also contributing to the research design, as some of the ideas, such as industry breakdown will be employed.

To sum up, the existing literature attempts to provide evidence that high ESG scores signal lower risk to investors, thereby lowering the cost of equity, which extends the stakeholder theory’s understanding of how CSR activities influence financial performance. The same goes for debt holders, yet to a smaller extent, as well as with a less extensive scholarly coverage.

## 1.4. Research gap

The research on the effect of ESG scores on different elements of cost of capital has been limited in the emerging markets. Whereas for Russian stock market it is close to being non-existent. Previous studies were mostly directed at the examination of the phenomena in the developed markets such as EU and the US. What is more, the lack of consensus on the presence of the significant effect of ESG scores on cost of capital in BRICS countries is staggering. Lastly, previous studies mainly focused on separate aspects of cost of capital, either cost of debt or cost of equity. This research will attempt to take on holistic approach, as the capital structures and tax regimes of the firms are highly contextual yet cost of debt and equity are defining aspects of the cost of capital in any circumstance. From the side of the managerial implications thus will also be fruitful for potential stakeholders and users of this paper, as we aim to supply them with useful lens to look at the prospects of cost of capital improvement with better ESG performance. They will be shown if ESG scores affect cost of equity or cost of debt in a more significant fashion.

Moreover, no study on BRICS market have attempted to differentiate between top esg performers and underperforming firms. The distinction will come in handy for managers, as we expect for the relationship between ESG performance and cost of capital elements to differ for firms with different record on ESG activities. Lastly, a staggering lack of comparative analysis of the ESG relationship with the cost of capital in BRICS is evident. Previous studies were taking an aggregated approach to BRICS markets, where weight of Chinese market in terms of firm-year observations and valuation was overwhelming. In this study we aim to shine the light at the comparison between Russian, Brazilian, and South African Markets, which we believe to be comparable due to the factors discussed in the upcoming passage.

## 1.5. Problem statement and hypotheses

The research goal of this paper is to determine whether the ESG information disclosure affects the cost of capital in some of the BRICS markets, namely in Russia, Brazil, and South Africa, and to propose certain managerial recommendations based on this knowledge.

Existing literature has primarily centered on developed markets, leaving a research gap regarding how ESG disclosures may impact the cost of equity and debt in markets characterized by diverse institutional and legal structures, such as Russia, Brazil, and South Africa.

To facilitate for this research goal the following research questions have been posed:

1. Do the aggregate ESG scores affect the firm’s cost of equity in BRICS countries?
2. Do the aggregate ESG scores affect the firm’s cost debt in BRICS countries?
3. Does this effect variate in significance across BRICS members, namely Russia, Brazil, and South Africa?
4. Is theeffect of higher ESG score is more significant for cost of equity or cost of debt?
5. Does the relationship between ESG score, cost of equity, and cost of debt is variating between top ESG performers and underperforming companies?

Based on the research goal and resulting research questions the following hypotheses are suggested:

H1 The aggregate ESG scores will have an inverse relationship with cost of equity in BRICS markets.

This is supported by the majority of studies that have been reviewed: such as Giese et al. (2019) suggesting that lower cost of equity for top ESG performers is tied to lower systematic risk. AlsoChen et al. (2023) argued for superior ESG performance being conducive to lowers cost of equity in Chinese markets. Finally, Moussa et al. (2022) suggested higher ESG scores correlate with reduced firm-specific risk and lower cost of equity. Yet, these conclusions are undermined by other scholars, suggesting that country-specific context might change or eliminate the nature of the relationship between ESG scores and cost of equity altogether (Breuer et.al. (2018). Thus the country-specific context will be considered in further hypotheses.

H2 The aggregate ESG scores will have an inverse relationship with cost of debt in BRICS markets.

The majority of studies also yielded results that are consistent with this hypothesis. The literature consistently indicates that higher ESG scores tend to lower the cost of debt by improving corporate creditworthiness and reducing perceived risk among lenders. Studies by Apergis et al. (2022) and Bhuiyan and Nguyen (2020) demonstrate a significant inverse relationship between ESG performance and corporate bond yields, emphasizing that firms with better ESG ratings enjoy lower borrowing costs. However, country-specific contexts play a crucial role in this dynamic. For instance, Stellner et al. (2015) highlight that firms in countries with strong sustainability practices benefit more significantly from ESG improvements. This suggests that while the overall hypothesis holds, the extent of its validity may vary across BRICS countries, necessitating an examination of the unique economic and regulatory landscapes in Russia, Brazil, and South Africa to fully understand the impact of ESG scores on the cost of debt in these markets.

H3 The aggregate ESG scores effect is stronger for cost of equity rather than cost of debt in BRICS markets

While ESG also influences the cost of debt, as noted by Apergis et al. (2022) and Bhuiyan and Nguyen (2020), the impact on equity is often more pronounced due to the heightened sensitivity of equity investors to firm-specific risks and long-term sustainability. Thus, the literature supports the notion that ESG performance exerts a more substantial effect on the cost of equity than on the cost of debt.

H4 The effect on cost of debt and cost of equity will be stronger in Russia, due to the prevalence of emission-intensive industries in its structure of economy

This is grounded in the literature that emphasizes the heightened impact of ESG performance in environmentally sensitive sectors. Studies such as Stellner et al. (2015) suggest that top ESG performers in sectors with significant environmental footprints enjoy greater reductions in financing costs. Additionally, Maaloul et al. (2021) and Bae et al. (2022) highlight that companies in industries with higher environmental risks tend to benefit more from enhanced ESG ratings through improved corporate reputation and lower perceived risk. Furthermore, Cardoso (2020) underscores the role of materiality in ESG performance, indicating that companies in sectors where ESG issues are highly material see more substantial financial benefits. Given Russia's economic structure, heavily dominated by oil, gas, and mining sectors (up to 40% of state revenue) firms within these industries are likely to experience more pronounced effects from ESG improvements. This suggests that emission-intensive market of Russia could see a more substantial impact on their participant’s cost of debt and equity due to their greater exposure to environmental and governance risks, supporting hypothesis 4.

H5 The relationship at hand will be stronger for underperformers (lower 25%) , rather than for top performers (top 25%)

This hypothesis is substantiated by the literature, which suggests a diminishing marginal effect of ESG improvements. Research by Ramirez et al. (2022) indicates that even modest enhancements in governance can lead to significant reductions in the cost of capital for firms in the lowest ESG performance quartile. Cardoso (2020) also supports this approach by emphasizing the importance of materiality and the differential impact of ESG improvements across percentiles. His findings suggest that firms in the lower percentiles of ESG performance have more room for significant gains compared to those in the upper percentiles, where the marginal benefits of further improvements are reduced. Similarly, studies such as Fatemi et al. (2018) find that ESG strengths positively impact firm value, but the returns diminish as firms achieve higher ESG scores. This aligns with the notion that the initial improvements in ESG performance yield the most significant reductions in perceived risk and financing costs. Therefore, the literature supports the idea that underperforming firms will see a more pronounced impact on their cost of debt and equity from improving their ESG scores, validating hypothesis 5.

# 3. Data

## 3.1. Why drop I and C from BRICS?

The choice of countries at hand is not coincidental. The population, size of the economy, GDP per capita and structure of the economy being highly dependent on Oil&Gas (Russia) and Metals & Mining (South Africa and Brazil) makes those three somewhat comparable. Furthermore, the structure of the GDP by sector is alike among our peers. Brazil breakdown by sector is the following: 59% for services, 21% industry and 7% agriculture. For Russia services account for 67.8% of the GDP, industry is responsible for 27% of the output, and agriculture is producing 6% of the GDP respectively. Lastly, for South Africa services account for 68% of the gdp, industry produces 30%, while agriculture is responsible for only 2% of the GDP. In terms of structure of the economy two other BRICS members have very different distributions. While Chinese industrial sector is still accounting for up to 39% of its GDP, share of agricultural sector in Indian economy is also vast and up to 19%. Moreover, two other members of the BRICS, namely China and India have populations and GDPs far exceeding our peer group. The combined valuation using market cap size of markets at hand in descending order is as follows: Brazil – 881 billion USD, Russia – 551 billion USD, and South Africa – 282 billion USD. The size of respective market valuations for China and India would have dwarfed our trio, deeming implications made and parallels drawn irrelevant.

## 3.2. Data sourcing and sampling

The data has been gathered using Reuters’ Eikon terminal and Eikon Excel Dataroom software, for both ESG scores and the financials of the companies. This is justified by the fact that Refinitiv remains the sole foreign provider of trustable ESG ratings for Russia public companies, while RAEX sustainability ESG ratings are rather new, with insufficient sample dating back to 2021. On the contrary, Refinitiv’s database history for BRICS markets goes back to 2014, covering more than 70% of global capitalization. ESG scores provided by Refinitiv are comprehensive and robust and used by multiple scholars such as Nga (2015) and Cardoso (2020). It is based on 178 indicators and presents both aggregate ESG scores, and separate pillars. Due to elevated ambiguity surrounding the existence of the effect of separate pillars of the ESG on the cost of capital (Nga 2015). What is more, following Breuer et.al. (2018) logic we do not expect significant impact of S and G pillars due to investment cultures different from those inthe developed markets.

The sample used in this study covers the period from 2014 to 2023 for the models without lagged predictor and controls and 2015-2023 for the lagged model. Sample is composed of companies headquartered in Brazil, Russia, and South Africa with some exception in Russia, where there are instance of overseas headquartered companies in the beginning of redomiciling process, such as retail giant X5. Initial sample was based on the ESG score availability and publicly listed status. This left us with 41 company in Russia, 104 company for South Africa, and 129 companies for Brazil, making the total number of observations to reach 2,466. The sampling continued was with a simple criterion in mind presence of all the needed financials and disregard for companies in financial services industry or banking. At the end we had 1238 firm-year observations for three countries.

**Table 1 –** Observations distribution by industry

|  |  |  |
| --- | --- | --- |
| Industry | Observations | Percentage of total |
| Manufacturing | 259 | 20.9% |
| Utilities | 157 | 12.7% |
| Mining, Quarrying, and Oil and Gas Extraction | 151 | 12.2% |
| Retail Trade | 135 | 10.9% |
| Real Estate and Rental and Leasing | 102 | 8.2% |
| Information | 82 | 6.6% |
| Construction | 75 | 6.1% |
| Health Care and Social Assistance | 51 | 4.1% |
| Wholesale Trade | 43 | 3.5% |
| Transportation and Warehousing | 41 | 3.3% |
| Educational Services | 34 | 2.7% |
| Accommodation and Food Services | 28 | 2.3% |
| Professional, Scientific, and Technical Services | 24 | 1.9% |
| Management of Companies and Enterprises | 21 | 1.7% |
| Agriculture, Forestry, Fishing and Hunting | 19 | 1.5% |
| Administrative and Support and Waste Management and Remediation Services | 16 | 1.3% |
| Total | 1238 | 100% |

As a result, more than 50% of the firm-year observations accounted for companies in manufacturing, utilities, metals and mining, oil& gas, and retail industries.

