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R&D Investments and Dividend Policies: Reputation or Flexibility?

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Abstract

We examine whether the reputation effect hypothesis is empirically valid for the dividend behavior of firms in an economy with moderate corporate governance pressures. We take the Japanese economy during the 2000s and early 2010s as a sort of case study. We obtain the following two empirical findings. First, the relationship between the R&D intensity and dividend payouts is inverse U-shaped. Second, for firms with extra cash, the R&D intensity is positively associated with the dividend payouts, and for firms with positive net debt the R&D intensity is less positively associated with the dividend payouts. These results are consistent with the contingency versions of the reputation effect hypothesis.

Key words: dividends, R&D, reputation, financial flexibility, and governance.

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Abstract

We examine whether the reputation effect hypothesis is empirically valid for the dividend behavior of firms in an economy with moderate corporate governance pressures. We take the Japanese economy during the 2000s and early 2010s as a sort of case study. We obtain the following two empirical findings. First, the relationship between the R&D intensity and dividend payouts is inverse U-shaped. Second, for firms with extra cash, the R&D intensity is positively associated with the dividend payouts, and for firms with positive net debt the R&D intensity is less positively associated with the dividend payouts. These results are consistent with the contingency versions of the reputation effect hypothesis.

1. Introduction

Recent literature on the relationship between R&D investments and dividend policies provides empirical evidence consistent with the financial flexibility hypothesis. Namely, R&D-intensive firms tend to reduce dividend payouts and increase cash holdings (Hoberg et al. (2014), Lee et al. (2011), Chaya ns Suh (2009), Pinkowitz, Stulz and R. Williamson (2006), and Fama and French (2001)). Since R&D-intensive firms are likely to be subject to severe information asymmetries, it is often difficult for these firms to rely on outside financing. Thus, R&D-intensive firms tend to reduce dividends and maintain high cash holdings or financial flexibility.

The financial flexibility hypothesis implicitly assumes that managers are under governance pressures to pay out extra cash in the future because of proper incentives or monitoring provided for managers (DeAngelo, DeAngelo and Skinner (2008)). Therefore, even though managers preserve some cash, shareholders are confident that they will receive the amount of payouts which is equivalent to the present value of preserved cash and reinvested R&D and other projects.

However, if well-functioning corporate governance has not been installed in firms, managers may not have any incentive to pay out extra cash to shareholders at any time. The reputation effect hypothesis, which we focus on in this paper, argues that managers in firms with weak corporate governance still have an incentive to pay out because managers want to build good reputation in the capital markets (Lambrecht and Myers (2012), DeAngelo and DeAngelo (2007), La Porta et al. (2000), Myers (2000), and Zwiebel (1996)). If managers are successful at building the reputation that they treat investors fairly, managers may be able to raise additional funds relatively easily or to prevent hostile investors from taking over their firms. R&D investments tend to require consistent cash outflows for multiple years, implying the need to raise additional funds. In addition, R&D-intensive firms are likely to be a target of takeovers.[1] Therefore, even

[1] Berstein (2015), Fang et al. (2014) and Atanassov (2013) show evidence that R&D-intensive firms are likely to be a target of hostile takeovers.

under weak governance pressures, R&D-intensive firms may decide to pay higher dividends than other firms.

In this paper we explore whether the reputation effect hypothesis is empirically valid for an economy with relatively weak corporate governance. We take the Japanese economy during the 2000s and early 2010s as a sort of case study. During this period, Japanese firms had insider-dominated boards, and most Japanese firms did not have any independent directors in the boards. Mutual shareholdings among firms were still widely observed, and the governance roles once played by the main bank became obscure due to the weakened banking sector in Japan.[2] Thus, we characterize the Japanese economy and firms during this period with moderate governance pressures on managers.

In order to examine whether the reputation effect hypothesis is a valid description for the dividend behavior of the Japanese firms, we run the regressions of the dividend payout on the R&D intensity and various control variables. Our main findings are based on the Tobit regressions and panel regressions with fixed effects. In addition, we use the Instrumental Variable approach in order to take into consideration endogenity issues related to R&D investments.

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[2] Miyajima and Hoda (2012) review the ownership structure of Japanese firms in the 1990s and 2000s. Saito and Odagiri (2008) discuss the characteristics of the boards for Japanese firms.

In this paper we show the following two major empirical findings. First, the relationship between the R&D intensity (proxied by the ratio of R&D expenditures to total sales) and dividend payouts is inverse U-shaped. For lower R&D intensity, the R&D intensity is positively associated with the dividend payouts. This result is consistent with the reputation effect hypothesis. However, for higher R&D intensity, the R&D intensity is negatively (less positively) associated with the dividend payouts. We interpret this latter finding as indicating that very high R&D intensity is favorably received by shareholders as a sign of the managers' commitment on strengthening the firms' competitiveness, thereby allowing the managers to reduce dividends payouts.

Second, for firms with extra cash (net debt <0), the R&D intensity is positively associated with the dividend payouts, and for firms with positive net debt the R&D intensity is less positively associated with the dividend payouts. While the presence of extra cash allows managers to have larger discretion leading to weaker governance pressures, the positive net debt limits the degree of managers' discretion and increase governance pressures (Jensen (1986) and Jensen (1993)). Therefore, the reputation effect hypothesis predicts that the positive relationship between the R&D intensity and dividend payouts is stronger for firms with extra cash (firms with weaker governance pressures) and is weaker for firms with positive net debt (firms with stronger governance pressures). Our findings are consistent with this prediction.

