

R&D intensity and firms dividend policy: Evidence from BRICS countries

Abstract

Purpose: Given the importance of both research and development (R&D) investments and dividend policy in the growth of firms, this paper examines the moderating effects of investor protection and other country-level governance mechanisms on the relationship between R&D investments and dividend payments in the firms from Brazil, Russia, India, China, and South Africa (BRICS countries).

Design/Methodology/Approach: This empirical study uses a sample of 22,073 firm year observations from the BRICS countries over a period of 2008-2020 and employs both OLS and system GMM estimation methods. The GMM estimation controls for unobservable heterogeneity and endogeneity and reduces estimation bias.

Findings: The findings indicate that although R&D intensity is negatively related with the cash dividend payments, with the interaction of investor protection and other country-level mechanisms the relationship between R&D intensity and dividend payments becomes positive. The results further show that investor protection has stronger impact on the relationship between R&D intensity and firm cash dividend payments than other selected country-level governance factors.

Practical implications: The research findings should encourage the policy makers in BRICS countries to strengthen investor protection and enhance quality of their institutions to make a right balance between retaining their growth potential and maintaining the value of the firms.

Originality: This is the first study to provide evidence of the moderating effects of investor protection and other country-level governance mechanisms on the relationship between R&D investments and dividend payments using the data from BRICS countries.

Keywords: R&D investment, dividend, BRICS countries, investor, governance

Paper Type: Research Paper

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1. Introduction

Research and development (R&D) expenditure has been an important driver for economic growth and the volume of R&D investment has increased substantially over the time across the globe (Yang, Chou and Zhao, 2020). Firms with substantial investment in R&D enjoy high growth potential and therefore are valued highly by the investors (Liao and Lin, 2017; Banker et al., 2019). However, this higher investment in R&D may come at the cost of cutting dividend payments which is value destructing for the firm. Kim et al. (2021) point out that dividend payout aggravates the liquidity situation of firms which eventually lead to underinvestment in value enhancing R&D projects. As it is important for firms to continue both R&D investment and dividend payments to ensure long-run value gain, in this paper, we have examined this very important issue by examining the following two research questions. First, we have examined if R&D investment have any negative impact on firms' dividend payment using data from BRICS countries. Second, if the country level governance factors help firms to continue dividend payment along with investment in R&D investments.

Both R&D investment and dividend payment are value enhancing strategies. However, researchers and policy makers are still curious about the exact link between these two (Yang et al., 2020). As the internal source of finance is less costly than external source in an imperfect capital market, firms may face dilemma to decide on whether to use this less costly fund to finance R&D investment or payout as dividend. Fama and French (2001) and Bates et al. (2009) confirm by using US data that firms that invest more in R&D projects typically pay less dividend. Similarly using Australian data, Gugler (2003) conclude that there is an inverse relationship between R&D investment and dividend payment. Although, there are some

evidences on the relationship between R&D investment and dividend payment using data from developed market, evidence from emerging markets is very rare (Yang et al., 2020). Moreover, the negative relationship between R&D investment and dividend payment, which is the conclusion from traditional finance theories (DeAngelo et al., 2006; Fama and French, 2002; Hasan, 2021a, 2021b and 2022) may not hold at all the time. For example, Yang et al. (2020) argue that R&D investment rely more on external equity financing due to its long-term and inflexible nature. To access the external equity financing, firms tend to pay more dividend to provide positive signal to external investors. As a result, it is possible that firms that invest more in R&D projects also pay higher dividends. Therefore, it would be interesting to see if investment in R&D projects reduces or enhance dividend payment for firms in our selected emerging markets (BRICS countries).

Traditional finance theories suggest a negative relationship between R&D investment and dividend payment. However, it is important to continue dividend payment to enhance the value of the firm. It has been argued in accounting and finance literature that both country level governance and firm level governance help to increase dividend payment. For example, using data from 19 emerging markets, Mitton (2004) conclude that stronger corporate governance in a country help to increase dividend payment. As suggested by agency theory, outside shareholders would prefer dividend more than retained earnings due to the possibility that extra fund would be used by the managers to increase their own benefits (Jensen, 1986; Myers, 2000). Mitton (2004) point out that this preference for dividend by outside investors would be much stronger in emerging countries due to weak investor protection that facilitates managerial expropriation to a greater extent. As a result, where investor protection is stronger that give minority shareholders power to exercise their right, they would use that power to extract dividend from firms (La Porta et al., 2000). Although both country level governance and firm level governance help to enhance dividend payment, Mitton (2004) point out that country level

measures have greater explanatory power. The author further state that firm level governance becomes more effective in enhancing dividend only when the country level governance is stronger. Following this line of arguments, we have focused on country level governance such as investor protection and other country level governance measures suggested by World Bank such as trustworthiness of politician, judicial independence and transparency in government policies to see if these governance factors can mediate the link between R&D investment and dividend payment in BRICS countries.

Using data from 22,073 firm year observations from all the BRICS countries and applying ordinary least squared (OLS) method and the generalised method of moments (GMM) estimation of panel data, this paper has found some interesting results that will make significant contribution to emerging market finance literature. First, the paper has found that R&D investment has a statistically significant negative effect on dividend payment across the whole sample. The results hold for all the subsamples such as technology firms and non-technology firms and also for across the industries. The paper also finds that investor protection has significant positive effect on dividend payment. Second, when we interact R&D intensity with investor protection, we find that the relationship between R&D intensity and dividend payment becomes positive. This is interesting findings as it clearly shows that country level governance helps investors to continue extracting dividend from firms while the firm is making investment in R&D projects. Third, the paper also finds that other country level governance measures such as public trust in politician, judicial independence and transparency in government policy also positively moderates the R&D-Dividend link. However, the effects of those governance measures are not as strong as investor protection. Fourth, the paper finds that firm size and sales growth have positive impact on dividend payment while leverage has a negative effect. As expected, the paper finds that firms struggle to keep up dividend payment during Covid-19 pandemic.

