THE IMPACT OF OWNERSHIP CONCENTRATION AND SHAREHOLDER IDENTITY ON DIVIDEND PAYOUT PROBABILITIES: NEW EVIDENCE FROM THE GERMAN STOCK MARKET

Sebastian Kuhlmann*, Joachim Rojahn*

*FOM University of Applied Sciences, Germany

Abstract

Numerous studies analyse the impact of ownership concentration and shareholder identity on dividend payout probabilities. In this paper, we seek to provide additional information about the importance different ownership proxies have for dividend payments. Because the importance of those proxies varies with the classification techniques applied, we use both traditional and machine learning techniques. We examine the dividend payout behaviour of German issuers, which is considered rather flexible in terms of its distribution frequencies and dividend yields compared to international practice. Our sample period covers the years 2007 to 2014. Despite considerable differences in the classification techniques applied, we find that previous years' dividend payments, corporate profitability and firm size are consistently the most important firm-specific determinants of dividend payout probabilities. Only the largest shareholders with equity stakes that are either between 25% and 50% or above 50% rank among the most important variables. The impact is nonlinear. When controlling for shareholders' identities, we find that both financial institutional and managerial ownership are especially important. Taking the location of institutional investors into account, only foreign financial investors influence payout probabilities.

Keywords: Dividend Payout Probability, Variable Importance, Shareholder Identity, German Stock Market, Foreign Ownership

1. INTRODUCTION

A large and growing body of literature examines the determinants of dividend payout probabilities. In addition to common explanatory variables derived from trade-off theory or pecking-order theory, agency-based implications are frequently used to explain corporate dividend payout probabilities. To overcome the well-known free-cash-flow problem (Jensen, 1986; Jensen & Meckling, 1976), ownership concentration is among the most prominent solutions.

As dividend payments reduce the danger of a misallocation of funds, agency costs of equity shrink (Easterbrook, 1984). Consequently, if concentrated ownership accompanies superior information, less profit distribution is required. The general finding in the literature is that concentrated ownership results in lower dividend payout probabilities (Barclay, Holderness & Sheehan, 2009; Huang, Shen & Sun, 2011; Khan, 2006), especially if managers' investments are considerable. However, empirical evidence proves a nonlinear impact of ownership concentration on dividend payout that might be driven by the entrenchment effect of managerial ownership (Florackis, Kanas & Kostakis, 2015). Moreover, dividend payout depends on the identity of the main shareholder (Gugler, 2003) and/or the level of shareholder activism (Klein & Zur, 2009). If outside block-holders are exposed to increasing information asymmetries, a desire for current income or investment constraints, they require

dividend payments. In addition, active shareholders such as hedge funds often buy substantial stakes in publicly traded companies with the intention of realizing a short-term profit, which regularly involves dividend increases or stock repurchases (Klein & Zur, 2009). Thus, there can be conflicts of interest among key shareholder groups, which are of special interest as ownership becomes increasingly concentrated (Bennedsen & Nielsen, 2010). Therefore, our paper seeks to contribute to the aforementioned body of literature in the following aspects.

First, we search for the most relevant variables that affect dividend payout decisions. Thus, in contrast to most prior studies, we must apply various classification techniques because these techniques determine whether variables are important (Bolón-Canedo, Sánchez-Maroño & Alonso-Betanzos, 2013). Whereas traditional multivariate techniques such as logit analysis require a researcher to develop the structure, machine-learning techniques find a feasible structure that fits the data with regard to an accepted level of error tolerance. Machine-learning techniques tend to achieve better performance than traditional statistical methods, but they are more complicated and difficult to interpret (Huang, Chen, Hsu, Chen & Wu, 2004). Machine-learning techniques are frequently used in research fields such as the evaluation of credit risk but are rarely used in the analysis of determinants of dividend payout (Luebke & Rojahn, 2016). Hence, employing different classification techniques aims at delivering additional insights into the decision about whether to pay dividends. We do so by analysing the payout behaviour of German Prime Standard issuers. In an international comparison, their behaviour has been declared more flexible than in Anglo-Saxon countries (Goergen, Renneboog & da Silva, 2005). The sample period covers the years 2007 to 2014. A heterogeneous payout behaviour of German firms characterizes this phase of financial turmoil (Luebke & Rojahn, 2016). Depending on the economic situation, firms change their dividend policies to ensure that the liquidity will be sufficient to overcome financial difficulties.

Second, we analyse the impact of various ownership variables on dividend payout probability and account for characteristics of the shareholder structure of German issuers (for details, see section 3.2). More precisely, we test for the potentially nonlinear impact of ownership concentration by decomposing large equity positions into different categories based on the procedures outlined in Morck, Shleifer & Vishny (1988). Moreover, we examine the effect on dividend payout if two large shareholders are present since neither the theoretical and nor the empirical implications are obvious. On the one hand, the second-largest investor may call for dividend payouts to strengthen minority shareholders' rights (details see section 3.2). On the other hand, there could be a coalition between the two largest shareholders to intensify their power to extract private benefits. Moreover, the identity of controlling shareholders is taken into consideration, because aggregated ownership concentration may conceal additional insights. Particularly, institutional investors are heterogeneous regarding their investment goals and monitoring skills. Hence, we differentiate between foreign and domestic ownership and between operational and financial institutional ownership. Additionally, we account for changes in the identity of the largest shareholder to control for clientele effects.

We organize the paper as follows: in the next section, related research is discussed. In section 3, the data set and the different variables' importance measures are introduced. Section 4 presents the results of our empirical analysis. Section 5 concludes.

2. RELATED RESEARCH

2.1. Ownership Concentration and Dividend Payout Probability

Ownership concentration often accompanies a lower dividend payout probability. In brief, several studies reveal that managerial and/or founding-family ownership concentration reduces dividend payout (Thanatawee, 2013). This can be explained either by insiders' informational advantage that causes well-informed investors to waive dividends for signalling purposes (Miller & Rock, 1985) or by a rent extraction of small, outside shareholders by larger owners. Omitting dividend payments leaves more money under management's control, increasing their potential for private benefits, i.e., rent extraction (Gugler & Yurtoglu, 2003). However, this relationship does not have to be strictly negative: At very high levels of insider ownership, this negative impact can become positive because insiders want dividends for liquidity reasons, to diversify their personal portfolios (Brown, Liang & Weisbenner, 2007).

If large external, i.e., institutional, shareholders are present, they should have strong incentives to monitor the issuer's management. This suggests that there is less need for a dividend payout as an instrument of control (Al-Najjar, 2009; Lee, 2011; Short, Zhang & Keasey, 2002). Furthermore, institutional investors are assumed to have informational advantages over private investors (Shleifer & Vishny, 1986). Under this assumption, institutional ownership is an indicator of good business prospects, and additional signals by dividend payments are redundant.

However, because shareholder rights, corporate governance systems, taxation and culture vary among countries, the impact of external ownership concentration on dividend payout is a regional phenomenon (Amihud & Murgia, 1997; Short et al., 2002). For instance, if large institutional shareholders have lower tax rates than retail investors, issuers paying dividends can attract even more institutions (Allen, Bernardo & Welch, 2000). In addition to this tax clientele effect, restrictions in their investment charter (Jain, 2007) and/or their need for permanent cash inflow to optimise asset-liability-management (Allen et al., 2000) cause institutional investors to call for dividend payments. Consistently, some studies reveal that institutional investors prefer stocks that pay out dividends, but with low dividend yields (Dahlquist & Robertsson, 2001; Jain, 2007). Because stocks with low dividend yields are often growth stocks, this institutional investment preference can be explained by their informational advantage.

2.2. Institutional Shareholder's Identity

Empirical evidence of the impact of institutional investors on dividend payout tends to be biased when institutional ownership is considered in a single broad category (Khan, 2006). In contrast, institutional investors constitute a heterogeneous group such that segregation may provide further insights into the dividend puzzle (Gaspar, Massa, Matos, Patgiri & Rehman, 2013; Truong & Heaney, 2007). Initially, institutional investors are divided into operating and financial investors.

Operating investors, i.e., corporations, primarily focus on synergies and strategic interactions with their target firms (Arping & Falconieri, 2010). Thus, synergies can lead to stronger future growth and higher capital expenditures while dividend payouts decline. To affect the target firms' business activities, operating shareholders tend to hold larger stakes than financial institutions, creating lower information asymmetries (Barclay et al., 2009). This again contributes to the assumption that the probability of paying out a dividend narrows in the presence of operating block-holders.

In contrast, institutional financial ownership commonly leads to a double-agency problem, as the ultimate owners of the company do not control the company directly. If financial institutions own several funds with different investment strategies, they will stick to the funds that perform best so that they can report good performance. Therefore, the intermediary, i.e., the financial institution, has an interest in constant dividend payments, thereby convincing the ultimate owner of the investment's prospects and reducing the danger of a misallocation of funds. In contrast to the previously outlined argument that both ownership concentration and financial ownership make it redundant to send out signals using dividend payments, firms are usually likely to pay dividends when large shareholders are outsiders (Truong & Heaney, 2007). Mainly, the institutional financial investor's incentive to monitor the firm's management positively depends on the weight of the firm in the portfolio of the institutional investor and the institution's investment horizon (Khan, 2006). Because control and dividends can serve as substitute monitoring devices, Gaspar et al. (2013) discover that long-term investors prefer payouts independent of their form, with a tendency to prefer dividends. When short-term investors are present, the firm is more likely to choose a stock repurchase instead of a dividend increase because of the former's short-term market reaction. When substantial equity positions are held by foreign institutional investors, we expect a rising dividend payout probability because these investors may be exposed to intensified information asymmetries caused by legal, political or cultural differences (Aggarwal, Cao & Chen, 2012; Kang, Kul & Kim, 2010).