This paper makes the following three contributions to previous literature. First, this paper provides the empirical evidence consistent with the reputation effect hypothesis in the context of the relationship between the R&D investments and dividend policies. Past literature repeatedly finds that the R&D intensity is negatively associated with dividend payouts, which is consistent with the financial flexibility hypothesis (Hoberg et al. (2014), Lee et al. (2011), and Fama and French (2001). However, as our evidence from the Japanese economy indicates, under moderate corporate governance pressures the R&D intensity turns out to be positively associated with dividend payouts. This finding is novel in the literature.

Second, our empirical results shed some light on the reasons why firms in the countries with poor investor protection pay dividends (La Porta et al. (2000) and Claessens et al. (2000)). In the countries with poor investor protection and weak corporate governance, managers still have an incentive to pay out to shareholders in order to build the good reputation in the capital markets. The reputation, once established among investors, helps the managers to raise additional funds in the future or to avoid becoming a target of hostile takeovers.

Third, the results in this paper suggest that the economy with weak corporate governance incurs additional costs related to the R&D investments and the growth of the economy. There are many studies about the link between financial markets and R&D activities (Brown and Petersen (2011), Brown, Fazzari, and Petersen (2009) and Hall (2002)). In this paper, we highlight the importance of dividend payout as managers' commitment device. If there are not enough governance pressures on managers in the economy, dividend payouts must come at the front to secure continual R&D investments. This "payouts at the front" tends to limit the internal funds available to the firms, thus possibly leading to under-investments in R&D projects. In turn, the under-investments in R&D projects are likely to disturb the growth of the economy as a whole.

This paper is structured as follows. Section 2 explains the hypotheses to be tested in this paper. Section 3 explains the data and variables. Section 4 reports the empirical results. Finally, Section 5 concludes this paper.

2. Hypotheses

Firms invest in R&D projects to expand their growth opportunities, and R&D investments are strategically important to build the competitive advantage of firms and to enhance firm value. However, R&D-intensive firms are likely to be subject to severe information asymmetries between the firms and outside investors, leading to high costs of outside financing.[3] Therefore, R&D-intensive firms tend to hold relatively large cash holdings in order to secure sources of funding for continual high R&D investments, compared with other firms.[4] Reflecting R&D-intensive firms' need to preserve internal funds, R&D-intensive firms are likely to reduce dividend payouts (Hoberg et al. (2014), Lee et al. (2011) and Fama and French (2001)). Thus, the financial flexibility hypothesis is stated as follows.

Financial Flexibility Hypothesis

H1: The R&D intensity is negatively associated with the dividend payout.

The reputation effect hypothesis argues that managers pay dividends in order to build the good reputation in the capital markets. If managers are successful at building the reputation that they treat investors fairly, managers may be able to raise additional funds easily or to prevent hostile investors from taking over their firms ((Lambrecht and

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[3] Refre to Benmelech and Bergman (2009), Hall (2002), Titman and Wessels (1988), and Myers and Majluf (1984).

[4] Refer to Brown and Petersen (2011), Bate, Kahle and Stulz (2009), Gamba and Triantis (2008), and DeAngelo and DeAngelo (2007).

Myers (2012), DeAngelo and DeAngelo (2007), La Porta et al. (2000), Myers (2000), and Zwiebel (1996)). R&D investments tend to require consistent expenditures for multiple years, implying the high likelihood to raise additional funds in the future. In addition, R&D-intensive firms have higher possibility to be a target of takeovers than others (Bernstein (2015) and Fang et al. (2014)). Thus, R&D-intensive firms may decide to pay higher dividends than other firms. This argument leads to the following hypothesis:

Reputation Effect Hypothesis

H2: The R&D intensity is positively associated with the dividend payout.

We empirically examine which hypothesis is consistent with the dividend behavior of Japanese firms in the net effect. We also consider the possible contingency-nature of these hypotheses. That is, while for some firms the reputation effect hypothesis is more relevant, the financial flexibility hypothesis is more appropriate for other firms. First, if investors view very high R&D intensity as managers' commitment to enhance the firm value, investors may be tolerant to accept low dividend payouts instead of keeping high dividends to build the investor reputation.

Second, while the presence of extra cash leads to weaker governance pressures through larger managerial discretion, the positive net debt increases governance pressures (Jensen (1986)). This implies that the relationship between the R&D intensity and dividend payouts is positive for firms with extra cash but could be negative (less positive) for firms with positive net debt. Thus, we draw the following additional hypotheses.

Contingency Versions of the Reputation Effect Hypothesis

H3: For lower R&D intensity, the R&D intensity is positively associated with the dividend payout, and for higher R&D intensity the R&D intensity is negatively (less positively) associated with the dividend payout.

H4: For firms with extra cash, the R&D intensity is positively associated with the dividend payout, and for firms with positive net debt the R&D intensity is negatively (less positively) associated with the dividend payout.