The rest of the paper proceeds as follows. Section 2 presents some relevant theoretical discussion and develops the hypotheses of the study. Section 3 describes data and methodology used in the paper. Section 4 presents and discusses empirical results and in section 5, we present the conclusion of the paper.

2. Theoretical discussion and development of hypotheses

2.1 Institutional background of BRICS countries:

BRICS comprises of five prominent emerging markets – Brazil, Russia, India, China and South Africa. Laidi (2012) views BRICS as a form a heterogeneous coalition of often competing nations with a common fundamental political objective: to erode the Western hegemony and protect the political sovereignty of states. The study also argues that BRICS countries – even the democratic ones – are fundamentally diverge from the liberal vision of Western countries. Clarke (2015) analyses the business models and governance system of the BRICS economies and find that those countries, except South Africa, stand in contrast to the Anglo-American model of developed legal and regulatory structures and market-oriented governance system. Also, the study finds considerable differences among those countries. The study suggests that, to sustain their economic performance and growth, those countries must build strong institutional structure and own governance systems rather than adopting Anglo-American practices. Governance system of those countries should reflect the ethical foundations and values of the society to remain important and meaningful.

Over the last 30 years, BRICS countries grew at an average rate of 5.42% and contributed over 22% of global GDP (Wang and Zhang, 2020). Lankapotu (2020) states that BRICS countries are striving for structural transformation of their economies through knowledge intensive industries. Although it is necessary for BRICS countries to significantly increase R&D

investment to promote sustainable growth in the long-run, the effective R&D investment as percentage of GDP has not increased significantly over the time (Lee et al. 2021). Wang et al., (2021) investigate the impact of institutional quality on technological innovation in BRICS countries and find that due to weak institutional quality those countries would not be able to provide a conducive environment where firms and researchers can successfully innovate. They suggest that BRICS countries should focus on strengthening their institutions to improve innovation.

It is pertinent to mention that as the BRICS countries continue to try to improve their institutional quality to promote more R&D investments, this can put pressure on firm level liquidity and eventually lead to scarcity of dividend payment. However, improving the quality of institutions will help the shareholders to exert pressure on managers to pay higher dividend. In this paper, we are examining this important and interesting mediation of institutional quality on the link between R&D investment and dividend payment using data from BRICS countries.

2.2 R&D intensity and dividend policy

R&D investments contain high level of information asymmetry. Moreover, R&D investments are risky, long-term and opaque in nature (Keupp and Gassmann, 2009). Firms with high R&D investment try to hide sensitive information to keep up the competitive advantage and therefore contain high level of information asymmetry (Lee and Lee, 2019). According to Pecking order theory, firms with high information asymmetry should choose their financing by ranking finance methods, starting with internal sources of finance, then using low-cost debt and finally stock issuance (Myera and Majluf, 1984). Therefore, when firms invest in R&D projects, they primarily use internal sources leaving very little to pay to the shareholders as dividend.

According to corporate finance theories, cashflow is one of the main determinants of corporate R&D (Hillier et al. 2011; Brown et al., 2009). So, the dividend pay-out policy of a firm, which can cause cash flow constraints, have strong implications on its R&D activities (Borisova and Brown, 2013; Gugler, 2003; Lim et al., 2018). Traditional corporate finance theories argue that in an imperfect capital market, internal funding is less costly than external sources of capital, and firms may be forced to choose between pursuing valuable investment projects and dividends due to limited internal funds (DeAngelo et al., 2006; Fama and French, 2002). This argument implies a negative relationship between firms' dividend policy and R&D investment. Firms with higher R&D needs rely extensively on cash holdings to smooth their R&D expenditures (Brown and Petersen, 2011; Lyandres and Palazzo 2016; Bates et al., 2009) and are more likely to face internal cash shortages and opt for more volatile external financing sources (Brown et al. 2009) hence pay less dividend (Bates et al., 2009).

Gaver and Gaver (1993) find significantly lower dividend yields for growth firms with higher R&D investments than for non-growth firms. Fama and French (2001), also find that US firms with higher R&D investments pay out substantially less or sometimes pay nothing compared to other firms. Similarly, Gugler (2003) finds Austrian firms that do not invest in R&D have larger target payout ratios. Using a sample of listed high-tech firms across 18 industries from China during 2007–2015, Huang and Sattar (2021) find that the marginal effect of subsidies on R&D diminishes and turns negative particularly among firms with higher dividend payment.

Based on the above discussion, we propose the following hypothesis:

H1: R&D investment will have a negative effect on dividend payments of the firms in BRICS countries.

2.3 Moderating role of investor protection

Pinkowitz et al. (2006) state that investor protection has two components. First, a legal rights component which empowers the investors with legal rights of their claims on the company. Second, an enforcement component which means that the quality of a country's institutions determines the extent to which these rights are respected and enforced. Agency theory predicts that the value of corporate cash holdings is less in countries with poor investor protection because in such countries controlling shareholders pose greater ability to extract private benefits from cash holdings (Pinkowitz et al., 2006). Easterbook (1984) and Jensen (1986) argued that dividend payment is a channel to reduce free cash flow at managers' disposal for potential extraction of private benefits and can be used as a monitoring mechanism, resulting in reduction in agency costs. La Porta et al. (2000), explored the association between the governance system and dividend pay-outs policy using a dataset of 4000 companies from 33 countries to find that in a country with weak investor protection and civil-law system, the controlling shareholders and managers tend to expropriate shareholders by paying out lesser dividends.

