Three essays on corporate boards

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Overview of the three papers

1.1 Introduction

The three essays in this thesis investigate the role of the board of directors from different angles. The first – "Aligned, informed, and decisive. Characteristics of value-creating boards" – is a broad overview and a test of theories that have been put forward on the relationship between board characteristics and firm performance. The second essay – "Better firm performance with employees on the board?" – deals in depth with one aspect, the impact of employee directors upon firm performance. The third essay – "Board control and departures" – takes up the question of CEO entrenchment as viewed through the interaction of CEO turnover and board changes. Overall, the three essays[1] find that board characteristics matter; that government regulation to favour worker participation in the board reduces firm performance; and that CEO entrenchment is not typical of Norwegian boards. While the co-determination essay explores the relationship between owners and employees, the board control essay investigates the relationship between owners, the board, and the CEO.

Why is the board an interesting object of study, and why should one study Norwegian boards? The board is interesting because of its importance. The board appoints the CEO, decides on the CEO's reward, larger investments and strategy, and monitors the company. Thus, the functioning board's decisions should have long-term impact upon the company in setting its future direction and in motivating its management. The Norwegian board is interesting because its institutional conditions allow the testing of aspects of the board's functions that are not possible elsewhere. This concerns regulations on co-determination and on the protection of minority shareholders (Porta et al., 1998).

Besides the main question of each essay, they all deal with endogene-

[1] For short: AID, co-determination, and board control

ity in some form. In the board literature, endogeneity is usually taken to mean that board characteristics are themselves at least partly determined by former firm performance (Hermalin and Weisbach, 1998). This may be termed reverse causation. The AID and co-determination essays test for this kind of endogeneity. Furthermore, the AID essay tests for simultaneous endogeneity among board characteristics (Agrawal and Knoeber, 1996). However, endogeneity is often defined for a model of simultaneous system of equations, where endogenous variables are determined jointly within the model as a function of exogenous variables (Davidson and MacKinnon, 1993, p. 622). This kind of endogeneity is explored in the co-determination essay. Here, the variable employee directors is taken to be exogenous together with former firm performance and control variables, and endogenous variables are board characteristics, leverage and average wage. The last essay on board control essay deals more closely with the Hermalin and Weisbach (1998) proposition that board characteristics are endogenously determined from the CEO's stronger bargaining position arising from former good firm performance.

Both Bhagat and Black (1999) and Hermalin and Weisbach (2003) divide board studies into overall studies of firm performance upon a set of board characteristics on the one hand, and on the other studies of the impact of board characteristics in discernable board actions, for instance a takeover bid. The AID and the co-determination essays fall into the first category, the board control essay belongs to the second. The two research strategies reflect different conceptions of the board. Bhagat and Black hold that the board's impact is best studied in a long-time data set, since the board's actions are general and apply to all value-creating aspects of the firm. Hermalin and Weisbach think that the board intervenes only in times of exception, thus, only the proper, discernable board actions can truly reveal which board characteristics have an impact upon firm performance. Both research strategies benefit from the availability of a panel data set. Such a data set is used here, unlike most board studies.

Thus, the three essays utilise the same data, that is, a relatively long-term panel data set of all non-financial listed firms in Norway in the period from 1989 to 2002. Since the essays share the same data set, it is natural to explain this first, and also to describe some salient institutional issues.

1.1.1 Data and institutional background

Our sample is all non-financial firms listed on the Oslo Stock Exchange (OSE) at year-end at least once over the period 1989–2002.[2] To reduce censoring bias in the tenure measures, I start collecting director data in 1986. The ownership structure data covers every equity holding by every investor in every sample firm. The public securities register (*VPS*) provided the ownership data, accounting and share price data is from the OSE, and board data was collected manually from *Kierulf's Håndbok* and a public electronic register. The registers provided the name of the CEO as well as the name, date of birth, and board position of every board member. In most cases, the records also show whether the director was elected by shareholders or the employees. Since the first name is known, the director's gender is known as well.

The resultant data set is of a panel data nature, that is, repeated observations of the same firms over a number of years are in the data base. This makes the data file large in international comparisons. The panel data requires statistical techniques that are only now beginning to be applied among researchers in the corporate governance field.

The institutional framework is important in understanding the papers. First, board regulations are such that the CEO cannot at the same time be the board's chairman. Thus, a power split is built into the law. The board is small by international comparisons, numbering about five shareholder elected members. The number of management members is likewise very low. Background checks on the board reveal, for instance, that the chief financial officer (CFO) is a member of the board only by exception. The CEO is seldom a member, too. Another law-based feature is the presence of employee representatives on the board. A politically induced effort to increase the fraction of female directors is also evident.

