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Is Board Size an Independent Corporate Governance Mechanism?

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Is Board Size an Independent Corporate Governance Mechanism?

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Abstract

Using a comprehensive set of listed Swiss companies, our findings suggest that the size of the board of directors is an independent control mechanism. However, in contrast to previous studies, we do not find a significant relationship between board size and firm performance. This suggests that Swiss firms, on average, choose their number of board members just optimally. Cross-sectional variations in board size reflect differences in firms' underlying environment, but not mistaken choices.

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1 Introduction

A growing body of research examines the structure and effectiveness of different corporate governance mechanisms. Numerous empirical studies reveal that executive compensation, takeover threats, monitoring by boards of directors, concentrated holding, debt, and other mechanisms influence top managers' decisions. We contribute to this literature by exploring whether the size of the board of directors constitutes an independent governance mechanism and is related to firm performance. This is an interesting research question with potentially important practical implications. Unfortunately, most studies are limited to a US perspective. Using a comprehensive set of companies listed on the Swiss Stock Exchange (SWX), our results support the notion that board size is indeed an independent control mechanism. However, in contrast to previous studies (e.g., Yermack, 1996), we do not find a significant relationship between firm performance and board size. This suggests that Swiss firms, on average, choose their number of board members just optimally. Cross-sectional variations in board size reflect differences in firms' underlying environment, and not mistaken choices.

Jensen (1993) and Lipton and Lorsch (1992) were the first to hypothesize that board size affects corporate governance independent of other board attributes. Specifically, they suggest that large boards can be less effective than small boards. They start with the presumption that the great emphasis on politeness and courtesy in boardrooms is at the expense of truth and frankness. Specifically, when boards become too big, agency problems (e.g., director free-riding) increase and the board becomes more symbolic and neglects its monitoring and control duties. The underlying notion is that at some point the coordination problems outweigh the advantages from having more people to draw on. Jensen (1993) notes that 'when boards get beyond seven or eight people they have less likely to function effectively and are easier for the CEO to control.' Confirming this hypothesis, Yermack (1996) and Eisenberg, Sundgren and Wells (1998) report that there is a significant relationship between board size and Tobin's Q. However, note that this finding is not necessarily clear ex ante. An alternative hypothesis could be that larger boards would bring together specialists from various functional areas and therefore contribute to higher firm values. However, using a large panel of Swiss firms, Loderer and Peyer (2002) also find that larger board size is associated with lower firm value. Interestingly,

they ultimately question causality and hypothesize that ‘larger board sizes simply identify firms that are not run as effectively as other firms.’

In fact, two main issues complicate empirical work on boards of directors. First, most of the variables are endogenous, i.e., the econometrician faces the problem of joint endogeneity. A plausible alternative to the Jensen (1993) and Lipton and Lorsch (1992) hypothesis is that troubled firms expand their board in response to poor past performance in order to increase managerial capacity. Firm performance is both a result of the actions of previous directors and itself a factor that influences the choice of subsequent directors. From an empirical point of view, it is notoriously hard to exactly determine causality, hence all results must be interpreted with due care. Second, many empirical results can be interpreted as either equilibrium or out-of-equilibrium phenomena. Hermalin and Weisbach (2001) explicitly demonstrate the problem using the relationship between board size and firm performance. Viewed as an out-of-equilibrium phenomenon, a negative relationship between board size and firm performance implies that limits on board size should be encouraged. In contrast, the equilibrium interpretation of this result is that some other factor is causing both board size and firm performance. In this case any correlation between the two variables is purely spurious, hence regulation would be at best useless and possibly counterproductive. The issue is illustrated in figure 1, which is adapted from Hermalin and Weisbach (2001).

[Insert figure 1 here]

In this paper, we examine whether larger board sizes simply identify firms that are not run as effectively as other firms or whether board size represents an independent governance mechanisms and is directly responsible for firms’ inefficiencies. This is an open question which has been explicitly raised in a recent paper by Loderer and Peyer (2002) on board overlap and firm performance in Switzerland. We look at four corporate governance mechanisms: board size, ownership concentration, leverage, and board composition. Specifically, using a sample of Swiss firms, our empirical analysis addresses three questions. First, is the size of the board an independent control mechanisms, or is it merely dependent on the three other mechanisms? Second, do firms with smaller boards exhibit higher valuations, as measured by Tobin’s Q? This is a direct test of the Lipton and Lorsch (1992) and

Jensen (1993) hypothesis. Third, are the four control mechanisms selected optimally? If this is indeed the case, any cross-sectionally variation in their use reflects differences in firms' underlying environment, but not inefficient choices. In contrast, if these mechanisms are not selected optimally, changes in their use alleviate governance malfunctions and increase firm value.

The remainder of this paper is as follows. Section 2 gives an overview of related literature on board size and firm performance. Section 3 explains the empirical approach. Section 4 describes our sample of Swiss firms. Section 5 presents our empirical results, and section 6 concludes.

2 Prior research on board size

At least in theory, the board of directors is one of the most important governance mechanism ensuring that managers pursue the interests of shareholders (e.g., Allen and Gale, 2000). Its task is to monitor, discipline and remove ineffective management teams. In recent years, there has been an intensive debate concerning the way that boards are structured. Monks and Minow (2001) and Hermalin and Weisbach (2001) survey the results of previous theoretical and empirical work. The general consensus is that different aspects and mechanisms play a role in increasing the effectiveness of board monitoring, e.g., board composition, board independence, and board dynamics. Our focus in this paper is on board size, or more specifically, on the proposal for limiting the size of boards in order to improve their effectiveness. This is an interesting question, because one potential approach is to regard boards simply as a product of regulation. However, as Hermalin and Weisbach (2001) note, if boards simply satisfy regulatory requirements, they 'would represent deadweight costs to firms, which subsequent lobbying presumably would have eliminated, at least somewhere in the world'. In any case, we should observe boards of minimum size. In practice, however, boards are generally *larger* than required by law. Therefore, a more plausible hypothesis is that boards are part of the equilibrium solution (but still second best) to the contracting problem between dispersed shareholders and management (e.g., Hart, 1995). Viewed from this point of view, boards should be interpreted as an endogenously determined institution that helps to alleviate agency problems in large firms.