Pinkowitz et al., (2006) find that the relation between cash holdings and firm value is much weaker in countries with poor investor protection while the relation between dividend pay-out and firm value is weaker in countries with stronger investor protection. Acemoglu et al., (2003) argue that the countries where extracting private benefits is easier are also typically riskier, so the firms in these countries may need to hold more cash as a buffer to protect themselves against adverse shocks.

Koo et al. (2017) find better reporting quality leads to higher dividend payments. Burns et al., (2015) find growth firms in countries with weak investor protection reduce dividends payments

and use equity incentives as a substitute for dividends. While Moortgat et al. (2017) show changes in investor protection have little impact on dividend policy of Belgian firms.

Bae et al. (2012) explore the interaction effects of culture and governance and find that strong investor protection induces higher dividend pay-outs in high uncertainty avoiding and/or highly masculine cultures. Alzahrani and Lasfer (2012) explore the impact of investor protection and taxation on the pay-out policy of listed firms in 24 OECD member countries and find that firms in high investor protection countries pay higher dividends, but the distribution of pay-out varies across different tax systems. Athari (2021) investigates the nexus between investor protection and dividend policy for 517 listed nonfinancial firms operating in Asian countries between the period 2008 and 2017 and reveals that stronger investor protection is associated with higher dividend pay-outs.

From the above discussion, we propose the following hypothesis:

H2: Investor protection positively moderates the strength of the relationship between firms' R&D intensity and dividend payments.

2.4 Moderating role of country level governance

Extant literature has provided some evidence in favour of the influence of country level governance on firm dividend policy. It has been argued that better county level governance increases firms' dividend payment. Pinkowitz et al. (2006) and Gompers et al. (2003) provide evidence that good firm level governance and country level governance will have positive impact on cash. Seifert and Gonenc (2018) state that good governance should reduce misappropriation of funds and increase the possibility of returning the cash to shareholders. The authors also state that good governance helps to discipline managers so that they spend wisely and distribute excess cash to shareholders by increasing dividend payment.

Roe (2006) and Roe and Siegel (2011) state that better political institutions improves investor protection and property rights enforcement. Using this observation, Lai et al. (2020) argues that countries where political institutions are sound, investors should have stronger bargaining power and can demand higher dividend from the firm. Mitton (2004) show that the positive relationship between corporate governance and dividend pay-outs is limited primarily to countries with strong investor protection, signifying that firm-level corporate governance and country-level investor protection complements each other. Sawicki (2009) also argued that both firm-level and country-level governance are important for improving investor protection. Based on this argument, we formulate the following hypothesis:

H3: Country-level governance positively moderates the strength of the relationship between firms' R&D intensity and cash dividend payments.

3. Data and methodology

3.1 Data, sample selection and variables

We collected data from several sources - Bloomberg, Heritage¹ and the World bank² - for the period of 2008-2020. Firm level data – R&D expenditure, cash dividend, fixed assets, total assets, sales value, total debt – were collected from Bloomberg. Investor protection data was collected from the World bank. Finally, governance level data were collected from the Heritage database.

¹ [Economic Data and Statistics on World Economy and Economic Freedom \(heritage.org\)](https://www.heritage.org/)

² [Strength of investor protection - TCdata360 \(worldbank.org\)](https://data.worldbank.org/)

We use an unbalanced panel of 22,073 firm year observations from all the BRICS countries covering a period of 2008-2020 (see Table 1). In our data set we excluded financial and utility firms because these two industries keep their financial records in a different way than for other industries (Claessens and Laeven, 2006). For the financial industry, profitability and valuation data are difficult to calculate compared to firms in other industries. For the utility industry, profitability and valuation can be strongly influenced by government regulations (Claessens and Laeven, 2006).

Table 1 Firm by country

Country Name	Firm frequency	Percentage	Cumulative percentage
Brazil	541	2.45	2.45
China	15,381	69.68	72.13
India	5,945	26.93	99.06
Russia	22	0.10	99.16
South Africa	184	0.84	100.00
Total	22,073	100.00	

Table 2 shows the definitions of the variables. Following Lee and Lee (2019), we have used cash dividend as our dependent variable for all our regressions, including in our robustness tests. We have calculated cash dividend payments using the formula of dividend payments divided by total assets (Lee and Lee, 2019). We have used R&D intensity as our independent variable and measured it by dividing total R&D expenditure by sales, as suggested by Honore et al. (2015) and Alam et al. (2020). Another independent variable used in this study is investor protection. Our investor protection variable is a continuous variable taking a score of between 0 and 10 where 0 is the lowest level of investor protection (no protection at all) and 10 is the highest level of investor protection. Finally, we used three governance level variables, namely public trust in politicians, judicial independence and government policy maker transparency.

These three variables take a score between 0 and 10, where 0 is the lowest level and 10 is the highest level.

Table 2 Variable definition

Data Type	Variables	Descriptions
Firm level	Dividend	Cash dividend pay-out divided by total assets
	R&D intensity	R&D expenditure of a firm over sales
	Size	Natural logarithm of firm's total assets
	Sales growth	Changes of sales over sales
	Leverage	Total debt over total assets
	Covid-19	Covid-19 takes value 1 if the year is 2020, and otherwise 0.
Industry data	Industry dummy	Takes a value of 1 if the firm is in technology-based industry
Governance level	Public trust in politicians	Measures the public trust in politicians
	Judicial independent	Measures judicial independence from the government
	Transparency of government policy makers	Measures the transparency of government policy markers
Investor level	Strength of investor protection	Measures the strength of investor protection

It well documented that larger firms usually generate a superior performance compared to small firms because of various diverse capabilities, such as implementation of effective operations and ability to implement economies of scales and scope (Majumder, 1997; Penrose, 1959). For this reason, there should be a positive relationship between firm size and firm dividend policy. As such, we have used firm size as one of our control variables, measured as the natural logarithm of total assets, following Alam et al. (2020). We also have used sales growth as another control variable because the previous literature has found that sales growth can increase market power, which in turn can lead to higher dividend payments (Frank, 1988). Lazar (2016) documented that leverage is a key indicator for firm dividend policy because increasing debt can create agency problems and lead to underinvestment (Ibhagui and Olokoyo, 2018).