With regard to their investment philosophy, we further divide financial institutions into active and passive investors, whereas operating investors are active in nature. Since the outbreak of the financial crisis, investors have shifted considerable amounts of funds from expensive active to more favourable passive funds, especially exchange-traded funds (Bogle, 2016). Theoretically, the impact of passive investors' ownership (hereafter: ETFs) on dividend payout is somewhat inconclusive. On the one hand, ETFs simply replicate indices by buying and holding shares of the corresponding index members. Hence, the predominant goal should be to reduce the tracking error instead of monitoring the firm's management. On the other hand, ETFs have strong incentives to influence corporation's dividend payouts: First, ETFs hold permanent positions until the index composition changes. Therefore, neither "exit" nor an "exit threat" (Edmans, 2009) is an option in the event of dissatisfaction. Consequently, to protect their clients' interests, the "vote" becomes more relevant and is emphasized by ETFs' proxy voting guidelines (e.g., BlackRock, 2017). Second, the profit margins of ETFs are rather small, leading to a highly concentrated ETF market. Thus, there is some public pressure on ETF to control issuers' managers (Fichtner, Heemskerk & Garcia-Bernardo, 2016).

When political institutions control listed companies, the incentive to influence company distribution policies differs significantly from the previously described corporate institutional investors. Politicians may not have the ability or resources to control state-owned companies but are held responsible by electors in the event of poor management. Therefore, Gugler (2003) finds that payout levels are highest in government-controlled firms.

In summary, both theoretical and prior empirical researches reveal that the impact of institutional ownership on dividend payments is not uniform. Additionally, changes in ownership composition can lead to clientele effects caused by taxes (Stinson & Ricketts, 2016), new signals about the issuer's prospects or different incentives to oversee management likely to affect dividend payments. When a financial institution takes over a formerly manager-controlled firm, we expect payout probability to increase because of the institutional investors' desire for current income and the double-agency problem mentioned above.

2.3. The Role of the Second Largest Shareholder

In addition to manager-shareholder conflicts, the majority-minority-shareholder conflict may help explain dividend payout behaviour. Normally, majority shareholders have a strong incentive to use their voting power to extract private benefits from the cash flows and assets under their control (Faccio, Larry & Young, 2001). Opportunistic behaviour becomes more likely if this anchor investor has an absolute majority in the absence of another controlling shareholder. In particular, this motivation to expropriate minority shareholders increases during economic downturns when major shareholders suffer from significant losses in their stock holdings (Young, Peng, Ahlstrom, Bruton & Jiang, 2008). Therefore, a second block-holder serves as an internal control mechanism and potentially limits this principal-principal conflict. If a company has multiple block-holders, they can even form a coalition to increase controlling efficiency (Jiang & Peng, 2011). Various empirical findings are in line with this argument and show that dividend payout increases in the presence of another large investor (Faccio et al., 2001; Rozeff, 1982). Analyzing the German stock market, Gugler & Yurtoglu (2003) find that the presence of a second large shareholder holding at least 5% of the shares outstanding leads to higher payout ratios.

However, this reasoning does not recognize that the majority shareholder can build coalitions

with other block-holders to intensify its power to extract private benefits, decreasing the firm's propensity to pay out cash dividends (Maury & Pajuste, 2002).

3. DATA AND METHODOLOGY

3.1. Sample

The sample period covers the years from 2007 to 2014, starting one year before the outbreak of the financial-market crisis. Our initial sample consists of all companies listed in the German Prime Standard, the segment of the German stock market with the most rigid information disclosure requirements. As of January 2007, 403 stocks are listed in the Prime Standard segment. We rely on the index composition as of January 2007 to avoid any survivorship bias and to make sufficiently valid statements about the impact of changes in ownership data on dividend payments. Therefore, we start with 3,224 observations over the entire sample period. In a first step, we eliminate 160 yearly observations to avoid double counting when firms have both common and preferred stocks outstanding. Depending on trading volume, we only consider the more liquid share class in our analysis (common stocks, in most cases). Second, we reject 80 yearly observations when firms report in a currency other than the EUR because we measure some explanatory variables in absolute terms. We do not convert the foreign currency into EUR to ensure that the fluctuations in the currency

exchange rate do not influence our results over time. Third, following the tradition in similar studies, we drop financials, utilities, and REITs because of external regulations and/or leverage ratios that are likely to affect dividend payout. This reduces the sample by 296 yearly observations. In the fourth step, 699 yearly observations are excluded because of missing data, particularly ownership data and/or data missing because of de-listings, takeovers, or liquidations. In the last step, we discard 208 observations with negative book values of equity or large one-off dividend payments. Thus, we have a final sample of 1,781 yearly observations. All of the data are collected from the S&P Capital IQ database. For the empirical analysis, we create a dummy, PAYER, which equals one if an issuer pays out a dividend and zero otherwise.

Table 1 provides descriptive information on cash dividend frequency paid by the sample companies. Overall, 1,143 yearly dividend payments can be observed. The fraction of yearly dividend payers ranges from 56.4% in 2010 to 70.8% in 2013, with a weighted average of 64.2% over the entire sample period. The sample contains 121 dividend initiations and 100 dividend omissions. Dividend cuts peak in 2009 with 25 observations as a result of the financial crisis, with only ten initiations during that year. With 29 observations overall, the most dividend initiations occur in 2011. Altogether, these findings add to the anecdotal flexibility of the dividend payout behaviour of German issuers.

Table 1. Sample descriptive statistics on dividend payouts, initiations and omissions

Year	2007	2008	2009	2010	2011	2012	2013	2014	Sum
Number of companies	234	234	229	227	225	219	209	204	1,781
Number of PAYER	136	149	133	128	152	154	148	143	1,143
Fraction PAYER (in % of yearly observations)	58.1	63.7	58.1	56.4	67.6	70.3	70.8	70.1	64.2% (weighted average)
Initiations	16	20	10	16	29	16	9	5	121
Omissions	10	7	25	21	4	13	11	9	100

3.2. Explanatory Variables

To examine the potentially nonlinear impact of controlling shareholders and to test the role of the second largest shareholder, we employ different ownership variables based on Morck et al. (1988). The fraction of shares held by the largest shareholder (CONTROL) is given as follows:

CONTROL   =   ownership if ownership < 0.05,
0.00-0.05   =   0.05 if ownership > 0.05;
CONTROL   =   0 if ownership < 0.05,
0.05-0.25   =   ownership – 0.05 if ownership between 0.05 and 0.25,
          =   0.20 if ownership > 0.25;
CONTROL   =   0 if ownership < 0.25,
0.25-0.50   =   ownership – 0.25 if ownership between 0.25 and 0.50,
          =   0.25 if ownership > 0.5;
CONTROL   =   0 if ownership < 0.50,
0.50-1.00   =   ownership – 0.50 if ownership between 0.50 and 1.00.

If the largest equity investor holds less than 0.05, the voting power to initiate or omit dividend payments is rather low, whereas stock holdings between 0.05 and 0.25 allow the shareholders' influence to grow. The impact of the largest investor is assumed to rise significantly with the 0.25-0.50 block. At least, a blocking minority is achieved at the annual shareholders' meeting. Depending on

meeting attendance, voting power might even be sufficient to achieve an absolute majority, which is required for dividend payout decisions. For that reason, we add CONTROL 0.50-1.00.

Accordingly, the stake held by the second largest shareholder (MONITOR) is categorized into the following three groups:

MONITOR   =   ownership if ownership < 0.05,
0.00-0.05   =   0.05 if ownership > 0.05;
MONITOR   =   0 if ownership < 0.10,
0.05-0.10   =   ownership – 0.05 if ownership between 0.05 and 0.10,
          =   0.05 if ownership > 0.10;
MONITOR   =   0 if ownership < 0.10,
0.10-0.50   =   ownership – 0.10 if ownership between 0.10 and 0.50.

Since it is impossible for the second-largest shareholder to hold the absolute majority of outstanding shares, there is no need for a control group with ownership equal to or above 50%. Moreover, only 3.76% of the monitoring investors hold equity stakes that exceed one-quarter of the outstanding shares. Accordingly, we reduce the lower boundary from 0.25 to 0.10, leading to a more uniform distribution and more reliable classification results.

Panel A of Table 2 reveals that concentrated ownership is a common phenomenon in our sample.

