The effect of dividend payouts on firm-level R&D

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Abstract

Previous literature has studied extensively the factors affecting R&D investment decisions and the effects of financialization on physical capital formation. This paper adds to this literature by arguing that dividend payouts have a negative effect on firm-level R&D. External financing constraints imply that firms tend to use internal funds to finance R&D investment but, due to shareholder-oriented corporate governance and the growing importance of financial performance indicators, managers often prioritize the payout of dividends over investment. To verify empirically the existence of a trade-off between dividend payouts and R&D investment, we use a dynamic two-step system GMM estimator and financial information from ORBIS for a sample of 6,787 publicly listed firms from 72 countries during the period 2010-2018. The regression results show that dividend payouts have a negative impact on firm-level R&D investment. This finding indicates that short-term shareholder value orientation undermines firm-level R&D activities and gives support for the view that stakeholders that are interested in the long-term growth of the firm should be empowered.

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Keywords: Research and development (R&D); dividends; shareholder-oriented corporate governance; financialization

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1. Introduction

It is well established that innovation and technological progress are crucial for economic growth (Schumpeter, 1934; Kaldor, 1961; Solow, 1970; Romer, 1990; Ahgion & Howitt, 1992; Pasinetti, 1993). Next to other factors –such as human and physical capital formation and internationalization–, research and development (R&D) has been identified as a key driver of innovation and technological progress (Mansfield, 1968; Bound et al., 1982; Griliches, 1986; Hall, 1996; Klette & Griliches, 2000). However, countries are prone to underinvest in R&D (Jones & Williams, 1998), which means that factors that influence R&D investment are a matter of academic and policy concern.

There is a broad consensus in the literature that external financing constraints are an important obstacle for firm-level R&D. Given its intangible nature, non-disclosure practices and uncertainty regarding the outcome of R&D projects, asymmetric information between firms and external finance providers is prevalent. Consequently, R&D investment is mainly financed with internal funds (Hall, 1992; 2002; Himmelberg & Petersen, 1994; Hubbard, 1998; Harhoff, 1998). Moreover, it is well established that shareholders try to reduce agency costs by demanding from managers to pay dividends (Jensen & Meckling, 1976; Rozeff, 1982; Easterbrook, 1984) and that the threat of hostile takeovers and modern executive pay structure align the interest of management with that of shareholders (Crotty, 1990; Lazonick & O'Sullivan, 2000). This shareholder value orientation can lead to internal financing constraints for investment because dividend payouts and investment represent competing demands on internal funds.

Previous literature also argues that internal financing constraints for investment are likely to have grown during the last four decades because of the predominance of shareholder-oriented corporate governance and the growing size and scope of financial markets –a process often referred to as financialization. As a result, managers increasingly are guided by financial performance indicators and use the cash-flow for share buybacks and dividends payouts instead of for investment activities (Lazonick & O'Sullivan, 2000; Stockhammer, 2004; Krippner, 2005; van Treeck, 2009b; Hein, 2010). This argument has been confirmed by various empirical studies that show that financialization in general, and dividend payouts in specific, have a negative effect on physical capital accumulation (Stockhammer, 2004; Orhangazi, 2008; Davis, 2017; Tori & Onaran, 2018; 2020).

On the contrary, empirical evidence on the effect of financialization and dividend payouts on R&D investment and innovation is scarce. The little existing evidence tends to find a negative effect of R&D investment and innovation (Thomas et al., 2003; Lazonick, 2007; 2010; Cleaveland, 2013; Billings et al., 2018), but is limited in the sense that only data from a small number of selected developed countries is considered. The novel contribution of this paper is to present empirical evidence for the existence of a trade-off between dividend payouts and firm-level R&D investment on a global scale. To this end, we use a dynamic two-step system GMM estimator and yearly financial information from ORBIS for a sample of 6,787 publicly listed firms from 72 countries during the period 2010-2018.

The regression results show that dividend payouts had a substantial negative effect on firm-level R&D investment during the period under study. This finding is robust throughout distinct specifications. Other robust explanatory variables of R&D investment are past investment, firm size and age, and an emerging market dummy. In line with the pecking-order model, we only find weak evidence that R&D investment is debt financed and no evidence that it is influenced by share issuance or buybacks. The main finding that dividend payouts affect R&D investment indicates that financialization and short-term shareholder value orientation not only undermine the formation of physical capital but also that of intangible capital.

The rest of this paper is structured as follows. Section 2 describes the dividend-R&D nexus and summarizes the existing literature that studies this nexus. Section 3 outlines the research design and describes the data used for analyzing whether dividend payouts affect R&D investment. Section 4 presents the regression results and analyses the main findings. Section 5 concludes.