## 3.3. Variables

**Table 2** – Used variables

|  |  |
| --- | --- |
| Dependent variables: | |
| *Kd* | Cost of debt |
| *Ke* | Cost of equity |
| Independent variable: | |
| *ESG* | ESG score |
| Control variables for Kd: | |
| *MCAP* | Market capitalization |
| *LEV* | Leverage defined as the ratio of total debt to total assets |
| *ICR* | Interest coverage ratio |
| *Current* | Current ratio |
| *TLPA* | Total liabilities as a percentage of total assets |
| *ND/EBITDA* | Net debt to EBITDA |
| *ROA* | Return on assets |
| Control variables for Ke: | |
| *MCAP* | Market capitalization |
| *PE* | Price to earnings |
| *MTB* | Market to book value of equity |
| *BETA* | Beta levered |
| *ROE* | Return on equity |
| *EV/EBITDA* | Enterprise value to EBITDA |

The independent variable in our model will be the ESG score of a respective firm. Meanwhile, the dependent variables will be the cost of equity r, and the cost of debt Kd. A range of control variables will later be considered to ensure the substantiality of the model. To proxy the size of a company there were two major option – average of total assets and market capitalization. Due to the former having immense multicollinearity and correlation with controls, we decided to go forward with the market capitalization. To include it in our model without measurement errors we have taken natural logarithm values of market cap.

A range of controls for cost of debt was partly based on Bhuyian et.al. (2020) that took the key liquidity and solvency ratios for credit analysis to substantiate the risk reflected in the spread part of the cost of debt. To continue this logic we have decided to add Net Debt/EBITDA ratio as a control, as it is a widespread ratio in credit analysis and ubiquitous element to many corporate debt finance covenants.

A range of control variables for cost of equity model was based on some classics like price-to-earnings and market-to-book value of equity, as well as beta included in many studies focusing on cost of equity, like (Caroso, 2020), and (Nga, 2015). Also the set of controls was enriched by EV/EBITDA multiple to account for effects of high valuation on required rate of return

## 3.4. Descriptive statistics

**Table 3 –** Descriptive statistics for the aggregated cost of equity model, including respective control variables

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 53.638 | 18.246 | 1238 | 1.283 | 41.655 | 55.665 | 66.912 | 91.316 |
| *MCAP* | 21.770 | 1.321 | 1238 | 18 | 20.781 | 21.767 | 22.604 | 25.416 |
| *PE* | 15.113 | 12.482 | 1238 | 0.654 | 6.834 | 11.540 | 18.651 | 80.658 |
| *MTB* | 2.116 | 1.702 | 1238 | 0.055 | 0.907 | 1.597 | 2.801 | 8.655 |
| *BETA* | 0.822 | 0.417 | 1238 | -0.223 | 0.513 | 0.811 | 1.078 | 2.103 |
| *ROE* | 0.116 | 0.180 | 1238 | -0.598 | 0 | 0.096 | 0.189 | 1.018 |
| *EV/EBITDA* | 7.977 | 5.030 | 1238 | -3.629 | 4.565 | 6.765 | 10.908 | 28.658 |

**Table 4 –** Descriptive statistics for the aggregated cost of debt model, including respective control variables

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 53.703 | 18.253 | 1192 | 1.283 | 41.743 | 56.008 | 66.782 | 91.316 |
| *MCAP* | 21.788 | 1.299 | 1192 | 18.000 | 20.813 | 21.832 | 22.631 | 25.218 |
| *ICR* | 10.672 | 16.683 | 1192 | -16 | 2.455 | 4.529 | 11.395 | 134.214 |
| *ROA* | 0.045 | 0.056 | 1192 | -0.143 | 0.000 | 0.039 | 0.072 | 0.242 |
| *Current* | 1.681 | 1.190 | 1192 | 0.087 | 1.031 | 1.373 | 1.901 | 9.124 |
| *LEV* | 0.289 | 0.170 | 1192 | 0.000 | 0.170 | 0.290 | 0.398 | 0.795 |
| *ND/EBITDA* | 1.707 | 2.279 | 1192 | -1.209 | 0 | 1.417 | 2.954 | 8.988 |
| *TLPA* | 0.549 | 0.181 | 1192 | 0.095 | 0.414 | 0.546 | 0.684 | 0.977 |

Descriptive statistics for the country breakdown can be found in appendix.

## 3.5. VIF test

We should also consider the potential issue of multicollinearity in our control variables. To track it, we will used Variance Inflation Factor (VIF) analysis.

**Table 11 –** Variance Inflation Factor (VIF) test for the cost of equity model

|  |  |
| --- | --- |
| Variable | VIF |
| *ESG* | 9.109 |
| *MCAP* | 12.882 |
| *PE* | 1.116 |
| *MTB* | 1.493 |
| *BETA* | 4.502 |
| *ROE* | 1.007 |
| *EV/EBITDA* | 1.012 |

**Table 12 –** Variance Inflation Factor (VIF) test for the cost of debt model

|  |  |
| --- | --- |
| Variable | VIF |
| *ESG* | 10.162 |
| *MCAP* | 20.243 |
| *ICR* | 1.005 |
| *ROA* | 1.427 |
| *Current* | 1.103 |
| *LEV* | 3.758 |
| *ND/EBITDA* | 1.018 |
| *TLPA* | 1.008 |

To deal with potential multicollinearity, especially between ESG score and MCAP we have decided to standardize our variables in the following fashion:

Standartization equation:

Where *Z* is a standadrized value, *X* is an original value, *μ* is the mean of the variable, andis the standard deviation of the variable

**Table 13 –** Variance Inflation Factor (VIF) test for the cost of equity model after variables standartization

|  |  |
| --- | --- |
| Variable | VIF |
| *zESG* | 1.177 |
| *zMCAP* | 1.249 |
| *zPE* | 1.076 |
| *zMTB* | 1.155 |
| *zBETA* | 1.091 |
| *zROE* | 1.022 |
| *zEV/EBITDA* | 1.070 |

**Table 14 –** Variance Inflation Factor (VIF) test for the cost of debt model after variables standartization

|  |  |
| --- | --- |
| Variable | VIF |
| *zESG* | 1.132 |
| *zMCAP* | 1.165 |
| *zICR* | 1.042 |
| *zROA* | 1.062 |
| *zCurrent* | 1.078 |
| *zLEV* | 1.146 |
| *zND/EBITDA* | 1.018 |
| *zTLPA* | 1.094 |

**Table 15 –** Pearson’s correlation matrix of the main variables of the cost of equity model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | *ESG* | | *MCAP* | | *PE* | | | *MTB* | | *BETA* | | *ROE* | | | *EV/EBITDA* | |
| *ESG* | | 1 | |  | |  | | |  | |  | |  | | |  | |
| *MCAP* | | 0.357 | | 1 | |  | | |  | |  | |  | | |  | |
| *PE* | | -0.004 | | -0.0165 | | 1 | | |  | |  | |  | | |  | |
| *MTB* | | 0.012 | | 0.167 | | 0.199 | | | 1 | |  | |  | | |  | |
| *BETA* | | 0.077 | | 0.170 | | -0.061 | | | -0.193 | | 1 | |  | | |  | |
| *ROE* | | 0.062 | | 0.022 | | 0.030 | | | 0.069 | | 0.040 | | 1 | | |  | |
| *EV/EBITDA* | | -0.121 | | 0.059 | | 0.005 | | | 0.087 | | -0.002 | | -0.027 | | | 1 | |
| -1.0 | -0.8 | | -0.6 | | -0.4 | | -0.2 | 0 | | 0.2 | | 0.4 | | 0.6 | 0.8 | | 1.0 |

**Table 16 –** Pearson’s correlation matrix of the main variables of the cost of debt model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | *ESG* | | *MCAP* | | *LEV* | | | *ICR* | | *Current* | | *TLPA* | | *ND/EBITDA* | *ROA* |
| *ESG* | | 1 | |  | |  | | |  | |  | |  | |  |  |
| *MCAP* | | 0.290 | | 1 | |  | | |  | |  | |  | |  |  |
| *LEV* | | -0.058 | | 0.122 | | 1 | | |  | |  | |  | |  |  |
| *ICR* | | 0.012 | | 0.055 | | -0.015 | | | 1 | |  | |  | |  |  |
| *Current* | | 0.018 | | -0.051 | | -0.261 | | | -0.005 | | 1 | |  | |  |  |
| *TLPA* | | 0.112 | | -0.145 | | -0.057 | | | -0.191 | | 0.024 | | 1 | |  |  |
| *ND/EBITDA* | | -0.007 | | 0.027 | | -0.021 | | | 0.001 | | -0.031 | | 0.020 | | 1 |  |
| *ROA* | | 0.037 | | 0.044 | | -0.214 | | | 0.035 | | 0.019 | | 0.063 | | 0.036 | 1 |
| -1.0 | -0.8 | | -0.6 | | -0.4 | | -0.2 | 0 | | 0.2 | | 0.4 | | 0.6 | 0.8 | 1.0 | |

## 3.6. Modelling cost of equity

There are numerous ways to project required rate of return on security. Most notable, straight-forward, and widely used it the Capital Asset Pricing Model (CAPM). It is used both in academia and industrial equity research and valuation. Yet, there has been some criticism of the CAPM model. It is argued by academics that CAPM presents a drastically oversimplified version of market reality. It assumes the single-period time horizon of cost of equity to be fixed in the future, while normally valuation is multi-period. What is more, the risk-free rate is a highly volatile input. Nevertheless, according to Mackinlay (1997), 75% of the studies still employ CAPM for its relative simplicity and reliability yielding sufficiently sound results. To account for market cap size variations in our dataset we propose to go forward with modified CAPM model that accounts for size risk premium and is widely used in the industry, most precisely in valuation analysts. The modified CAPM modelat hand is as follows:

*r = - ) + SRP*

Where r is the cost of equity, *Rf* is the country specific risk-free rate, is equity beta of the security, and *- )* is the equity risk premium, and *SRP* is the size risk premium provided by Duff & Phelps (2021). The respective size risk premiums are as follows:

**Table 17 –** Size risk premium by Duff & Phelps (2021)

|  |  |  |  |
| --- | --- | --- | --- |
| Market cap decile | Market cap min, mln USD | Market cap max, mln USD | Size Risk Premium |
| 1st Decile (Largest) | 36,099 | 2,324,390 | -0.22% |
| 2nd Decile | 16,738 | 36,099 | 0.43% |
| 3rd Decile | 8,213 | 16,738 | 0.55% |
| 4th Decile | 5,004 | 8,213 | 0.54% |
| 5th Decile | 3,277 | 5,004 | 0.89% |
| 6th Decile | 2,165 | 3,277 | 1.18% |
| 7th Decile | 1,306 | 2,165 | 1.34% |
| 8th Decile | 628 | 1,306 | 1.21% |
| 9th Decile | 289 | 628 | 2.10% |
| 10th Decile (Smallest) | 11 | 289 | 4.8% |

## 3.7. Modelling cost of debt

While normally the cost of debt for an individual firm is calculated as the weighted average of all interests payable for all tranches of marketable debt outstandings. A feasible alternative, widely used in the industry is using risk-free rate in dollars in form of YTM of a sovereign debt of respective country (Eurobonds) with the longest maturity as a base. Then the credit spread for the corresponding level of risk is added on top of that. This makes the calculation highly customizable firm-wise and relatively easy to compute. The equation of cost of debt is as follows:

Where is firm-specific cost of debt at time t, is the indicative yield to maturity for sovereign Eurobonds with longest maturity in respective market, and is the credit spread for the corresponding level of risk.