Table 2. Summary statistics on ownership variables

Panel A. Controlling and monitoring investors

Explanatory Variable	No. of observations	Mean	Std. Dev.	Min	Max
CONTROL 0.0-0.05	1,781	0.0471	0.0116	0.0000	0.0500
CONTROL 0.05-0.25	1679	0.1436	0.0756	0.0000	0.2000
CONTROL 0.25-0.50	973	0.0905	0.1101	0.0000	0.2500
CONTROL 0.50-1.00	465	0.0426	0.1023	0.0000	0.5000
MONITOR 0.00-0.05	1,781	0.0337	0.0235	0.0000	0.0500
MONITOR 0.05-0.10	1,196	0.0416	0.0558	0.0000	0.2000
MONITOR 0.10-0.50	67	0.0014	0.0116	0.0000	0.1871

Panel B. Ownership identity of controlling shareholders – number of observations

Variable	CONTROL 0.00-0.05	CONTROL 0.05-0.25	CONTROL 0.25-0.50	CONTROL 0.50-1.00
Financial ownership	680	610	307	51
(domestic)	(342)	(309)	(186)	(38)
Corporate Ownership	699	681	479	299
(domestic)	(434)	(429)	(326)	(198)
Managerial Ownership	334	332	167	111
ETF Ownership	19	17	0	0
Others	49	39	20	4
Total no. of observations	1,781	1,679	973	465

Panel C. Ownership identity of monitoring shareholders – number of observations

Variable	MONITOR 0.00-0.05	MONITOR 0.05-0.10	MONITOR 0.10-0.50
Financial ownership	886	479	21
(domestic)	(412)	(251)	(18)
Corporate Ownership	420	351	27
(domestic)	(173)	(154)	(18)
Managerial Ownership	307	251	16
ETF Ownership	64	24	0
Others	104	91	3
Total no. of observations	1,781	1,196	67

Our explanatory variables CONTROL 0.00-0.05 and MONITOR 0.10-0.50 do not disperse much around their mean, i.e., most companies have at least one controlling shareholder, whereas there are few second-largest investors with holding equity stakes of greater than 10% of all shares outstanding. In 973 of our yearly observations, i.e., 54.6% of all observations, controlling shareholders holding equity stakes exceeding 25% of all shares outstanding are present.

Next, we control for the identity of controlling and monitoring shareholders by differentiating between managerial ownership, institutional ownership, (i.e., financial institutions and corporations), ETFs and other equity investors (governmental ownership and private investors). Panel B of Table 2 lists the dominant role of institutions in the group of controlling shareholders, with 1,379 yearly observations, 699 of which are corporations and 680 of which are financial institutions. These findings add to the prior research on the increasing role of institutional investors (Bennedsen & Nielsen, 2010). In 465 of our yearly observations, controlling investors with an equity fraction above 50% of all shares outstanding can be identified, 350 of which are institutional investors, including 299 corporations. As revealed by Brown et al. (2007), corporations tend to hold larger equity stakes than financial investors. Because of corporations' common investment goals, we expect CONTROL 0.50-1.00 to affect dividend payout probability negatively.

Turning to monitoring shareholders (Panel C of Table 2), institutional equity claimants are again the most widespread, with 1,306 observations, 886 of which are financial investors. Overall, 420 monitoring shareholders are identified to be strategically oriented. Unlike the largest shareholder, monitoring institutional equity investors are often foreign companies. With 721 observations overall, the second-largest institutional investor is not a German enterprise. Accordingly, the geographical distance of those foreign shareholders is expected to increase payout probabilities. Since monitoring shareholders that hold more than 10% of the total shares outstanding are primarily managers or domestic strategic investors, we expect MONITOR 0.10-0.50 to reduce the propensity of paying out dividends. Assuming informational advantages, both managers and domestic strategic investors can forego cash distributions for signalling purposes.

In addition to ownership concentration, CHANGE measures a shift in shareholder composition. If the identity of the largest shareholder changes from managerial to financial institutional ownership, CHANGE is coded one, zero otherwise. We expect shifts from managerial to financial institutional ownership to positively affect dividend payout probabilities. Because we only observe 33 changes from managerial to financial institutional ownership in our sample, we do not expect CHANGE to contribute to explaining dividend payout behaviour.

We review and crosscheck the shareholder structure with data from the annual report of each company in each year of the sample period. There are no discrepancies.

3.3. Controlling Variables

Because we ask for variable importance, we control for a broad set of firm-specific characteristics that frequently prove to have an impact on dividend payout probabilities, including profitability, debt, size, turnover growth, price-to-book ratio, stock repurchases, cash reserves, and previous years' dividend payments (e.g., Ferris, Jayaraman & Sabherwal, 2009; von Eije & Megginson, 2008).

The pecking-order theory, trade-off theory and dividend-signaling assumptions predict that the decision to pay out is positively affected by the issuer's profitability and ability to generate cash flows. OIA is defined as operating net income divided by total assets and OCF as operating cash flow divided by total assets. DEBT is calculated as total debt to total assets. Debt financing also serves as a control mechanism (Stulz, 1990), so that dividends and debt can generally be considered as substitutes (Jensen, 1986) and we expect a negative influence on dividend probabilities. Additionally, issuing debt is a positive signal about the firm's future because managers are controlled by debt-holders and reveal their confidence in the firm's ability to satisfy future debt obligations. Moreover, the propensity to pay dividends is affected by creditor rights. Brockman & Unlu (2009) find evidence to support the substitution hypothesis developed by La Porta, Lopez-de-Silanes, Shleifer & Vishny (2000). Accordingly, weak creditor rights are compensated by financial covenants such as dividend restrictions, decreasing dividend payout probability. In our analyses, SECURED serves as a proxy for creditor rights. It is measured by total secured debt capital to total debt capital and is expected to display a negative effect on dividend payments, as reported by Brennan & Thakor (1990). Company size is captured by the first principal component of total assets and market capitalization of the total Euro value of the company's outstanding shares. Accordingly, we reduce the dimension to one latent variable (SIZE) that accounts for 90% of the variance. Based on the tradition in similar studies (Charitou, Lambertides & Theodoulou, 2011; Fama &

French, 2002), we use the natural logarithm of SIZE (lnSIZE). We account for investment alternatives using the annual turnover growth rate (GROWTH), expecting a negative effect on dividend payout probability. Alternatively, the price-to-book ratio (PBR), defined as the market value of equity over the book value of common shareholders' equity, serves as a measure for growth opportunities (Li & Lie, 2006). However, PBR can also be considered a measure of the issuer's market valuation (Payne, 2011). In the latter case, dividend payout probabilities would increase if the management were to perceive its stock as undervalued. Hence, the theoretical effects of PBR on dividend payout probabilities are elusive. Stock repurchases have emerged as an alternative payout vehicle and are frequently used in conjunction with dividends to pay out earnings (Skinner, 2008). Therefore, a substitution effect between stock buybacks (BBS) and dividend payouts can be expected, although stock repurchases involve a lower level of commitment than dividends (Skinner & Soltes, 2009). BBS measures the firm's yearly buyback volume in relation to the company's market capitalization. The impact of cash reserves, captured by cash and equivalents to total assets (CASH), on the propensity to pay out dividends, is ambiguous: On the one hand, high cash reserves may be an indicator of profitability. On the other hand, firms may keep high cash reserves because access to fresh money to finance future growth is uncertain (DeAngelo, DeAngelo & Stulz, 2006). It is conventional wisdom that managers are reluctant to cut dividends; in other words, dividends are sticky (Lintner, 1956). Therefore, we add a dummy variable (PREVIOUS) that equals one if a firm paid out a cash dividend in the previous year and zero otherwise. All explanatory and controlling variables are lagged by one year to account for their causality on changes in the dividend during period t+1. Yearly dummy variables are used to control for time effects (Y2008 to Y2014). Table 3 provides descriptive statistics of the continuous controlling variables mentioned above.

Table 3. Descriptive statistics on continuous controlling variables

Controlling Variable	Mean	Std. Dev.	Min	Max	Expected Sign
OIA	0.0265	0.1253	-1.5706	0.6509	+
OCF	0.0794	0.1018	-1.3650	0.4854	+
DEBT	0.5273	0.1878	0.0235	0.9955	-
SECURED	0.2250	0.3497	0.0000	1.0000	-
lnSIZE	5.9931	2.1579	1.0961	12.2968	+
GROWTH	0.0765	0.4432	-0.9916	14.3150	-
PBR	2.1087	2.5919	0.1968	76.6229	+/-
BBS	0.0067	0.0385	0.0000	0.9500	-
CASH	0.1737	0.1558	0.0014	0.8742	+/-

Because the sample period covers phases of economic down- and upturns, standard deviations of OIA, OCF, GROWTH, and PBR are considerably high.

When applying the classification methods introduced in the next section, we normalize all independent variables except for the dummy variables so that the dimensions and magnitude of these variables are comparable to each other. In that way, it is certain that the algorithms discussed below work properly (Jain, Nandakumar & Ross, 2005).

3.4. Classification Methods and Variable Importance Measures

When testing for the most important determinants of dividend payout probabilities, we run two "classical" multivariate techniques: a random effects panel logistic regression and a linear discriminant analysis (LDA). For the variable importance ranking of the binary panel logit model, the value of the t-

test statistic of H_0: $\beta_{ij} = 0$ is used. There are no distributional assumptions for the explanatory variables. LDA is similar to the logit model but is based on the assumption of a multivariate normal distribution of the independent variables random vector with a common covariance matrix within the classes. To evaluate the variable importance of LDA, we employ a forward selection that is based on the p-value of Wilk's lambda. These "classical" techniques use all variables in estimation and prediction simultaneously.