2. The dividend–R&D nexus

According to the funds flow identity model, dividends are one element among various interacting financial decisions of a firm, and their payout reduces the amount of internal finance that is available for investment. The investment financing constraint of a firm can be expressed as follows (Dhrymes & Kurz, 1967; Partington, 1985; Stockhammer, 2004; Lee et al., 2011):

$$I = \pi - Div + EF \quad (1)$$

where I is net investment, π are profits, Div are dividends, and EF is external finance (i.e., debt and equity finance).

There exist no consensus in the theoretical literature whether dividend payouts affect investment. A strong case against the importance of dividend payments is made by the renowned Modigliani-Miller irrelevance theorems (1958; 1961), which show that internal and external finance are perfect substitutes when capital markets are efficient, and no information asymmetries exist. In this special case, investment projects will always be undertaken when they raise the market value of the firm, regardless of the firm's capital structure and dividend policy. However, dividend payouts can have a negative effect on firm-level R&D when (i) firms face external financing constraints, and (ii) dividends payouts are independent and not a residual that adjusts according to the "optimal" R&D investment level.

Regarding the first point, it is well established that market imperfections, such as asymmetric information, can impede the external evaluation of the quality of investment projects or, at least, make this evaluation costly. In this case, external and internal finance are not any longer perfect substitutes, i.e., the access to external funds is restricted when the internal ones do not suffice to finance all profitable investment projects (Fazzari et al., 1988). Besides, a firm might not be willing to issue new shares to finance profitable investment opportunities because managers act in the interest of existing shareholders. With asymmetric information, share issuance will be perceived as bad signal by market participants and thereby reduce the price of existing shares (Myers & Majluf, 1984). Accordingly, the pecking-order model predicts that the preferred finance option for investment is internal finance, the second-best option is debt finance, and the least option is equity finance (Myers, 1984).

Regarding the second point, in line with Modigliani-Miller (1961), it is often assumed that firms adjust their dividend payouts according to existing investment opportunities, in which case dividend payouts should have no effect on investment. However, it is well established that dividend payouts tend to be sticky because managers take historical dividend payout ratios and future earnings expectations as benchmark for actual payout ratios, and because they want to avoid that changes in the dividend policy lead to strong market responses (Lintner, 1956; Ha et al., 2017). Moreover, firm managers can use dividends to try to signal private information to investors and to influence share prices, at least in the short term (Miller & Rock, 1985). Another argument against the assumption that dividend payouts are a mere residual that adjusts to investment is made by the financialization theory. It is well established that shareholders try to reduce agency costs by demanding from managers to pay dividends and to finance investment with debt (Jensen & Meckling, 1976; Rozeff, 1982; Easterbrook, 1984). This alignment of the interest of managers and shareholders has contributed to the expansion of the financial sector after 1980, which has had negative effects on the economic system, the behaviour of nonfinancial agents, the distribution of profits and capital accumulation (Krippner, 2005; Epstein, 2005; Palley, 2013).

An outcome of this financialisation process was that shareholders started to impose a 'financial norm' on managers to distribute profits or to buy back shares instead of reinvesting them. Both phenomena mean that managers have less cash flow available for investment. Moreover, financialization changed the way managers and shareholders face their agency problems because executive pay structures and the threat of hostile takeovers also aligned the interest of managers and shareholders (Crotty, 1990; Lazonick & O'Sullivan, 2000; Stockhammer, 2004; van Treeck, 2009a; Fasianos et al., 2018). The overall outcome is that shareholder-oriented managers have little incentives to reduce dividend payouts to finance profitable investment opportunities.

When firms do not have a residual dividend payout policy though, even small cost differentials between external and internal finance can reduce investment (Fazzari et al., 1988). This insight that dividend payouts are not irrelevant for investment is not recent but was first formulized by Dhrymes & Kurtz (1967), which show that "dividend disbursals and investment outlays represent competing demands on the resources available to the firm; thus … investment activities of the firm will be affected by its dividend activities; postponement or curtailment of investment could conceivably result because of inability of the firm to carry out a given investment program, "optimally" determined by some "rational" criteria, and at the same time continue to make "satisfactory" dividend payments" (435).

In line with the argumentation from above, many empirical studies show that financialization in general, and dividend payouts in specific, have a negative effect on physical capital accumulation (see e.g., Dhrymes & Kurtz, 1967; McCabe, 1979; Stockhammer, 2004; Davis, 2017; Tori & Onaran, 2018; 2020). However, despite the importance of R&D for technological progress and the similarities that exist in the investment decision process of R&D and physical capital (Hall & Hayashi, 1989), little empirical evidence exists that verifies if financialization and dividend payouts also affect R&D investment. Typically, the empirical literature that studies the relationship between corporate governance and R&D investment analyzes the effect of owner identity (e.g., Munari et al., 2010), ownership concentration (e.g., Tribo et al., 2007), compensation schemes (e.g., Coles et al., 2006), power separation (Driver & Coelho Guedes, 2012), anti-takeover devices, voting rights restrictions, shareholder's consensus at the general assembly and the presence of performance based remuneration schemes (e.g. Honoré et al., 2015).