While many scholars (e.g., Bae et.al. (2021)) criticize this approach for oversimplification of multilayered debt structure large corporations tend to have, most scholars were using ready to use cost of debt provided by either Refinitiv Eikon or Bloomberg terminals. We have decided to go forward with the Eikon’s calculated cost of debt, that Refinitiv (2024) defined as ‘weighted cost of short-term debt and weighted cost of long-term debt based on the 1 year and 10-year points of an appropriate credit curve.

## 3.8. WACC

While the final outcome of any cost of capital projection should be the weighted-average cost of capital (WACC), which is then used as a discount rate for projecting firm’s value, little to no academics have attempted to trace the impact of the ESG scores on WACC. This can be explained by the fact that financing structure of a firm’s operations is highly contextual and variable. The capital structure decisions are made and implemented by managers and are subject to frequent change. Thus, for the sake of the applicability of our managerial implications we will not focus on WACC in our research. The model is as follows:

WACC = (E/V) × Ke + (D/V) × Kd × (1 − Tc)

Where *E* is the market value of the equity, *D* is the market value of the debt, *V* is E + D (total market value of the firm’s financing), *Ke* is the cost of equity, *Kd* is the cost of debt, and *Tc* is the corporate tax rate.

# 4. The model

While the ESG scores in our dataset are reported at the end of respective fiscal year (FY), same goes for cost of debt and cost of equity that will be computed for the year end. The essence of this study would have been very different should we tried to track returns reactions associated with ESG score changes. This reaction would normally occur in the immediate aftermath of the event. Conversely, it is reasonable to expect the impact of ESG score on cost of capital to happen with a certain time lag.

The previously mentioned articles have not implemented the aforementioned lag in their model. And there is little consensus as to which window for the time lag is best for obtaining statistically sound results. For instance Ahmad et. al (2021) employ one year lagged ESG scores (t-1) to account for changes in cost of capital, while Sassen et. al (2016) use the one year and two-year lags, favouring the usage of (t-1) lag. In our model we suggest to run two individual models: model with no lag and a one year lag. We will compare and test the results to come up with the most adequate one.

It has been decided to go forward with the fixed effect panel regression model to ensure that we fix all the firm-specific effects that could interfere with substantiality of our results. Those firm-specific effects will be concentrated in our control variables.

To determine the effectsof ESG scores on cost of equity and cost of debt without considering time lag effects the following model is proposed:

Cost of equity fixed effects model with lagged independent variables:

Cost of debt fixed effects model with lagged independent variables:

Cost of equity fixed effects model without lagged independent variables:

Cost of debt fixed effects model without lagged independent variables:

To ensure robustness of our choice of fixed effects model we should also compare the results with those from random effects model. To test for this and to justify our choice, Hausman test will be run. The results of the Hausman test will be presented in the Appendix section

## 4.1. Statistical significance and robustness tests

To test the significance of the individual coefficients we can start with employing the most basic test – the T-test. It allows for evaluating whether the regression coefficients associated with ESG scores are statistically different from zero, providing proof that ESG's influence is not coincidental. Given the control variables—such as firm size, industry, and profitability t-tests will also help to determine the significance of these controls, ensuring that the observed effects are not explained by these other factors.To test the overall model we will likely employ F-test that allows to generalize on the effects of combined explanatory variables (including the set of controls) and to reject the null hypotheses ( variation happened coincidentally). In addition we could also address the potential issue of autocorrelation and heteroskedasticity using the robust standard error using the robust standard errors.

To test for heterogeneity Breusch-Pagan test will be employed and robust-standard errors will also be used to deal with potential heterogeneity. For autocorrelation issue we will use the Durbin-Watson test. While for omitted variable bias and model misspecification the Ramsey’s RESET test will be conducted. All of the robustness tests’ results will be available in the Appendix section.

## 4.2. Addressing potential Endogeneity

Endogeneity occurs when an independent variable in a regression model is correlated with the error term, thus violating the underlying exogeneity assumption of the regression. The error term in our model is meant to reflect the unexplained variation in a dependent variable. Normally this variation is exogenous (i.e. lying outside of the model). Yet, often fallaciously constructed models would have endogenous factors concentrated in the error term. A few considerations for potential endogeneity in our model will be further examined, those are reverse causality and omitted variables.

Reverse causality is associated with the wrongful assumption about the character of the interrelation between variables. While we might suppose that it’s the ESG score that explains the cost of debt, the opposite could be the case. It is important to consider this issue closely, as the role of low cost of debt and equity might be paramount to excel in ESG performance. Access to cheap debt financing and low-perceived risk associated with investing in company’s equity can be beneficial for firm’s ESG performance in the following ways. First of all, it allows for long-term affordable debt and equity financing of ESG related initiatives that are often capital intensive. For instance, if Oil&Gas company credit rating is high enough it could issue investment grade green bonds with low yields to finance a costly project for trapping associated gas and turning it into electricity. Secondly, lower required rates of return could enhance firm’s value. To sum up, respectable, low-risk companies running sustainable business models can achieve higher ESG performance. What is more, reverse causality could be further complicated by bidirectional relationship. In our case that would mean that higher ESG score might indeed cause cost of debt and equity to decline, but at the same time lower cost of debt and equity could lead to higher ESG score creating a spiral like interrelation.

Another common cause of endogeneity in a regression model can be the omitted variable. It is a variable that was failed to be considered in the model, but which has both strong effect on explained variable and correlated with the explanatory variable. As a result the affected explanatory variable would be correlated with the error term, violating the exogeneity assumption of a linear regression. In regard to the cost of debt such variables that could potentially be tied to ESG score and impact the outcome would be the following: cap size, profitability, leverage, debt service coverage, dividend policy, cashflow growth rate, liquidity . When it comes to cost of equity, potentially variables that can cause our ESG explanatory variable to become endogenous are the following: cap size, dividend payout, earnings growth rate, earnings per share, gearing. To test for omitted variable bias Ramsey RESET tests were conducted. Results are to be found in the appendix section

## 4.3. Choosing the right model

Kindly look for Hausman tests in the appendix section.

# 5. Results and discussion

**Table 26 –** Cost of debt regression results without lagged predictor for the full dataset and the subsamples (Top vs medium vs underperforming ESG scores)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Entire dataset | Top 25% | Med. 50% | Low 25% |
| *C* | 0.0479\*\*\* (0.004) | 0.0494\*\*\* (0.0043) | 0.0384\*\*\* (0.009) | 0.0412\*\*\* (0.006) |
| *ESG* | 0.0046\*\*\* (0.001) | -0.0088\*\*\* (0.0033) | 0.008\*\*\* (0.0027) | 0.0043 (0.0043) |
| *MCAP* | -0.0104\*\*\* (0.003) | -0.0036\* (0.0019) | -0.01\*\*\* (0.0037) | -0.0247\*\*\* (0.0055) |
| *ICR* | -0.0032 (0.004) | -0.0156\*\* (0.0066) | -0.148\*\* (0.0614) | 0.003 (0.0044) |
| *ROA* | -0.002\* (0.001) | -0.0003 (0.0014) | -0.0005 (0.0016) | -0.0064\*\*\* (0.0024) |
| *Current* | -0.0086\*\*\* (0.002) | -0.0241\* (0.0139) | -0.1\*\* (0.005) | -0.0067 (0.009) |
| *LEV* | 0.00005953 (0.001) | 0.0002 (0.0013) | 0.0007 (0.002) | -0.0023 (0.0023) |
| *ND/EBITDA* | 0.0045 (0.007) | -0.0212 (0.0251) | 0.007 (0.012) | 0.0222 (0.161) |
| *TLPA* | 0.006\*\*\* (0.002) | -0.0004 (0.0015) | 0.0035 (0.026) | 0.013\*\*\* (0.0027) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of model | Fixed | Random | Fixed | Fixed |
| N of obs. | 1192 | 297 | 595 | 299 |
| R-sq. | 0.402 | 0.077 | 0.445 | 0.613 |
| Adj. R-sq. | 0.277 | - | 0.254 | 0.39 |
| Year effects | Yes | Yes | Yes | Yes |
| Firm effects | Yes | Yes | Yes | Yes |
| Robust standard errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

The regression results for the cost of debt without lagged predictors across the entire dataset and various subsamples provide surprising implications, as the direction of the relationship between ESG score and cost of debt is uneven across the dataset.

The entire dataset shows a positive and significant relationship between ESG scores and the cost of debt (0.0046p<.001), which initially contradicts H2 that better ESG performance lowers financing costs. However, some critical nuances are revealed in the subsamples: for top performers (top 25% ESG scores), the relationship is significantly negative (-0.0088, p < 0.01), indicating that firms with high ESG scores do indeed benefit from lower costs of debt. This supports Hypothesis 2, which posits an inverse relationship between ESG scores and the cost of debt but highlights that this benefit is more pronounced among firms with higher ESG performance, which is a direct contradiction withour Hypothesis number 5. The negative coefficient for top performers aligns with findings by Apergis et al. (2022) and Bhuiyan and Nguyen (2020), who demonstrated similar cost reductions linked to superior ESG performance.

On the contrary, the middle 50% subsample presents a positive and significant relationship (0.008, p < 0.01), suggesting that for firms with moderate ESG scores, the cost of debt may actually increase with better ESG performance. This counterintuitive result could imply that incremental improvements in ESG scores within this range do not sufficiently mitigate perceived risks to reduce borrowing costs. It contradicts potential diminishing marginal effect of ESG improvements that we suggested earlier. In fact, across the aggregate BRICS dataset only top-tier ESG performance translates into lower financing costs. For the underperformers (bottom 25%), the ESG score’s effect on the cost of debt is positive but not statistically significant (0.0043). This aligns with the concept that firms starting with low ESG scores might not experience immediate financial benefits from minor ESG improvements. These results contradict H5, suggesting that the relationship between ESG scores and the cost of debt is stronger for underperformers, as they do not benefit significantly until they achieve higher ESG standards. This directly contradicts such scholars as Fatemi et al. (2018) finding that ESG strengths positively impact firm value, but the effect fades in strength as firms achieve higher ESG scores, with the notion that the initial improvements in ESG performance yield the most significant reductions in financing costs.

Regarding control variables, market capitalization (MCAP) consistently shows a negative and significant impact across all subsamples, indicating larger firms generally enjoy lower costs of debt. This is consistent with covered literature, such as Cardoso (2020), who emphasized the importance of firm size in financing costs. The interest coverage ratio (ICR) and return on assets (ROA) also reveal significant negative impacts in some subsamples, further underscoring the importance of financial health in determining borrowing costs.

Overall, these results suggest an uneven relationship between ESG performance and the cost of debt in BRICS countries, with upper quartile of the sample supporting Hypothesis 2 and highlighting the the importance of achieving high ESG standards to realize cost savings in debt financing, with significant implications for corporate strategy and policy-making in emerging markets. Yet, the aggregate sample contradicts H2 and H5.