Additionally, we apply the classification tree approach. A classification tree involves a hierarchical process from the root of the tree to its final nodes. The classification tree is grown as follows: For each node, any allowable split of any variable is examined. The most discriminating of these splits is chosen to create two new "daughter" nodes so that smaller and smaller nodes with increasing purity are created. Thus, to indicate the importance of a variable, the number of observation splits by the variable is counted. The more at the top the variables split the tree, the more important they are.

However, classification trees tend to be unstable, so that a forest of trees is applied for classification. This random forest is generated by bootstrapped samples for which a full tree is built. A random sub-sample of explanatory variables represents the candidates for each split and is robust against overfitting (Breiman, 2001). We implemented a set of 250 trees. The importance of each variable within the random forest classification can either be identified by a mean decrease in accuracy or the Gini index. We choose the former because it is more reliable than the Gini index (Breiman and Cutler, 2003).

4. EMPIRICAL RESULTS

4.1. Ownership Concentration

In this section, we present results without controlling for the identity of the largest and second largest shareholder. Table 4 displays the results of the random-effects logistic panel analysis.

Table 4. Results and variable importance of the panel logit model

Rank	Variable	Estimate	Std. Error	t-value	Pr(>|t|)	Sig.
1	PREVIOUS	0.7237	0.0153	47.3149	0.0000	***
2	OIA	0.0730	0.0088	8.2590	0.0000	***
3	lnSIZE	0.0439	0.0067	6.5361	0.0000	***
4	CONTROL 0.50-1.00	-0.0244	0.0076	-3.1937	0.0014	***
5	Y2011	0.0867	0.0307	2.8241	0.0048	***
6	OCF	0.0150	0.0077	1.9578	0.0504	*
7	CONTROL 0.25-0.50	0.0166	0.0087	1.9000	0.0576	*
8	Y2009	-0.0546	0.0309	-1.7668	0.0774	*
9	CONTROL 0.0-0.05	-0.0105	0.0074	-1.4288	0.1532	
10	MONITOR 0.10-0.50	-0.0093	0.0070	-1.3314	0.1832	
11	Y2008	0.0393	0.0305	1.2869	0.1983	
12	CONTROL 0.10-0.25	0.0093	0.0088	1.0634	0.2877	
13	MONITOR 0.05-0.10	0.0084	0.0080	1.0472	0.2951	
14	CHANGE	0.0457	0.0538	0.8496	0.3957	
15	Y2010	-0.0213	0.0309	-0.6886	0.4911	
16	MONITOR 0.00-0.05	-0.0055	0.0083	-0.6602	0.5092	
17	Y2012	0.0203	0.0309	0.6558	0.5120	
18	CASH	0.0041	0.0066	0.6182	0.5365	
19	DEBT	-0.0032	0.0067	-0.4843	0.6282	
20	BBS	0.0024	0.0068	0.3501	0.7263	
21	Y2013	0.0065	0.0314	0.2079	0.8354	
22	SECURED	0.0006	0.0059	0.0952	0.9242	
23	Y2014	-0.0028	0.0315	-0.0883	0.9296	
24	PBR	0.0004	0.0063	0.0651	0.9481	
25	GROWTH	0.0003	0.0075	0.0456	0.9637	

*Note: *** indicates significant at the 1 percent level;*
* indicates significant at the 10 percent level.

Based on the estimated t-values of the variables, PREVIOUS is by far the most important for the classification of dividend payers. Additionally, we find that OIA, lnSIZE and CONTROL 0.5-1.00 are statistically significant at the 1% level; the signs of the coefficients meet our expectations as discussed in section 3. Furthermore, CONTROL 0.25-0.50 is significant at the 10% level. As dividend payout probabilities rise with CONTROL 0.25-0.50, these findings add to the nonlinear relationship between dividend payout and ownership concentration. Whereas information asymmetries grow with the

reduction of ownership concentration, shareholders might call for disciplinary dividends as soon as they do not control the majority of shares. None of the remaining variables capturing shareholder structure is statistically significant. The yearly dummy variables Y2009 and Y2011are likely to express the peak and slope of the financial market crisis and again uncover the flexibility of German issuers' dividend-payout policy.

Essentially, the results of the subsequent LDA are in line with the binary panel logit and are summarized in Table 5.

Table 5. LDA Wilk's lambda ranking and estimated class means

Rank	Variable	Wilks lambda	p-value diff	Mean NOPAY	Mean PAY
1	PREVIOUS	0.4637	0.0000	0.1567	0.8941
2	OIA	0.4317	0.0000	-0.0392	0.0631
3	lnSIZE	0.4172	0.0000	4.7125	6.7079
4	Y2011	0.4141	0.0003	0.1144	0.1330
5	Y2009	0.4125	0.0096	0.1505	0.1164
6	OCF	0.4111	0.0140	0.0444	0.0990
7	Y2010	0.4103	0.0558	0.1552	0.1120
8	CONTROL 0.50-1.00	0.4097	0.1043	0.0545	0.0359
9	CONTROL 0.25-0.50	0.4080	0.1743	0.0891	0.0913
10	MONITOR 0.10-0.50	0.4076	0.1835	0.0022	0.0010
11	Y2008	0.4072	0.1888	0.1332	0.1304
12	CONTROL 0.0-0.05	0.4068	0.2083	0.0473	0.0470
13	CONTROL 0.05-0.25	0.4063	0.2186	0.1388	0.1463
14	DEBT	0.4059	0.2818	0.5055	0.5394
15	Y2012	0.4057	0.3321	0.1019	0.1347
16	MONITOR 0.05-0.10	0.4055	0.3913	0.0405	0.0422
17	BBS	0.4054	0.4628	0.0055	0.0074
18	CHANGE	0.4053	0.5399	0.0157	0.0201
19	Y2013	0.4052	0.5907	0.0956	0.1295
20	CASH	0.4052	0.6008	0.1988	0.1597
21	MONITOR 0.00-0.05	0.4051	0.6174	0.0348	0.0330
22	Y2014	0.4051	0.7993	0.0956	0.1251
23	GROWTH	0.4051	0.8223	0.1040	0.0629
24	PBR	0.4051	0.8390	1.9317	2.2075
25	SECURED	0.4051	0.9231	0.2450	0.2139

When employing the forward selection based on the p-value of Wilk's lambda, the most important variables are again PREVIOUS, OIA and lnSIZE. Additionally, Y2011 and Y2009 are of high importance, consistent with the results of the logistic regression. Among the ownership variables discussed in section 3.2, CONTROL 0.50-1.00 is top-ranked at eighth place and CONTROL 0.25-0.50 is in ninth place. Against our expectations, monitoring shareholders (MONITOR 0.10-0.50) hold larger fractions in non-dividend paying firms. However, corresponding to the findings of the logit analysis, the difference in class means is not statistically significant. Even though a normalized variable set can lead to the mistakable implication of the discriminant function coefficients (McLachlan, 2004)

our analysis provides the same results for the normalized and the non-normalized dataset.

Figure 1 reveals that three variables split the classification tree: PREVIOUS, OIA and lnSIZE. PREVIOUS splits the tree at the top and makes dividends more likely if dividends have been paid out in the previous year. If the company paid out dividends in the previous year and OIA exceeds -20%, dividend payments in the current year are very likely. Remarkably, operating loss-incurring enterprises do not necessarily fail to pay dividends. In our sample, we find 45 yearly firm observations in which firms pay dividends despite negative operating profitability as measured by OIA. If OIA falls below -20%, dividend payout probability is still high if lnSIZE is large. Again, these results correspond to our previous findings.

Figure 1. Classification tree for the probability of paying dividends
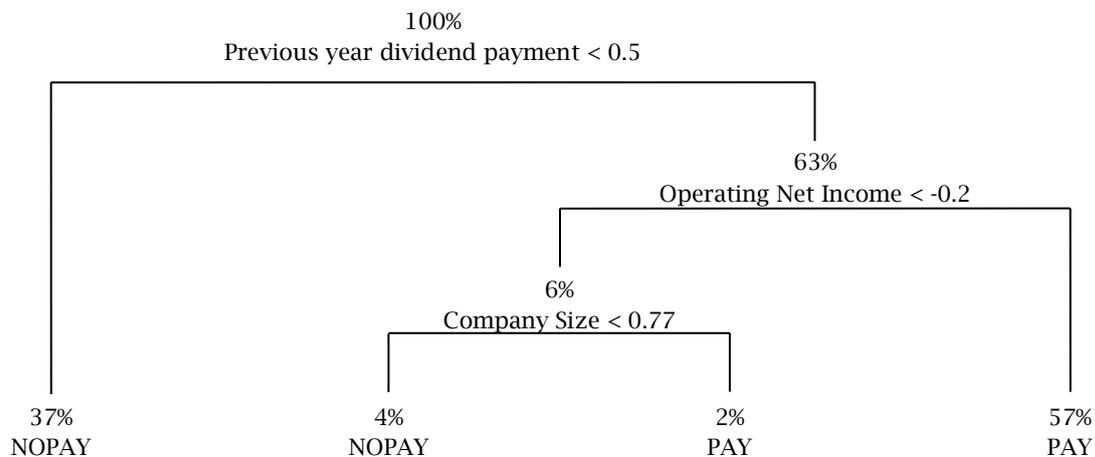
Machine-learning techniques such as random forests do not require the researcher to build the model but allow the particular structure of the model to be learned from the data (Huang et al., 2004). Consequently, random forests are more

complex to interpret and tend to over-fit the data. Table 6 reports the results of the measurement of variable importance based on the mean decrease in accuracy.