The limited empirical evidence on the effect of financialization and dividend payouts is especially surprising when one considers that R&D is a major contributor to information asymmetry, financial constraints, and insider gains (Hall, 1992; Aboody & Lev, 2002). R&D is often a long-term investment whose outcome and return are uncertain and that produces an intangible capital stock that is often embedded in the knowledge of workers (who can leave the firm). This means that it provides few collateral assets. Moreover, lenders have difficulties to assess the (re-)payment capabilities of firms because information asymmetry often is high. Besides, firms themselves have reduced knowledge about the projects' likelihood of success, and often they are not willing to reveal many details to outsiders since confidentiality is vital for innovation (; 2002; Hao & Jaffe, 1993; Himmelberg & Petersen, 1994; Hubbard, 1998; Harhoff, 1998; Hall & Lerner, 2009; Brown & Peterson, 2011).

The empirical evidence on the effects of dividend payouts is limited to few developed countries and tends to suggest that dividend payouts have a negative effect on R&D investment. With regard to the effects of financialization on R&D, Lazonick (2007; 2010) presents evidence that from 1980 onwards US firms distributed enormous amounts of funds to their shareholders –mainly via large scale stock buybacks but also via dividend payouts– and argues that this change from a "retain-and-reinvest" to a "downsize-and-distribute" corporate governance regime came at the expense of investment in R&D and innovation.

Some related research shows that managers reduce R&D investment to meet the earnings expectations of short-term oriented transient shareholders (Bushee, 1998) or when CEOs have short-term concerns about the price of their stocks or options (Edmans et al., 2017). Hahn (2017), on the contrary, relies on interviews with a small representative sample of innovating German firms and does not find much evidence that pressure from shareholders affects R&D investment but rather strategic management decisions at the firm level.

Another strand of research studies the effect of changes in dividend taxes on R&D. More specifically, Thomas et al. (2003) examine the effect of dividend payouts and taxation on firm-level R&D spending, considering Worldscope data from 6 OECD countries (Canada, France, Germany, Japan, UK and USA) between 1993 and 1997. They find that dividend payouts reduce R&D investment, and that this effect becomes stronger when countries offer dividend encouraging imputation credits. Their results furthermore show that the negative effect of dividend payouts on R&D investment is not altered by the existence of R&D tax credits. Cleaveland (2013) presents similar results for Australia and New Zealand, using Worldscope and hand-selected firm-level data for the period 1982 to 1993. She finds that dividend paying firms increased their payouts when tax incentives for dividend payments were introduced, and that this increase in dividend payments reduced R&D investment in both countries. Billings et al. (2018), on the other hand, study in how far the lowering of dividend taxes in the US Jobs and Growth Tax Relief Reconciliation Act affected firm-level R&D spending in the USA. In line with the other two studies, they find that the lowering of dividend taxes induced higher dividend payouts, which in turn led to a decline of R&D investment.

Finally, some research for the USA is not interested directly on the effects of dividend payments on R&D but separates their samples in high and low dividend paying firms. Fama & French (2001) find that that R&D intensive US firms tend to have lower dividend payouts than other firms. Brown et al. (2011), on the other hand, presents evidence that cash flow and cash holdings only have a positive effect on R&D investment in US firms that do not pay dividends, while their effect is insignificant in US firms that have positive dividend payout ratios. They interpret this result as indication that dividend paying firms face less external financial constraints. Finally, Sheikh (2022) shows that US firms that have a low profitability and high cash flow volatility powerful CEOs are more likely to pay high dividends because they want to improve their reputation in capital markets to improve their access to external finance. His regression results suggest that R&D investment competes with dividend payments.

The remainder of this paper aims to add to this literature by presenting new empirical evidence for the potential existence of a trade-off between dividend payouts and firm-level R&D investment on a global scale.

3. Research Design

In line with (1), the baseline regression model that is used to verify empirically the existence of a trade-off between dividend payouts and R&D investment is as follows:

$$R\&D_{it} = \beta_0 + \beta_1 EBIT_{it-1} + \beta_2 Div_{it-1} + \beta_3 \Delta Debt_{it-1} + \beta_4 \Delta Equity_{it-1} + \vartheta_{st} + \varepsilon_{it} \quad (2)$$

where i are firms, t are years, $R\&D$ is the ratio of R&D investment to total assets, $EBIT$ is the ratio of earnings before interest and taxes to total assets (to control for profits)[1], Div is the ratio of dividend payouts to total assets, $\Delta Debt$ is the ratio of the change in liabilities to total assets (to control for debt financing), and $\Delta Equity$ is the ratio of the market value of the change in outstanding shares to total assets (to control for equity financing and share buybacks), ϑ is a dummy variable that interacts a time (t) with a sector (s) dummy (to account for unexplained heterogeneity across sectors that varies over time), and ε is an error term. The variables are normalized by assets to have a common reference scale and to make different sized firms comparable, while a one-year lag is used to reflect the planning of investment decisions and to reduce potential reverse causality.