3. Data and Variables

Our sample is drawn from Astra Manager compiled by QUICK Inc. and includes all manufacturing firms listed on the Tokyo Stock Exchange. The sample period ranges from 2000 to 2013, covering 14 years. We focus on firms operating in the manufacturing industries because R&D investments are important for the manufacturing industries. The IPO firms are included in our sample after the IPOs, and the information of delisted firms is included up to the time of delisting. Thus, we use the unbalanced panel data.

In order to examine which hypothesis (the financial flexibility hypothesis or the reputation effect hypothesis) is a valid description for the dividend behavior of the Japanese firms, we run the regressions of the dividend payout on the R&D intensity and various control variables. The empirical results are based on the Tobit regressions and panel regressions with fixed effects. In addition, we use the Instrumental Variable approach in order to take into consideration endogenity issues related to R&D investments.

In our regression the dependent variable is the ratio of the dividend to total sales and is denoted by DIV_S. The variable of our focus is the R&D intensity measured by the ratio of the R&D expenditures to total sales, denoted by RD_S. Following the past studies (Lee et al. (2011), Chaya and Suh (2009), DeAngelo et al. (2006), and Fama and French (2001)), we include several control variables (fixed asset ratio, market-to-book ratio of equity, cash flow ratio, interest coverage ratio, retained earnings ratio, and firm size). The detailed definitions of these variables are shown in Table 1. For DIV_S and RD_S we trim these variable at the highest 2% to remove outliers. For other variables we trim at the lowest 2% and highest 2% as outliers.

Table 2 reports the fractions of dividend-paying firm-year observations by industry in our sample. The industry classification is based on that of Nikkei Inc. The petroleum industry shows the highest fraction of dividend payers (91.2%) among all manufacturing industries. The textile industry shows the lowest fraction of dividend payers (73.6%). The fraction of dividend payers across all manufacturing industries is equal to 81.9%, indicating that dividends are still important channels for Japanese firms to pay out.[5]

[Insert Tables 1 and 2 about here.]

[5] Denis and Osobov (2008) report that for the US firms the fraction of dividend payers is about 20 % in 2002.

4. Empirical Results

4.1. Univariate Analysis

Table 3 shows the basic statistics of our main variables. Table 4 reports the basic statistics of the dividend ratio (DIV_S) by industry. According to Table 4, the chemical, pharmaceutical and machinery industries, which are highly R&D-intensive, exhibit relatively high dividend ratio in terms of the mean and median. Table 5 reports the movement of the dividend ratio for the period from 2000 to 2013. The mean dividend ratio gradually increases till 2008 and declines in 2009 and 2010 possibly due to the global financial crisis. After 2010 the dividend ratio starts to increase again.

[Insert Tables 3-5 about here.]

Table 6 reports the mean and median of individual variables for each of the quantile groups based on the dividend ratio (DIV_S). In the column under ”0” (leftmost column), we report the mean and median of individual variables for the firms that do not pay any dividends. The rightmost three columns report p-values for testing the differences in the mean and median between the highest quantile and non-dividend payers, the highest and lowest quantiles, and the highest and second highest quantiles, respectively.

According to Table 6, the R&D intensity (RD_S) increases with the dividend ratio (DIV_S). That is, the R&D intensity is positively associated with the dividend ratio in this univariate setting. For the R&D intensity, the differences in the mean and median are significant at the 1 % level for all tested pairs of portfolios as shown in the rightmost three columns. These results are consistent with the reputation effect hypothesis and inconsistent with the financial flexibility hypothesis. In addition, the market-to-book ratio of equity (MV_BV) also increases with the dividend ratio. Put in another way, the growth opportunities are positively associated with the dividend ratio in the univariate setting. This is also consistent with the reputation effect hypothesis.

In order to examine the impact of extra cash holdings on the relation between the R&D intensity and dividends, we divide the sample firm-year observations into two categories. The first category includes the firm-year observations with the extra cash holdings (cash holdings > total debt) and the second category includes the firm-year observations with positive net debt (cash holdings < total debt). Then for each category, we sort dividend-paying firm-year observations into the five quantile groups according to the R&D intensity (RD_S) and calculate the mean and median dividend ratios (DIV_S) for each of the quantile groups as well as the group of firm-years with no dividends.

The upper panel in Table 7 shows that when firms have extra cash holdings (cash holdings > total debt), the R&D intensity is positively associated with the dividend ratio. By contrast, the lower panel in Table 7 shows that there is a non-linear relation between the R&D intensity and the dividend ratio. That is, when firms have positive net debt (cash holdings < total debt), the R&D intensity is positively associated with the dividend ratio up to the fourth quantile but the dividend ratio declines in the highest R&D-intensity quantile. Further, the dividend ratios of the firms with extra cash are significantly higher than the dividend ratios of the firms with positive net debt for the non-dividend group and each of quantile groups. These results are consistent with the contingency versions of the reputation effect hypothesis, H3 and H4.

Finally, Table 8 reports the correlation matrix among our main variables. The correlation between the R&D intensity (RD_S) and dividend ratio (DIV_S) is positive, 0.271. This is in a sharp contrast with other studies (Hoberg et al. (2014) and Fama and French (2001)) which report the negative correlation between the R&D intensity and the dividend. The market-to-book ratio of equity (MV_BV) is positively correlated with

DIV_S. The fixed asset ratio (F_A) is negatively correlated with DIV_S. The cash flow ratio (CF_A), retained earnings ratio (RE_K) and interest coverage ratio (INTE_CO) are all positively correlated with DIV_S.