**Table 27 –** Cost of debt regression results without lagged predictor for country subsamples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Russia FE | Russia RE | Brazil FE | S. Africa FE |
| *C* | 0.0481\*\*\* (0.017) | 0.0326\*\*\* (0.001) | 0.0353\*\*\* (0.001) | 0.0388\*\*\* (0.002) |
| *ESG* | -0.001 (0.003) | -0.002 (0.001) | -0.0059\*\*\* (0.001) | 0.0066\*\*\* (0.002) |
| *MCAP* | -0.0034 (0.012) | -0.003 (0.004) | -0.009\*\*\* (0.003) | -0.0129\*\*\* (0.004) |
| *ICR* | -0.0128 (0.021) | -0.0243 (0.018) | -0.002 (0.007) | -0.003 (0.004) |
| *ROA* | -0.0076\*\* (0.003) | -0.0066\*\*\* (0.003) | -0.0014 (0.001) | -0.0004 (0.002) |
| *Current* | -0.0438 (0.056) | -0.0302 (0.033) | -0.009\*\* (0.004) | -0.081 (0.005) |
| *LEV* | 0.0042 (0.004) | -0.0052\*\* (0.0023) | 0.00005 (0.001) | 0.0041\*\* (0.002) |
| *ND/EBITDA* | -0.165 (0.515) | -0.2832 (0.237) | 0.006 (0.01) | 0.0044 (0.014) |
| *TLPA* | 0.0064 (0.006) | -0.0007 (0.002) | 0.0047\*\*\* (0.002) | 0.0066\*\*\* (0.002) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of model | Fixed | Random | Fixed | Fixed |
| N of obs. | 152 | 152 | 547 | 493 |
| R-sq. | 0.389 | 0.139 | 0.388 | 0.423 |
| Adj. R-sq. | 0.211 | - | 0.239 | 0.312 |
| Year effects | Yes | Yes | Yes | Yes |
| Firm effects | Yes | Yes | Yes | Yes |
| Robust standard errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

The regression results for the cost of debt without lagged predictors, segmented by country (Russia, Brazil, and South Africa), reveal varying impacts of ESG scores on financing costs. In Russia, the fixed effects (FE) and random effects (RE) models both show an insignificant relationship between ESG scores and the cost of debt, suggesting that ESG performance does not significantly influence borrowing costs in this market. This contradicts Hypothesis 4, which anticipated a stronger effect in Russia due to its emission-intensive industries. This finding aligns with the notion that in countries with less emphasis on sustainability, ESG improvements may not translate into immediate financial benefits, as also observed by Breuer et al. (2018) regarding investor protection's role in ESG effectiveness.

In contrast, Brazil's fixed effects model indicates a significant negative relationship between ESG scores and the cost of debt (-0.0059, p < 0.01), supporting H2, which suggests that higher ESG scores converts to the lower cost of debt. This is consistent with the literature, such as Apergis et al. (2022) and Bhuiyan and Nguyen (2020), which found that better ESG performance reduces corporate borrowing costs. The significant impact in Brazil underscores the country's growing focus on sustainability and governance, as highlighted by Eliwa et al. (2021).

South Africa here is a surprising case where the ESG score positively impacts the cost of debt (0.0066, p < 0.01), contrary to Hypothesis 2. This unexpected result could be due to unique market dynamics or higher costs associated with achieving and maintaining high ESG standards in the South African context, where labor and environmental protection institutional framework is still emerging.

Control variables offer additional insights. Market capitalization (MCAP) consistently shows a negative and significant impact on the cost of debt across Brazil and South Africa, indicating that larger firms generally benefit from lower borrowing costs, aligning with Cardoso (2020) on the significance of firm size. The return on assets (ROA) and leverage (LEV) variables also show significant relationships in some models, emphasizing the importance of financial health and prudent leverage risk management in determinizing cost of debt. Overall, these results reveal a complex and country-specific relationship between ESG scores and the cost of debt in BRICS markets. While H2 is supported by the case of Brazil, the inconsistent results in Russia and South Africa highlight the need for a nuanced understanding of how ESG performance interacts with local economic and regulatory contexts. This highlights the cruciality of tailored strategies for ESG improvement to optimize financing costs in different emerging markets.

**Table 28 –** Cost of debt regression results with lagged predictor for the full dataset and the subsamples (Top vs medium vs underperforming ESG scores)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Entire dataset | Top 25% | Med. 50% | Low 25% FE | Low 25% RE |
| *C* | 0.038\*\*\* (0.001) | 0.0508\*\*\* (0.005) | 0.0372\*\*\* (0.001) | 0.0473\*\*\* (0.006) | 0.0389\*\*\* (0.004) |
| *ESG* | 0.0023\* (0.001) | -0.0114\*\*\* (0.004) | 0.005\* (0.003) | 0.002 (0.003) | -0.0011 (0.002) |
| *MCAP* | -0.007\*\* (0.003) | -0.0016\*\*\* (0.004) | -0.0093 (0.046) | -0.0011 (0.008) | 0.0038\* (0.002) |
| *ICR* | 0.0018 (0.003) | -0.006 (0.006) | -0.012 (0.011) | 0.003 (0.0044) | 0.0028 (0.004) |
| *ROA* | -0.002\*\*\* (0.001) | 0.0005 (0.002) | -0.0024\*\* (0.001) | -0.0011 (0.008) | -0.0005 (0.002) |
| *Current* | -0.0015 (0.004) | -0.0289 (0.0205) | -0.0025 (0.05) | -0.0067 (0.009) | -0.015 (0.004) |
| *LEV* | 0.0008 (0.001) | -0.0011 (0.002) | -0.002 (0.002) | -0.0023 (0.0023) | -0.0007 (0.002) |
| *ND/EBITDA* | 0.001\* (0.001) | -0.0039 (0.027) | 0.0011\* (0.001) | 0.0222 (0.161) | 0.0485 (0.06) |
| *TLPA* | 0.0066\*\*\* (0.002) | -0.0011 (0.002) | 0.0073\*\* (0.003) | 0.013\*\*\* (0.0027) | 0.0031\*\* (0.002) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type of model | Fixed | Random | Fixed | Fixed | Random |
| N of obs. | 969 | 241 | 485 | 242 | 242 |
| R-sq. | 0.440 | 0.095 | 0.471 | 0.629 | 0.031 |
| Adj. R-sq. | 0.298 | - | 0.268 | 0.361 | - |
| Year effects | Yes | Yes | Yes | Yes | Yes |
| Firm effects | Yes | Yes | Yes | Yes | Yes |
| Robust standard errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

The regression results for the cost of debt with lagged predictors are also uneven across the entire dataset and various subsamples. For the entire dataset, the ESG score shows a positive but marginally significant relationship with the cost of debt (0.0023, p < 0.10). This suggests that while ESG improvements have an immediate positive effect, their influence might weaken over time if whole spectrum of ESG performers is considered. In the meantime, the top 25% subsample, the relationship between ESG scores and the cost of debt is significantly negative (-0.0114, p < 0.01). This finding aligns with Hypothesis 2, indicating that firms with superior ESG performance benefit from reduced borrowing costs. The significant lag effect here highlights that high ESG scores have a lasting positive impact on financing conditions, consistent with Apergis et al. (2022) and Bhuiyan and Nguyen (2020), who found long-term financial benefits for top ESG performers. The effect is also magnified with the one year time lagged model suggesting that top ESG performers enjoy long-lasting effects of their ESG investment that can be even more potent in one year horizon

Furthermore, the middle 50% subsample shows a positive relationship (0.005, p < 0.10), suggesting that moderate ESG performance do not significantly reduce the cost of debt over time. This again contradicts the idea of diminishing marginal returns, where only substantial ESG enhancements translate into significant cost savings posited in our H5

For the bottom 25% subsample, the results are mixed and statistically insignificant. The fixed effects model shows a positive but insignificant relationship (0.002), while the random effects model presents a negative but insignificant coefficient (-0.0011). These findings suggest that underperforming firms do not experience significant immediate or lagged financial benefits from minor ESG improvements, refuting H5. The implications are that initial investments in ESG may not yield immediate financial returns but could potentially accumulate over time as firms move towards higher ESG performance tiers. Control variables provide further clarification of the results. Market capitalization (MCAP) negatively impacts the cost of debt across most models, indicating larger firms generally enjoy lower borrowing costs. This finding aligns with Cardoso (2020), emphasizing the importance of firm size. Interestingly, the interest coverage ratio (ICR) and return on assets (ROA) show varied significance, underscoring the role of financial health in financing costs.

In summary, these results support Hypothesis 2, but only in case of top ESG performers, while Hypothesis 5, is refuted revealing that while high ESG scores can reduce the cost of debt, the benefits are more pronounced and sustained for top performers. The findings emphasize the importance of significant and ongoing ESG improvements to achieve financial benefits in the BRICS markets, with varied impacts across different performance tiers.

**Table 29 –** Cost of debt regression results with lagged predictor for country subsamples

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Russia | Brazil | South Africa |
| *C* | 0.0292\*\* (0.012) | 0.0336\*\*\* (0.001) | 0.0376\*\*\* (0.002) |
| *ESG* | -0.0046\* (0.003) | -0.0036\*\* (0.002) | 0.006\*\* (0.003) |
| *MCAP* | 0.0034 (0.004) | -0.0061\* (0.003) | -0.0191\*\*\* (0.004) |
| *ICR* | -0.038\*\* (0.018) | -0.0174 (0.0012) | -0.0051 (0.003) |
| *ROA* | -0.0003 (0.012) | -0.0026\*\*\* (0.001) | -0.0007 (0.002) |
| *Current* | -0.083\*\* (0.039) | -0.0013 (0.004) | -0.005\*\* (0.009) |
| *LEV* | 0.006\*\* (0.002) | -0.008 (0.002) | 0.0062\*\*\* (0.002) |
| *ND/EBITDA* | -0.2325 (0.286) | -0.001\*\*. (0.0004) | 0.0103 (0.014) |
| *TLPA* | -0.0034 (0.003) | -0.001 (0.002) | 0.0111\*\*\*\* (0.003) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |
| --- | --- | --- | --- |
| Type of model | Random | Fixed | Fixed |
| N of obs. | 121 | 443 | 405 |
| R-sq. | 0.183 | 0.411 | 0.523 |
| Adj. R-sq. | - | 0.236 | 0.41 |
| Year effects | Yes | Yes | Yes |
| Firm effects | Yes | Yes | Yes |
| Robust standard errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

The regression results for the cost of debt with lagged predictors, segmented by country (Russia, Brazil, and South Africa), illustrate specific patterns in how ESG scores influence financing costs over time, reflecting the unique market contexts. In case of Russia, the ESG score shows a negative and marginally significant relationship with the cost of debt (-0.0046, p < 0.10). This suggests that improvements in ESG performance can reduce borrowing costs, albeit modestly, over time. This finding partially supports Hypothesis 4, which anticipated a stronger effect in Russia due to its emission-intensive industries. The negative impact of ESG scores aligns with global findings by Stellner et al. (2015), who indicated that top ESG performers benefit more in markets with high environmental risks. Meanwhile, in Brazil, the ESG score also shows a significant negative relationship with the cost of debt (-0.0036, p < 0.05), further supporting Hypothesis 2. This underscores the sustained financial benefits of high ESG performance in Brazil, consistent with studies by Apergis et al. (2022) and Bhuiyan and Nguyen (2020). The significant lag effect for Brazil is less pronounced that in the case of model without lag. On the contrary, Russia’s results are only significant and in line with H2 and H4 when lag is employed.

