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

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 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.

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

Acknowledgements: The authors thank Karsten Luebke, Joachim Schwarz and Florian Zechser for their helpful comments and suggestions. The authors are fully responsible for any errors remaining in this paper.
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-Marcano & 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 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 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.
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 (Tuong & 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 investment (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 company distribution policies: 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, fewer protection 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-Bernando, 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 & Rickets, 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.

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | Sum |
|------|------|------|------|------|------|------|------|------|-----|
| Number of companies | 136 | 149 | 133 | 129 | 152 | 154 | 148 | 149 | 1,143 |
| Number of PAYER | 244 | 243 | 229 | 227 | 226 | 219 | 209 | 204 | 1,781 |
| 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; 0.05-0.25 = 0.20 if ownership > 0.25; 0.25-0.50 = ownership - 0.25 if ownership between 0.25 and 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 < 0.10, 0.05-0.10 = 0.10 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.
Turning to 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.

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.

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| Panel A. Controlling and monitoring investors |
|---|---|---|---|---|
| Explanatory Variable | No. of observations | Mean | Std. Dev. | Min | Max |
| CONTROL 0.00-0.05 | 1,781 | 0.0473 | 0.0116 | 0.0000 | 0.0500 |
| CONTROL 0.05-0.25 | 1,679 | 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 | 0.0358 | 0.0000 | 0.2000 |
| MONITOR 0.10-0.20 | 67 | 0.0014 | 0.0116 | 0.0000 | 0.1871 |

| Table 2. Summary statistics on ownership variables |

| Variable | Financial ownership (domestic) | Corporate Ownership (domestic) | Managerial Ownership | ETF Ownership | Others |
|---|---|---|---|---|---|
| No. of observations | 680 | 679 | 134 | 19 | 49 |
| Std. Dev. | (342) | (390) | (434) | (114) | (39) |
| Mean | 641 | 681 | 312 | 17 | 39 |
| Min | 19 | 479 | 0 | 0 | 0 |
| Max | 51 | 299 | 111 | 0 | 4 |

| Variable | MONITOR 0.00-0.05 | MONITOR 0.05-0.10 | MONITOR 0.10-0.50 |
|---|---|---|---|
| Financial ownership | 886 | 479 | 21 |
| Corporate Ownership | (412) | (251) | (118) |
| Managerial Ownership | 307 | 251 | 16 |
| ETF Ownership | 64 | 24 | 0 |
| Others | 104 | 91 | 3 |
| Total no. of observations | 1,781 | 1,679 | 973 | 465 |
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 as 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, 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                  | 0.0263   | 0.1233    | -1.5700   | 0.6309    | +             |
| OCF                  | 0.0794   | 0.1018    | -1.3650   | 0.4834    | +             |
| DEBT                 | 0.5273   | 0.1878    | 0.0235    | 0.9955    | -             |
| SECURED              | 0.2250   | 0.3497    | 0.0000    | 1.0000    | -             |
| lnSIZE               | 3.9931   | 2.1579    | 1.0961    | 12.2968   | +             |
| GROWTH               | 0.0765   | 0.4412    | -0.9916   | 14.3100   | +             |
| 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 \( H_0: \beta_4 = 0 \) 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   | 0.7247   | 0.0153     | 47.3149 | 0.0000*** |
| 2    | OIA        | 0.0740   | 0.0088     | 8.2390  | 0.0000*** |
| 3    | InSIZE     | 0.0433   | 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 | 0.0067     | -2.5000 | 0.0123*    |
| 8    | Y2009      | -0.0346  | 0.0309     | -1.1768 | 0.2417*    |
| 9    | CONTROL 0.0.0-0.05 | -0.0105 | 0.0074     | -1.4282 | 0.1532*    |
| 10   | MONITOR 0.10-0.50 | -0.0093 | 0.0070     | -1.3314 | 0.1832*    |
| 11   | Y2008      | 0.0393   | 0.0035     | 1.2960  | 0.1983*    |
| 12   | CONTROL 0.10-0.25 | 0.0093  | 0.0088     | 1.0634  | 0.2873*    |
| 13   | MONITOR 0.05-0.10 | 0.0084  | 0.0080     | 1.0472  | 0.2951*    |
| 14   | CHANGE     | 0.0457   | 0.0538     | 0.8496  | 0.3937*    |
| 15   | Y2010      | -0.0213  | 0.0309     | -0.6886 | 0.4911*    |
| 16   | MONITOR 0.00-0.05 | -0.0055 | 0.0083     | -0.6002 | 0.5092*    |
| 17   | Y2012      | 0.0053   | 0.0039     | 0.6553  | 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     | 0.0852  | 0.9242*    |
| 23   | Y2014      | -0.0028  | 0.0335     | -0.6883 | 0.4911*    |
| 24   | PBR        | 0.0004   | 0.0063     | 0.0651  | 0.9481*    |
| 25   | GROWTH     | 0.0003   | 0.0075     | 0.0456  | 0.9617*    |