[Insert Tables 7 and 8 about here.]

4.2. Multivariate Analysis

We run the following Tobit regression of the dividend ratio on the R&D intensity and other variables.

$$\mathrm{DIV\_S}_{j,t} = \beta_1 \mathrm{RD\_S}_{j,t-1} + \beta_2 \mathrm{RD\_S}^2_{j,t-1} + \beta_3 \mathrm{F\_A}_{j,t-1} + \beta_4 \mathrm{MV\_BV}_{j,t-1} + \beta_5 \mathrm{CF\_A}_{j,t-1} + \beta_6 \mathrm{INTE\_CO}_{j,t-1} + \beta_7 \mathrm{RE\_K}_{j,t-1} + \beta_8 \mathrm{SIZE}_{j,t-1} + d_i + \alpha_t + v_{j,t} \qquad \text{eq.(1)}$$

$$\mathrm{DIV\_S}_{j,t} = \begin{cases} \mathrm{DIV\_S}^*_{j,t} & \text{if } \mathrm{DIV\_S}^*_{j,t} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The detailed definitions of the variables are listed in Table 1. d_i is an industry fixed effect for industry *i*, and α_t is a yearly fixed effect for year *t*. $v_{j,t}$ is an error term for firm *j* and year *t*.

Table 9 reports the results from the Tobit regressions for several specifications. In specification (1), the R&D intensity (RD_S) is statistically significant and positively associated with the dividend ratio (DIV_S). This is consistent with the reputation effect hypothesis, H2. In order to take into consideration the possible non-linearity effect of the R&D intensity, we include the squared value of the R&D intensity in the Tobit regression. According to specifications (2) and (3), the squared R&D intensity is significant and negatively associated with the dividend ratio. Together with the positive significant coefficient of the R&D intensity, these results are consistent with one of the contingency versions of the reputation effect hypothesis, H3.

We also run the panel regressions with the industry and yearly fixed effects by using the same specification as eq. (1) and report the obtained results in Table 10. t statistics are based on the standard errors robust to the within-firm clustering and heteroscedasticity of error terms. The results from the panel regressions in Table 10 are very similar to the results from the Tobit regressions in Table 9. The R&D intensity (RD_S) is statistically significant and positively associated with the dividend ratio (DIV_S) when included alone. However, the squared R&D intensity is significant and negatively associated with the dividend ratio. These results are still consistent with one of the contingency versions of the reputation effect hypothesis, H3.

The R&D intensity could be endogenous in the sense that the error term is correlated with the R&D intensity in the multivariate regressions. Managers may determine the R&D investments and dividend policies simultaneously and there could be a third variable that correlates with both the R&D investments and dividends. We address this endogenity concern by using the Instrumental Variable approach. We use the lagged values, RD_S_{t-2} and RD_S_{t-3}, as instruments for RD_S_{t-1}, and $RD\_S^2_{t-2}$ as an instrument for $RD\_S^2_{t-1}$.[6] The results are also shown in Table 10. t statistics are based on the standard errors robust to the within-firm clustering and heteroscedasticity of error terms. Overall, the results using the Instrumental Variable approach are qualitatively very similar to the results from the Tobit and panel regressions.

[Insert Tables 9 and 10 about here.]

4.3.Impact of Cash Holdings

We examine whether the presence of extra cash holdings may have any impact on the

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[6] The Sargan test does not reject the orthogonality of these instruments to error terms.

relation between the R&D intensity and dividend payout. During the sample period from 2000 to 2013, about 40 % of sample firms have cash holdings greater than total debt. Specifically, we run the following Tobit regression with the R&D intensity interacted with the dummy variable corresponding to net debt (NETLEV_D), which is equal to one if cash holding is lower than total debt and zero otherwise.

$$\begin{aligned}\mathrm{DIV\_S}_{\mathrm{j,t}} = {} & \beta_1 \mathrm{RD\_S}_{\mathrm{j,t-1}} + \beta_2 \mathrm{NETLEV\_D}_{\mathrm{j,t-1}} \times \mathrm{RD\_S}_{\mathrm{j,t-1}} + \beta_3 \mathrm{F\_A}_{\mathrm{j,t-1}} + \beta_4 \mathrm{MV\_BV}_{\mathrm{j,t-1}} \\ & + \beta_5 \mathrm{CF\_A}_{\mathrm{j,t-1}} + \beta_6 \mathrm{INTE\_CO}_{\mathrm{j,t-1}} + \beta_7 \mathrm{RE\_K}_{\mathrm{j,t-1}} + \beta_8 \mathrm{SIZE}_{\mathrm{j,t-1}} + d_i \\ & + \alpha_t + v_{j,t}\end{aligned}$$

eq.(2)

$$\mathrm{DIV\_S}_{\mathrm{j,t}} = \begin{cases} \mathrm{DIV\_S}^{*}_{\mathrm{j,t}} & \text{if } \mathrm{DIV\_S}^{*}_{\mathrm{j,t}} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The definitions of variables are shown in Table 1. The fixed effect terms are the same as those of eq. (1).