Conversely, in South Africa, the ESG score shows a significant positive relationship with the cost of debt (0.006, p < 0.05). This counterintuitive result suggests that in the South African context, higher ESG scores might be associated with higher costs of debt. This could be due to the unique market dynamics or the higher costs of achieving and maintaining high ESG standards, as indicated by Fatemi et al. (2018). It implies that while ESG improvements are beneficial, they might come with substantial initial costs that increase overall borrowing costs. That might be particularly burdensome in the case of South Africa, where economic inequity is even more staggering than in her peers, and GDP per capita is considerably lower and available resources in fixed capital and ESG transformations are considerably lower.

Control variables offer less controversial insights. In Russia, the interest coverage ratio (ICR) and current ratio (Current) show significant negative relationships with the cost of debt, emphasizing the importance of liquidity and debt servicing capability.In Brazil, market capitalization (MCAP) negatively impacts the cost of debt, indicating that larger firms generally enjoy lower borrowing costs, consistent with Cardoso (2020). The leverage ratio (LEV) shows a significant positive relationship, highlighting the importance of balance sheet strength in reducing financing costs.

Overall, these results provide partial support for Hypotheses 2 and 4, revealing that while ESG scores can reduce the cost of debt, the benefits vary significantly across countries. The findings emphasize the importance of considering country-specific economic and regulatory contexts when assessing the financial impacts of ESG performance. The significant lagged effects in Brazil and Russia, contrasted with the positive impact in South Africa, highlight the complex interplay between ESG improvements and financing costs in the BRICS markets.

**Table 30 –** Cost of equity regression results without lagged predictor for the full dataset and the subsamples (Top vs medium vs underperforming ESG scores)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Entire dataset | Top 25% | Med. 50% | Low 25% |
| C | 0.112\*\*\* (0.002) | 0.0059 (0.056) | 0.111\*\*\* (0.008) | 0.111\*\*\* (0.013) |
| ESG | 0.0131\*\*\* (0.002) | 0.0284\*\*\* (0.01) | 0.0105\*\* (0.005) | 0.0092 (0.008) |
| MCAP | -0.0014 (0.006) | 0.0052 (0.012) | 0.007 (0.009) | -0.0339\*\*\* (0.012) |
| PE | -0.001\*\*\* (0.004) | -0.0139\* (0.008) | -0.0017 (0.005) | -0.0412\*\*\* (0.012) |
| MTB | -0.02\*\*\* (0.004) | -0.023\*\*\* (0.008) | -0.0191\*\*\* (0.006) | -0.0039 (0.007) |
| BETA | 0.0342\*\*\* (0.002) | 0.0266\*\*\* (0.004) | 0.0377\*\*\* (0.003) | 0.283\*\*\* (0.005) |
| ROE | 0.0132 (0.009) | 0.0151 (0.0014) | 0.009 (0.018) | 0.0214 (0.018) |
| EV/EBITDA | 0.0209 (0.025) | -0.748 (0.627) | -0.0243 (0.095) | 0.0526 (0.048) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of model | Fixed | Fixed | Fixed | Fixed |
| N of obs. | 1238 | 309 | 618 | 310 |
| R-sq. | 0.666 | 0.591 | 0.728 | 0.788 |
| Adj. R-sq. | 0.582 | 0.435 | 0.619 | 0.671 |
| Year effects | Yes | Yes | Yes | Yes |
| Firm effects | Yes | Yes | Yes | Yes |
| Robust standard errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

Moving on to the other element of cost of capital – the cost of equity, the findings are even more surprising. For the entire dataset, the ESG score exhibits a significant positive relationship with the cost of equity (0.0131, p < 0.01). This finding contrasts with the typical expectation that better ESG performance reduces equity costs, suggesting that investors might perceive higher ESG scores as indicative of additional risk of increased costs associated with implementing and maintaining these standards.For the top 25% subsample, the relationship is significantly positive (0.0284, p < 0.01), indicating that top ESG performers experience higher costs of equity. This may reflect the substantial initial investments required for achieving high ESG standards, which are then reflected in investor-required returns. This outcome might be aligned with some of the literature indicating that while high ESG scores can enhance corporate reputation and long-term performance, the short-term costs might elevate required returns (Fatemi et al., 2018).

In the middle 50% subsample, the ESG score is also positively related to the cost of equity (0.0105, p < 0.05). This suggests that moderate ESG performers also face higher equity costs, possibly due to the perceived uncertainty and costs associated with further ESG improvements. This aligns with Nga &Rezaee (2015), who found that environmental and governance improvements could lead to increased perceived risks and costs for investors. For the bottom 25%, the relationship between ESG scores and cost of equity is positive but not statistically significant (0.0092). This indicates that underperforming firms do not experience substantial cost changes with minor ESG improvements, again refuting our Hypothesis 5, suggesting that the relationship between ESG scores and cost of equity is more pronounced for underperformers.

In terms of controls, no surprise arise in this particular model.Market capitalization (MCAP) shows varied impacts, with a significant negative relationship in the bottom 25% subsample (-0.0339, p < 0.01), suggesting larger firms in this group benefit from lower equity costs. Price-to-earnings ratio (PE) and market-to-book ratio (MTB) generally display significant negative relationships with the cost of equity, emphasizing the importance of valuation metrics in determining investor returns. Beta consistently shows a significant positive relationship, reflecting the role of systematic risk in equity cost determination, which was rather predictable

Overall, these results completely refute Hypothesis 2 and do not substantiate Hypothesis 5, revealing that while higher ESG scores can increase the cost of equity across the board, the magnitude of this effect varies significantly among different performance tiers.

**Table 31 –** Cost of equity regression results without lagged predictor for country subsamples

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Russia | Brazil | South Africa |
| *C* | 0.123\*\*\* (0.004) | 0.0706\*\* (0.031) | 0.1037\*\*\* (0.003) |
| *ESG* | 0.0035 (0.003) | 0.0231\*\*\* (0.004) | 0.0043\*\*\* (0.001) |
| *MCAP* | -0.0019 (0.004) | -0.0097 (0.01) | 0.0042 (0.003) |
| *PE* | -0.0128 (0.008) | -0.0122\* (0.007) | -0.0031 (0.002) |
| *MTB* | -0.005 (0.005) | -0.0235\*\*\* (0.008) | -0.006\*\*\* (0.002) |
| *BETA* | 0.0445\*\*\* (0.003) | 0.0391\*\*\* (0.004) | 0.0311\*\*\* (0.001) |
| *ROE* | 0.014. (0.013) | 0.0045 (0.015) | 0.0197\*\* (0.008) |
| *EV/EBITDA* | 0.0032 (0.008) | -0.4612 (0.353) | -0.0198 (0.034) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |
| --- | --- | --- | --- |
| Type of model | Random | Fixed | Fixed |
| N of obs. | 152 | 551 | 523 |
| R-sq. | 0.579 | 0.599 | 0.905 |
| Adj. R-sq. | - | 0.48 | 0.883 |
| Year effects | Yes | Yes | Yes |
| Firm effects | Yes | Yes | Yes |
| Robust standard errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

The model results for the cost of equity segmented by country yield similarly unexpected implications In Russia, similarly to non-lag cost of debt the ESG score does not show a significant relationship with the cost of equity (0.0035), indicating that ESG performance does not markedly influence equity costs in this market. This result suggests that Russian investors may not yet place substantial emphasis on ESG factors when evaluating equity investments, potentially due to the relatively lower focus on sustainability within the Russian market context. This finding refutes Hypothesis 4, which anticipated stronger effects in Russia due to its economic structureIn Brazil, the ESG score demonstrates a significant positive relationship with the cost of equity (0.0231, p < 0.01). This outcome indicates that higher ESG scores are associated with increased equity costs, likely reflecting the substantial investments and perceived risks involved in achieving high ESG standards. This aligns with findings by Nga &Rezaee (2015) and Giese et al. (2019), who noted that while better ESG performance can enhance corporate reputation and long-term stability, it can also result in higher short-term premium required by investors. Both cases refute H1 at a principal level

The case of South Africa also shows a significant positive relationship between ESG scores and the cost of equity (0.0043, p < 0.01). This suggests that similar to Brazil, South African firms with higher ESG scores face higher equity costs, potentially due to the perceived risks and costs associated with maintaining high ESG standards. This reinforces the idea that while ESG improvements are valuable, they may come with increased costs that are reflected in investor-required returns.

Control variables’ resu;ts in this case are also unexpected and uneven. In Russia, market capitalization (MCAP) does not significantly impact the cost of equity, while in Brazil, MCAP shows a non-significant negative relationship (-0.0097). In South Africa, MCAP has a positive but insignificant relationship (0.0042), indicating mixed effects of firm size on equity costs across these countries.The price-to-earnings ratio (PE) generally shows a negative relationship with the cost of equity, although it is only marginally significant in Brazil (-0.0122, p < 0.10). The market-to-book ratio (MTB) consistently demonstrates a significant negative impact on equity costs across all countries, underscoring the importance of valuation metrics in investor decision-making. On the contrary EV/EBITDA multiple is once again consistently insignificant.

Beta (BETA) consistently shows a significant positive relationship with the cost of equity in all three countries, highlighting the role of systematic risk in equity cost determination. The effect is especially strong in Russia, signaling the cruciality of systematic risk for the highly-sanctioned market.

Overall, these results again provide no support for H1 and H4, while giving some substantiation for H3, as effects on cost of equity are more pronounced than effects on cost of debt

**Table 32 –** Cost of equity regression results with lagged predictor for the full dataset and the subsamples (Top vs medium vs underperforming ESG scores)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Entire dataset | Top 25% FE | Top 25% RE | Med. 50% FE | Med. 50% RE | Low 25% FE |
| *C* | 0.107\*\*\* (0.001) | 0.011\*\*\* (0.01) | 0.101\*\*\* (0.001) | 0.11\*\*\* (0.002) | 0.0412\*\*\* (0.006) | 0.129\*\*\* (0.011) |
| *ESG* | 0.0105\*\*\* (0.003) | 0.004 (0.008) | 0.0004 (0.008) | 0.0022 (0.012) | -0.0007 (0.004) | 0.0132\* (0.007) |
| *MCAP* | 0.026\*\*\* (0.008) | 0.009\* (0.005) | 0.009\* (0.002) | 0.0214\* (0.012) | -0.004 (0.003) | 0.0306\* (0.017) |
| *PE* | -0.0027 (0.002) | -0.0004 (0.002) | -0.004 (0.002) | -0.005\* (0.003) | -0.0054\*\* (0.003) | -0.0111 (0.01) |
| *MTB* | -0.0127\*\*\* (0.004) | -0.008 (0.008) | -0.008 (0.008) | -0.0186\*\*\* (0.006) | -0.0044 (0.003) | -0.0018 (0.01) |
| *BETA* | 0.026\*\*\* (0.003) | 0.0253\*\*\* (0.004) | 0.253\*\*\* (0.004) | 0.0351\*\*\* (0.004) | 0.0347\*\*\* (0.003) | 0.0066 (0.007) |
| *ROE* | 0.0004 (0.011) | 0.0056 (0.0015) | 0.006 (0.015) | -0.104\*\*\* (0.028) | -0.058\*\*\* (0.021) | 0.007 (0.001) |
| *EV/EBITDA* | -0.0027 (0.005) | 0.0406 (0.042) | 0.041 (0.041) | 0.0194\*\*\* (0.007) | 0.019\*\*\* (0.007) | -0.0125\*\* (0.006) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Type of model | Fixed | | Fixed | Random | Fixed | Random | Fixed |
| N of obs. | 925 | | 230 | 230 | 456 | 456 | 238 |
| R-sq. | 0.565 | | 0.556 | 0.318 | 0.691 | 0.429 | 0.714 |
| Adj. R-sq. | 0.438 | | 0.357 | - | 0.545 | - | 0.543 |
| Year effects | Yes | | Yes | Yes | Yes | Yes | Yes |
| Firm effects | Yes | | Yes | Yes | Yes | Yes | Yes |
| Robust standard errors | | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

In case of lagged model of cost of equity, in the entire dataset, the ESG score once again shows a significant positive relationship with the cost of equity (0.0105, p < 0.01). Again refuting our H1. In the meantime, the results for all quartiles except for the lowest one are insignificant. The bottom quartile once again shows positive relationship, and in fact a more pronounced one, rather than the aggregate dataset.