To ensure the robustness of the results, additional regressions control for the logarithm of total assets ($Size$) and of the age of the firms (Age), an emerging market dummy ($Emerging$), the ratio of market capitalization plus total liabilities to total assets plus total liabilities (Tobin's Q), the ratio of total liabilities to total assets ($Liabilites$) and the interest rate coverage ratio ($IntCov$). We choose these control varialbes, given that it is well established that R&D intensity is related with firm size (Cohen et al., 1987; Shefer & Frenkel,

[1] The main results are robust when, instead of $EBIT$, the cash-flow-to-asset ratio is used as proxy for profits.

2005; Govindarajan et al., 2019) and age (Czarnitzki & Kraft, 2004; Fan & Wang, 2021), and that firms in emerging markets tend to undertake less R&D (Lederman & Maloney, 2003; Tudor & Sova, 2022). Moreover, exernal finance constraints for investment can be expected to be smaller in larger and mature firms because they have audited financial statements, they possess more tangible assets that serve as collateral and they demand higher credit volumes, which reduces the unit cost of banks that are associated with screening, contracting, monitoring and repayment (Colombo et al., 2013).

In addition, Tobin (1969) and Hayashi (1982) show that a high ratio of a firm's market value to the replacement cost of its capital stock can stimulate physical investment due to a high expected profitability of new investment; a similar mecanism can also be expected for intangible investment (Peters & Taylor, 2017). Interest payments and indebtedness, on the other hand, reduce the available cash flow for investment and can influence the access to finance (Fazzari & Mott, 1987; Ndikumana, 1999).

In line with previous studies (e.g., Brown et al., 2011; Tori & Onaran, 2018; 2020), all regressions are estimated using a dynamic GMM estimator to avoid potential endogeneity, measurement and contemporaneous collinearity issues (Arellano & Bover, 1995; Blundell & Bond, 1998). Besides, the GMM estimator is especially efficient for panels with large N and small T, such as ours, and permits to capture the well-established persistence of investment and the inclusion of time and time-industry dummies (allowing different intercepts for these units of observations). More specifically, we employ a two-step system GMM estimator, which uses lagged differences as instruments for the equation in levels and the moment conditions of lagged levels as instruments for the differenced equation. Please note that $R\&D$, $EBIT$, Div, $Debt$, $Equity$, Q, $Liabilites$ and $Interest$ are treated as endogenous variables and entered into the instrument matrix with two lags and longer, while Age, $Size$, $Emerging$ and the industry-time dummy are treated as exogenous. The instrument sets are collapsed and the lags are restricted to a maximum of four periods to avoid instrument proliferation (see Rodman, 2009). To check the validity of the instruments the Hansen (1982) tests of overidentifying restrictions is employed, while the Arellano & Bond (1991) autocorrelation test is used to verify the assumption of no serial correlation in the residuals. To obtain robust standard errors, the Windmeijer (2005) finite sample correction is used.

All data are obtained from the ORBIS database, which provides harmonized financial firm-level data on a global scale and has a much broader coverage than similar databases (such as Compustat). In Orbis firms are organized according to the statistical classification of the European Community economic activities (NACE Rev. 2) that comprises 19 industries at the one-digit and 88 divisions at the two-digit level. We only consider firms from five industries though because these constitute approximately 98% of the R&D expenditure of the whole ORBIS sample. Moreover, to have a more balanced dataset, we only include medium sized and large firms (with assets > US$10 million) that are listed at the stock market and for which R&D investment data in at least three consecutive years is available. To avoid biased estimations, we exclude extreme outliers from the sample (i.e., 18 firms that report variable to asset ratios above/below 100 or have negative sales values).[2] The resulting sample comprises 6,787 firms from 72 countries during the period 2010-2018. Most of these firms are located in developed countries (88.4%) and engage in the manufacturing sector (77.5%). The second largest industry is information and communication (11.0%), while only relatively few of the sample firms are active in wholesale and retail (4.6%), professional, scientific & technical activities (4.4%) and mining and quarrying (2.5%) (see Table A2 in the Appendix for more sample details).