3.2 Summary of statistics

Table 3 reports the descriptive statistics by firm and Table 4 provides the correlation matrix for the firm level sample. We can observe from Table 3 that R&D intensity has a very low minimum value and a very high maximum value. This indicates that some small firms failed to invest continuously over the period of 2008 to 2020, while others invested more. It has also been confirmed by the previous literature that technology-based firms usually invest more in R&D compared to non-technology-based firms (Tabrizi, 2005). We can see a similar kind of pattern in the case of sales growth, although this may be attributable to data variability, and obviously small firms' sales growth is lower (and may be negative) compared to larger firms. But in the case of standard deviation, only firm size showed a higher standard deviation (1.63985), indicating variation in observations of firms.

Table 3 Sample by firm

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
Cash Dividend	22,073	0.02537	0.09609	0	7.36486
R&D Intensity	22,073	0.04075	0.54944	-0.01226	78.43508
Size	22,073	8.54045	1.63985	3.23506	16.12050
Sales Growth	22,073	0.79674	0.78723	-0.94576	0.19937
Leverage	22,073	0.06726	0.10141	0	0.97231
Covid_19	22,073	0.12056	0.32562	0	1

Table 4 documents the pair wise correlation matrix. Here we see that leverage and size are significantly correlated with dividend payment. On the other hand, leverage, size and Covid-19 are significantly correlated with R&D investments.

Table 4 Correlation matrix for firm level sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)
(1) Cash Dividend	1.0000					
(2) R&D Intensity	0.0005	1.0000				
(3) Leverage	-0.0793*	-0.0151*	1.0000			
(4) Size	-0.0795*	-0.0309*	0.4048*	1.0000		
(5) Covid_19	-0.0094	0.0218*	-0.0179*	0.0775*	1.0000	
(6) Sales Growth	-0.0022	-0.0016	0.0142*	0.0452*	-0.0059	1.0000

Note: * represent 5% level significant.

3.3 Model and method

Using the following model, we want to examine the impact of the influence of country governance factors and investor protection on the relationship between R&D intensity and firm cash dividend pay-out policy.

$$\begin{aligned}
 Dividend_{i,t} = & \alpha_{i,t} + \gamma_1(Investor\ Protection) + \gamma_2(RD\ intensity_{i,t}) + \\
 & \gamma_3(RD\ intensity_{i,t} * Investor\ Protection) + \gamma_4(RD\ intensity_{i,t} * Governance) + \\
 & \delta_1 Ln(Size) + \delta_2 (Sales\ Growth) + \delta_3 (Leverage) + \delta_4 (Covid - 19) + \sum \varphi_1 Year_I + \\
 & \sum \varphi_2 Industry_I + \mu_{i,t}
 \end{aligned} \tag{1}$$

Where subscript i represents the country and t represents the year. Year dummies capture the time-specific effect to control for macroeconomic variables on R&D intensity and dividend policy. On the other hand, industry dummies capture the industry specific effect. $\mu_{i,t}$ is the standard error term.

This research paper examining the moderating effect of investor protection and country governance on the relationship between R&D investment and firm cash dividend payout policy using two different research methods - OLS and system GMM. First, in Table 5 OLS shows our main results. The table is divided into three sections. The first section shows the entire data sample results; the second section shows only the technology-based industry sample; finally,

the third section shows the non-technology-based industry sample. In our robustness test section, we used both the OLS and the GMM methods. Table 6 shows our results based on firm size. The table is divided into two sections. The first section shows small firm results (i.e. firms with a mean size value of between 2.00 and 3.00); the second section shows large firm results (i.e. firms with a mean size value of between 6.00 and 7.00). In our robustness test section, we also show our results using system the GMM method. We have used the GMM method because it is consistent with panel data structure and it is efficient when a panel data set has a small-time dimension (where $T = 13$) compared to its cross-sectional dimension (where $N=22,073$) (Asongu et al., 2018)³. Due to reverse causality a number of issues could arise, like omitted variable bias, measurement errors, unobserved heterogeneity and endogeneity. The GMM estimation method helps to address these issues (Alam et al., 2019b; Mthanti and Ojah, 2017).

4. Results and discussion

Table 5 reports results from the estimating equation (1). This table presents the results of industry classifications. Considering the entire sample, the result in model (1) suggests that firm cash dividend is negatively related to R&D intensity (R&D Intensity, p-value < 0.01). Alternatively, we find a positive relation between firm cash dividend and investor protection (Investor Protection, p-value < 0.01). Both findings are consistent with the previous literature (Lee and Lee, 2019) and suggest that higher investor protector firms pay more cash dividend to their investors than lowered investor protected firms. In the same way, R&D intensive firms

³ In this study we used system GMM instead of difference GMM because the former is more efficient than the latter (Blundell and Bond, 1998) and the latter suffers from the problem of weak instruments (Alonso-Borrego and Arellan, 1999). We applied two-step estimation because two-step estimation is more efficient than one-step estimation (Alam et al., 2020).

pay less or no dividend to their investors. Consequently, we mention that model (1) results support Hypotheses 1 and 2.