A natural question is whether there is an optimal board size. Interestingly, most previous studies looked at board structure and board composition and their influence on corporate performance.[6] In contrast, the mere number of board members received less attention. Table 1 shows a summary of results from previous empirical research on board size. Lipton and Lorsch (1992) and Jensen (1993) have argued that large boards can make coordination, communication, and decision making more cumbersome than it is in smaller groups. Yermack (1996) was the first to present empirical support for this proposition. Using a sample of large US public corporations, he reports an inverse association between board size and firm value, as measured by Tobin's Q. His results are robust to a variety of control variables, such as company size, growth opportunities, quality of corporate governance, and ownership structure. Yermack (1996) carefully accounts for possible endogeneity problems. Causality runs from board size to firm valuation, and there is no evidence that companies change board size as a result of past performance. Specifically, the results are inconsistent with the conjecture that board size increases after poor performance in an attempt to increase management capacity. Yermack (1996) also reports that smaller boards are more likely to dismiss CEOs for poor performance, and that CEO compensation is less dependent on performance if board size increases.

[Insert table 1 here]

Huther (1997) analyzes the relationship between board size and operating costs of US electricity companies. He also reports a negative size effect. Nevertheless, because the possible endogeneity of board size is not properly taken into account, his results must be interpreted with due care. Eisenberg, Sundgren and Wells (1998) also confirm Yermack's (1996) findings for a sample of small Finnish firms. The average number of board members is 3.7 in their sample, as compared to 12.25 in Yermack (1996). This is interesting for two reasons. First, average board size is significantly below the 'critical' number of board members (approximately 7 or 8), which has been suggested by Litpon and Lorsch (1992) and Jensen (1993). Second, small boards generally lack the same degree of separation of ownership and man-

6 For example, see Morck, Shleifer and Vishny (1988), Hermalin and Weisbach (1988, 1991) and Bhaghat and Black (1999).

agement that plays a central role in the standard explanations of the board size effect. Even though owner and manager interests coincide, there is an inverse relationship between board size and firm performance, as measured by the return on assets. To avoid biased estimates in ordinary least square regressions in the presence of endogeneity, Eisenberg, Sundgren and Wells (1998) test a simultaneous system of equations modeling board size and return on assets as the dependent variables. Finally, while bad performance implies larger board changes, there is no significant relation between the lagged return on assets and the net change in board size.

Conyon and Peck (1998) test the board size effect for a sample of firms from the United Kingdom, France, the Netherlands, Denmark, and Italy. Their results show negative relationships between board size and Tobin's Q and the return on equity, respectively. However, the statistical significance is rather mixed. In addition, they do not control for other board characteristics. However, as hypothesized by Yermack (1996), the number of board outsiders is likely to be positively related with board size. Therefore, it could possibly be the case that the board size effect actually relates to the composition of the board. In a related study for a sample of Dutch firms, Postma, van Ees and Sterken (2001) control for this relationship between board size and board composition. They still report a negative relationship between board size and the market-to-book ratio, but again do not properly account for the endogeneity problem.

In a recent study, Loderer and Peyer (2002) analyze the effects of board overlap and seat accumulation on share prices for a panel of Swiss firms. They report that seat accumulation is negatively related to firm value. Board size is used as a control variable in their pooled regressions. Their results document that larger board sizes are associated with lower Tobin's Q values. In contrast to the interpretations in previous studies, Loderer and Peyer (2002) are hesitant to draw final conclusions. They argue that the problem with the traditional argument is that it cannot explain why marginally larger boards should impair performance even if boards are small to begin with, which is the case in the Eisenberg, Sundgren and Wells (1998) study for Finnish firms. Maybe more important, one could generally expect that executive committees are an effective way to increase board effectiveness and conceivably correct the drawback of large boards. However, Loderer and Peyer (2002) find that

the delegation of activities and responsibilities in companies with large boards to executive committees does not impact firm value. Therefore, they come up with an alternative explanation, suggesting that it is not so much that large boards make it harder to run firms properly, but rather that firms whose governance systems are not working properly are also characterized by larger boards. If this is the case, large board sizes simply identify firms that are run inefficiently, but they are not the main reason for those inefficiencies. Using the Hermalin and Weisbach (2001) terminology, this notion favors an equilibrium interpretation. We take this as our starting point and explore whether board size should be viewed as an independent corporate governance mechanisms, or whether it is merely a sign of a bad overall corporate governance system. Or put simpler, are we on the upper or the lower panel of figure 1?

3 Empirical approach

3.1 Theoretical considerations

We choose four corporate governance mechanisms: board size, outside representation on the board, ownership structure, and debt. In a first step, we are interested whether there are any interdependencies among these mechanisms. We include board size to examine whether it is an independent control mechanism or simply related to the other mechanisms, but with no peculiar impact on other firm characteristics (see Loderer and Peyer, 2002). With the exception of ownership structure, these are all mechanisms chosen internally by the firms' decision makers. Therefore, as argued by Agrawal and Knoeber (1996), all of the costs and benefits should be considered. Optimal choice requires that the use of a mechanism is increased until marginal benefit just offsets marginal cost. If this is indeed the case, a carefully specified cross-sectional regression should find no relation between firm performance and the use of *internally* chosen mechanisms (i.e., board size, outside representation, and debt). This, in turn, does not imply that the mechanisms are ineffective. Conversely, for a mechanism chosen by *outside* parties, such as ownership structure, part of the costs or benefits may be borne by parties other than those choosing the use of mechanism. As a consequence, these choices need not maximize firm value.

If a firm altered the use of one of the internally chosen mechanisms, this would likely lead to a change in managerial behavior and a change in the firm's performance. But if these mechanisms are chosen optimally, any cross-sectional variation in their use reflects differences in firms' underlying environments, *not* mistaken choices. If these differences are controlled for, then there should be no cross-sectional relation between the extent to which these mechanisms are used and firm performance. In contrast, variation across firms in the use of external mechanisms may reflect both differences in firms' environment and non-value maximizing choices. Hence, regression analysis might reveal a cross-sectional relation between firm performance and the extent to which an external mechanism is used. We test these hypothesis empirically in a second step.