Table 1 summarizes the descriptive statistics of the sample. The mean R&D to asset ratio is 5.3%, while the mean dividend payout to asset ratio is 2.2%. The median of both variables is substantially lower, with respective values of 1.7% and 0.7%. Both values are equivalent to one-third of the mean value and imply that the sample firms show substantial heterogeneity in terms of R&D investment and dividend payouts. The median profit to asset ratio (4.9%), on the contrary, is much higher than the mean ratio (0.2%) because 23.5% of the firm-year observations report a loss. Regarding access to external finance, the average liability-to-asset ratio is nearly constant, while the average ratio of the market value of the change in outstanding shares to total assets is 5.7%. The latter does not mean though that most firm-year observations report a change in outstanding shares: during the period of study only 36% of the firm-year observations issue new ones and 9.6% bought back shares. The respective

[2] See Kalemli-Ozcan et al. (2015) for further details how to construct a representative firm-level sample with ORBIS data. Please note that dropping out firms that do not report R&D does not lead to selection bias because non-reporting is unrelated to the amount of R&D investment and dividend payouts.

mean and median Q ratios of 1.3 and 0.8 indicate that for most firms of the sample new investment would not be very profitable but that in some cases it should have a high profitability. Finally, the mean liability-to-asset (47%) and interest coverage (6.6) ratios show that most sample firms are financially healthy and that interest obligations are not a large constraint on their available cash flow.

Table 1: Descriptive Statistics

	Obs.	Mean	Median	Std. Dev.	Min	Max
$\boldsymbol{R\&D_{it}}$	55,821	0.0529	0.0167	0.1556	0.0000	12.8134
$\boldsymbol{Div_{it}}$	54,408	0.0217	0.0069	0.1839	0.0000	32.0843
$\boldsymbol{EBIT_{it}}$	56,281	0.0017	0.0490	0.5444	-69.8163	10.6965
$\boldsymbol{\Delta Debt_{it}}$	49,433	-0.0007	0.0053	0.5137	-66.8800	25.2062
$\boldsymbol{\Delta Equity_{it}}$	48,079	0.0569	0.0000	0.7246	-93.9778	84.4937
$\boldsymbol{Age_{it}}$	56,282	3.3640	3.3673	0.8452	0.0000	6.4831
$\boldsymbol{Size_{it}}$	56,282	12.6799	12.4281	2.0259	1.1787	20.0781
$\boldsymbol{Q_{it}}$	55,007	1.2609	0.8234	1.5492	0.0436	95.7759
$\boldsymbol{Liabilites_{it}}$	56,281	0.4747	0.4455	0.6795	0.0000	94.7845
$\boldsymbol{IntCov_{it}}$	50,613	6.6078	9.0000	3.9513	0.0000	10.0000

Note: This table shows the descriptive statistics of the sample.

4. Results

Table 3 presents the baseline regression results. In line with the theoretical framework, the results indicate that dividend payouts crowd-out R&D investment. Regressions (i) – (iv) show that the negative effect of dividend payouts on R&D investment is robust when no control variables are considered and when one controls for profits, external finance, and firm size and age (i.e., in all specifications the dividend coefficient is significant at least at the

5%-level). The Wald χ^2 test shows that in all specifications the included variables are jointly significant, while the Hansen J statistics indicates that the instrument set is coherent. Furthermore, the z statistic for the Arellano-Bond AR(2) tests shows no evident misspecification in terms of autocorrelation.

Table 2: Baseline Regression Results

	(i)	***(ii)***	***(iii)***	***(iv)***
$\boldsymbol{R\&D_{it-1}}$	**0.3376***** [0.0492]	**0.3481***** [0.0642]	**0.4174***** [0.0925]	**0.4119***** [0.0928]
$\boldsymbol{Div_{it-1}}$	**-0.0442**** [0.0178]	**-0.0435**** [0.0172]	**-0.0681***** [0.0232]	**-0.0689***** [0.0232]
$\boldsymbol{EBIT_{it-1}}$		0.0156 [0.0230]	0.0007 [0.0025]	-0.0000 [0.0025]
$\boldsymbol{\Delta Debt_{it-1}}$			0.0019 [0.0016]	**0.0027*** [0.0014]
$\boldsymbol{\Delta Equity_{it-1}}$			0.0004 [0.0017]	-0.0001 [0.0015]
$\boldsymbol{Age_{it}}$				**-0.0153***** [0.0025]
$\boldsymbol{Size_{it}}$				**-0.0049***** [0.0008]
Wald χ^2	4,416***	4,234***	5,919***	7,012***
Hansen J	3.03	10.94	23.08	18.78
AR(2) z	-0.67	-0.68	-0.13	-0.15
Instruments	43	48	54	56
Observations	47,438	47,438	39,692	39,692
Firms (Periods)	6,787 (8)	6,787 (8)	6,757 (7)	6,757 (7)

*Note: This table summarizes the baseline regression results that show the effect of dividend payouts (Div) on R&D investment during 1995-2018, using system GMM estimators (see Section 3 for details). In each column coefficients and robust standard errors (in parenthesis) are reported. An unreported dummy variable that interacts a time with a sector dummy and a constant are included in all regressions. The significance of a coefficient or test statistic at the 1%, 5% and 10% level of significance is indicated by ***, ** and *, respectively.*