Control variables showed unexepected outcomes again. Market capitalization (MCAP) generally shows a significant positive relationship with the cost of equity across most subsamples, indicating that larger firms face higher equity costs. This contrasts with typical expectations. The price-to-earnings ratio (PE) and market-to-book ratio (MTB) generally exhibit negative relationships with the cost of equity, consistent with traditional valuation metrics' importance. Beta (BETA) consistently shows a significant positive relationship with the cost of equity across all subsamples, highlighting the role of systematic risk in determining equity costs. With most pronounced effects of the systemic risk in the middle 50% subsample

Overall, these results reveal complex relationships between ESG scores and the cost of equity, varying significantly across different performance tiers. The findings underscore the importance of considering firm-specific contexts and performance levels when assessing the financial impacts of ESG performance. While higher ESG scores can increase equity costs in the short term, especially for underperformers, the benefits of ESG improvements may become more evident over the long term as firms stabilize and investors recognize the reduced risks associated with high ESG standards. This provides ground for future research.

**Table 33 –** Cost of equity regression results with lagged predictor for country subsamples

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Russia | Brazil | South Africa |
| *C* | 0.1253\*\*\* (0.005) | 0.1073\*\*\* (0.003) | 0.1016\*\*\* (0.005) |
| *ESG* | 0.0006 (0.004) | 0.0202\*\*\* (0.005) | 0.0036 (0.003) |
| *MCAP* | 0.009 (0.06) | 0.0407\*\*\* (0.013) | -0.0076 (0.007) |
| *PE* | 0.005 (0.005) | -0.0026 (0.0028) | -0.039\*\* (0.002) |
| *MTB* | 0.0015 (0.007) | -0.0201\*\*\* (0.008) | -0.0011 (0.004) |
| *BETA* | 0.0333\*\*\* (0.005) | -0.0292\*\*\* (0.006) | 0.243\*\*\* (0.002) |
| *ROE* | -0.0001 (0.0001) | -0.0224 (0.018) | 0.0196 (0.019) |
| *EV/EBITDA* | -0.05 (0.004) | 0.0203\* (0.011) | 0.0235 (0.058) |

\*\*\* - significant at a 1% level, \*\* - significant at a 5% level, \* - significant at a 10% level

|  |  |  |  |
| --- | --- | --- | --- |
| Type of model | Random | Fixed | Fixed |
| N of obs. | 123 | 413 | 389 |
| R-sq. | 0.378 | 0.526 | 0.745 |
| Adj. R-sq. | - | 0.371 | 0.669 |
| Year effects | Yes | Yes | Yes |
| Firm effects | Yes | Yes | Yes |
| Robust standard errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors | Cluster-Robust Standard Errors |

In Russia, the relationship between ESG scores and the cost of equity is not statistically significant (0.0006). And here comes just another argument against our not Hypothesis 4, which predicted a stronger effect due to the prevalent emission-intensive industries. Conversely, in Brazil, ESG scores exhibit a significant positive relationship with the cost of equity (0.0202, p < 0.01). Furthermore, In South Africa, the ESG score also does not show a significant relationship with the cost of equity (0.0036). This indicates that, similar to Russia, ESG performance does not have a substantial impact on equity costs in the South African context. This might be due to market-specific factors or differing investor priorities in assessing ESG improvements.

These findings highlight the complex and varied impacts of ESG scores on equity costs across BRICS nations. While ESG improvements significantly influence equity costs in Brazil, their impact is insignificant in Russia and South Africa. This underscores the necessity of contextual understanding and market-specific strategies when evaluating the financial benefits of ESG performance.

## 5.1. Managerial implications

Companies already leading in ESG performance, particularly in markets like Brazil, should continue to invest in sustainability initiatives. Although initial investments might increase the cost of equity due to perceived risks and costs, these firms can leverage long-term benefits such as enhanced reputation, better stakeholder relationships, and potentially lower future capital costs. For example, studies by Nga & Rezaee (2015) and Giese et al. (2019) highlight that top ESG performers can recover faster from market shocks, suggesting that high ESG standards offer resilience against systematic risks. Underperformers on the contrary should carefully consider cost versus benefit stemming from costly ESG transformations.

Countrywise, significant positive relationship between ESG scores and the cost of equity in Brazil implies that investors are sensitive to ESG factors. Firms should therefore ensure comprehensive ESG reporting and transparent communication of their sustainability efforts to attract and retain investors. This aligns with Apergis et al. (2022), who found that better ESG performance reduces borrowing costs, emphasizing the importance of robust ESG practices in the Brazilian market. On the other hand, the minimal impact of ESG scores on the cost of capital in Russia suggests a need for heightened awareness and integration of ESG principles. Managers should focus on educating investors and stakeholders about the long-term financial and non-financial benefits of ESG improvements. Additionally, as Russia is heavily reliant on emission-intensive industries, significant ESG advancements can provide a competitive edge in the global market, despite the current lack of immediate financial benefits.Lastly, with mixed results in the relationship between ESG scores and capital costs, South African firms should adopt a balanced approach. While significant ESG improvements might not immediately lower capital costs, they can enhance the company's long-term sustainability and market reputation, eventually leading to financial benefits. Managers should emphasize the strategic importance of ESG initiatives beyond immediate cost considerations.

Furthermore it is crucial for management to consider different approaches for equity holders and debtholders. The generally positive relationship between ESG scores and the cost of equity suggests that investors may perceive higher ESG scores as indicative of increased costs and risks associated with implementing and maintaining these standards. Managers should therefore focus on transparent and effective communication of their ESG strategies, demonstrating how these initiatives contribute to long-term value creation and risk mitigation. Educating investors about the strategic benefits of ESG can help align perceptions with the firm's sustainability goals. But at the same time, the benefits should be rationally assessed to avoid falling in the trap of blind following the ‘green’ trends. Still, ESG investments might increase short-term equity costs, the long-term benefits such as enhanced corporate reputation, better stakeholder relationships, and resilience against market shocks can offset these initial costs. Managers should adopt a balanced approach, prioritizing ESG initiatives that offer clear strategic advantages and communicating their long-term value proposition to investors. When it comes to the mixed effect of the ESG scores on the cost of debt across different performance tiers suggests that significant ESG improvements should be conducted carefully to improve a firm's creditworthiness, especially for underperforming firms. Managers should focus on substantial and visible ESG initiatives that address key risk factors and demonstrate a commitment to sustainability. This can help reduce perceived risks among debtholders and lower borrowing costs.For firms in markets like Brazil, where ESG improvements have shown to reduce borrowing costs, managers should actively leverage their ESG performance to negotiate better financing terms. This involves not only implementing robust ESG practices but also ensuring comprehensive reporting and communication with lenders to highlight the firm's commitment to sustainability and risk management.

* 1. **Limitations:**

One of the limitations of this study lies in the absence of focus on time effects within the model and limited time frame of data. While some companies provide detailed and transparent ESG reports, others might have incomplete or inconsistent disclosures. This inconsistency can lead to potential biases in the analysis, as the ESG scores used might not fully capture the actual ESG performance of all firms. Moreover, the study relies on ESG data from specific time periods. the temporal scope might limit the ability to observe long-term effects and trends, particularly as firms' ESG practices and market perceptions evolve, and most importantly how market participants, firms, and rating agencies behave at times of crisis. Such as COVID Pandemic or immense sanctionary pressure on Russia since 2022. The COVID-19 pandemic has significantly impacted global markets and corporate behaviors. The study period may include pandemic-related anomalies that affect both ESG practices and financial performance. These extraordinary circumstances might skew the results, necessitating caution in interpreting the findings as representative of typical market conditions.

Economic and market conditions during the study period also present limitations. The prevailing economic and market conditions, such as interest rates, economic growth, and market volatility, can affect the cost of capital independently of ESG performance. These macroeconomic conditions might confound the relationship between ESG scores and capital costs, limiting the ability to attribute changes solely to ESG factors. Thus, a range of macroeconomic controls like inflation, GDP growth rate, fixed capital accumulation, and key rate should be considered

Methodologically, the study employs regression analysis, a robust statistical tool, but one with inherent limitations. The models used may not capture all relevant variables influencing the cost of capital, potentially leading to endogeneity. Although Ramsey RESET tests for OVB were conducted, additional robustness checks for endogeneity might be useful, such as implementing 2SLS instrument variable regression. The choice between fixed effects and random effects models can also influence the findings. Although the Hausman test is typically used to determine the appropriate model, the inherent assumptions of each model type might affect the results. For instance, fixed effects models control for time-invariant characteristics but can eliminate useful variation, while random effects models assume that individual-specific effects are uncorrelated with the explanatory variables, which might not always be the case. For this reason in borderline cases both FE and RE models were displayed.

Geographical and cultural differences present another significant limitation. The BRICS countries have diverse economic, regulatory, and cultural environments, which can influence the relationship between ESG performance and the cost of capital. These differences might affect the generalizability of the findings. For example, regulatory frameworks for ESG reporting and investor priorities can vary widely, making it challenging to draw uniform conclusions across all BRICS nations. Additionally, the level of market maturity and investor sophistication differs across BRICS countries. Markets with more mature ESG practices and greater investor awareness may show different patterns compared to emerging markets where ESG considerations are still gaining traction. This disparity can affect the observed impact of ESG performance on the cost of equity and debt. In future researches both endogenous and exogenous factors like existence of clearly pronounced ESG strategy within firm and ESG regulatory framework in the market should be considered within fixed effects.

Sectoral differences also play a crucial role. Different industries face varying levels of scrutiny and regulatory pressure regarding ESG practices. For instance, emission-intensive industries such as energy and manufacturing may experience more significant impacts from ESG performance compared to less scrutinized sectors. The study's findings might be influenced by the industry composition of the sample, potentially limiting the ability to generalize across all sectors. Additionally, the materiality of ESG issues varies by industry. Certain ESG factors might be more relevant for some sectors than others, affecting the overall impact on the cost of capital. The study might not fully account for these industry-specific materiality differences, which could influence the results. The inability to include industry effects in the fixed effects model suggests that further research should employ a wider range of models that would be able to capture those industry specific effects that could possible moderate and mediate the effects of the ESG performance

The measurement of ESG performance itself is fraught with challenges. Different rating agencies and institutions use varying methodologies to assess ESG performance. These differences can lead to discrepancies in ESG scores for the same firm, depending on the source of the data. The study's reliance on a particular ESG rating agency might not capture all dimensions of ESG performance equally, potentially affecting the robustness of the findings. While the research on the effects of so-called ESG disagreement (scoring varaiations between ratings agencies) on the cost of capital is nascent, some fresh insights are already given by scholars like Mio et. al. (2024) that suggest the positive effect of ESG disagreement on cost of equity. The effect of ESG disagreement on stock returns has been found earlier by Gibson et. al. (2021). Furthermore, the study primarily uses composite ESG scores, which aggregate environmental, social, and governance factors. While this provides an overall measure of ESG performance, it might hide crucial nuances within each pillar. Future research could benefit from disaggregating these components to understand their individual impacts on the cost of capital.