We find the same results in model (2) for R&D intensity and investor protection after including the interaction variable, R&D Intensity*Investor Protection. Additionally, we find a positive coefficient and statistically significant result for R&D Intensity*Investor Protection (p-value < 0.01). This finding suggests that investor protection significantly influences R&D spending in increasing firms' cash dividend payments and supports the Hypotheses (2). In model (3), after including a few governance level indexes, we find the similar coefficients sign and statistical significance level for R&D intensity, investor protection and R&D Intensity*Investor Protection. However, the interactions between R&D intensity and governance indexes provide positive coefficients but statistically insignificant results. The statistical insignificance may be happened because of the weaker strength of country-level governance in BRICS countries (Yang et al., 2020). The results in model (3) lend some support to hypothesis 3, but, as mentioned earlier, the strength of this support is not statistically significant.

Models (4) through (6) of Table 5 present results for Technology based Industry and models (7) through (9) of Table 5 present results for Non-Technology based Industry. In all six models (Model (4) to (9)), our results are similar to what find in the first three models (Model (1) to (3)). Considering all findings, we indicate that our results strongly support hypothesis 2 while providing some weak support to hypothesis 3.

We also note that the coefficients of control variables suggest differently. The firm size positively impacts firm dividend payment and R&D expenditure. A larger firm size indicates a higher capacity for higher levels of investment, greater assets and greater human capital, helping to distribute more cash dividends and invest more money in R&D. The coefficient of sales growth is positive but statistically insignificant. On the other hand, leverage reveals a

negative and significant impact on the firm's cash dividend payment, consistent with the findings documented by Asimakopoulos et al. (2009). As expected, COVID-19 adversely affects the firm's cash dividend payment.

Table 5 Summary of results based on industry classification

Variables	All Obs			Technology based Industry			Non-Technology based Industry		
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)
<i>R&D Intensity</i>	-0.00155*** (0.00116)	-0.02703*** (0.04457)	-0.27839*** (0.33847)	-0.00293*** (0.00117)	-0.01885*** (0.04341)	-0.41464** (0.34099)	-0.00156*** (0.00115)	-0.02877*** (0.04370)	-0.30408*** (0.33681)
<i>Investor protection</i>	0.00257*** (0.00089)	0.00148*** (0.00091)	0.00891*** (0.00093)	0.00252*** (0.00083)	0.00166*** (0.00085)	0.00968*** (0.00088)	0.00149*** (0.00882)	0.00148*** (0.00905)	0.00108*** (0.00929)
<i>R&D Intensity* Investor protection</i>		0.04337*** (0.00711)	0.06848*** (0.01859)		0.00296*** (0.00693)	0.00458*** (0.01856)		0.00461*** (0.00697)	0.00860*** (0.01839)
<i>R&D Intensity* Public trust in politicians</i>			0.02765 (0.02233)			0.04243 (0.02238)			0.02783 (0.02229)
<i>R&D Intensity* Judicial independent</i>			0.05157 (0.03868)			0.07311 (0.03878)			0.05162 (0.03862)
<i>R&D Intensity* Transparency of government policy makers</i>			0.01852 (0.04327)			0.01596 (0.04342)			0.01509 (0.04307)
Controls									
<i>Size</i>	0.00348*** (0.00051)	0.00346*** (0.00051)	0.00344*** (0.00052)	0.00297*** (0.00045)	0.00299*** (0.00046)	0.00299*** (0.00045)	0.00354*** (0.00051)	0.00351*** (0.00050)	0.00349*** (0.00050)
<i>Sales growth</i>	0.00449 (0.002478)	0.00446 (0.00245)	0.00445 (0.00243)	0.00385 (0.00208)	0.00388 (0.00209)	0.00388 (0.00208)	0.08579 (0.05472)	0.00449 (0.00252)	0.00447 (0.00250)
<i>Leverage</i>	- 0.07189*** (0.00799)	- 0.07185*** (0.00799)	- 0.07214*** (0.00801)	- 0.06238*** (0.00728)	- 0.06251*** (0.00729)	- 0.06325*** (0.00730)	-0.07026** (0.00792)	- 0.07020*** (0.00792)	- 0.07051*** (0.00793)
<i>Covid-19</i>	-0.00338** (0.00452)	-0.00347** (0.00452)	-0.00383** (0.00453)	-0.00354** (0.00452)	-0.00348** (0.00452)	-0.00388* (0.00453)	- 0.00304*** (0.00451)	- 0.00314*** (0.00451)	- 0.00351*** (0.00452)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	22,073	22,073	22,073	3,548	3,548	3,548	18,525	18,525	18,525

Note: Level of significance: * <0.10, ** <0.05 and *** <0.01; standard errors in parenthesis.