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, InSIZE 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 Y2011 are 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.
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 mistaken 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 payout probability is still 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

100%
Previous year dividend payment < 0.5

63%
Operating Net Income < -0.2

6%
Company Size < 0.77

37% NOPAY
4% NOPAY
2% PAY
57% PAY

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       | 4.1225     | 6.2797   |
| 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       | 0.0058       | 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 0.00-0.05 | 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 0.00-0.10 | 0.4055    | 0.3913       | 0.0405     | 0.0422   |
| 17   | BBS           | 0.4054       | 0.4628       | 0.0053     | 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     | 0.1397   |
| 21   | MONITOR 0.00-0.05 | 0.4051    | 0.8174       | 0.0148     | 0.0310   |
| 22   | Y2014         | 0.4051       | 0.8993       | 0.0956     | 0.1231   |
| 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       | 0.2430     | 0.2139   |

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                    | 60.9561                  |
| 3    | lnSIZE                 | 35.7163                  |
| 4    | DEBT                   | 18.3082                  |
| 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      | 3.5050                   |
| 17   | Y2010                  | 3.1629                   |
| 18   | Y2009                  | 2.5860                   |
| 19   | CONTROL 0.0-0.05       | 0.9140                   |
| 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. Variable importance ranking for dividend payout probability

| 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   | Y2009               | DEBT          |
| 5    | Y2011       | Y2009  | GROWTH              |               |
| 6    | OCF         | OCF    |                     |               |
| 7    | CONTROL 0.25-0.50 | Y2010   |                     |               |
| 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 shareholder 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.

| Rank | Variable                              | Estimate | Std. Error | t-value | Pr(>|t|) | Sig. |
|------|---------------------------------------|----------|------------|---------|---------|------|
| 1    | PREVIOUS                              | 0.1714   | 0.0118     | 45.1018 | 0.0000  | ***  |
| 2    | OBA                                   | 0.0781   | 0.0091     | 8.5881  | 0.0000  | ***  |
| 3    | InlnSIZE                              | 0.0432   | 0.0077     | 5.6076  | 0.0000  | ***  |
| 4    | OPERATING CONTROL 0.00-0.05           | -0.0975  | 0.0600     | -1.6890 | 0.0902  | *    |
| 5    | OTHER CONTROL 0.00-0.05               | -0.0199  | 0.0112     | -1.8409 | 0.0651  | *    |
| 6    | MANAGER CONTROL 0.10-0.50             | 0.0189   | 0.0087     | 2.1561  | 0.0193  | **   |
| 7    | OPERATING CONTROL 0.05-0.10           | 0.0157   | 0.0110     | 1.3453  | 0.1789  | *    |
| 8    | OTHER CONTROL 0.10-0.50               | 0.0015   | 0.0072     | -0.2142 | 0.0426  | *    |
| 9    | ETF CONTROL 0.05-0.10                 | 0.0092   | 0.0083     | 1.1160  | 0.2446  | *    |
| 10   | OPERATING CONTROL 0.10-0.50           | 0.0077   | 0.0072     | 1.0784  | 0.2810  | *    |
| 11   | OTHER CONTROL 0.05-0.05               | 0.0114   | 0.0169     | 0.6922  | 0.4889  |      |
| 12   | MANAGER CONTROL 0.25-0.50             | -0.0136  | 0.0193     | -0.6922 | 0.4889  |      |
| 13   | OPERATING CONTROL 0.00-0.05           | 0.0050   | 0.0110     | 0.1324  | 0.0515  | *    |
| 14   | OTHER CONTROL 0.05-0.25               | 0.0052   | 0.0072     | 0.2409  | 0.0426  | *    |
| 15   | ETF MONITOR 0.00-0.05                 | 0.0026   | 0.0048     | 0.2448  | 0.0867  |      |
| 16   | OTHER CONTROL 0.00-0.05               | 0.0002   | 0.0084     | -0.2416 | 0.0426  | *    |
| 17   | Y2011                                 | 0.0076   | 0.0315     | 0.2409  | 0.0426  | *    |
| 18   | OTHER MONITOR 0.10-0.50               | 0.0020   | 0.0103     | 0.1908  | 0.0426  | *    |
| 19   | BRS                                   | 0.0003   | 0.0179     | 0.1724  | 0.0426  | *    |
| 20   | DEBT                                  | 0.0011   | 0.0070     | -0.1612 | 0.8720  |      |
| 21   | SECURED                               | 0.0022   | 0.0173     | 0.1268  | 0.8991  |      |
| 22   | OPERATING MONITOR 0.00-0.05           | -0.0011  | 0.0105     | -0.1093 | 0.9201  |      |
| 23   | OTHER CONTROL 0.50-1.00               | -0.0011  | 0.0112     | -0.0906 | 0.9231  |      |
| 24   | ETF CONTROL 0.05-0.10                 | -0.0013  | 0.0116     | -0.0917 | 0.9270  |      |
| 25   | GROWTH                                | 0.0006   | 0.0075     | 0.0814  | 0.9351  |      |
| 26   | Y2014                                 | -0.0015  | 0.0317     | -0.0469 | 0.9626  |      |
| 27   | PBR                                   | 0.0003   | 0.0065     | 0.0410  | 0.9657  |      |
| 28   | OPERATING CONTROL 0.05-0.25           | 0.0089   | 0.0068     | 0.1115  | 0.9992  |      |
| 29   | CASH                                  | 0.0001   | 0.0068     | 0.0109  | 0.9913  |      |
| 30   | OTHER MONITOR 0.00-0.05               | -0.0001  | 0.0135     | -0.0070 | 0.9944  |      |