The estimation results are reported in Table 11. The R&D intensity (RD_S) alone is significant and positively associated with the dividend ratio (DIV_S). The coefficients of the interaction term between the R&D intensity and NETLEV_D are significant and negative in both specifications, implying that the effect of the R&D

intensity on the dividend ratio declines when firms move from the extra cash holding status to the positive net debt status. In the net effect, the R&D intensity is still positively associated with the dividend ratio for firms with positive net debt because $\beta_1+\beta_2$ is positive. In the unreported test, we confirm that this net effect is statistically significant for the null "$\beta_1+\beta_2=0$." These results are consistent with one of the contingency versions of the reputation effect hypothesis, H4.

We run the panel regressions for the same specification as eq. (2) and also use the Instrumental Variable approach to adjust to the endogenity concern on the R&D intensity. Table 12 reports the estimation results. t statistics are based on the standard errors robust to the within-firm clustering and heteroscedasticity of error terms. The overall results are very similar to Table 11. The effect of the R&D intensity on the dividend ratio declines greatly when firms move from the extra cash holding status to the positive net debt status. This result is still consistent with one of the contingency versions of the reputation effect hypothesis, H4.

[Insert Tables 11 and 12 about here.]

5. Conclusions

In this paper we examine whether the reputation effect hypothesis is empirically valid for the dividend behavior of firms in an economy with relatively weak corporate governance. We take the Japanese economy during the 2000s and early 2010s as a sort of case study. During this time period, we characterize the Japanese economy and firms with moderate governance pressures on managers.

Specifically, we run the regressions of the dividend payout on the R&D intensity and various control variables. Our main findings are based on the Tobit regressions and panel regressions with fixed effects. In addition, we use the Instrumental Variable approach in order to take into consideration endogenity issues related to R&D investments.

The following two empirical findings emerge. First, the relationship between the R&D intensity and dividend payouts is inverse U-shaped. For lower R&D intensity, the R&D intensity is positively associated with the dividend payouts. However, for higher R&D intensity, the R&D intensity is negatively (less positively) associated with the dividend payouts. These results are consistent with the contingency version of the reputation effect hypothesis.

Second, for firms with extra cash (net debt <0), the R&D intensity is positively associated with the dividend payouts, and for firms with positive net debt the R&D intensity is less positively associated with the dividend payouts. The reputation effect hypothesis predicts that the positive relationship between the R&D intensity and dividend payouts is stronger for firms with extra cash (firms with weaker governance pressures) and is weaker for firms with positive net debt (firms with stronger governance pressures). Our results are consistent with this prediction.

Our empirical results shed some light on the reasons why firms in the countries with poor investor protection pay dividends. Firms pay dividends to establish the good reputation in the capital markets. Further, the results in this paper suggest that the economy with weak corporate governance incurs additional costs related to the R&D investments and the growth of the economy. Since R&D-intensive firms must pay dividends at the front to maintain high R&D investments, the R&D-intensive firms could under-invest in R&D projects.

Future studies should take into consideration the simultaneous determination of various financial policies as well as R&D investment policies in a more extensive manner. We try to tackle this issue in our future research.

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Table 1 Definition of Variables	
Variables	Definition
DIV_S	Dividend/total sales
RD_S	R&D expenditures /total sales
F_A	Fixed asset/total assets
MV_BV	(Total debt +market value of equity)/total assets
CF_A	Operating cash flow/total assets
INTE_CO	Operating profit/interest expenses
RE_K	Retained earnings/book equity
SIZE	Log(total assets)

Table 2 Distribution of Dividend Payers and Non-Dividend Payers across Industries

Industry	Total	# of Dvidend payers	Dvidend payers %	# od Non-dvidend payers	Non-dvidend payers %
CHEMICALS	2,093	1,869	89.30%	224	10.70%
DRUGS	582	457	78.52%	125	21.48%
ELECTRONIC	3,039	2,385	78.48%	654	21.52%
FOODS	1,485	1,292	87.00%	193	13.00%
IRON_STEEL	630	481	76.35%	149	23.65%
MACHINERY	2,284	1,827	79.99%	457	20.01%
MOTOR	905	756	83.54%	149	16.46%
NON_METAL	1,255	983	78.33%	272	21.67%
PETROLEUM	160	146	91.25%	14	8.75%
PRECISION	576	457	79.34%	119	20.66%
PULP	244	204	83.61%	40	16.39%
RUBBER	279	236	84.59%	43	15.41%
STONE_GLASS	551	486	88.20%	65	11.80%
TEXTILE	680	501	73.68%	179	26.32%
TRANSPORTATION	186	153	82.26%	33	17.74%
OTHERS	1,014	847	83.53%	167	16.47%
AVERAGE			81.94%		18.06%
Number of observations	15,963	13,080		2,883	

Table 3 Basic Statistics of Variables								
	DIV_S_t	RD_S_{t-1}	F_A_{t-1}	MV_BV_{t-1}	CF_A_{t-1}	$INTE\_CO_{t-1}$	RE_K_{t-1}	$SIZE_{t-1}$
Mean	0.0081	0.0263	0.2009	1.0391	0.0565	36.0892	0.4510	11.0765
Median	0.0065	0.0190	0.1936	0.9685	0.0578	8.5105	0.5202	10.9111
Maximum	0.0404	0.1496	0.4324	2.6096	0.1670	741.6667	1.0131	17.3846
Minimum	0.0000	0.0000	0.0322	0.5019	-0.0901	-15.6154	-1.7234	3.2958
Std. Dev.	0.0077	0.0262	0.0872	0.3406	0.0449	86.5517	0.3751	1.5517
Observations	15,964	15,025	14,661	14,709	14,702	14,720	14,716	15,326