Our analysis is related to the general problem that empirical results on governance can be interpreted as either equilibrium or out-of-equilibrium phenomena. As forcefully argued by Hermalin and Weisbach (2001), it is generally difficult to distinguish between the two interpretations, but they often have opposite implications for policy. For example, Yermack (1996) reports a negative relationship between board size and Tobin's Q for a broad sample of US firms. The out-of-equilibrium interpretation of this finding is that limits on board size should be encouraged. But then, of course, if large boards are destructive to firm value, the question is why do we still see large boards?[7] In contrast, the equilibrium interpretation of this result is that some other factor is causing both board size and Tobin's Q, so that regulation would be at best useless and possible counterproductive (see Loderer and Peyer, 2002). But then there is the question, what is the 'other' factor? Therefore, it is important to account for the endogeneity problem appropriately in a simultaneous system of equations and to carefully choose appropriate controlling variables to distinguish between the two types of interpretation.

7 This is particularly interesting in light of the result of Wu (2000), who reports that board sizes over the 1990-1995 period decreased in the US, among other things, due to pressure from active investors such as CalPERS.

3.2 Definition of variables

The four corporate governance mechanisms we explore empirically are board size, outsider representation on the board, ownership structure, and leverage. The variables are defined as follows (see table 2 for a summary of all variables):

- BOARDSIZE is the number of directors on the board of the company.
- OUTSIDER refers to outsider membership on the board, measured by the percentage of board seats held by non-officers and members without relationship to the founding family (if any). We suspect that the proportion of outside directors is positively correlated with board size (see Yermack, 1996).
- LEV denotes firm leverage, measured as the ratio of total (nonequity) liabilities to total assets.
- OWNERSHIP denotes the percentage of cumulated voting rights exercised by large investors with >5% of voting rights.[8] For firms with unitary shares, this is equivalent to the percentage of actual stockholdings.

In addition to the interrelations between the four control mechanisms, we also examine their cross-sectional relationship with firm performance, measured by Tobin's Q. This variable is defined as the ratio of market value to book value of assets. Market value of assets is computed as market value of equity plus book value of assets minus book value of equity (see also Loderer and Peyer, 2002).[9]

[Insert table 2 here]

The choice of any of the four control mechanisms may depend upon choices of the other three, but these choices will depend on other factors as well. These other factors are mainly related to the technology of production, the market in which the

8 Unfortunately, the 'Aktienführer Schweiz 2002' (Swiss Stock Guide 2002) by Finanz und Wirtschaft only includes voting rights. Therefore, we also use the variable RESTR (i.e., a dummy variable that is 1 if the firm has voting restrictions, and 0 otherwise) as a controlling variable for OWNERSHIP. In our sample of 169 Swiss firms, 25% of the firms have some form of voting restrictions.

9 Alternatively, Eisenberg, Sundgren and Wells (1998) and Conyon and Peck (1998) use return of assets (ROA) and return on equity (ROE), respectively.

firm operates and characteristics of the CEO. We treat these other factors as exogenous and keep our focus on the endogeneity of the governance mechanisms. Specifically, the regressions include the following controlling arguments:

- Firm size, measured by the natural logarithm of total (book) assets. This variable is denoted by SIZE.
- The average annual sales growth over the past three years. This variable is labeled GROWTH.
- The number of years since inception as a private limited company. The symbol for this variable is AGE.
- A dummy variable that is one if the CEO is also Chairman of the Board (COB), and zero otherwise. The variable is labeled CEOCOB.
- A dummy variable that is one if the firm has holding and/or voting restrictions, and zero otherwise. Firms with voting restrictions cap the number of registered shares that investors can hold or vote. This leads to a deviation from the one share-one vote principle. The variable is labeled RESTR.
- A dummy variable that is one if the state owns more than 5% of the firm's equity, and zero otherwise. This variable is denoted by GOV.
- A dummy variable that is one if the firm belongs to a particular industry (as classified by the Swiss Stock Exchange (SWX)), and zero otherwise. We denote this variable by IND.
- To measure profitability, we construct two variables. First, we use the return on assets, denoted as ROA. This variable is defined as operating income over total assets, where the latter is a simple average of the year 2001 starting and ending values. Second, we use the return on equity, denoted as ROE. It is defined as the cumulated risk-adjusted abnormal return over the 24 months period from 2000.01 to 2001.12.

3.3 Empirical methodology

To account for the problem of joint endogeneity, we test several equations separately as well as in a system of simultaneous equations.[10] Our first regression equation contains BOARDSIZE as the dependent variable. In addition to the other three governance mechanisms, we include SIZE, GOV, ROA, and IND as control variables that potentially affect board size. Assuming that all relations are linear, we have:

$$(1) \quad \begin{aligned} BOARDSIZE_i = {} & \alpha_0 + \alpha_1 \cdot OUTSIDER_i + \alpha_2 \cdot LEV_i + \alpha_3 \cdot OWNERSHIP_i \\ & + \alpha_4 \cdot SIZE_i + \alpha_5 \cdot GOV_i + \alpha_6 \cdot ROA_i + \alpha_7 \cdot IND_i + \varepsilon_i \end{aligned}$$

Most important, large firms will naturally have larger boards, hence we expect a positive relationship between BOARDSIZE and SIZE. We also include the GOV dummy to account for the possibility that political influences lead to presumably larger boards with a disproportionate number of government representatives. As hypothesized by Hermalin and Weisbach (2001) and Yermack (1996), small boards could contribute to better performance, or companies might adjust board size in response to past performance in order to increase managerial capacity. While causation is not clear ex ante, Yermack's (1996) results provide no evidence that boards either expand or contract in response to performance. Nevertheless, to capture possible relationships between operating performance and board size, we also include current-year ROA. Finally, to control for industry effects, we use the industry dummy, IND, as an exogenous variable.