Table 6. Random forest variable importance ranking based on mean decrease in accuracy

Rank	Variable	Mean decrease in accuracy
1	PREVIOUS	84.6522
2	OIA	69.9563
3	lnSIZE	35.7163
4	DEBT	18.5082
5	GROWTH	14.1784
6	OCF	13.5127
7	CASH	13.4785
8	PBR	12.0752
9	CONTROL 0.50-1.00	9.4176
10	BBS	8.5982
11	CONTROL 0.25-0.50	7.6570
12	CONTROL 0.05-0.25	6.6055
13	MONITOR 0.05-0.10	6.3609
14	SECURED	5.6932
15	MONITOR 0.00-0.05	4.4653
16	MONITOR 0.10-0.50	3.5059
17	Y2010	3.1629
18	Y2009	2.5860
19	CONTROL 0.0-0.05	0.9340
20	Y2011	0.4970
21	Y2012	0.0751
22	Y2008	-0.1217
23	CHANGE	-0.3376
24	Y2014	-1.7313
25	Y2013	-2.1885

Table 6 once more reveals that PREVIOUS, OIA and lnSIZE are the most important variables for dividend payment classification. In this analysis, DEBT proves to be essential, as discussed in section 3.2. Of our explanatory variables, CONTROL 0.50-1.00 reaches the highest rank based on variable importance, whereas, according to the random forest analysis, all other explanatory variables are less important.

Table 7 summarizes the ten most important variables measured by the different classification methods mentioned above.

Table 7. Variable importance ranking for dividend payout probability

	Probability to pay			
Rank	Panel Logit	LDA	Classification Tree	Random Forest
1	PREVIOUS	PREVIOUS	PREVIOUS	PREVIOUS
2	OIA	OIA	OIA	OIA
3	lnSIZE	lnSIZE	lnSIZE	lnSIZE
4	CONTROL 0.50-1.00	Y2011		DEBT
5	Y2011	Y2009		GROWTH
6	OCF	OCF		OCF
7	CONTROL 0.25-0.50	Y2010		CASH
8	Y2009	CONTROL 0.50-1.00		PBR
9	CONTROL 0.0-0.05	CONTROL 0.25-0.50		CONTROL 0.50-1.00
10	MONITOR 0.10-0.50	MONITOR 0.10-0.50		BBS

Despite noteworthy differences in the methods applied, every technique identifies PREVIOUS, OIA and lnSIZE to be of the greatest importance.

To evaluate which method performs best, we calculate the accuracy values for the probability to pay.

Table 8. Accuracy values for the probability of paying

Method	Panel Logit	LDA	Tree	RF
Accuracy	90.28	90.09	87.85	76.45

Surprisingly, Table 8 displays that the panel logit and LDA methods outperform the machine-learning methods, with an accuracy of approximately 90%. The classification tree and random forest algorithm correctly predict approximately 88% and 76% of the sample observations. Using additional trees for the random forest analysis (500, 1,000) only marginally improves the goodness of fit. The predictive ability is cross validated, which means the data are separated into training and test data. Our "training set" contains 70% of the observations so that the best combination of parameters can be identified. The results of the statistical analysis are generalized to a set of variables that is not used in estimation, the "test set," which is composed of the remaining 30% of the observations. Cross validation is used to limit overfitting problems and obtain reliable error estimates (Rodriguez, Perez, Garcia & Molina, 2008).

4.2. The Impact of Controlling and Monitoring Shareholders' Identities

Overall, based on both statistical significance and variable importance, of our explanatory variables only CONTROL 0.50-1.00 and CONTROL 0.25-0.50 make a considerable contribution to explaining the dividend-payout decision. These ownership categories are dominated by institutional ownership, as discussed in section 3.2. Since institutional investors cannot be considered homogeneous, we differentiate between financial, corporate, managerial, ETF and other ownership (see panel B and C of Table 2). Among other things, we account for shareholder identity because we seek additional explanations for the nonlinear relationship between

ownership concentration and dividend payout probabilities based on our findings in section 4.1. We use the same variable definitions for all CONTROL and MONITOR blocks as described in section 3.2, but replace CONTROL with the following:

FINANCIAL CONTROL 0.00-0.05 (0.05-0.25, 0.25-0.50, 0.50-1.00), if the largest investor is a financial investor that holds more than 0% (5%, 25%, 50%) of all shares outstanding. Accordingly, the variables OPERATING CONTROL, MANAGER CONTROL, ETF CONTROL, and OTHER CONTROL are created to capture the equity stakes held by operating institutional investors (corporations), members of the management board, passively managed index tracking funds, and governmental or private stock ownership, respectively.

Correspondingly, MONITOR is replaced by FINANCIAL MONITOR 0.00-0.05, (0.05-0.10, 0.10-0.50), if the second-largest investor is a financial investor that exercises control via an equity stake exceeding 0% (5%, 10%) of all shares outstanding. The variables OPERATING MONITOR, MANAGER MONITOR, ETF MONITOR, and OTHER MONITOR stand for the second-largest shareholders' identities if operating investors, members of the management board, passively managed index tracking funds, and governmental or private stock ownership are present.

When employing the same techniques as in section 4.1, all of the different estimation techniques provide comparable results and the estimation accuracy remains constant so that we report and discuss the outcome of the random-effects logistic panel analysis only.

Table 9. Results and variable importance of the panel logit model – Differentiating financial, institution and managerial ownership

Rank	Variable	Estimate	Std. Error	t-value	Pr(>|t|)	Sig.
1	PREVIOUS	0.7114	0.0158	45.1018	0.0000	***
2	OIA	0.0781	0.0091	8.5881	0.0000	***
3	lnSIZE	0.0432	0.0077	5.6076	0.0000	***
4	FINANCIAL CONTROL 0.50-1.00	-0.0177	0.0060	-2.9614	0.0031	***
5	Y2011	0.0821	0.0309	2.6620	0.0078	***
6	MANAGER MONITOR 0.10-0.50	-0.0169	0.0072	-2.3415	0.0193	**
7	OCF	0.0185	0.0080	2.3182	0.0206	**
8	MANAGER MONITOR 0.05-0.10	0.0230	0.0102	2.2433	0.0250	**
9	MANAGER MONITOR 0.00-0.05	-0.0330	0.0168	-1.9600	0.0502	*
10	FINANCIAL CONTROL 0.00-0.05	-0.0199	0.0102	-1.9490	0.0515	*
11	FINANCIAL CONTROL 0.25-0.50	0.0155	0.0088	1.7537	0.0797	*
12	Y2009	-0.0516	0.0310	-1.6643	0.0962	*
13	MANAGER CONTROL 0.50-1.00	-0.0127	0.0077	-1.6421	0.1008	
14	FINANCIAL CONTROL 0.05-0.25	0.0198	0.0130	1.5161	0.1297	
15	OPERATING CONTROL 0.50-1.00	-0.0139	0.0096	-1.4503	0.1472	
16	OTHER CONTROL 0.05-0.25	-0.0284	0.0196	-1.4486	0.1476	
17	Y2008	0.0404	0.0305	1.3208	0.1867	
18	OTHER CONTROL 0.25-0.50	0.0208	0.0168	1.2406	0.2149	
19	FINANCIAL MONITOR 0.10-0.50	-0.0087	0.0072	-1.2032	0.2291	
20	ETF MONITOR 0.05-0.10	0.0092	0.0083	1.1160	0.2646	
21	OPERATING MONITOR 0.10-0.50	0.0077	0.0072	1.0784	0.2810	
22	OTHER CONTROL 0.00-0.05	0.0174	0.0169	1.0304	0.3030	
23	MANAGER CONTROL 0.25-0.50	0.0104	0.0115	0.9027	0.3668	
24	MANAGER CONTROL 0.00-0.05	-0.0156	0.0193	-0.8039	0.4216	
25	Y2012	0.0223	0.0310	0.7193	0.4721	
26	OPERATING CONTROL 0.25-0.50	0.0088	0.0124	0.7101	0.4777	
27	Y2010	-0.0215	0.0310	-0.6922	0.4889	
28	CHANGE	0.0340	0.0549	0.6193	0.5358	
29	OPERATING CONTROL 0.00-0.05	-0.0126	0.0211	-0.5966	0.5509	
30	OTHER MONITOR 0.05-0.10	0.0074	0.0135	0.5468	0.5846	
31	FINANCIAL MONITOR 0.05-0.10	-0.0036	0.0087	-0.4193	0.6751	
32	MANAGER CONTROL 0.05-0.25	0.0069	0.0211	0.3285	0.7426	
33	FINANCIAL MONITOR 0.00-0.05	0.0029	0.0098	0.2984	0.7654	
34	ETF CONTROL 0.05-0.25	-0.0033	0.0111	-0.2968	0.7667	
35	OPERATING MONITOR 0.05-0.10	-0.0026	0.0104	-0.2448	0.8067	
36	ETF MONITOR 0.00-0.05	-0.0020	0.0084	-0.2416	0.8091	
37	Y2013	0.0076	0.0315	0.2409	0.8096	
38	OTHER MONITOR 0.10-0.50	0.0020	0.0103	0.1908	0.8487	
39	BBS	0.0308	0.1789	0.1724	0.8632	
40	DEBT	-0.0011	0.0070	-0.1612	0.8720	
41	SECURED	0.0022	0.0173	0.1268	0.8991	
42	OPERATING MONITOR 0.00-0.05	-0.0011	0.0105	-0.1003	0.9201	
43	OTHER CONTROL 0.50-1.00	-0.0011	0.0112	-0.0966	0.9231	
44	ETF CONTROL 0.00-0.05	-0.0011	0.0116	-0.0917	0.9270	
45	GROWTH	0.0006	0.0075	0.0814	0.9351	
46	Y2014	-0.0015	0.0317	-0.0469	0.9626	
47	PBR	0.0003	0.0065	0.0430	0.9657	
48	OPERATING CONTROL 0.05-0.25	-0.0003	0.0206	-0.0135	0.9892	
49	CASH	0.0001	0.0068	0.0109	0.9913	
50	OTHER MONITOR 0.00-0.05	-0.0001	0.0135	-0.0070	0.9944	