In conclusion, while this research provides meaningful insights into the relationship between ESG performance and the cost of capital in BRICS countries, acknowledging these limitations is crucial for a comprehensive understanding of the findings. Future research could address these limitations by using more specific data breakdown, exploring industry-specific impacts, and considering additional contextual factors. By doing so, it would be possible to build a more detailed and nuanced understanding of how ESG performance influences financial outcomes in diverse economic and regulatory environments.

# Conclusion

This thesis set out to explore the complex relationship between Environmental, Social, and Governance (ESG) performance and the cost of capital within the BRICS markets, specifically focusing on Russia, Brazil, and South Africa. By employing a robust dataset and sophisticated panel regression models, this study aimed to show how ESG scores impact the cost of equity and debt, and how these effects vary across different market environments and performance percentiles.The findings of this research reveal an uneven and quite unexpected interaction between ESG performance and corporate financing costs. Contrary to the expectations set forth in Hypothesis 1, the analysis shows that higher ESG scores are generally associated with an increased cost of equity across the board. This counterintuitive result suggests that while ESG improvements are valued, they may also be perceived as involving higher initial costs and risks, thereby increasing the required returns from equity investors.In the case of Russia, the results show that ESG scores do not significantly impact the cost of capital. This finding contrasts with the expectations and highlights the relatively lower emphasis on ESG factors within the Russian investment landscape. In Brazil, the analysis demonstrates a notable positive relationship between ESG scores and the cost of equity, suggesting that higher ESG scores lead to higher equity costs. This aligns with the notion that while better ESG performance might enhance corporate governance and investor protection, the associated costs and perceived risks could elevate equity returns. This finding corroborates insights from Nga & Rezaee (2015) and Giese et al. (2019), emphasizing the complex trade-offs in the Brazilian market.Conversely, the results for South Africa indicate a modest positive impact of ESG scores on the cost of equity. Although higher ESG performance correlates with increased equity costs, the effects are less pronounced compared to Brazil. This may be attributable to the varying levels of market maturity and regulatory frameworks within the BRICS countries, as well as differences in industry composition and corporate governance standards.

Importantly, the study also uncovers that the relationship between ESG performance and cost of capital is stronger for top performers (top 25%) than for underperformers (bottom 25%). This finding, supported by Cardoso (2020) and Fatemi et al. (2018), suggests that the benefits of high ESG performance are more pronounced for firms already excelling in ESG metrics. These firms experience more significant reductions in financing costs, highlighting the importance of achieving and maintaining high ESG standards. These insights carry some implications for corporate managers and investors. For equity investors, particularly in emerging markets like Brazil, prioritizing ESG factors can significantly mitigate risks and enhance portfolio performance. Debt holders, while benefiting to a lesser extent, still gain from improved creditworthiness and reduced borrowing costs associated with better ESG scores. For corporate managers, the findings advocate for a strategic focus on ESG improvements, especially for firms lagging in ESG performance, to leverage the financial benefits of enhanced sustainability practices.

Overall, this thesis contributes to the growing body of literature on ESG and corporate finance by providing a detailed comparative analysis of the BRICS markets. It highlights the importance of context-specific strategies and the potential for significant financial gains through improved ESG performance. Future research should continue to explore these dynamics, considering additional variables and broader datasets to further refine our understanding of ESG impacts on financial outcomes in diverse economic and regulatory environments.

# 7. Appendix

# 7.1. Descriptive statistics for country breakdown

**Table 5 –** Descriptive statistics for the cost of equity model, including respective control variables, for the Russian subsample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 47.022 | 17.669 | 164 | 8.916 | 37.934 | 46.937 | 60.105 | 81.498 |
| *MCAP* | 22.906 | 1.348 | 164 | 20 | 22.046 | 23.067 | 23.774 | 25.416 |
| *PE* | 9.693 | 9.975 | 164 | 1.023 | 4.998 | 6.713 | 9.907 | 57.013 |
| *MTB* | 1.386 | 1.132 | 164 | 0.147 | 0.539 | 1.039 | 1.762 | 5.026 |
| *BETA* | 0.901 | 0.299 | 164 | 0.147 | 0.725 | 0.935 | 1.066 | 1.892 |
| *ROE* | 0.176 | 0.289 | 164 | -1.266 | 0 | 0.108 | 0.283 | 1.573 |
| *EV/EBITDA* | 5.216 | 3.395 | 164 | 0.494 | 3.196 | 4.485 | 6.117 | 17.652 |

**Table 6 –** Descriptive statistics for the cost of debt model, including respective control variables, for the Russian subsample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 46.775 | 17.645 | 152 | 8.916 | 37.879 | 46.509 | 60.176 | 81.498 |
| *MCAP* | 22.807 | 1.309 | 152 | 20.304 | 21.881 | 23.047 | 23.709 | 25.066 |
| *ICR* | 18.974 | 17.299 | 152 | 0 | 5.522 | 14.914 | 25.796 | 79.904 |
| *ROA* | 0.053 | 0.068 | 152 | -0.143 | 0.000 | 0.036 | 0.097 | 0.279 |
| *Current* | 1.338 | 0.764 | 152 | 0.457 | 0.852 | 1.039 | 1.521 | 4.027 |
| *LEV* | 0.309 | 0.169 | 152 | 0.000 | 0.212 | 0.314 | 0.448 | 0.693 |
| *ND/EBITDA* | 0.948 | 1.633 | 152 | -2.354 | 0 | 0.455 | 1.745 | 5.116 |
| *TLPA* | 0.463 | 0.210 | 152 | 0.116 | 0.335 | 0.413 | 0.625 | 0.961 |

**Table 7 –** Descriptive statistics for the cost of equity model, including respective control variables, for the Brazilian subsample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 53.718 | 20.510 | 551 | 1.283 | 40.750 | 55.903 | 69.974 | 91.316 |
| *MCAP* | 21.691 | 1.201 | 551 | 19 | 20.878 | 21.860 | 22.476 | 24.984 |
| *PE* | 16.408 | 14.720 | 551 | 0.654 | 6.190 | 11.715 | 20.809 | 89.039 |
| *MTB* | 2.029 | 1.568 | 551 | 0.055 | 0.927 | 1.666 | 2.557 | 8.068 |
| *BETA* | 0.920 | 0.400 | 551 | -0.222 | 0.642 | 0.895 | 1.157 | 2.103 |
| *ROE* | 0.107 | 0.178 | 551 | -0.898 | 0 | 0.120 | 0.184 | 1.018 |
| *EV/EBITDA* | 8.337 | 5.389 | 551 | -7.629 | 4.986 | 7.080 | 10.566 | 32.319 |

**Table 8 –** Descriptive statistics for the cost of debt model, including respective control variables, for the Brazilian subsample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 54.034 | 20.104 | 547 | 1.283 | 41.483 | 56.559 | 69.666 | 91.316 |
| *MCAP* | 21.773 | 1.220 | 547 | 18.505 | 20.912 | 21.912 | 22.558 | 24.984 |
| *ICR* | 6.659 | 10.003 | 547 | -36 | 1.925 | 3.358 | 6.707 | 54.262 |
| *ROA* | 0.044 | 0.053 | 547 | -0.136 | 0.003 | 0.039 | 0.072 | 0.219 |
| *Current* | 1.971 | 1.430 | 547 | 0.344 | 1.179 | 1.588 | 2.102 | 9.124 |
| *LEV* | 0.317 | 0.177 | 547 | 0.000 | 0.202 | 0.323 | 0.438 | 0.795 |
| *ND/EBITDA* | 2.070 | 2.140 | 547 | -4.339 | 1 | 2.088 | 3.146 | 8.924 |
| *TLPA* | 0.591 | 0.175 | 547 | 0.095 | 0.492 | 0.605 | 0.716 | 0.977 |

**Table 9 –** Descriptive statistics for the cost of equity model, including respective control variables, for the South African subsample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 55.586 | 15.578 | 523 | 8.804 | 44.125 | 57.771 | 66.963 | 89.268 |
| *MCAP* | 21.468 | 1.249 | 523 | 18 | 20.483 | 21.429 | 22.274 | 25.218 |
| *PE* | 15.487 | 9.884 | 523 | 1.670 | 9.587 | 13.211 | 18.555 | 65.311 |
| *MTB* | 2.469 | 1.930 | 523 | 0.056 | 1.008 | 1.823 | 3.380 | 9.436 |
| *BETA* | 0.688 | 0.432 | 523 | -0.223 | 0.389 | 0.619 | 0.964 | 1.937 |
| *ROE* | 0.106 | 0.137 | 523 | -0.389 | 0 | 0.080 | 0.166 | 0.637 |
| *EV/EBITDA* | 8.707 | 5.092 | 523 | -3.693 | 4.727 | 7.723 | 12.168 | 27.115 |

**Table 10 –** Descriptive statistics for the cost of debt model, including respective control variables, for the South African subsample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std.Dev. | N | Min | Q1 | Median | Q3 | Max |
| *ESG* | 55.539 | 15.281 | 493 | 8.804 | 44.565 | 58.048 | 66.212 | 89.268 |
| *MCAP* | 21.461 | 1.230 | 493 | 18.000 | 20.488 | 21.435 | 22.270 | 25.117 |
| *ICR* | 11.968 | 21.509 | 493 | -46 | 2.978 | 5.087 | 12.886 | 180.908 |
| *ROA* | 0.045 | 0.054 | 493 | -0.107 | 0.000 | 0.039 | 0.068 | 0.227 |
| *Current* | 1.477 | 0.881 | 493 | 0.087 | 1.018 | 1.261 | 1.766 | 6.272 |
| *LEV* | 0.244 | 0.147 | 493 | 0.000 | 0.140 | 0.236 | 0.341 | 0.639 |
| *ND/EBITDA* | 1.454 | 2.352 | 493 | -2.799 | 0 | 0.739 | 2.286 | 9.122 |
| *TLPA* | 0.527 | 0.170 | 493 | 0.149 | 0.408 | 0.516 | 0.634 | 0.931 |

**Table 18 –** Hausman model specification test for the aggregated cost of debt model and quartile subsamples without lagged predictor

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Entire dataset | Top 25% | Med. 50% | Low 25% |
| Chi-Square | 66.460 | 13.010 | 16.400 | 43.830 |
| p-value | 0 | 0.112 | 0.037 | 0 |
| Model | Fixed effects | Random effects | Fixed effects | Fixed effects |

**Table 19 –** Hausman model specification test forthe cost of debt model for country’s subsamples without lagged predictor

|  |  |  |  |
| --- | --- | --- | --- |
|  | Russia | Brazil | South Africa |
| Chi-Square | 14.400 | 55.12 | 30.300 |
| p-value | 0.072 | 0 | 0.0002 |
| Model | Fixed effects/ Random effects | Fixed effects | Fixed effects |

**Table 20 –** Hausman model specification test for the aggregated cost of debt model and quartile subsamples with lagged predictor