Table 6 Summary of results based on firm size

Variables	Small Firm			Large Firm		
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
<i>R&D Intensity</i>	-0.00689 (0.04780)	-0.22562 (1.08447)	-0.52622 (3.14419)	-0.08133** (0.04910)	-0.19348** (0.24472)	-0.58661** (0.79732)
<i>Investor protection</i>	0.00520*** (0.02132)	0.00833*** (0.02396)	0.00721*** (0.01432)	0.00405*** (0.00101)	0.00384*** (0.00110)	0.00385*** (0.00111)
<i>R&D Intensity* Investor protection</i>		0.03525* (0.21482)	0.11343* (0.57039)		0.01826** (0.03904)	0.01789** (0.04389)
<i>R&D Intensity* Public trust in politicians</i>			0.02130 (0.50415)			0.03545 (0.05483)
<i>R&D Intensity* Judicial independent</i>			0.08838 (0.58055)			0.22523 (0.14022)
<i>R&D Intensity* Transparency of government policy makers</i>			0.09644 (0.54182)			0.07635 (0.17799)
<i>Size</i>	0.03971* (0.03148)	0.03900* (0.03179)	0.03914* (0.03187)	0.00927* (0.00111)	0.00932* (0.00143)	0.00808* (0.00111)
<i>Sales growth</i>	0.00064 (0.00201)	0.00068 (0.00241)	0.00075 (0.00292)	0.00125 (0.00311)	0.00124 (0.00315)	0.00138 (0.00299)
<i>Leverage</i>	-0.61174** (0.30234)	-0.61100** (0.30261)	-0.61228** (0.30696)	-0.07174*** (0.00693)	-0.07167*** (0.00694)	-0.06993*** (0.00698)
<i>Covid-19</i>	-0.00374* (0.17201)	-0.00220* (0.17240)	-0.00312* (0.17320)	-0.00637* (0.00412)	-0.00644* (0.00413)	-0.00731* (0.00419)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	753	753	753	734	734	734

Note: Level of significance: * <0.10, ** <0.05 and *** <0.01; standard errors in parenthesis.

4.1 Robustness test

This section reports the robustness checks we undertake to strengthen our baseline findings. We consider the two tests to ensure the robustness of the results. We first divide the whole sample into two different subsamples based on firm size. We classify the firms as small if the mean value of firm size is between 2.00-3.00 and as large if the mean value of firm size is between 6.00-7.00. Firm size-based coefficients provide more robust results for two reasons. Firstly, a larger firm will pay more cash dividends and at the same time they have enough money to invest in R&D; on the other hand, it is commonplace that small firms invest less in R&D and pay less or no cash dividend, investing those funds instead in positive NPV (net present value) projects. Secondly, larger firms pay more attention to investor protection than smaller firms, which is why larger firms pay more cash dividends than smaller firms.

Table 6 presents the results of firm size-based OLS estimation. Models (1) through (3) suggest that the relationship between cash dividend payment and R&D intensity is negative but statistically insignificant. The model (3) coefficient indicates that the firm's cash dividend is changed by 0.526 if R&D intensity is changed by one unit. This finding is consistent with the baseline empirical results. However, for larger firms in models (4) to (6), we find that the relationship between cash dividend payments and R&D intensity is negative and statistically significant.

Interestingly, we find similar results across all the models when R&D intensity interacts with the investor protection index and with other governance level indexes, regardless of firm size. For all control variables, the results in Table 6 are consistent with those given in Table 5. Overall, the results suggest that investor protection has a greater impact on the relationship between R&D intensity and firm cash dividend payments than country-level governance.

4.2 GMM estimation

Table 7 reports the further robustness test based on GMM estimation. Here we consider the system GMM estimation and the entire data sample. All three models present a negative and statistically significant relationship between cash dividend payments and R&D intensity. This result is also similar to those seen in Table 5 and Table 6. Overall, the findings indicate that investor protection has a greater impact on the relationship between R&D intensity and firm cash dividend payments than country-level governance.

Table 7 Result Summary based on GMM

Variables	Model (1)	Model (2)	Model (3)
<i>R&D Intensity</i>	-0.00325*** (0.00099)	-0.02413*** (0.02212)	-0.04486*** (0.13023)
<i>Investor protection</i>	0.00133*** (0.00050)	0.00121** (0.00053)	0.00938* (0.00055)
<i>R&D Intensity* Investor protection</i>		0.00380** (0.00351)	0.00336** (0.00816)
<i>R&D Intensity* Public trust in politicians</i>			0.06196 (0.00898)
<i>R&D Intensity* Judicial independence</i>			0.10729 (0.01611)
<i>R&D Intensity* Transparency of government policy makers</i>			0.03378 (0.01735)
<i>Size</i>	0.00343*** (0.00042)	0.00346*** (0.00043)	0.00339*** (0.00042)
<i>Sales growth</i>	0.00427 (0.00259)	0.00431 (0.00261)	0.00422 (0.00255)
<i>Leverage</i>	-0.05512*** (0.00298)	-0.05536*** (0.00305)	-0.05722*** (0.00314)
<i>Covid-19</i>	-0.00163* (0.00096)	-0.00161* (0.00096)	-0.00224** (0.00100)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
N	22,073	22,073	22,073

Note: Level of significance: * <0.10, ** <0.05 and *** <0.01; standard errors in parenthesis.

5. Conclusion

This paper analyses how investor protection and other country-level governance mechanism moderate the relationship between R&D investment and dividend payments of firms in BRICS countries. We reassess the previous evidence that firms with higher R&D investments pay lower dividend and firms from countries with better country-level governance pay higher dividends. More specifically, we examine whether investor protection and other country-level governance mechanism or the combination of both makes firms pay higher dividends or not.

The study finds that R&D intensity is negatively related with the cash dividend payment, while investor protection and other country-level governance measures have a positive association with dividend payments of the firms. However, when investor protection and other country-level mechanisms interact with R&D investment the relationship between R&D investment and dividend payments becomes positive. Also, investor protection has a greater impact on the relationship between R&D intensity and firm cash dividend payments than other country-level governance measures. These results suggests that firms in BRICS countries with strong investor protection, invest more in R&D projects and continue to pay higher dividends.

We believe that these findings contribute to the existing literature on the relationships among R&D, dividend policy, and country-level governance and have important implications for researchers, investors, and policy makers, especially in emerging economies. This study suggests that BRICS countries should focus more on enforcing strong investor protection and enhancing quality of their institutions to retain their growth potential and attract more external investments.