*Note: *** indicates significant at the 1 percent level;*
*** indicates significant at the 5 percent level;*
** indicates significant at the 10 percent level.*

With regard to the three most important variables that are given in Table 9, we again obtain the same findings as in section 4.1. When differentiating among ownership identities, only controlling financial institutional and monitoring managerial ownership significantly affect dividend payout probabilities.

Dividend payout probabilities shrink if financial institutions hold an absolute majority of all shares outstanding; the variable FINANCIAL CONTROL 0.50-1.00 is the most important ownership variable and is ranked in fourth place. The negative impact of FINANCIAL CONTROL 0.50-1.00 might be driven by financial institutions' focus on value creation. Therefore, they might be willing to exercise direct control, reducing the need for dividend payments. Moreover, if financial shareholders hold large equity stakes, the exit threat may also discipline managers and dividends become redundant. Against that background, financial ownership with an equity stake of between 25% and 50% of all shares outstanding leads to increasing dividend payout probabilities, which is in line with the literature review in section 2.2.

Other than controlling ownership, all of the ownership variables capturing equity stakes held by monitoring members of the management board are statistically significant. If managerial monitoring ownership exceeds the 10% level or is below 5%, dividend payment becomes less likely; managerial ownership between these rates increases the probability of paying a dividend. If the second-largest investor is a member of the management board and holds more than 10% or less than 5% of the outstanding shares, the controlling function of the second-largest investor is not self-evident. Managerial owners have the incentive to hold cash reserves for private motives instead of distributing the money in the form of dividends. To our surprise, however, monitoring managerial ownership between 5% and 10% increases the probability of a dividend being paid. Among other things, managerial owners might influence cash distributions positively when their compensation is dividend-related. Again, this calls for additional research that is beyond the scope of this paper.

Moreover, it is conspicuous that neither controlling operating investors, nor monitoring institutional investors, nor other equity claimants have any statistically significant influence on the sample firms' dividend payout decisions. Additionally, despite their increasing importance in the investment industry, ETF ownership does not affect dividend payout probabilities. These findings are potentially dominated by lnSIZE, because ETFs simply track indices, and the criteria for inclusion in the leading German equity selection indices are market capitalization and order book turnover (Deutsche Boerse, 2013). Consequently, ETFs must focus on large firms.

In the next step, we control for shareholder origin. Because geographical distance might hamper the exercise of efficient control, geographical proximity gives domestic investors an advantage over foreign shareholders. Hence, dividend payout probabilities are expected to rise with increasing foreign financial ownership. Consequently, controlling and monitoring institutions are further divided into domestic and foreign investors. Again, the same variable definitions for all CONTROL and MONITOR blocks are used as are described in section 3.2. However, we substitute CONTROL by DOMESTIC FINANCIAL CONTROL 0.00-0.05 (0.05-0.25, 0.25-0.50, 0.50-1.00) if the largest investor is a domestic financial investor that holds more than 0% (5%, 25%, 50%) of all shares outstanding. Accordingly, the variables FOREIGN FINANCIAL CONTROL, DOMESTIC OPERATING CONTROL, and FOREIGN OPERATING CONTROL are created.

Likewise, we replace MONITOR by DOMESTIC FINANCIAL MONITOR 0.00-0.05, (0.05-0.10, 0.10-0.50) if the second-largest investor is a domestic financial investor that holds more than 0% (5%, 10%) of all shares outstanding. In addition, we obtain FOREIGN FINANCIAL MONITOR, DOMESTIC OPERATING MONITOR, and FOREIGN OPERATING MONITOR.

Once again, we only report the outcome of the logistic panel analysis with random effects as a result of our comparable results when applying alternative techniques, as in section 4.1.

Table 10 reveals that when controlling for the origin of institutional investors, only the variables capturing the equity stakes held by financial controlling institutions rank among the most important variables thereof. Accordingly, FOREIGN FINANCIAL CONTROL 0.50-1.00 and FOREIGN FINANCIAL CONTROL 0.25-0.50 are statistically significant. Apparently, foreign financial institutions holding majority stakes exercise direct control despite their geographical distance, and dividend payout probabilities therefore vanish. If foreign financial investors hold between 25% and 50% of the outstanding shares, the impact on dividends becomes positive. Obviously, exercising control by claiming cash distributions becomes a more important tool to minimize investment risk.

4.3. The Decision to Initiate Dividends

The results in 4.1 and 4.2 reveal the importance of PREVIOUS. Consequently, the question arises of which firm-specific determinants affect the decision to *initiate* dividend payments. Based on Payne (2011), we select a sample consisting of two groups of 121 observations each. The first group consists of the dividend initiations in our sample, as described in section 3.1. The second group is composed of 121 randomly chosen yearly firm observations from the 638 yearly non-dividend-payers in our sample but from the same year and the same industry as in the group of dividend-initiating yearly firm observations. When repeating the analysis according to section 4.1, but naturally leaving out PREVIOUS as an explanatory variable, average prediction accuracy drops below 60%.

Table 10. Results and variable importance of the panel logit model – Differentiating foreign and domestic institutional ownership

Rank	Variable	Estimate	Std. Error	t-value	Pr(>|t|)	Sig.
1	PREVIOUS	0.7217	0.0156	46.3328	0.0000	***
2	OIA	0.0749	0.0090	8.3457	0.0000	***
3	lnSIZE	0.0449	0.0070	6.3863	0.0000	***
4	FOREIGN FINANCIAL CONTROL 0.50-1.00	-0.0213	0.0060	-3.5543	0.0004	***
5	Y2011	0.0857	0.0309	2.7739	0.0056	***
6	FOREIGN FINANCIAL CONTROL 0.25-0.50	0.0197	0.0100	1.9761	0.0483	**
7	DOMESTIC FINANCIAL CONTROL 0.00-0.005	-0.0279	0.0148	-1.8802	0.0602	*
8	Y2009	-0.0571	0.0311	-1.8382	0.0662	*
9	OCF	0.0143	0.0078	1.8359	0.0665	*
10	DOMESTIC FINANCIAL CONTROL 0.05-0.25	-0.0187	0.0111	-1.6877	0.0916	*
11	FOREIGN FINANCIAL CONTROL 0.00-0.05	0.0267	0.0164	1.6249	0.1044	
12	FOREIGN OPERATING MONITOR 0.10-0.50	0.0119	0.0076	1.5767	0.1151	
13	DOMESTIC FINANCIAL MONITOR 0.10-0.50	-0.0112	0.0076	-1.4716	0.1413	
14	Y2008	0.0365	0.0307	1.1897	0.2343	
15	FOREIGN OPERATING CONTROL 0.50-1.00	-0.0113	0.0106	-1.0574	0.2905	
16	FOREIGN FINANCIAL MONITOR 0.05-0.10	-0.0083	0.0083	-0.9902	0.3222	
17	Y2010	-0.0252	0.0311	-0.8101	0.4180	
18	CHANGE	0.0402	0.0552	0.7284	0.4665	
19	DOMESTIC OPERATING CONTROL 0.25-0.50	0.0084	0.0123	0.6805	0.4963	
20	Y2012	0.0202	0.0311	0.6506	0.5154	
21	CASH	0.0041	0.0066	0.6220	0.5340	
22	DOMESTIC FINANCIAL CONTROL 0.50-1.00	0.0047	0.0077	0.6109	0.5413	
23	FOREIGN FINANCIAL MONITOR 0.10-0.50	-0.0043	0.0072	-0.5987	0.5494	
24	DOMESTIC OPERATING CONTROL 0.50-1.00	-0.0051	0.0089	-0.5699	0.5688	
25	FOREIGN OPERATING MONITOR 0.05-0.10	-0.0062	0.0113	-0.5540	0.5797	
26	DOMESTIC OPERATING CONTROL 0.00-0.05	-0.0125	0.0229	-0.5445	0.5862	
27	FOREING FINANCIAL CONTROL 0.005-0.25	0.0070	0.0133	0.5270	0.5983	
28	FOREIGN FINANCIAL MONITOR 0.00-0.05	0.0046	0.0087	0.5243	0.6001	
29	DOMESTIC OPERATING MONITOR 0.10-0.50	-0.0034	0.0078	-0.4370	0.6621	
30	DOMESTIC FINANCIAL MONITOR 0.05-0.10	0.0040	0.0094	0.4240	0.6716	
31	FOREING OPERATING CONTROL 0.00-0.05	-0.0061	0.0156	-0.3949	0.6930	
32	FOREIGN OPERATING CONTROL 0.05-0.25	0.0079	0.0204	0.3900	0.6966	
33	FOREIGN OPERATING CONTROL 0.25-0.50	-0.0043	0.0151	-0.2828	0.7774	
34	SECURED	0.0017	0.0060	0.2792	0.7801	
35	Y2013	0.0069	0.0316	0.2168	0.8284	
36	DOMESTIC OPERATING MONITOR 0.05-0.10	0.0023	0.0106	0.2158	0.8292	
37	BBS	0.0014	0.0070	0.2045	0.8380	
38	Y2014	-0.0048	0.0318	-0.1516	0.8796	
39	DOMESTIC FINANCIAL MONITOR 0.00-0.05	0.0009	0.0089	0.1060	0.9156	
40	DOMESTIC OPERATING MONITOR 0.00-0.05	0.0008	0.0098	0.0866	0.9310	
41	DOMESTIC OPERATING CONTROL 0.05-0.25	0.0021	0.0262	0.0806	0.9358	
42	DEBT	-0.0004	0.0068	-0.0649	0.9483	
43	DOMESTIC FINANCIAL CONTROL 0.25-0.50	-0.0006	0.0092	-0.0639	0.9491	
44	FOREIGN OPERATING MONITOR 0.00-0.05	-0.0005	0.0106	-0.0428	0.9659	
45	GROWTH	-0.0001	0.0075	-0.0156	0.9875	
46	PBR	-0.0001	0.0064	-0.0117	0.9907	