We measure the extent of outsider membership on the board as OUTSIDER, i.e., the percentage of board seats held by non-officers and members without relationship to the founding family (if any). This is the dependent variable in our second equation:

$$(2) \quad \begin{aligned} OUTSIDER_i = {} & \alpha_0 + \alpha_1 \cdot BOARDSIZE_i + \alpha_2 \cdot LEV_i + \alpha_3 \cdot OWNERSHIP_i \\ & + \alpha_4 \cdot CEOCOB_i + \alpha_5 \cdot ROA_i + \alpha_6 \cdot GOV_i + \alpha_7 \cdot IND_i + \varepsilon_i \end{aligned}$$

10 See Hermalin and Weisbach (2001) for a generalized description of this approach.

In addition to ROA and IND, we use the CEOCOB dummy as a control variable. Being CEO and COB at the same time alleviates coordination and communication problems. On the other hand, a major conflict *within* the boardroom is between the CEO and the directors. The CEO has the incentive to 'capture' the board, so as to ensure that he can keep his job and increase the other benefits he derives from being CEO. Directors have the incentives to maintain their independence and monitor the CEO. Shivdasani and Yermack (1999) suggest that a situation where the CEO is also the CBO leads to a concentration of power and the election of less independent board members. Accordingly, we expect a negative relationship between OUTSIDER and CEOCOB. Finally, to control for government ownership, we also include GOV as an exogenous explanatory variable. Ex ante, one could argue that firms with large government stakes have less outsiders on the board.

Our third internal control mechanism, firm leverage, denoted by LEV, is the ratio of total (nonequity) liabilities to total assets. We use this control mechanism as the dependent variable in our third regression equation:

$$\begin{aligned} \text{(3)} \qquad \text{LEV}_i = {} & \alpha_0 + \alpha_1 \cdot \text{BOARDSIZE}_i + \alpha_2 \cdot \text{OWNERSHIP}_i + \alpha_3 \cdot \text{OUTSIDER}_i \\ & + \alpha_4 \cdot \text{SIZE}_i + \alpha_5 \cdot \text{AGE}_i + \alpha_6 \cdot \text{GROWTH}_i + \alpha_7 \cdot \text{IND}_i + \varepsilon_i \end{aligned}$$

The control variables are chosen following previous results. Recently, Drobetz and Fix (2003) report that Swiss firms with more growth opportunities have less leverage. Hence, we expect a negative relation between LEV and GROWTH. In contrast, their results indicate that larger and more mature firms exhibit higher leverage ratios, implying a positive relationship between LEV and both SIZE and AGE. This is also consistent with Jensen's (1986) free cash-flow hypothesis, where mature firms with substantial cash-flows use more debt to discipline managers. To control for industry effects, we also include the IND dummy.

Our only external governance mechanism is ownership structure. The variable OWNERSHIP denotes the percentage of shares held by owners of 5% or more of the firm's equity. The fourth regression specification is:

$$\begin{aligned} \text{(4)} \qquad \text{OWNERSHIP}_i = {} & \alpha_0 + \alpha_1 \cdot \text{BOARDSIZE}_i + \alpha_2 \cdot \text{LEV}_i + \alpha_3 \cdot \text{OUTSIDER}_i \\ & + \alpha_4 \cdot \text{SIZE}_i + \alpha_5 \cdot \text{RESTR}_i + \alpha_6 \cdot \text{GROWTH}_i + \alpha_7 \cdot \text{IND}_i + \varepsilon_i \end{aligned}$$

We include SIZE as an exogenous variable because one might suspect that larger firms have less ownership concentration. Voting restrictions could allow some shareholder groups (e.g., founding families) to practically dominate the firm even if they own less than 50% of the firm's stock. This allows them to pursue their own interest at the expense of other shareholders with less board influence. We therefore expect a positive relationship between OWNERSHIP and RESTR. Zeckhauser und Pound (1990) argue that the higher the R&D intensity, the more closed is the information structure, and the more difficult is outside monitoring. Large investors will recognize the problems associated with asymmetric information, hence ownership concentration will be lower for firms with closed information structure. We use GROWTH as a proxy for asymmetric information (i.e., the difficulty to monitor) and ex ante expect a negative relationship with OWNERSIP.

To summarize, each of the control mechanisms depend on all of the others as specified in equations (1)-(4). To estimate these relationships empirically, we adopt a simultaneous equations framework and employ the weighted two-stage least squares (W2SLS) procedure. This procedure also accounts for heteroscedasticity. There are eight exogenous variables in the four equations. Therefore, at least three of the exogenous variables must be excluded from any single equation to identify the system. Our development of equations (1)-(4) is motivated partially by the need for these exclusion restrictions to be met. Many of the exclusion restrictions seem non-controversial. For example, AGE is likely to be related to leverage, but it is unlikely to be related to all other governance mechanisms. Similarly, CEOCOB should only be important for the OUTSIDER equation. Excluding ROA from the LEV equation seems more problematic. The findings in Drobetz and Fix (2003) indicate that ROA is an important variable to explain cross-sectional difference in leverage of Swiss firms. However, this exclusion is driven by the requirement that any single equation of the system must be identified.[11]

11 Note that in the system of equations (1)-(4) we could add ROA as an additional variable, still leaving the system identified. However, when we expand the system and add the Tobin's Q regression in equation (5), we must exclude at least four exogenous variable from each equation to identify the system. In untabulated tests we find that using ROA in equation (3) instead of AGE (which we think could most easily be replaced) does not qualitatively change our results.

In addition to the interrelations among the control mechanisms, we also examine the cross-sectional relation between the mechanisms and firm performance. We measure firm performance by Tobin's Q. Similar to Yermack (1996), our final regression specification is:

$$\begin{aligned} Q_i = {} & \alpha_0 + \alpha_1 \cdot BOARDSIZE_i + \alpha_2 \cdot LEV_i + \alpha_3 \cdot OUTSIDER_i \\ & + \alpha_4 \cdot OWNERSHIP_i + \alpha_5 \cdot SIZE_i + \alpha_6 \cdot GROWTH_i + \\ & \alpha_7 \cdot ROA_i + \alpha_8 \cdot IND_i + \varepsilon_i \end{aligned} \tag{5}$$

In addition to the four governance mechanisms, we include controls for other variables that might affect Tobin's Q directly. Following Morck, Shleifer and Vishny (1988), we control for growth opportunities and expect a positive relationship between Tobin's Q and GROWTH. We also control for SIZE, since growth opportunities should be lower for larger firms. On the basis of simple valuation models, ROA seems a purely analytical control variable; one expects a positive relationship.