References

- Acemoglu, Daron, Simon Johnson, James A. Robinson, and Yunyong Thaicharoen. (2003) Institutional causes, macroeconomic symptoms: Volatility, crises, and growth. *Journal of Monetary Economics*, 50, 49–123.
- Alam, A., Uddin, M. and Yazdifar, H. (2019a). Financing behaviour of R&D investment in the emerging markets: the role of alliance and financial system. *R&D Management*. 49(1), 21-32.
- Alam, A., Uddin, M. and Yazdifar, H. (2019b). Institutional determinants of R&D investment: Evidence from emerging markets. *Technology Forecasting and Social Changes*. 138, 34-44.
- Alam, A., Uddin, M., Yazdifar, H., Shafique, S. and Lartey, T. (2020). R&D investment, firm performance and moderating role of system and safeguard: Evidence from emerging markets. *Journal of Business research*. 106, 94-105.
- Alzahrani, M. and Lasfer, M. (2012). Investor protection, taxation, and dividends. *Journal of Corporate Finance*, 18(4), 745-762.
- Asimakopoulou, I., Samitas, A. and Papadogonas, T. (2009). Firm-specific and economy wide determinants of firm profitability: Greek evidence using panel data. *Managerial Finance*, 35(11), 930-939.
- Athari, S.A. (2022). Does investor protection affect corporate dividend policy? Evidence from Asian markets. *Bulletin of Economic Research*. 74(2), 579-598.
- Banker, R.D., Huang, R., Natarajan, R., and Zhao, S. (2019). Market valuation of intangible asset: evidence on SG&A expenditure. *Accounting Review*. 94 (6), 61–90.
- Bates, T.W., Kahle, K.M. and Stulz, R.M. (2009). Why do U.S. firms hold so much more cash than they used to? *The journal of Finance*, 64(5), 1985-2021.
- Bae, S.C., Chang, K. and Kang, E. (2012). Culture, corporate governance, and dividend policy: international evidence. *Journal of Financial Research*, 35(2), 289-316.
- Bhattacharya, S. (1979). Imperfect information, dividend policy, and “the bird in the hand” fallacy. *The Bell Journal of Economics*, 10(1), 259-270.
- Brown, J.R., Fazzari, S.M. and Petersen, B.C. (2009), Financing innovation and growth: cash flow, external equity, and the 1990s R&D boom. *The Journal of Finance*, 64, 151-185.
- Brown, J. R., and Petersen, B. C. (2011). Cash holdings and R&D smoothing. *Journal of Corporate Finance*, 17, 694–709.
- Brown, J. R., Martinsson, G., and Petersen, B. C. (2013). Law, stock markets, and innovation. *The Journal of Finance*, 68(4), 1517–1549.
- Burns, N., McTier, B.C. and Minnick, K. (2015). Equity-incentive compensation and payout policy in Europe. *Journal of Corporate Finance*, 30, 85-97.
- Charitou, A., Lambertides, N. and Theodoulou, G. (2010). The effect of past earnings and dividend patterns on the information content of dividends when earnings are reduced. *Abacus*, 46(2), 153-187.

Claessens, S. and Laeven, L. (2006). *A Reader in International Corporate Finance*, 1, Washington, DC : World Bank.

Clarke, T. (2015). The transformation of corporate governance in emerging markets: Reform, convergence, and diversity. *Emerging Markets Finance and Trade*, 51(sup2), S25-S46.

DeAngelo, H.; DeAngelo, L. and Stulz, R.M. (2006) Dividend Policy and the Earned/Contributed Capital Mix: A Test of the Life-cycle Theory. *Journal of Financial Economics*, 81, 227–254.

Easterbrook, F. H. (1984). Two agency cost explanations of dividends. *American Economic Review*, 74, 650–659.

Fama, E. F. and French, K.R. (2001). Disappearing dividends: Changing firm characteristics or lower propensity to pay? *Journal of Financial Economics*, 60, 3–43.

Fama, E. F., and French, K. R. (2002). Testing Trade-Off and Pecking Order Predictions about Dividends and Debt. *The Review of Financial Studies*, 15(1), 1–33.

Frank, M.Z. (1988). An Intertemporal Model of Industrial Exit. *The Quarterly Journal of Economics*, 103(2), 333–344.

Gaver, J.J., and Gaver, K.M. (1993). Additional evidence on the association between the investment opportunity set and corporate financing, dividend, and compensation policies. *Journal of Accounting and Economics*, 16, 125–160.

Gompers, P., Ishii, J. and Metrick, A. (2003). Corporate Governance and Equity Prices, *The Quarterly Journal of Economics*, 118(1), 1107–156.

Gugler, K. (2003). Corporate Governance, Dividend Payout Policy, and the Interrelation between Dividends, R&D, and Capital Investment. *Journal of Banking & Finance*, 27, 1297–1321.

Hasan, F. (2021a). Dividend changes as predictors of future profitability. *The Journal of Prediction Markets*. 15(1), 37-66.

Hasan, F. (2021b). Relationship between orthodox finance and dividend policy: a literature review. *Indian-Pacific Journal of Accounting and Finance*. 5(1), 13-40.

Hasan, F. (2022). Using UK Data to Study the Effects of Dividends Announcements on Stock Market Returns. *The Journal of Prediction Markets*. In press.

Hillier, D., Pindado, J., Queiroz, V. and Torre, C.d.l. (2011). The impact of country-level corporate governance on research and development. *Journal of International Business Studies*, 42, 76–98.

Honore, F., Munari, F. and Potterie, B. P. (2015). Corporate governance practices and companies' R&D intensity: Evidence from European countries. *Research Policy*. 44(2), 533-543.