According to the full baseline regression (iv), a 10 percentage point increase in the dividend payout-to-asset ratio decreases the R&D investment-to-asset ratio by 0.69 percentage points, ceteris paribus. This value seems reasonable and is economic meaningful, considering that the average (median) R&D investment-to-asset ratio of the sample is 5.3% (1.7%). To put it differently, a 10% percentage point increase in the dividend payout reduces

R&D by an amount that is equivalent to 13% (41%) of the R&D investment ratio of a typical firm in our sample. Please note that the values of the dividend coefficient that are presented in Table 2 are relatively similar but below that found by Thomas et al. (2003) and Billings et al. (2018): they report coefficient values of -0.16 and -0.35 in their respective country studies. Although the results from these studies are not directly comparable with ours, due to distinct research designs, they suggest that the results from Table 2 do not overstate the effect of dividend payments on R&D investment.

Regarding the control variables, profits and the change in outstanding shares are insignificant (i.e., their p-value is > 0.5 in all regressions), with a coefficient that is close to cero. External debt finance, on the other hand, is significant at the 10%-level in regression (iv); but its coefficient value is very small, implying that a 10% increase in debt leads to a 0.03% increase in R&D investment. The insignificance of share issuances and the weak significance of debt finance are in line with the predictions of the pecking-order model, and probably reflect the fact that financing costs for equity are higher than that for debt. In line with previous literature (Cohen et al., 1987; Czarnitzki & Kraft, 2004; Shefer & Frenkel, 2005; Fan & Wang, 2021), firm age and size have a significant negative impact on the R&D investment-to-asset ratio. Moreover, the results confirm that R&D investment is an intrinsically dynamic phenomenon, given that the lagged value of the dependent variable has a robust and significant positive impact.

Table 3 shows that the significant negative effect of dividend payouts is robust when one includes additional control variables, considers different samples, and changes the lag structure of the dividend payout variable. Furthermore, except for the reduced sample regression (xi), the results show that the dividend coefficient values are similar throughout the different specifications, with values ranging from -0.069 to -0.098. The first three robustness check regressions add a Tobin’s Q proxy, liabilities-to-asset and interest rate coverage ratios, and an emerging market dummy. Out of these variables, the only significant variable is the emerging market dummy, suggesting that firms in emerging markets invest less in R&D. This latter finding is in line with previous empirical evidence (e.g., Lederman & Maloney, 2003; Tudor & Sova, 2022).

Table 3: Robustness checks

	(v)	*(vi)*	*(vii)*	*(viii)*	*(xi)*	*(x)*
$R\&D_{it-1}$	**0.4141*** [0.0930]**	**0.4596*** [0.0889]**	**0.4567*** [0.0888]**	**0.4155*** [0.0901]**	**0.7098*** [0.1209]**	**0.4172*** [0.0638]**
Div_{it}						0.1801 [0.1328]
Div_{it-1}	**-0.0689***** [0.0237]	**-0.0747***** [0.0272]	**-0.0751***** [0.0270]	**-0.0976***** [0.0191]	**-0.0283***** [0.0056]	**-0.0898***** [0.0251]
Div_{it-2}						**-0.0706***** [0.0075]
$EBIT_{it-1}$	-0.0005 [0.0028]	0.0180 [0.0134]	0.0178 [0.0135]	0.0209 [0.0166]	0.0165 [0.0134]	**0.0244*** [0.0147]
$\Delta Debt_{it-1}$	**0.0028* [0.0015]**	0.0059 [0.0040]	0.0061 [0.0040]	**0.0135* [0.0071]**	-0.0024 [0.0035]	0.0045 [0.0041]
$\Delta Equity_{it-1}$	0.0001 [0.0016]	0.0005 [0.0016]	0.0004 [0.0016]	-0.0003 [0.0057]	0.0014 [0.0051]	0.0009 [0.0023]
Age_{it}	**-0.0157***** [0.0025]	**-0.0146***** [0.0023]	**-0.0142***** [0.0022]	**-0.0202***** [0.0036]	**-0.0024*** [0.0013]	**-0.0152***** [0.0017]
$Size_{it}$	**-0.0050***** [0.0008]	**-0.0049***** [0.0008]	**-0.0052***** [0.0008]	**-0.0126***** [0.0020]	**-0.0015**** [0.0008]	**-0.0056***** [0.0007]
Q_{it-1}	-0.0025 [0.0019]	-0.0017 [0.0019]	-0.0017 [0.0018]	-0.0036 [0.0033]	0.0022 [0.0047]	-0.0011 [0.0014]
$Liabilites_{it-1}$		0.0094 [0.0105]	0.0098 [0.0107]	0.0223 [0.0250]	**0.0180*** [0.0104]	0.0042 [0.0102]
$IntCov_{it-1}$		-0.0003 [0.0002]	-0.0003 [0.0002]	-0.0007 [0.0005]	-0.0002 [0.0002]	**-0.0005**** [0.0002]
$Emerging_i$			**-0.0253***** [0.0041]	**-0.0346***** [0.0063]	**-0.0118***** [0.0044]	**-0.0277***** [0.0031]
Wald χ^2	6,503***	6,290***	6,523***	3,532***	5,672***	5,672***
Hansen J	23.44	43.23*	40.46	31.38	32.22	31.11
AR(2) z	-0.15	-0.10	-0.10	-0.62	-0.20	-0.04
Instruments	61	71	72	72	72	68
Observations	39,692	39,604	39,604	14,062	3,733	37,882
Firms (Periods)	6,757 (7)	6,757 (7)	6,757 (7)	4,325 (7)	1,861 (7)	6,756 (7)