We first estimate equation (5) using ordinary least square. This allows us to examine the effect of all control mechanisms together, but treats each of them as exogenous. If the previous analysis had shown that all four governance mechanisms were independent, this would be an adequate and sufficient procedure. Nevertheless, in a second step we include equation (5) along with (1)-(4) in a simultaneous system, adding Tobin's Q as an independent variable, and again apply weighted two-stage least square (W2SLS) to estimate the system. This treats Tobin's Q as endogenous along with the control mechanisms, allowing each of the mechanisms to affect Tobin's Q but also allowing Tobin's Q to affect the choice of each mechanism. Finally, note that this system is just identified equation-by-equation.

4. Data description

We potentially target all 267 firms contained in the Swiss Performance Index. In a first step, we exclude those firms that went public in 2002. In a second step, we also exclude all banks, insurances, and other financial services firms. After inspecting the collected data, we drop another two firms, which we regard as obvious out-

liers.[12] This leaves us with a final sample of 169 publicly-listed firms. Our primary source of data is Worldscope. Several data had to be collected manually from 'Aktienführer Schweiz 2002/2003' and the website of 'Finanz und Wirtschaft'. Most of the data are as of end 2001, i.e., they refer to the reporting period from January 2000 to January 2001.

Table 3 shows descriptive statistics of Tobin's Q and the four governance mechanisms. Following Loderer and Peyer (2002), we define Tobin's Q as the ratio of market value to book value of assets. Market value of assets is computed as market value of equity plus book value of assets minus book value of equity. To avoid that daily fluctuations influence our results, we compute the market value of equity as the mean of daily observations during 2001. The average value of Tobin's Q is 1.31, the median is 1.08. This indicates that Swiss firms, on average, invest in positive NPV projects. Second, average board size is 6.56. This is only half of the size of boards studies in Yermack (1996), but significantly larger than those in Eisenberg, Sundgren and Wells (1996). Interestingly, this is just the board size hypothesized to be optimal by Lipton and Lorsch (1992) and Jensen (1993).

However, as hypothesized, there are pronounced differences between firms with and without government influence. Specifically, there are seven firms in our sample where some state authority owns more than 5% of the firm's equity. On average, board size for these firms is 11.71. The difference in board size is statistically significant; a one-sided t-test has a value of 2.23.

[Insert table 3 here]

Lipton and Lorsch (1992) and Jensen (1993) argue that for a board size beyond seven or eight the benefits of increasing monitoring capacities is outweighed by such costs as slower decision-making, less-candid discussions of managerial performance, and biases against risk-taking. Roughly 85% of all firms in the full sample have a board size equal to or less than eight. Therefore, we do not expect any significant 'size effect' in our sample. Figure 2 shows the mean and median values of Tobin's Q for companies sorted by board size. As expected, there is no obvious relationship between the two variables. Specifically, in a univariate analysis, larger

12 These firms are Actelion and Straumann.

board sizes are not associated with lower valuations. This is in sharp contrast to the results in Yermack (1996) for US data. Plotting board size against average Tobin's Q as in figure 2, he finds that Tobin's Q values decline almost monotonically over the range of board size.[13] However, for board sizes below six, he also finds no consistent association between board size and firm value. In contrast, Eisenberg, Sundgren and Wells (1998) present a figure with very similar results for their sample of Finnish firms, where the average board size is only 3.7.

[Insert figure 2 here]

Table 3 further shows that the average value of OUTISDERS (defined as the percentage of board seats held by non-officers without relationship to a founding family) is 0.87, which is also in contrast to the results in Yermack (1996). He reports a much lower value of 0.54 for US firms. This is a surprising result for two reasons. First, similar to the United States (but in contrast to Germany), Switzerland has a one-tier board system. And second, founding families are still regarded as a non-negligible factor in corporate Switzerland. The data for the variable OUTSIDER is taken from the website of 'Finanz und Wirtschaft'.[14]

We define leverage as the ratio of total (nonequity) liabilities to total assets as of end 2001. The average leverage ratio (LEV) is 54%, which closely corresponds to the figures recently reported in Drobetz and Fix (2003). The average of OWNERSHIP is 0.47. Recall, this variable is defined as the percentage of cumulated voting rights exercised by large investors with >5% of all voting rights. The maximum of 1 for this variable is due to Hilti, where all registered shares with voting rights are in the hands of the founding family, while all publicly traded participation notes have no voting rights.

Finally, table 4 shows the correlation coefficients between Tobin's Q and the four governance mechanisms. All correlations are relatively small. The only noteworthy correlation is that between BOARDSIZE and OUTSIDER. The respective value is 0.274, which is slightly higher than in Yermack (1996). This is an important result, because it indicates that part of the board size effect reported in earlier studies may

13 See Yermack (1996), figure 1, p. 193.
14 See http://www.finanzinfo.ch.

relate to the composition of the board. Note that we account for this possibility in our empirical setup, having both OUTSIDER and BOARDSIZE as explanatory variables in equations (1) and (4), respectively.

[Insert table 4]

SIZE is measured as the natural logarithm of total (book) assets as of end 2001.15 We define GROWTH as the average annual sales growth over the past three years (1999-2001). For the firms which went public after 1999, we use average sales growth since IPO.[16] ROA is defined as the ratio of operating income to total assets (return on assets). Operating income is measured as of end 2001, but total assets and book equity are simple averages of the respective starting and ending values. ROE is the cumulated risk-adjusted abnormal return over the 24 months period from 2000.01 to 2001.12 (return on equity). RESTR is a dummy variable, which is 1 if firm has holding and/or voting restrictions, and 0 otherwise. The corresponding list of firms can directly be found in the 'Aktienführer Schweiz 2002/2003'.[17] The data for the variable CEOCOB is from the website of 'Finanz und Wirtschaft'. It is a dummy variable, which is 1 if the CEO is also chairman of the board (COB), and 0 if otherwise. Finally, we apply the industry classification, as provided from the Swiss Stock Exchange (SWX).[18] For each of the 15 industries we construct a dummy variable, denoted as IND.

5. Empirical results

This section describes our empirical results. In section 5.1 we examine the interdependencies among the four governance mechanisms. In the section 5.2 we extend the simultaneous system of equations and analyze the relationship between firm performance and the control mechanisms. Section 5.3 contains several robustness tests.

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15 We also experimented with the logarithm of sales in 2001, but the results are qualitatively similar.

16 We also excluded particular firm-years for Allreal, Bon Appétit, Sulzer und Züblin due to firm-specific events, such as acquisitions and spin-offs.