Table 4 Basic Statistics of Dividend Ratio (DIV_S) by Industry

Industry	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
CHEMICALS	0.0096	0.0085	0.0401	0	0.0072	2,093
DRUGS	0.0141	0.0141	0.0402	0	0.0107	582
ELECTRONIC	0.0080	0.0059	0.0401	0	0.0082	3,039
FOODS	0.0068	0.0059	0.0404	0	0.0058	1,485
IRON_STEEL	0.0065	0.0052	0.0404	0	0.0070	630
MACHINERY	0.0093	0.0074	0.0404	0	0.0087	2,284
MOTOR	0.0042	0.0036	0.0206	0	0.0036	905
NON_METAL	0.0065	0.0054	0.0345	0	0.0062	1,255
PETROLEUM	0.0061	0.0045	0.0404	0	0.0057	160
PRECISION	0.0088	0.0077	0.0378	0	0.0081	576
PULP	0.0060	0.0048	0.0338	0	0.0054	244
RUBBER	0.0085	0.0067	0.0358	0	0.0075	279
STONE_GLASS	0.0089	0.0075	0.0399	0	0.0075	551
TEXTILE	0.0075	0.0063	0.0349	0	0.0074	680
TRANSPORTATION	0.0062	0.0048	0.0309	0	0.0060	186
OTHERS	0.0086	0.0075	0.0401	0	0.0073	1,014

Table 5 Time-Series Behavior of the Dividend Ratio (DIV_S)

Year	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
2000	0.0063	0.0050	0.0371	0	0.0065	1,241
2001	0.0067	0.0055	0.0397	0	0.0065	1,213
2002	0.0066	0.0054	0.0398	0	0.0066	1,226
2003	0.0065	0.0051	0.0395	0	0.0069	1,200
2004	0.0070	0.0057	0.0376	0	0.0070	1,180
2005	0.0080	0.0064	0.0398	0	0.0074	1,171
2006	0.0090	0.0071	0.0402	0	0.0079	1,147
2007	0.0097	0.0077	0.0404	0	0.0083	1,128
2008	0.0100	0.0083	0.0404	0	0.0081	1,113
2009	0.0098	0.0081	0.0400	0	0.0081	1,099
2010	0.0078	0.0058	0.0404	0	0.0079	1,091
2011	0.0088	0.0072	0.0395	0	0.0082	1,072
2012	0.0092	0.0075	0.0401	0	0.0081	1,049
2013	0.0094	0.0077	0.0404	0	0.0082	1,034

	Table 6 Mean and Median of Variables for 5 Quantile Groups Formed by Sorting Firms Based on DIV_S									
			Smallest	------ DIV_S -----			Largest	Testing the difference between:		
		0 (non-dividend payer)	1	2	3	4	5	5−0 p-Value	5−1 p-Value	5−4 p-Value
DIV_S_t	Mean	0.0000	0.0026	0.0054	0.0080	0.0116	0.0220	0.0000	0.0000	0.0000
	Median	0.0000	0.0028	0.0054	0.0079	0.0115	0.0202	0.0000	0.0000	0.0000
RD_S_{t-1}	Mean	0.0200	0.0201	0.0227	0.0249	0.0293	0.0384	0.0000	0.0000	0.0000
	Median	0.0107	0.0111	0.0168	0.0205	0.0235	0.0314	0.0000	0.0000	0.0000
F_A_{t-1}	Mean	0.1963	0.2151	0.2118	0.2122	0.1994	0.1776	0.0000	0.0000	0.0000
	Median	0.1837	0.2082	0.2098	0.2102	0.1929	0.1679	0.0000	0.0000	0.0000
MV_BV_{t-1}	Mean	1.0137	0.9374	0.9864	1.0014	1.0546	1.1986	0.0000	0.0000	0.0000
	Median	0.9584	0.9210	0.9522	0.9558	0.9929	1.0869	0.0000	0.0000	0.0000
CF_A_{t-1}	Mean	0.0279	0.0523	0.0574	0.0613	0.0656	0.0712	0.0000	0.0000	0.0000
	Median	0.0256	0.0522	0.0581	0.0607	0.0660	0.0716	0.0000	0.0000	0.0000
$INTE\_CO_{t-1}$	Mean	2.3813	15.2269	22.7039	31.3596	52.6361	86.5275	0.0000	0.0000	0.0000
	Median	0.5021	5.3471	8.9561	11.9606	20.1347	33.3943	0.0000	0.0000	0.0000
RE_K_{t-1}	Mean	-0.0441	0.4469	0.5024	0.5374	0.5707	0.6340	0.0000	0.0000	0.0000
	Median	0.0324	0.4677	0.5115	0.5542	0.5899	0.6641	0.0000	0.0000	0.0000
$SIZE_{t-1}$	Mean	10.1198	11.4436	11.3564	11.3578	11.1755	11.0475	0.0000	0.0000	0.0009
	Median	10.0924	11.1263	11.1925	11.1939	10.9622	10.8508	0.0000	0.0000	0.0031