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

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 0.00-0.50 (0.50-0.25, 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 0.25-0.50 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 | 0.2155   | 0.0597     | 4.273   | 0.0000  | ***  |
| 2    | OIA      | 0.0035   | 0.0061     | 0.078   | 0.9768  |      |
| 3    | lnSIZE   | 0.0011   | 0.0006     | 0.017   | 0.984   |      |
| 4    | FOREIGN FINANCIAL CONTROL 0.30-1.00 | -0.0205 | 0.0075 | -2.712 | 0.0068  | *** |
| 5    | Y2011    | 0.0383   | 0.0078     | 0.491   | 0.6246  |      |
| 6    | FOREIGN FINANCIAL CONTROL 0.25-0.90 | 0.0073 | 0.0026 | 2.825 | 0.0049  | **  |
| 7    | DOMESTIC FINANCIAL CONTROL 0.00-0.06 | -0.0247 | 0.0146 | -1.686 | 0.0962  |      |
| 8    | Y2009    | -0.0512  | 0.0060     | -8.553  | 0.0000  | ***  |
| 9    | OCF      | 0.0147   | 0.0073     | 2.027   | 0.0426  |      |
| 10   | DOMESTIC FINANCIAL CONTROL 0.05-0.25 | -0.0131 | 0.0046 | -2.852 | 0.0044  | **  |
| 11   | FOREIGN FINANCIAL CONTROL 0.00-0.05 | 0.0077 | 0.0017 | 4.488 | 0.0007  | *** |
| 12   | FOREIGN OPERATING MONITOR 0.10-0.50 | 0.0119 | 0.0050 | 2.411 | 0.0164  |      |
| 13   | DOMESTIC FINANCIAL MONITOR 0.10-0.50 | -0.0119 | 0.0063 | -1.835 | 0.0668  |      |
| 14   | Y2008    | 0.0868   | 0.0050     | 17.367  | 0.0000  | ***  |
| 15   | FOREIGN OPERATING CONTROL 0.50-1.00 | -0.0125 | 0.0035 | -3.534 | 0.0004  | *** |
| 16   | FOREIGN FINANCIAL CONTROL 0.05-0.10 | -0.0083 | 0.0080 | -1.042 | 0.2980  |      |
| 17   | Y2010    | -0.0252  | 0.0110     | -2.304  | 0.0213  |      |
| 18   | CHANGE   | 0.0402   | 0.0052     | 7.698   | 0.0000  | ***  |
| 19   | DOMESTIC OPERATING CONTROL 0.25-0.50 | 0.0084 | 0.0123 | 0.680 | 0.4963  |      |
| 20   | Y2012    | 0.0202   | 0.0111     | 1.805   | 0.0707  |      |
| 21   | CASH     | 0.0041   | 0.0066     | 0.622   | 0.5340  |      |
| 22   | DOMESTIC OPERATING CONTROL 0.50-1.00 | 0.0047 | 0.0077 | 0.609 | 0.5413  |      |
| 23   | FOREIGN OPERATING CONTROL 0.10-0.50 | -0.0034 | 0.0072 | -0.507 | 0.6103  |      |
| 24   | FOREIGN OPERATING CONTROL 0.50-1.00 | -0.0031 | 0.0089 | -0.350 | 0.7273  |      |
| 25   | FOREIGN OPERATING CONTROL 0.05-0.10 | -0.0062 | 0.0113 | -0.554 | 0.5807  |      |