*Note: *** indicates significant at the 1 percent level;*
*** indicates significant at the 5 percent level;*
** indicates significant at the 10 percent level.*

Table 11 summarizes the results of the diverse classification techniques (detailed results are not reported here) and focuses on the top three variables according to variable importance. Surprisingly, the probability of initiating dividend payments shrinks with increasing lnSIZE, whereas the high importance and positive impact of OIA are in line with our previous findings. Unlike large firms, small companies are usually less well known and might initiate dividends to gain the attention of market participants and investors that prefer cash. Additionally, high cash reserves and low PBR make dividend initiations more likely. Apparently, issuers tend to initiate dividends when stocks are perceived to be undervalued. None of the ownership variables ranks in the top three most important variables for dividend initiations. These findings call for larger samples and a more detailed future analysis.

Table 11. Variable importance ranking for dividend initiations

Dividend initiations				
Rank	Panel Logit	LDA	Classification Tree	Random Forest
1	lnSIZE	lnSIZE	lnSIZE	OIA
2	OIA	OIA	OIA	OCF
3	PBR	PBR	CASH	CASH

5. CONCLUSIONS

Testing a broad set of firm-specific variables and applying different classification techniques, our study reveals previous year's dividend payments and proxies for corporate profitability and company size to be of utmost importance to explain dividend payout probabilities in our sample period from 2007 to 2014. Interestingly, "classical" explanatory variables derived from pecking order or trade-off-theory, such as growth rates or debt ratios, do not

significantly contribute to predicting German issuers' dividend payout behaviour.

Referring to our proxies for ownership concentration, shareholder identity and changes in shareholder identity, some of our hypotheses must be rejected. Changes from managerial to financial institutional ownership prove immaterial. Likewise, ETF ownership is neither important nor significant for the prediction of dividend payout. The latter result may be concealed by size effects because membership in German selection indices is based on both market capitalization and order book turnover.

Against that background, large controlling shareholders with equity stakes exceeding 50% of all shares outstanding significantly reduce payout probabilities, whereas block positions between 25% and 50% significantly increase dividend payout probabilities. Both variables rank among the ten most important variables. When controlling for shareholders' identity, financial institutions exert significant nonlinear influence on dividend payout probabilities. The second-largest shareholder only affects dividend-payment decisions when it is a member of the board.

Accounting for the origin of financial and operating institutional investors, we find that foreign financial institutional investors exert both a significant and an important influence on dividend payout decisions, whereas the influence of German financial institutional investors and both foreign and domestic operating owners is considerably lower. Distinct investment goals, investment horizons and even cultural characteristics might help explain these results.

Because the previous year's dividend payments are the most important variable in any analysis, we also investigate the determinants of dividend initiations. We find that smaller, more profitable companies with high cash reserves and low price-to-book ratios are more likely to initiate dividend payments. Because our sample period contains only 121 dividend initiations, additional research is needed.

REFERENCES

1. Aggarwal, R. A. J., Cao, J., & Chen, F. (2012). Information environment, dividend changes, and signaling: Evidence from ADR firms. *Contemporary Accounting Research, 29(2),* 403-431. https://doi.org/10.1111/j.1911-3846.2011.01101.x
2. Al-Najjar, B. (2009). Dividend behaviour and smoothing new evidence from Jordanian panel data. *Studies in Economics and Finance, 26(3),* 182-197. https://doi.org/10.1108/10867370910974017
3. Allen, F., Bernardo, A. E., & Welch, I. (2000). A theory of dividends based on tax clienteles. *The Journal of Finance, 55(6),* 2499-2536. https://doi.org/10.1111/0022-1082.00298
4. Amihud, Y., & Murgia, M. (1997). Dividends, taxes, and signaling: Evidence from Germany. *The Journal of Finance, 52(1),* 397-408. https://doi.org/10.1111/j.1540-6261.1997.tb03822.x
5. Arping, S., & Falconieri, S. (2010). Strategic versus financial investors: The role of strategic objectives in financial contracting. *Oxford Economic Papers, 62(4),* 691-714. https://doi.org/10.1093/oep/gpp038

6. Barclay, M. J., Holderness, C. G., & Sheehan, D. P. (2009). Dividends and corporate shareholders. *The Review of Financial Studies, 22(6),* 2423-2455. https://doi.org/10.1093/rfs/hhn060
7. Bennedsen, M., & Nielsen, K. M. (2010). Incentive and entrenchment effects in European ownership. *Journal of Banking & Finance, 34(9),* 2212-2229. https://doi.org/10.1016/j.jbankfin.2010.02.007
8. BlackRock (2017). *Proxy voting guidelines for European, Middle Eastern and African securities.* Retrieved from the World Wide Web: https://www.blackrock.com/corporate/en-it/literature/fact-sheet/blk-responsible-investment-guidelines-emea.pdf
9. Bogle, J. C. (2016). The index mutual fund: 40 years of growth, change, and challenge. *Financial Analysts Journal, 72(1),* 9-13. https://doi.org/10.2469/faj.v72.n1.5
10. Bolón-Canedo, V., Sánchez-Maro-o, N., & Alonso-Betanzos, A. (2013). A review of feature selection methods on synthetic data. *Knowledge and Information Systems, 34(3),* 483-519. https://doi.org/10.1007/s10115-012-0487-8
11. Breiman, L. (2001). Statistical modeling: The two cultures. *Statistical Science, 16(3),* 199-231. https://doi.org/10.1214/ss/1009213725
12. Breiman, L., & Cutler, A. (2003). *Manual on setting up, using, and understanding Random Forests V4.0.* Retrieved from the World Wide Web: https://www.stat.berkeley.edu/~breiman/Using_random_forests_ v4.0. pdf
13. Brennan, M. J., & Thakor, A. V. (1990). Shareholder preferences and dividend policy. *The Journal of Finance, 45(4),* 993-1018. https://doi.org/10.1111/j.1540-6261.1990.tb02424.x
14. Brockman, P., & Unlu, E. (2009). Dividend policy, creditor rights, and the agency costs of debt. *Journal of Financial Economics, 92(2),* 276-299. https://doi.org/10.1016/j.jfineco.2008.03.007
15. Brown, J. R., Liang, N., & Weisbenner, S. (2007). Executive financial incentives and payout policy: Firm responses to the 2003 dividend tax cut. *The Journal of Finance, 62(4),* 1935-1965. https://doi.org/10.1111/j.1540-6261.2007.01261.x
16. Charitou, A., Lambertides, N., & Theodoulou, G. (2011). Dividend increases and initiations and default risk in equity returns. *Journal of Financial and Quantitative Analysis, 46(5),* 1521-1543. https://doi.org/10.1017/S0022109011000305
17. Dahlquist, M., & Robertsson, G. (2001). Direct foreign ownership, institutional investors, and firm characteristics. *Journal of Financial Economics, 59(3),* 413-440. https://doi.org/10.1016/S0304-405X(00)00092-1
18. DeAngelo, H., DeAngelo, L., & Stulz, R. M. (2006). Dividend policy and the earned/contributed capital mix: A test of the life-cycle theory. *Journal of Financial Economics, 81(2),* 227-254. https://doi.org/10.1016/j.jfineco.2005.07.005
19. Deutsche Boerse. (2013). *Guide to equity indices of Deutsche Boerse, Version 6.25.* Frankfurt am Main, Germany, Deutsche Boerse AG.
20. Easterbrook, F. H. (1984). Two agency-cost explanations of dividends. *The American Economic Review, 74(4),* 650-659.
21. Edmans, A. (2009). Blockholder trading, market efficiency, and managerial myopia. *The Journal of Finance, 64(6),* 2481-2513. https://doi.org/10.1111/j.1540-6261.2009.01508.x
22. Faccio, M., Larry, H. P. L., & Young, L. (2001). Dividends and expropriation. *The American*

Economic Review, 91(1), 54-78. https://doi.org/10. 1257/aer.91.1.54

23. Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. *The Review of Financial Studies, 15(1),* 1-33. https://doi.org/10.1093/rfs/15.1.1

24. Ferris, S. P., Jayaraman, N., & Sabherwal, S. (2009). Catering effects in corporate dividend policy: The international evidence. *Journal of Banking & Finance, 33(9),* 1730-1738. https://doi.org/10. 1016/j.jbankfin.2009.04.005

25. Fichtner, J., Heemskerk, E. M., & Garcia-Bernardo, J. (2016). *Hidden power of the big three? Passive index funds, re-concentration of corporate ownership, and new financial risk.* Retrieved from the World Wide Web: http://ssrn.com/abstract= 2798653 (August 25, 2016).