- Huang, W. and Sattar, M. (2021). Corporate finance policies, subsidies and R&D: Evidence from China. *International Journal of Finance & Economics*, 26(3), 3875-3891.
- Ibhagui, O.W. and Olokoyo, F.O. (2018). Leverage and firm performance: New evidence on the role of firm size. *The North American Journal of Economics and Finance*, 45, 57-82.
- Jensen, M. (1986). Agency cost of free cash flow, corporate finance and takeovers. *American Economic Review*, 76(2), 323–329.
- Keupp, M.M. and Gassmann, O. (2009). Determinants and archetype users of open innovation. *R&D Management*, 39(4) 331-341.
- Kim, J., Yang, I., Yang, T. and Koveos, P. (2021). The impact of R&D intensity, financial constraints, and dividend payout policy on firm value. *Finance Research Letters*, 40,101802.
- Koo, D.S., Ramalingegowda, S., and Yu, Y. (2017). The effect of financial reporting quality on corporate dividend policy. *Review of Accounting Studies*, 22, 753–790.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R.(2000). Investor protection and corporate governance, *Journal of Financial Economics*, 58(1-2), 3-27.
- Lai, K.M.Y., Saffar,W., Zhu, X. and Liu, Y.(2020). Political institutions, stock market liquidity and firm dividend policy: Some international evidence. *Journal of Contemporary Accounting & Economics*, 16(1), 100180.
- Laidi, Z. (2012). BRICS: Sovereignty power and weakness. *International Politics*, 49(5), 614-632.
- Lankapotu, K.V. (2020). Inflow and outflow of foreign direct investments in BRICS countries: An analysis. *Economy*, 7(2), 98-103.
- Lazar, S. (2016). Determinants of firm performance: evidence from Romanian listed companies. *Review of Economic and Business Studies*, 17, 53-69.
- Lee, H. S., Moseykin, Y. N., and Chernikov, S. U. (2021). Sustainable relationship between FDI, R&D, and CO2 emissions in emerging markets: An empirical analysis of BRICS countries. *Russian Journal of Economics*, 7(4), 297-312.
- Lee, N. and Lee, J. (2019). R & D Intensity and Dividend Policy: Evidence from South Korea's Biotech Firms. *Sustainability*, 11(18), 4837.
- Liao, T.L., and Lin, W.C. (2017). Corporate governance, product market competition, and the wealth effect of R&D spending changes. *Financial Manager*, 46 (3), 717–742.
- Lim, C. Y., Wang, J., and Zeng, C. C. (2018). China's “mercantilist” government subsidies, the cost of debt and firm performance. *Journal of Banking & Finance*, 86, 37–52.
- Lyandres, E., and Palazzo, B. (2016). Cash holdings, competition, and innovation. *Journal of Financial and Quantitative Analysis*, 51, 1823–1861.
- Mitton, T. (2004). Corporate governance and dividend policy in emerging markets. *Emerging Markets Review*, 5(4), 409-426.
- Moortgat, L., Annaert, J. and Deloof, M. (2017). Investor protection, taxation and dividend policy: long-run evidence, 1838–2012. *Journal of Banking & Finance*, 85, 113-131.

- Majumdar, S.K. (1997). The Impact of Size and Age on Firm-Level Performance: Some Evidence from India. *Review of Industrial Organization*, 12, 231–241.
- Miller, M.H. and Rock, K. (1985). Dividend policy under asymmetric information. *The Journal of finance*, 40(4), 1031-1051.
- Mthanti, T. and Ojah, P. (2017). Entrepreneurial orientation (EO): Measurement and policy implications of entrepreneurship at the macroeconomic level. *Research Policy*, 46(4), 724-739,
- Myers, S.C. and Majluf, N.S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 5, 157–175.
- Penrose, E. (1995). *The Theory of the Growth of the Firm*. Oxford University Press.
- Pindado, J., Queiroz, V.d. and Torre, C.d.l. (2015). Relationship between R&D and firm value. *R&D Management*. 45(5), 515-526.
- Pinkowitz, L., Stulz, R. and Williamson, R. (2006). Does the contribution of corporate cash holdings and dividends to firm value depend on governance? A cross-country analysis. *The Journal of Finance*, 61(6), 2725-2751.
- Roe, M. J. (2006). Legal origin and modern stock market. *Harvard Law Review*, 10, 460-527.
- Roe, M.J. and Siegel, J.I. (2011). Political instability: Effects on financial development, roots in the severity of economic inequality, *Journal of Comparative Economics*, 39(3), 279-309,
- Sawicki, J. (2009). Corporate governance and dividend policy in Southeast Asia pre-and post-crisis. *The European Journal of Finance*, 15(2), 211-230.
- Seifert, B., and Gonenc, H. (2018). The effects of country and firm-level governance on cash management. *Journal of International Financial Markets, Institutions & Money*, 52, 1-16.
- Skinner, D.J. and Soltes, E. (2011). What do dividends tell us about earnings quality? *Review of Accounting Studies*, 16(1), 1-28.
- Tabrizi, B. (2005). *Accelerating transformation: Process innovation in the global information technology industry*. Universal-Publishers.
- Yang, B., Chou, H. and Zhao, J. (2020). Innovation or dividend payout: Evidence from China. *International Review of Economics & Finance*. 68, 180-203.
- Wang, Q. and Zhang, F. (2020). Does increasing investment in research and development promote economic growth decoupling from carbon emission growth? An empirical analysis of BRICS countries, *Journal of Cleaner Production*, 252, 119853.
- Wang, C., Qiao, C., Ahmed, R.I. and Kirikkaleli, D. (2021). Institutional quality, bank finance and technological innovation: a way forward for fourth industrial revolution in BRICS economies. *Technological Forecasting and Social Change*, 163, 120427.