Note: This table summarizes the robustness regression results. See Table 2 notes.

To see if the non-significance of the change in outstanding shares can explained by the fact that a positive effect of share issuance is canceled out by a negative effect of share buybacks, regression (viii) only considers firm-year observations where the value of ΔEquity is positive, while regression (xi) only considers firm-year observations with a negative ΔEquity value. The results of these subsample regressions suggests that during 2011-2018 R&D investment was neither influenced positively by share issuance nor negatively by share buybacks. Finally, regression (x) verifies if the main finding is robust when dividend payouts are considered simultaneously without a lag and with one- and two-year lags.[3] The results indicate that dividend payouts do not have an immediate effect but reduce R&D investment in the following two years. Moreover, in this regression EBIT becomes significant at the 10%-level, providing some evidence for the expected result that profits influence R&D investment positively.

In sum, according to our results, the lagged value of dividend payouts, firm size, firm age, the emerging market dummy and the lagged value of R&D investment are robust explanatory variables for R&D investment. This finding indicates that financialization not only has aa negative effect on physical capital investment but also on R&D investment – please note that it is common in the literature to use dividend payouts as financialization indicator (see Davis, 2017: Table 1).

The change in outstanding shares and Tobin's Q, on the contrary, are not significant in any of the specifications, whereas the liabilities-to-asset and the interest rate coverage ratios are significant in 1 out of 5 regressions, profits in 1 out of 9 regressions, and external debt finance in 3 out of 8 regressions. Given that our sample only comprises relatively large publicly listed firms, the latter findings provide weak evidence in favor of previous findings that the investment of large companies is not very sensitive to changes in the cash flow and stock issuance, and less constrained by external finance than small companies (Harhoff, 1998; Carreira & Silva, 2010; Colombo et al., 2013; Brown & Petersen, 2011).

[3] The main finding that dividend payouts have a negative impact on firm-level R&D investment is also robust when the variables $EBIT$, Div, $\Delta Debt$ and $\Delta Equity$ are introduced simultaneously in levels and in first and second lags. The results of these specifications are available upon request.

5. Conclusions

This paper is the first that has empirically examined a potential trade-off between firm-level dividend payouts and R&D investment at a global level. The regression results indicate that such a trade-off exists and show that dividend payouts influence R&D investment to a substantial degree. This finding provides support to the theoretical arguments regarding the negative effects of financialization and shareholder-oriented corporate governance on investment and confirms previous country-level findings.

In addition to being an important contribution to the existing literature on the factors affecting R&D investment decisions and the potential negative effects of financialization, the encountered trade-off between dividend payouts and R&D investment is also of significance for public policy makers and stakeholders. Firm-level R&D activities are fundamental for innovation and technological progress, and thus also for the competitiveness and growth prospects of firms and countries alike. The current management priority to create shareholder value is thus likely to be growth reducing. This implies that stakeholders should urge for institutional changes that somewhat disincentivize the alignment of management with shareholder interests and empower other groups that have a greater interest in the long-term growth of the firm. However, changes in corporate governance structures are difficult and take time. Hence, public policy maker should not only rely on tax incentives to encourage R&D investment but also consider changing the tax code in a way that makes dividend payouts less attractive as they are currently.

Finally, it is important to mention that more research on this important topic is necessary. A limitation of existing studies (including ours) is that R&D investment is hard to measure; in part, because R&D spending frequently is not declared as such but included in salary payments etc. Future research might therefore consider corroborating our results with distinct R&D measures. Moreover, corporate governance structures can be expected to differ to some degree across countries and industries. Instead of controlling for these differences with fixed effects and time-industry dummies, as we have done, it might be worthwhile for future research to try identifying in how far specific corporate rules and governance mechanism influence the relationship between dividend payouts and R&D investment.