17 See ‚Aktienführer Schweiz 2002/2003', p. 468.

18 See http://www.swx.com.

5.1 Relationships among the governance mechanisms

To examine the relationships between the four governance mechanisms, we estimate (1)-(4) as a system of linear equations using weighted two-stage least square (2SLS). Each of the governance mechanisms appears on the left-hand side of one equation and the right-hand side of each of the others. We are primarily interested in the null hypothesis that board size is not an independent governance mechanism. If this is true, any findings that board size is negatively related to firm performance are spurious and some other factor is causing both board size and firm performance. In this case we are in the lower panel of figure 1. The null hypothesis must be rejected if the coefficients on the other three control mechanisms in the BOARD-SIZE equation are insignificant. Results of the weighted 2SLS estimation are displayed in table 5.

[Insert table 5 here]

In table 5, the coefficients of the exogenous variables generally have the predicted sign, but they are often statistically insignificant. As hypothesized, looking at board size (equation (1)), firms with government ownership have larger boards. On average, a firm where the state owns a significant portion of stock has four additional board members, all else equal. The coefficient on GOV is significant at the 1% level. In contrast to what we expected, there is a positive relationship between contemporaneous performance and board size. The coefficients on SIZE and ROA are positive, but insignificant.

With respect to board composition (equation (2)), we find evidence for a potential conflict within the boardroom. There is a negative relationship between OUTSIDER and CEOCOD, indicating that outsiders seek independence from the CEO and prohibit the CEO to take the role as COB at the same time. Looking at leverage (equation (3)), the signs of the coefficients are as predicted ex ante. Large firms carry higher debt levels, and the coefficient on SIZE is significant at the 10% level. Older firms (measured by the variable AGE) are also more levered, but the relationship is not significant. In addition, firms with more growth opportunities exhibit lower leverage, but the coefficient on GROWTH is again insignificant. Finally, with respect to ownership structure (equation (4)), the only significant exogenous variable is RESTR, indicating that a firm has holding and/or voting restrictions. As

hypothesized, larger firms have less ownership concentration, although the relationship is insignificant.

We now look at the coefficients for the endogenous variable in the upper part of table 5. Evidently, there are no interdependencies between any of the four governance mechanisms; the respective coefficients are all insignificant. Therefore, we conclude that the null hypothesis must be rejected. Board size should be regarded as an independent control mechanism and potential correlations with firm performance are not merely spurious, i.e., we are in the upper panel in figure 1. Most important, any potential board size effect is not (solely) related to board composition. Of course, with no interdependencies at all, the other three mechanisms – board composition, ownership structure and leverage – also constitute independent control mechanisms. However, given the results from previous studies, this should come as no surprise.

Finally, the explanatory power of the BOARDSIZE and LEVERAGE regressions is 0.249 and 0.127, respectively. In contrast, the adjusted R-squares for the OWNERSHIP and OUTSIDER regressions are negative. Note, however, that the R-square has no statistical meaning in the context of 2SLS; it is merely reported for completeness. A Wald test for the significance of all the coefficients (except the constant and the industry dummies) always rejects the null hypothesis that they are jointly zero.

5.2 Firm performance and control mechanisms

In this section we examine the null hypothesis that board size has no influence on firm performance against the alternative hypothesis by Lipton and Lorsch (1992) and Jensen (1993), suggesting that reductions in board size increase firm performance. For this purpose, we estimate the extended system of simultaneous equations (1)-(5). The null hypothesis must be rejected if the coefficient on BOARDSIZE in the regression with Tobin's Q as the dependent variable (equation (5)) is significant. A final (and closely related) question is whether the four control mechanisms are selected optimally. As hypothesized, this is the case if the marginal benefit of a mechanism just offsets marginal cost. This hypothesis can also be tested in the same system of equations (1)-(5); it must be rejected if a significant relation be-

tween firm performance and the use internally chosen mechanisms is uncovered. In contrast, insignificant coefficients on the respective variables in the regression involving Tobin's Q as the dependent variable (equation (5)) are a sign of optimal choice. An exception is ownership structure, which is an externally chosen mechanism. In this case, variation across firms may reflect both differences in firms' environment and non-value maximizing choices. So, even a carefully specified regression may reveal a cross-sectional relation between firm performance and the extent to which an external mechanism is used. Table 6 shows the empirical results.

[Insert table 6 here]

In the first column of table 6 we test equation (5) using simple OLS, with Tobin's Q as the dependent variable. Given that all four mechanisms are unrelated and independent, we can treat them as exogenous in this simplest specification. This setup does not allow for any interdependence in the choices of control mechanisms, but it does allow for the availability of alternative control mechanisms. In the second column we also add an interaction term, OWNERSHIP*RESTR, to account for the strong relationship between the two variables.

In both equations, BOARDSIZE has a positive coefficient, but they are far from being statistical significant. Therefore, we cannot reject the null hypothesis that board size has no influence on Tobin's Q. This confirms our initial intuition from a mere visual inspection of figure 2, where board size has been plotted against average Tobin's Q. Because OWNERSHIP is an external mechanisms, it should not be surprising that the corresponding coefficient is significant at the 1% level. What is surprising, however, is the negative sign of the coefficient, i.e., a more dispersed ownership leads to a higher Tobin's Q. When we include the interaction term OWNERSHIP*RESTR, it becomes evident that not ownership concentration itself drives the results, but holding and/or voting restrictions. While the coefficient on OWNERSHIP becomes insignificant, the coefficient on the interaction term is negative and significant at the 10% level. This result has an important practical implication. It clearly indicates that the interests of dominating shareholders (possibly in combination with some voting restrictions) and other shareholders are not always in line (see Morck, Shleifer und Vishny (1988)) In fact, many Swiss firms have abandoned their common dual class shares and introduced unitary shares only in

recent years (see Kunz, 2002). This seems to be an important step towards overall firm value maximization.