| 26   | FOREIGN OPERATING CONTROL 0.00-0.05 | -0.0125 | 0.0229 | -0.545 | 0.5862  |      |
| 27   | FOREIGN OPERATING CONTROL 0.00-0.25 | 0.0060 | 0.0133 | 0.470 | 0.6330  |      |
| 28   | FOREIGN OPERATING CONTROL 0.00-0.50 | 0.0046 | 0.0087 | 0.524 | 0.6001  |      |
| 29   | FOREIGN OPERATING CONTROL 0.10-0.50 | -0.0034 | 0.0075 | -0.437 | 0.6621  |      |
| 30   | FOREIGN OPERATING CONTROL 0.05-0.10 | 0.0040 | 0.0094 | 0.424 | 0.6716  |      |
| 31   | FOREIGN OPERATING CONTROL 0.00-0.05 | -0.0061 | 0.0136 | -0.439 | 0.6300  |      |
| 32   | FOREIGN OPERATING CONTROL 0.05-0.25 | 0.0079 | 0.0204 | 0.390 | 0.6990  |      |
| 33   | FOREIGN OPERATING CONTROL 0.25-0.50 | -0.0043 | 0.0151 | -0.282 | 0.774  |      |
| 34   | SECURED  | 0.0017   | 0.0060     | 0.272   | 0.780 |      |
| 35   | Y2013    | 0.0069   | 0.0316     | 0.216   | 0.828 |      |
| 36   | DOMESTIC OPERATING MONITOR 0.05-0.10 | 0.0023 | 0.0106 | 0.215 | 0.8292  |      |
| 37   | BBS      | 0.0014   | 0.0070     | 0.2045  | 0.838 |      |
| 38   | Y2014    | -0.0048  | 0.0118     | -0.356  | 0.722 |      |
| 39   | DOMESTIC FINANCIAL CONTROL 0.00-0.05 | -0.0099 | 0.0089 | -1.060 | 0.286 |      |
| 40   | DOMESTIC OPERATING CONTROL 0.00-0.05 | 0.0008 | 0.0098 | 0.085 | 0.9310  |      |
| 41   | DOMESTIC OPERATING CONTROL 0.05-0.25 | 0.0021 | 0.0262 | 0.080 | 0.9358  |      |
| 42   | NET     | -0.0004  | 0.0068     | -0.064 | 0.948 |      |
| 43   | DOMESTIC FINANCIAL CONTROL 0.25-0.50 | -0.0006 | 0.0092 | -0.063 | 0.9491  |      |
| 44   | FOREIGN OPERATING CONTROL 0.00-0.05 | -0.0005 | 0.0106 | -0.042 | 0.9659  |      |
| 45   | GROWTH   | -0.0001  | 0.0075     | -0.015 | 0.9875  |      |
| 46   | PBR      | -0.0001  | 0.0064     | -0.011 | 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. Variable importance ranking for dividend initiations

| Rank | Panel Logit | LDA | Classification Tree | Random Forest |
|------|-------------|-----|---------------------|---------------|
| 1    | ln SIZE     | ln SIZE | ln SIZE | OIA | OIA |
| 2    | DOMESTIC OPERATING CONTROL 0.25-0.50 | 0.0005 | 0.0106 | 0.968 | 0.968 |
| 3    | PBR | PBR | CASH | 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.

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