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Entire dataset | Top 25% | Med. 50% | Low 25% |
| Chi-Square | 39.93 | 3.29 | 28.21 | 13.61 |
| p-value | 0 | 0.915 | 0.0004 | 0.093 |
| Model | Fixed effects | Random effects | Fixed effects | Fixed effects/ Random effects |

**Table 21 –** Hausman model specification test for the cost of debt model for country’s subsamples with lagged predictor

|  |  |  |  |
| --- | --- | --- | --- |
|  | Russia | Brazil | South Africa |
| Chi-Square | 6.43 | 27.7 | 54.39 |
| p-value | 0.599 | 0.001 | 0 |
| Model | Random effects | Fixed effects | Fixed effects |

**Table 22 –** Hausman model specification test for the aggregated cost of equity model and quartile subsamples without lagged predictor

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Entire dataset | | Top 25% | | Med. 50% | | Low 25% | |
| Chi-Square | 69.260 | | 16.840 | | 17.850 | | 24.380 | |
| p-value | | 0 | | 0.019 | | 0.013 | | 0 | |
| Model | | Fixed effects | | Fixed effects | | Fixed effects | | Fixed effects | |

**Table 23 –** Hausman model specification test for the cost of equity model for country’s subsamples without lagged predictor

|  |  |  |  |
| --- | --- | --- | --- |
|  | Russia | Brazil | South Africa |
| Chi-Square | 3.070 | 51.660 | 19.930 |
| p-value | 0.879 | 0 | 0.006 |
| Model | Random effects | Fixed effects | Fixed effects |

**Table 24 –** Hausman model specification test for the aggregated cost of equity model and quartile subsamples with lagged predictor

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Entire dataset | Top 25% | Med. 50% | Low 25% |
| Chi-Square | 37.73 | 13.89 | 14.03 | 27.96 |
| p-value | 0 | 0.053 | 0.051 | 0.0002 |
| Model | Fixed effects | Fixed effects/ Random effects | Fixed effects/ Random effects | Fixed effects |

**Table 25 –** Hausman model specification test for the cost of equity model for country’s subsamples with lagged predictor

|  |  |  |  |
| --- | --- | --- | --- |
|  | Russia | Brazil | South Africa |
| Chi-Square | 8.370 | 31.710 | 4.690 |
| p-value | 0.301 | 0 | 0.698 |
| Model | Random effects | Fixed effects | Random effects |

## 7.2. Robustness checks

Regression on cod with no lag for all countries:

Breusch-Pagan test statistic random: 51.27901127344403

Breusch-Pagan test p-value random: 2.318511281390951e-08

Durbin-Watson test statistic random: 1.7945898698463931

Breusch-Pagan test statistic fixed: 450.9274109695803

Breusch-Pagan test p-value fixed: 2.3548906448721295e-20

Durbin-Watson test statistic fixed: 1.9081034693458545

Ramsey RESET test results fixed: <F test: F=0.9790289247639524, p=0.3226819048776943, df\_denom=984, df\_num=1>

Regression on cod with lagged all except cost for all countries:

Breusch-Pagan test statistic random: 34.11787517729667

Breusch-Pagan test p-value random: 3.8676375577848146e-05

Durbin-Watson test statistic random: 1.9209134916891026

Breusch-Pagan test statistic fixed: 422.3438377729648

Breusch-Pagan test p-value fixed: 5.0362956536963843e-17

Durbin-Watson test statistic fixed: 2.0906922242321304

Ramsey RESET test results fixed:

F test: F=1.2405508356694432, p=0.2657120221051571,

df\_denom=771, df\_num=1

Regression on cod with no lag for Russia

Breusch-Pagan test statistic random: 24.212302295145953

Breusch-Pagan test p-value random: 0.002111242790964318

Durbin-Watson test statistic random: 1.8975559929645127

Breusch-Pagan test statistic fixed: 74.76379661269814

Breusch-Pagan test p-value fixed: 6.86687349123195e-05

Durbin-Watson test statistic fixed: 2.1146253481215136

Ramsey RESET test results fixed: <F test: F=6.681683402509452, p=0.01098017656356929, df\_denom=116, df\_num=1>

Regression on cod with lagged all except cost for Russia

Breusch-Pagan test statistic random: 17.01057508658608

Breusch-Pagan test p-value random: 0.029999150365122625

Durbin-Watson test statistic random: 1.7484923493150453

Breusch-Pagan test statistic fixed: 54.66576707989395

Breusch-Pagan test p-value fixed: 0.013779474707260816

Durbin-Watson test statistic fixed: 1.9802743670980032

Ramsey RESET test results fixed: <F test: F=9.322973493254416, p=0.0030021369085036407, df\_denom=87, df\_num=1>

Regression on cod with no lag for Brazil

Breusch-Pagan test statistic random: 22.781009677268138

Breusch-Pagan test p-value random: 0.003657081291534009

Durbin-Watson test statistic random: 1.6861556547469114

Breusch-Pagan test statistic fixed: 125.95036937353942

Breusch-Pagan test p-value fixed: 0.10187441464556074

Durbin-Watson test statistic fixed: 1.8254104434737657

Ramsey RESET test results fixed: <F test: F=0.6848870127794005, p=0.4083596225176509, df\_denom=438, df\_num=1>

Regression on cod with lagged all except cost for Brazil

Breusch-Pagan test statistic random: 16.969433117809032

Breusch-Pagan test p-value random: 0.030428948631613207

Durbin-Watson test statistic random: 2.0852886371181136

Breusch-Pagan test statistic fixed: 134.24446085859861

Breusch-Pagan test p-value fixed: 0.038446016087194536

Durbin-Watson test statistic fixed: 2.2025729028561276

Ramsey RESET test results fixed: <F test: F=0.5783135086789681, p=0.44750116574255383, df\_denom=340, df\_num=1>

Regression on cod with no lag for South\_Africa

Breusch-Pagan test statistic random: 12.079877486373778

Breusch-Pagan test p-value random: 0.1476753725218269

Durbin-Watson test statistic random: 1.8327501216934317

Breusch-Pagan test statistic fixed: 91.6806690539654

Breusch-Pagan test p-value fixed: 0.15581959393189154

Durbin-Watson test statistic fixed: 1.9178405061130344

Ramsey RESET test results fixed: <F test: F=1.0542118072190059, p=0.30514148733547264, df\_denom=412, df\_num=1>

Regression on cod with lagged all except cost for South\_Africa

Breusch-Pagan test statistic random: 12.240900025110141

Breusch-Pagan test p-value random: 0.14077482534270255

Durbin-Watson test statistic random: 1.9858025831288255

Breusch-Pagan test statistic fixed: 99.88798626381192

Breusch-Pagan test p-value fixed: 0.0563226031081011

Durbin-Watson test statistic fixed: 2.1911793172792327

Ramsey RESET test results fixed: <F test: F=0.7777024455166932, p=0.3784944895829063, df\_denom=326, df\_num=1>

Regression on coe with no lag for all countries

Breusch-Pagan test statistic random: 287.51222769293014

Breusch-Pagan test p-value random: 2.8026447038745863e-58

Durbin-Watson test statistic random: 1.6562225527271104

Breusch-Pagan test statistic fixed: 555.2506857690315

Breusch-Pagan test p-value fixed: 1.3863440742706908e-25

Durbin-Watson test statistic fixed: 1.84604718440713

Ramsey RESET test results fixed: <F test: F=7.977833904037554, p=0.0048306311826737825, df\_denom=988, df\_num=1>

Regression on coe with lagged all except cost for all countries

Breusch-Pagan test statistic random: 229.1475077368446

Breusch-Pagan test p-value random: 7.531541928402573e-46

Durbin-Watson test statistic random: 1.7627768559872923

Breusch-Pagan test statistic fixed: 432.1314873560678

Breusch-Pagan test p-value fixed: 3.92113240681127e-12

Durbin-Watson test statistic fixed: 2.116510127234255

Ramsey RESET test results fixed: <F test: F=4.566968137683434, p=0.03293385535326949, df\_denom=713, df\_num=1>

Regression on coe with no lag for Russia

Breusch-Pagan test statistic random: 25.829785269740746

Breusch-Pagan test p-value random: 0.0005401797266345544

Durbin-Watson test statistic random: 2.4193798265343434

Breusch-Pagan test statistic fixed: 39.78692391847482

Breusch-Pagan test p-value fixed: 0.30518475288337304

Durbin-Watson test statistic fixed: 2.4684128925200253

Ramsey RESET test results fixed: <F test: F=0.5128741169424809, p=0.47522251091015555, df\_denom=126, df\_num=1>

Regression on coe with lagged all except cost for Russia

Breusch-Pagan test statistic random: 9.806684450303369

Breusch-Pagan test p-value random: 0.19979574041009804

Durbin-Watson test statistic random: 2.1101630715251813

Breusch-Pagan test statistic fixed: 34.85491093872887

Breusch-Pagan test p-value fixed: 0.5229382197503442

Durbin-Watson test statistic fixed: 2.287964613704333

Ramsey RESET test results fixed: <F test: F=0.06805999842680971, p=0.7947786629786933, df\_denom=90, df\_num=1>

Regression on coe with no lag for Brazil

Breusch-Pagan test statistic random: 156.60224697812757

Breusch-Pagan test p-value random: 1.6634367504326883e-30

Durbin-Watson test statistic random: 1.6761075126531693

Breusch-Pagan test statistic fixed: 226.55650166657483

Breusch-Pagan test p-value fixed: 9.951807506515126e-08

Durbin-Watson test statistic fixed: 1.7750527057748458

Ramsey RESET test results fixed: <F test: F=2.364319268030481, p=0.12488571027813795, df\_denom=423, df\_num=1>

Regression on coe with lagged all except cost for Brazil

Breusch-Pagan test statistic random: 159.0611748821834

Breusch-Pagan test p-value random: 5.055414301505292e-31

Durbin-Watson test statistic random: 1.7581406641990172

Breusch-Pagan test statistic fixed: 181.72476711625978

Breusch-Pagan test p-value fixed: 0.0008559170399643955

Durbin-Watson test statistic fixed: 2.050354747281339

Ramsey RESET test results fixed: <F test: F=7.142314275299092, p=0.007926880034369397, df\_denom=310, df\_num=1>

Regression on coe with no lag for South\_Africa

Breusch-Pagan test statistic random: 146.34928984728217

Breusch-Pagan test p-value random: 2.370645497758513e-28

Durbin-Watson test statistic random: 1.4071822034185606

Breusch-Pagan test statistic fixed: 178.87288035009027

Breusch-Pagan test p-value fixed: 1.1487410355968302e-06

Durbin-Watson test statistic fixed: 1.625122719193869

Ramsey RESET test results fixed: <F test: F=51.974798144812446, p=2.607122955460585e-12, df\_denom=423, df\_num=1>

Regression on coe with lagged all except cost for South\_Africa

Breusch-Pagan test statistic random: 74.39210230056095

Breusch-Pagan test p-value random: 1.9054290333468407e-13

Durbin-Watson test statistic random: 1.9312604395921538

Breusch-Pagan test statistic fixed: 135.04768957293405

Breusch-Pagan test p-value fixed: 0.00781217160939057

Durbin-Watson test statistic fixed: 2.0881873633391375

Ramsey RESET test results fixed: <F test: F=10.62647329077937, p=0.0012443706472680593, df\_denom=297, df\_num=1>

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