Finally, in the third column we treat all four control mechanisms as endogenous and allow for possible interrelations. The system of equations (1)-(5) is again estimated simultaneously using weighted 2SLS. In this case, the coefficient on BOARDSIZE is negative, but again insignificant. Similarly, the coefficients on the other internal control mechanisms, LEV and OUTSIDER, are also not significant. This is in contrast to Agrawal and Knoeber (1996), who report a persistent effect of board composition on firm performance. Interestingly, in our Swiss sample even the relationship between OWNERSHIP and firm performance disappears. This is consistent with optimal choice of *all* mechanisms (i.e., both internal and external). Hence, the cross-sectional variation in the use of these mechanisms reflects differences in firms' underlying environments, and not mistaken choices which need to be reversed. This also implies that any changes in their use leave firm performance unaffected at best, but possibly lead to a decrease in Tobin's Q. But this time it is *not* because some other factor is responsible for a spurious correlation between any of these mechanisms (e.g., board size) and firm valuation, but it is because the mechanisms are already in optimal use. One obvious explanation for this result is that average board size in our sample (6.567) is just below the 'critical' value of 7-8, as postulated by Lipton and Lorsch (1992) and Jensen (1993). Accordingly, the average number of board members in Swiss firms is just about optimal, i.e., the advantages of larger boards from increased management capacities are offset by the potential disadvantages from coordination, communication, and decision making problems.

Finally, as expected, current level of profitability, measured by return on assets, has a positive association with Tobin's Q. The explanatory power of our cross-sectional regressions are reasonably high, The adjusted R-squares range between 0.195 and 0.431. Again, Wald tests for the null hypothesis that all coefficients are jointly zero (except the constant and the industry dummies) strongly reject.

5.3 Robustness tests

To make sure our results are accurate, we conduct several robustness test. First, in untabulated regressions we reproduced all our results using three-stage least square (3SLS), but the results are qualitatively the same. Because the expanded system of equations (1)-(5) is just identified equation-by-equation, even the coefficient estimates in 2SLS and 3SLS are identical in this case. Second, instead of the return on assets (ROA) we used the return on equity (ROE), but again the results did not change. Third, we used alternative measures of firm valuation. In the spirit of Eisenberg, Sundgren and Wells (1998), we compute an industry-adjusted Tobin's Q. This variable is defined as the residual between the firm's and industry's median Tobin's Q. Alternatively, we also used the ratio of market-to-book equity as a measure of firm value. Our results are robust in both cases, and the interpretations do not change.

To make sure causality runs from board size to firm valuation, Yermack (1996) and Eisenber, Sundgren and Wells (1998) test whether companies expand board size in response to bad performance. They both find that poor performance leads to both more departures of board members and more appointments to the boards, but net board size remains constant. While we think that our approach appropriately controls for endogeneity problems, we test for this possibility in a very simplistic way by including lagged values of the return on assets in the BOARDSIZE equation (equation (1)). We use lags of one and two years, but in both cases the coefficients are insignificant.

Finally, to check the validity of the results in table 6, we replicate the OLS regressions with Tobin's Q as the dependent variable separately for each control mechanism. We use the same exogenous variables (SIZE, GROWTH, ROA and IND) in each of the four regressions. As before, only the coefficient on OWNERSIP is significant. BOARDSIZE, LEV and OUTSIDER are estimated insignificant in their respective regressions.

6 Conclusions

Boards of directors are an economic institution that, in theory, helps to solve the agency problems in large public corporations. While there is only limited theoreti-

cal work, the empirical literature is well developed. Most previous studies have focused on specific board characteristics, such as board composition and board dynamics, and their relationship with firm performance. Surprisingly, there has been relatively little work on the relationship between the size of boards and firm valuation. We contribute to this literature by exploring whether board size constitutes an independent governance mechanism and is related to Tobin's Q. This is an interesting research question with potentially important practical implications. Using a comprehensive set of companies listed on the Swiss Stock Exchange (SWX), our results support the notion that board size is indeed an independent governance mechanism. In particular, board size is independent from board composition.

However, in contrast to previous studies we do not find a significant relationship between board size and firm performance, as measured by Tobin's Q. This suggests that Swiss firms, on average, choose their number of board members just optimally. In a simultaneous system of equations we carefully control for the endogeneity problems inherent in empirical studies on governance. Cross-sectional variations in board size reflect differences in firms' underlying environment, and not mistaken choices which should be reversed. Accordingly, any changes in the size of boards leave firm performance unaffected at best, but more probably lead to a decrease in Tobin's Q. This is consistent with the observation that the average board size in our sample of Swiss firms (6.567) is just below the 'critical' value of 7-8, as hypothesized by Lipton and Lorsch (1992) and Jensen (1993). The advantages of larger boards from increased management capacities are offset by the potential disadvantages from coordination, communication, and decision making problems.

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Table 1: Overview of previous literature on board size

	Sample	Board Size	Endogenous variable	Findings
Yermack (1996)	Panel of 452 large US firms (1984-1991)	4 to 34 Mean: 12.25 Median: 12	Tobin's Q	• Significant negative effect of board size • Smaller boards fire CEOs more frequently • CEO compensation less performance dependent if board size large • Large changes in board size (>3) have significant price impact
Huther (1997)	US electricity companies	3 to 16 Mean: 9	Total variable costs	• significant positive impact of board size
Eisenberg, Sundgren and Wells (1998)	785 small Finnish firms (1992-1994)	Mean: 3.7	Industry effect adjusted ROA	• significant negative effect of board size • Bad performance implies larger board changes
Conyon and Peck (1998)	2886 firms from UK, 360 from France, 186 from Netherlands, 132 from Denmark, 126 from Italy (1990-1995)	UK: 8.5 France: 10.5 Netherlands: 10.3 Denmark: 10.7 Italy: 11.8	ROE, modified Tobin's Q	• negative board size effect in all equations • ROE: significant negative board effect in 3 countries • Tobin's Q: significant negative effect in 2 countries
Postma, van Ees amd Sterken (2001)	94 Dutch firms (1996)	Mean 4.95 Median: 5	Market-to-book ratio	• negative board size effect
Loderer and Peyer (2002)	Panel of 169 Swiss firms	Means: between 10.5 and 8.5 (depending on year) Medians: between 7 and 9	Tobin's Q	• significant negative relationship between board size and Tobin's • committee work has no impact of firm value; thus new interpretation – large boards is a sign of bad overall governance system