Table 7 Relation between the R&D Intensity and Dividend Ratio for Firms with Extra Cash Holdings and Positive Net Debt

		CASH > DEBT											
		Low RD_S										High RD_S	
		0		1		2		3		4		5	
DIV_S	Mean	0.0087	***	0.0099	***	0.0104	***	0.0125	***	0.0136	***	0.0150	***
	Median	0.0073	***	0.0082	***	0.0093	***	0.0108	***	0.0115	***	0.0139	***
		CASH ≤ DEBT											
		Low RD_S										High RD_S	
		0		1		2		3		4		5	
DIV_S	Mean	0.0038		0.0043		0.0057		0.0061		0.0072		0.0067	
	Median	0.0000		0.0035		0.0052		0.0056		0.0069		0.0055	

*** Significant at the 1% level for testing for the null of no difference in the mean and median dividend ratio between the firms with extra cash holdings (CASH>DEBT) and the firms with positive net debt (CASH<DEBT).

Table 8 Correlation Matrix

	DIV_S_t	RD_S_{t-1}	F_A_{t-1}	MV_BV_{t-1}	CF_A_{t-1}	$INTE\_CO_{t-1}$	RE_K_{t-1}	$SIZE_{t-1}$
DIV_S_t	1.0000							
RD_S_{t-1}	0.2718	1.0000						
F_A_{t-1}	-0.1227	-0.1179	1.0000					
MV_BV_{t-1}	0.2520	0.1811	-0.0155	1.0000				
CF_A_{t-1}	0.2354	0.0946	0.2598	0.2126	1.0000			
$INTE\_CO_{t-1}$	0.3205	0.1217	-0.0816	0.1253	0.1714	1.0000		
RE_K_{t-1}	0.4116	0.0838	-0.0086	-0.0146	0.2153	0.2209	1.0000	
$SIZE_{t-1}$	0.0075	0.1378	0.1567	0.1733	0.1639	-0.0026	0.1078	1.0000

Table 9 Tobit Regression of Dividend Ratio (DIV_S) on R&D Intensity (RD_S) and Control Variables

DEPENDENT VARIABLE	DIV_S_t							
	(1)		(2)		(3)		(4)	
CONSTANT	-0.0014		-0.0016	**	0.0010		-0.0021	***
	(-1.9200)		(-2.1607)		1.4425		(-2.9308)	
RD_S_{t-1}	0.0618	***	0.1101	***	0.1362	***		
	(17.2018)		(13.9559)		(16.2981)			
RD_S_{t-1}^2			-0.4865	***	-0.6521	***		
			(-6.1922)		(-7.7741)			
F_A_{t-1}	-0.0058	***	-0.0063	***	-0.0103	***		
	(-6.9779)		(-7.4694)		(-11.1637)			
MV_BV_{t-1}	0.0043	***	0.0042	***	0.0025	***		
	(16.3926)		(16.2407)		(8.9800)			
CF_A_{t-1}	0.0265	***	0.0262	***	0.0439	***		
	(16.1282)		(15.9566)		(24.5121)			
INTE_CO_{t-1}	0.0000	***	0.0000	***	0.0000	***	0.0000	***
	(14.8984)		(14.9628)		(22.3338)		(19.0742)	
RE_K_{t-1}	0.0118	***	0.0118	***			0.0131	***
	(44.0586)		(44.1165)				(47.9266)	
$SIZE_{t-1}$	-0.0003	***	-0.0004	***			0.0002	***
	(-7.0793)		(-8.0415)				(5.1321)	
INDUSTRY DUMMY	YES		YES		YES		YES	
YEAR DUMMY	YES		YES		YES		YES	
LOG LIKELIHOOD	37883.71		37914.42		36756.92		39453.28	
OBS	12,395		12,395		12,781		13,674	

t statistics are shown in parentheses. ** Significant at the 5% level. *** Significant at the 1% level.

Table 10 Panel Regression and IV Estimation

DEPENDENT VARIABLE	DIV_S_t						
	FIXED EFFECTS				INSTRUMENTAL VARIABLES WITH FIXED EFFECTS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONSTANT	0.0044 **	0.0043 **	0.0035 **	0.0049 ***	0.0039 **	0.0037 **	0.0029 *
	(2.4319)	(2.3841)	(2.1933)	(2.7895)	(2.0372)	(1.9616)	(1.7496)
RD_S_{t-1}	0.0575 ***	0.0952 ***	0.1075 ***		0.0644 ***	0.1009 ***	0.1125 ***
	(7.6859)	(5.9493)	(6.5135)		(7.4237)	(5.3360)	(5.6578)
$RD\_S_{t-1}^2$		-0.3825 ***	-0.4579 ***			-0.3863 **	-0.4619 **
		(-2.5924)	(-2.9571)			(-2.0893)	(-2.3193)
F_A_{t-1}	-0.0060 ***	-0.0063 ***	-0.0089 ***		-0.0057 ***	-0.0061 ***	-0.0087 ***
	(-3.5218)	(-3.6933)	(-4.7856)		(-3.1973)	(-3.3483)	(-4.4047)
MV_BV_{t-1}	0.0044 ***	0.0044 ***	0.0029 ***		0.0052 ***	0.0051 ***	0.0036 ***
	(9.8489)	(9.7509)	(6.2626)		(10.1116)	(9.9606)	(6.6438)
CF_A_{t-1}	0.0223 ***	0.0221 ***	0.0330 ***		0.0216 ***	0.0214 ***	0.0333 ***
	(11.1320)	(11.0584)	(15.3896)		(10.1609)	(10.1066)	(14.5943)
$INTE\_CO_{t-1}$	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***
	(9.1378)	(9.1633)	(12.0471)	(10.8298)	(8.7628)	(8.8053)	(11.7075)
RE_K_{t-1}	0.0070 ***	0.0069 ***		0.0073 ***	0.0076 ***	0.0076 ***	
	(20.4804)	(20.3831)		(22.4052)	(20.2087)	(20.0460)	
$SIZE_{t-1}$	-0.0004	-0.0005 ***		0.0000	-0.0005 ***	-0.0005 ***	
	(-4.5257)	(-4.8495)		(0.2760)	(-4.7166)	(-4.9286)	
INDUSTRY DUMMY	YES	YES	YES	YES	YES	YES	YES
YEAR DUMMY	YES	YES	YES	YES	YES	YES	YES
ADJ RSQ	0.3795	0.3818	0.2876	0.2959	0.3904	0.3930	0.2936
PROB(J-STATISTIC)					0.1272	0.2806	0.8820
OBS	12,395	12,395	12,781	13,674	10,197	10,197	10,501