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Appendix

Table A1: Country information

Country	ISO Code	R&D	Dividend	Number of firms					
				B	C	G	J	M	Total
United Arab Emirates	AE	0.3%	2.7%		1				1
Antigua and Barbuda	AG	5.3%	0.6%		1				1
Argentina	AR	0.5%	2.9%	1					1
Austria	AT	3.1%	1.8%	1	22		4	1	28
Australia	AU	6.7%	2.9%	15	58	7	17	13	110
Bosnia and Herzegovina	BA	0.0%	0.1%		1				1
Bangladesh	BD	0.1%	3.8%		12				12
Belgium	BE	7.1%	2.1%	1	27		2	2	32
Bermuda	BM	2.0%	1.9%	2	75	5	14	1	97
Brazil	BR	1.8%	1.4%	4	9	1	3		17
Canada	CA	12.9%	4.8%	10	67	1	17	10	105
Switzerland	CH	6.0%	3.5%		73	3	4	1	81
China	CN	2.1%	1.5%	7	46	2	6	4	65
Colombia	CO	0.6%	4.7%		1				1
Curaçao	CW	1.5%	3.1%	1	1				2
Germany	DE	5.6%	2.0%	1	146	10	33	6	196
Denmark	DK	8.9%	3.4%		25	1	4	2	32
Egypt	EG	1.2%	3.0%		2				2
Spain	ES	1.8%	1.6%	2	14	1	4	1	22
Finland	FI	3.9%	3.7%		47		14	1	62
France	FR	5.7%	1.3%	3	103	4	24	5	139
United Kingdom	GB	7.3%	2.3%	8	152	7	37	18	222
Greece	GR	1.3%	0.3%	1	21	5	7		34
Hong Kong	HK	1.6%	1.1%	1	23	1	2	1	28
Hungary	HU	5.1%	1.8%		1				1
Indonesia	ID	0.7%	1.9%	1	31	3	4	1	40
Ireland	IE	5.6%	1.8%		21	1	1	1	24
Israel	IL	7.9%	2.4%	2	67	5	18	8	100
India	IN	0.7%	2.2%	10	299	16	19	8	352
Iraq	IQ	0.4%	5.0%		4		1		5
Islamic Republic of Iran	IR	0.1%	9.4%		17				17
Iceland	IS	3.1%	0.7%		2				2
Italy	IT	3.3%	1.5%	2	24		3		29
Jordan	JO	0.5%	1.4%	1	8				9
Japan	JP	2.3%	1.2%	7	1261	93	179	53	1,594

Republic of Korea	KR	1.6%	0.0%		125	2	16	3	146
Cayman Islands	KY	2.9%	2.1%	8	267	22	51	15	363
Kazakhstan	KZ	0.5%	0.2%			1			1
Sri Lanka	LK	0.0%	2.0%		5	2			7
Luxembourg	LU	0.9%	1.6%		9	1	1		11
Latvia	LV	0.1%	0.9%		1				1
North Macedonia	MK	0.5%	0.1%		1				1
Mexico	MX	1.6%	3.8%	1	1				2
Malaysia	MY	0.8%	3.2%		43	5	5		53
Nigeria	NG	0.6%	2.0%	1	2			1	4
Netherlands	NL	6.5%	1.8%	1	29	1	2	6	39
Norway	NO	3.0%	2.7%	7	9		2	1	19
New Zealand	NZ	10.0%	2.8%		9	1	2		12
Oman	OM	0.4%	2.9%		1				1
Peru	PE	0.9%	0.2%	2					2
Philippines	PH	0.3%	2.9%	3	10		3		16
Pakistan	PK	0.1%	2.8%	2	18		2		22
Poland	PL	4.8%	0.5%	1	3				4
Palestinian Territories	PS	0.5%	3.3%		2		1		3
Portugal	PT	1.5%	2.2%	1	1	1	1		4
Romania	RO	0.0%	0.2%		3				3
Serbia	RS	0.0%	0.3%		1				1
Russian Federation	RU	0.3%	0.8%	5	12				17
Saudi Arabia	SA	0.4%	3.9%		7				7
Sweden	SE	8.2%	2.9%	2	74	2	8	7	93
Singapore	SG	2.1%	1.7%		30		5	2	37
Slovenia	SI	11.2%	1.8%		1		1		2
Slovakia	SK	0.6%	15.2%		1				1
Thailand	TH	2.7%	5.0%		2				2
Tunisia	TN	0.1%	0.8%		3	1	1	1	6
Turkey	TR	0.6%	1.1%	1	65	3	4		73
Taiwan	TW	3.8%	3.3%	2	1,087	79	36	18	1,222
Ukraine	UA	4.0%	0.1%		1				1
United States of America	US	15.5%	2.2%	46	752	21	183	103	1,105
Virgin Islands	VG	4.0%	0.6%	2	7		1	1	11
Vietnam	VN	0.5%	4.1%		3	1			4
South Africa	ZA	0.3%	6.9%	5	16	2	5	1	29

Note: R&D and Dividends are the mean ratios of R&D and dividend payouts relative to total assets respectively. B: Mining and quarrying, C: Manufacturing, G: Wholesale and retail trade, J: Information and communication, M: Professional, scientific and technical activities.