Table 2: Summary of variables

Endogenous variables:	
Tobin's Q	Ratio of market value to book value of assets. Market value of assets is computed as market value of equity plus book value of assets minus book value of equity.
BOARDSIZE	Number of directors on the board of the company
OUTSIDER	Outsider membership on the board, measured by the percentage of board seats held by non-officers without relationship to the founding family (if any)
LEV	Leverage, measured as the ratio of total (nonequity) liabilities to total assets
OWNERSHIP	Percentage of cumulated voting rights exercised by large investors with >5% of voting rights
Exogenous variables:	
SIZE	Firm size, measured by the natural logarithm of total (book) assets
GOV	Dummy variable = 1 if state owns >5% of the firm's equity, = 0 if otherwise
ROA [ROE]	Ratio of operating income and total assets (return on assets) [cumulated risk-adjusted abnormal return over the last 24 months (return on equity)]
AGE	Number of years since inception as private limited company
RESTR	Dummy variable = 1 if firm has holding and/or voting restrictions, = 0 if otherwise
CEOCOD	Dummy variable = 1 if the CEO is also COB, = 0 if otherwise
GROWTH	Average annual growth of sales over the past three years (1999-2001)
IND	Fifteen dummy variable = 1 if firm belongs to a particular industry (as classified by SWX), = 0 if otherwise

Table 3: Descriptive statistics

Variable	Mean	Median	S.D.	Maximum/ Minimum
Tobin's Q	1.31	1.08	0.70	4.71/0.45
BOARDSIZE	6.56	6	2.31	19/3
BOARDSIZE*GOV	11.71	11	3.64	19/8
OUTSIDER	0.87	0.88	0.16	1/0.2
LEV	0.54	0.57	0.18	0.99/0.043
OWNERSHIP	0.47	0.50	0.26	1/0

Table 4: Correlation matrix between control mechanisms

	BOARD-SIZE	LEV	OWNERSHIP	OUTSIDER
Tobin's Q	0.021	-0.136	-0.216	-0.118
BOARDSIZE		0.084	-0.004	0.274
LEV			-0.011	0.020
OWNERSHIP				-0.092

Table 5: Results from weighted 2SLS regressions of control mechanisms

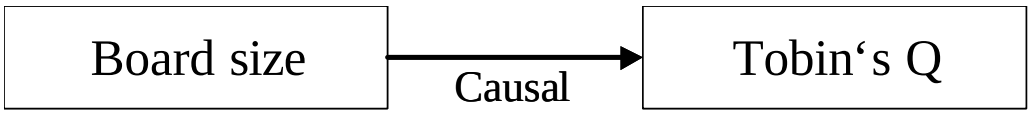
	Dependent variable (N=169)			
Independent variable	BOARDSIZE	OUTSIDER	LEV	OWNERSHIP
Constant	-1.053 0.7728	0.779 *** 0.0000	-0.127 0.7020	0.549 0.3791
BOARDSIZE		0.49 0.3871	0.0145 0.3751	0.025 0.4864
LEV	5.619 0.3969	-0.365 0.6675		-1.340 0.1612
OWNERSHIP	-0.694 0.5438	-0.026 0.7911	-0.0085 0.9311	
OUTSIDER	-0.792 0.8348		0.121 0.7233	0.662 0.3817
SIZE	0.339 0.1296		0.0203 * 0.0892	-0.014 0.6312
GOV	4.282 *** 0.0000	-0.160 0.5010		
AGE			0.00033 0.1556	
GROWTH			0.0511 0.4929	-0.0745 0.6178
RESTR				0.345 *** 0.0000
CEOCOB		-0.108 *** 0.0033		
ROA	0.146 0.9427	-0.036 0.8330		
Industry	included	included	included	included
Wald test	61.204(6) 0.0000	13.705(6) 0.0331	18.538(6) 0.0050	34.752(6) 0.0000
Adjusted R^2	0.249	-0.123	0.127	-0.580

Table 6: Results from OLS and W2SLS regressions using Tobin's Q

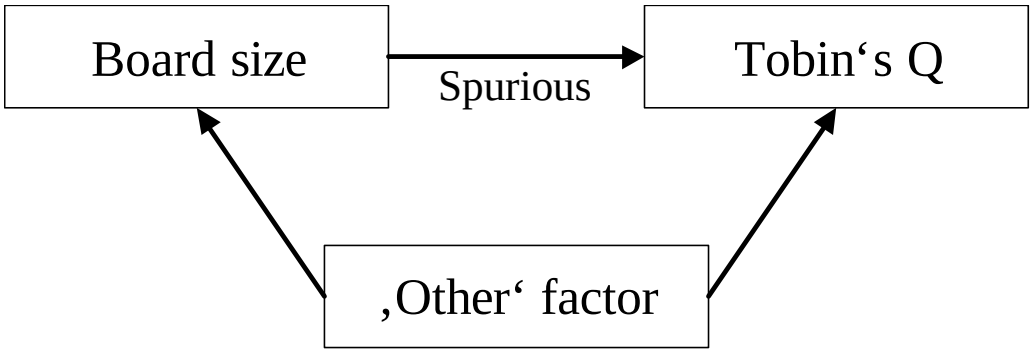
	Tobin's Q (N=169)		
Variable	OLS	OLS	W2SLS
Constant	1.274 * 0.0751	1.070 0.1382	-0.196 0.8887
BOARDSIZE	0.0089 0.5932	0.0083 0.6044	-0.041 0.5538
LEV	0.327 0.3216	0.332 0.3151	-0.877 0.7344
OWNERSHIP	-0.532 *** 0.0018	-0.330 0.1215	-0.517 0.1910
OWNERSHIP*RESTR		-0.272 * 0.0964	
OUTSIDER	-0.489 0.2004	-0.529 0.1627	1.294 0.4608
SIZE	0.014 0.6765	0.025 0.4720	0.056 0.4608
GROWTH	0.207 0.4395	0.223 0.3989	0.409 0.2266
ROA	2.782 *** 0.0000	2.795 *** 0.0000	2.527 *** 0.0006
Industry	included	included	included
Wald test	42.261(7) 0.0000	49.761(8) 0.0000	40.565(7) 0.0000
Adjusted R^2	0.426	0.431	0.195

Figure 1: Out-of-equilibrium and equilibrium explanations for the relationship between board size and Tobin's Q

Panel A: Out-of-equilibrium explanation



Panel B: Equilibrium explanation



Note: The figure is adapted from Hermalin and Weisbach (2001), p. 2.

Figure 2: Tobin's Q and board size