26. Florackis, C., Kanas, A., & Kostakis, A. (2015). Dividend policy, managerial ownership and debt financing: A non-parametric perspective. *European Journal of Operational Research, 241(3),* 783-795. https://doi.org/10.1016/j.ejor.2014.08.031

27. Gaspar, J. M., Massa, M., Matos, P., Patgiri, R., & Rehman, Z. (2013). Payout policy choices and shareholder investment horizons. *Review of Finance, 17(1),* 261-320. https://doi.org/10.1093/ rof/rfr040

28. Goergen, M., Renneboog, L., & da Silva, L. C. (2005). When do German firms change their dividends? *Journal of Corporate Finance, 11(1-2),* 375-399. https://doi.org/10.1016/j.jcorpfin.2003.09.001

29. Gugler, K. (2003). Corporate governance, dividend payout policy, and the interrelation between dividends, R&D, and capital investment. *Journal of Banking & Finance, 27(7),* 1297-1321. https://doi.org/10.1016/S0378-4266(02)00258-3

30. Gugler, K., & Yurtoglu, B. B. (2003). Corporate governance and dividend pay-out policy in Germany. *European Economic Review, 47(4),* 731-758. https://doi.org/10.1016/S0014-2921(02)00291-X

31. Huang, J. J., Shen, Y., & Sun, Q. (2011). Nonnegotiable shares, controlling shareholders, and dividend payments in China. *Journal of Corporate Finance, 17(1),* 122-133. https://doi.org/10.1016/j.jcorpfin.2010.09.007

32. Huang, Z., Chen, H., Hsu, C. J., Chen, W. H., & Wu, S. (2004). Credit rating analysis with support vector machines and neural networks: A market comparative study. *Decision Support Systems, 37(4),* 543-558. https://doi.org/10.1016/S0167-9236(03)00086-1

33. Jain, A., Nandakumar, K., & Ross, A. (2005). Score normalization in multimodal biometric systems. *Pattern Recognition, 38(12),* 2270-2285. https://doi.org/10.1016/j.patcog.2005.01.012

34. Jain, R. (2007). Institutional and individual investor preferences for dividends and share repurchases. *Journal of Economics and Business, 59(5),* 406-429. https://doi.org/10.1016/j.jecon bus.2007.04.004

35. Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review, 76(2),* 323-329.

36. Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3(4),* 305-360. https://doi.org/10.1016/0304-405X(76)90026-X

37. Jiang, Y., & Peng, M. W. (2011). Principal-principal conflicts during crisis. *Asia Pacific Journal of Management, 28(4),* 683-695. https://doi.org/10. 1007/s10490-009-9186-8

38. Kang, S., Kul, W., & Kim, S. (2010). Impact of foreign institutional investors on dividend policies in Korea: A stock market perspective. *Journal of Financial Management and Analysis, 23(1),* 10-26.

39. Khan, T. (2006). Company dividends and ownership structure: Evidence from UK panel data. *The Economic Journal, 116(510),* 172-189. https://doi.org/10.1111/j.1468-0297.2006.01082.x

40. Klein, A., & Zur, E. (2009). Entrepreneurial shareholder activism: Hedge funds and other private investors. *The Journal of Finance, 64(1),* 187-229. https://doi.org/10.1111/j.1540-6261.2008. 01432.x

41. La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W. (2000). Agency problems and dividend policies around the World. *The Journal of Finance, 55(1),* 1-33. https://doi.org/10.1111/ 0022-1082.00199

42. Lee, W. J. (2011). Managerial entrenchment and the value of dividends. *Review of Quantitative Finance and Accounting, 36(2),* 297-322. https://doi.org/10.1007/s11156-010-0179-y

43. Li, W., & Lie, E. (2006). Dividend changes and catering incentives. *Journal of Financial Economics, 80(2),* 293-308. https://doi.org/10.1016/j.jfineco. 2005.03.005

44. Lintner, J. (1956). Distribution of incomes of corporations among dividends, retained earnings, and taxes. *The American Economic Review, 46(2),* 97-113.

45. Luebke, K., & Rojahn, J. (2016). Firm-specific determinants on dividend changes: Insights from data mining. In A.F.X. Wilhelm & H.A. Kestler (Eds.), *Analysis of large and complex data* (pp. 335-344). Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-25 226-1_29

46. Maury, C., & Pajuste, A. (2002). Controlling shareholders, agency problems, and dividend policy in Finland. *Liiketaloudellinen Aikakauskirja, 51(1),* 15-45.

47. McLachlan, G. (2004). *Discriminant analysis and statistical pattern recognition.* Hoboken, NJ, USA: Wiley.

48. Miller, M. H., & Rock, K. (1985). Dividend policy under asymmetric information. *The Journal of Finance, 40(4),* 1031-1051. https://doi.org/10.1111/ j.1540-6261.1985.tb02362.x

49. Morck, R., Shleifer, A., & Vishny, R. W. (1988). Management ownership and market valuation. *Journal of Financial Economics, 20(1-2),* 293-315. https://doi.org/10.1016/0304-405X(88)90048-7

50. Payne, B. C. (2011). On the financial characteristics of firms that initiated new dividends during a period of economic recession and financial market turmoil. *Journal of Economics and Finance, 35(2),* 149-163. https://doi.org/10.1007/s12197-009-9084-4

51. Rodriguez, B., Perez, O., Garcia, J., & Molina, J. M. (2008). Machine learning techniques for acquiring knowledge in image tracking. *Applied Artificial Intelligence, 22(3),* 266-282. https://doi.org/10. 1080/08839510701821652

52. Rozeff, M. S. (1982). Growth, beta and agency costs as determinants of dividend payout ratios. *Journal of Financial Research, 5(3),* 249-259. https://doi.org/10.1111/j.1475-6803.1982.tb00299.x

53. Shleifer, A., & Vishny, R. W. (1986). Large shareholders and corporate control. *Journal of Political Economy, 94(3),* 461-488. https://doi.org/10.1086/261385

54. Short, H., Zhang, H., & Keasey, K. (2002). The link between dividend policy and institutional

ownership. *Journal of Corporate Finance, 8(2),* 105-122. https://doi.org/10.1016/S0929-1199(01) 00030-X

55. Skinner, D. J. (2008). The evolving relation between earnings, dividends, and stock repurchases. *Journal of Financial Economics, 87(3),* 582-609. https://doi.org/10.1016/j.jfineco.2007.05.003

56. Skinner, D. J., & Soltes, E. (2009). What do dividends tell us about earnings quality? *Review of Accounting Studies, 16(1),* 1-28. https://doi.org/10. 1007/s11142-009-9113-8

57. Stinson, S. R., & Ricketts, R. C. (2016). Shifts in ownership composition and changes in the implied cost of equity capital for dividend and non-dividend stocks following JGTRRA03. *The Journal of the American Taxation Association, 38(1),* 103-124. https://doi.org/10.2308/atax-51302

58. Stulz, R. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics,* *26(1),* 3-27. https://doi.org/10.1016/0304-405X (90)90011-N

59. Thanatawee, Y. (2013). Ownership structure and dividend policy: Evidence from Thailand. *International Journal of Economics and Finance, 5(1),* 121-132.

60. Truong, T., & Heaney, R. (2007). Largest shareholder and dividend policy around the world. *The Quarterly Review of Economics and Finance, 47(5),* 667-687. https://doi.org/10.1016/j.qref.2007. 09.002

61. von Eije, H., & Megginson, W. L. (2008). Dividends and share repurchases in the European union. *Journal of Financial Economics, 89(2),* 347-374. https://doi.org/10.1016/j.jfineco.2007.11.002

62. Young, M. N., Peng, M. W., Ahlstrom, D., Bruton, G. D., & Jiang, Y. (2008). Corporate governance in emerging economies: A review of the principal–principal perspective. *Journal of Management Studies, 45(1),* 196-220. https://doi.org/10.1111/j. 1467-6486.2007.00752.x