t statistics are based on the standard errors robust to the whin-firm clustering and heteroskedasticity of error terms and are shown in parentheses. ** Significant at the 5% level. *** Significant at the 1% level.

Table 11 Cash Holdings and the Relation between the R&D intensity and Dividend (Tobit)

DEPENDENT VARIABLE	DIV_S_t		
	(1)		(2)	
CONSTANT	-0.0021	***	0.0015	**
	(-2.9427)		(2.3159)	
RD_S_{t-1}	0.0898	***	0.1127	***
	(21.3901)		(25.0587)	
$NETLEV\_D_{t-1} \times RD\_S_{t-1}$	-0.0709	***	-0.1013	***
	(-16.7895)		(-22.9243)	
F_A_{t-1}	-0.0027	***	-0.0046	***
	(-3.2281)		(-5.0933)	
MV_BV_{t-1}	0.0047	***	0.0035	***
	(17.9988)		(13.1888)	
CF_A_{t-1}	0.0219	***	0.0362	***
	(13.4842)		(20.7308)	
$INTE\_CO_{t-1}$	1.02E-05	***	1.66E-05	***
	(11.2506)		(16.9307)	
RE_K_{t-1}	0.0110	***		
	(41.3208)			
$SIZE_{t-1}$	-0.0002	***		
	(-4.9790)			
INDUSTRY DUMMY	YES		YES	
YEAR DUMMY	YES		YES	
LOG LIKELIHOOD	37767.73		36858.42	
OBS	12,174		12,486	

t statistics are shown in parentheses. ** Significant at the 5% level. *** Significant at the 1% level.

Table 12 Cash Holdings and the Relation between the R&D intensity and Dividend (Panel Regression and IV Estimation)

DEPENDENT VARIABLE	DIV_S_t							
	FIXED EFFECTS				INSTRUMENT VARIABLES WITH FIXED EFFECTS			
	(1)		(2)		(3)		(4)	
CONSTANT	0.0034		0.0037	**	0.0026		0.0031	
	(1.9552)		(2.4175)		(1.4259)		(1.9273)	
RD_S_{t-1}	0.0894	***	0.1039	***	0.1064	***	0.1239	***
	(10.2240)		(11.5181)		(10.3348)		(11.5748)	
$NETLEV\_D_{t-1} \times RD\_S_{t-1}$	-0.0758	***	-0.0967	***	-0.1012	***	-0.1306	***
	(-9.3698)		(-11.2906)		(-9.8640)		(-12.1417)	
F_A_{t-1}	-0.0029		-0.0040	**	-0.0017		-0.0026	
	(-1.7414)		(-2.2487)		(-0.9726)		(-1.3309)	
MV_BV_{t-1}	0.0048	***	0.0038	***	0.0056	***	0.0046	***
	(10.9075)		(8.5409)		(11.2656)		(9.0445)	
CF_A_{t-1}	0.0177	***	0.0268	***	0.0162	***	0.0254	***
	(8.9285)		(12.7402)		(7.6665)		(11.1619)	
$INTE\_CO_{t-1}$	1.09E-05	***	1.53E-05	***	9.15E-06	***	1.31E-05	***
	(7.0504)		(9.3192)		(5.8805)		(7.7910)	
RE_K_{t-1}	0.0066	***			0.0069	***		
	(19.6577)				(18.7467)			
$SIZE_{t-1}$	-0.0003	***			-0.0003	***		
	(-3.4722)				(-3.3032)			
INDUSTRY DUMMY	YES		YES		YES		YES	
YEAR DUMMY	YES		YES		YES		YES	
ADJ RSQ	0.407743		0.32944		0.418103		0.336617	
PROB(J-STATISTIC)					0.325622		0.903164	
OBS	12,174		12,486		9,981		10,234	

t statistics are based on the standard errors robust to the whin-firm clustering and heteroskedasticity of error terms and are shown in parentheses. ** Significant at the 5% level. *** Significant at the 1% level.