The ownership concentration of Norwegian firms is low by European standards. Norwegian firms have a less concentrated ownership structure than in any other European country except the UK. For example, the average largest owner holds close to 50% of voting equity in a continental-European listed firm, and 15% in the UK. The corresponding US figure

[2]The OSE had an aggregate market capitalization of 68 bill. USD equivalents by year-end 2002, ranking the OSE sixteenth among the twenty–two European stock exchanges for which comparable data is available. During our sample period, the number of firms listed increased from 129 to 203, market capitalization grew by 8% per annum, and market liquidity, measured as transaction value over market value, increased from 52% in 1989 to 72% in 2002 (sources: `www.ose.no` and `www.fibv.com`).

is 3% (Barca and Becht, 2001). Norway has a civil law regime, which is generally considered less investor–protective than common law. Nevertheless, La Porta et al. (2000) find that Norway's regulatory environment provides better protection of shareholder rights than the average common law country. According to their theory of institutionally determined ownership structures, the strong investor protection is a major reason why Norway's ownership concentration is so low.

1.2 Aligned, informed, and decisive

The first essay pulls together different components of board design in order to explain firm performance, and to explore possible endogenous relationships. Most of the literature in corporate governance approaches the analysis of board structure in a piecemeal manner (Bhagat and Black, 1999). But to be effective in furthering shareholder value, board composition must solve the three problems of alignment with shareholders' interests, internal and external information collection, and rational and expedient decision-making. The paper builds upon explanations given in the literature, but also develops new measures to reflect this many-sided board nature.

Interest *alignment* in a board is achieved through ownership and board independence. The higher is the share of ownership in the company, the higher is the owner's incentives and power to monitor the agent (Shleifer and Vishny, 1986). Two variables measure this effect, that is, the directors' ownership and the outside ownership concentration. The outside ownership concentration is measured by the Herfindahl index[3]. The higher the board independence from monitored officers the better aligned is the board with owners.

The Hermalin and Weisbach (1998) model predicts that the longer the history of good performance under the current CEO, the less independent the current board. Consistent with the model, we introduce a new measure of board's independence as the difference between the average tenure of its non-CEO directors and the tenure of the CEO:

$$\text{Independence} \equiv \frac{1}{n}\sum_{i=1}^{n}\text{non-CEO director tenure}_i - \text{CEO tenure} \quad (1.1)$$

[3]The Herfindahl index for outside ownership concentration is the sum of squared ownership fractions across all the firm's outside owners. Its maximum value is one (a single investor owns every share held by the outsiders), approaching its minimum value of zero as the ownership structure gets increasingly diffuse.

where non-CEO director tenure$_i$ is the number of years since non-CEO director i entered office, and n is the number of shareholder–elected directors. The average director has longer (shorter) tenure than the CEO when expression (1.1) is positive (negative). According to Hermalin and Weisbach (1998), the board is more independent the higher the value of (1.1).

The board may have access to better *information* when the CEO is also a board member, when the CEO is a board member in other companies (exported CEO), when CEOs of other companies are directors (imported CEO), and when directors who are not CEOs are directors in other companies and meet directors in yet other companies. This so-called small world property of interlocking corporate boards (Conyon and Muldoon, 2006) is approached with network theory (Wasserman and Faust, 1994), that is, with the information centrality measure.

Finally, the board's *decisiveness* is approached with the board size and board heterogeneity. Decisions are supposed to be made more easily the smaller and more homogeneous is the group (Mueller, 2003). Yermack (1996) and Eisenberg et al. (1998) show that smallness is a desirable property in boards. Gender, the age dispersion of directors, and the fraction of employee directors constitute the heterogeneity measures. Most studies of the gender effect in boards, for instance Shrader et al. (1997) and Smith et al. (2006), conclude that increased gender heterogeneity means lower firm performance. Likewise, evidence in FitzRoy and Kraft (1993); Gorton and Schmid (2000) and Falaye et al. (2006) show a negative relation between employee directors and firm performance. The age dispersion is new to the literature. Notice that employee board representation is imposed through the political process, while gender diversity became strongly recommended during the period under study, but no concern is given to age dispersion.

In the main relation Tobin's Q, measured as the firm's market value over its book value of assets, is the dependent variable whose variation we seek to explain using the above board characteristics. Panel data give repeated observations of the same firm, so that data need to be transformed in order to remove the serial dependence in the error terms. We choose the fixed effects method (Woolridge, 2002) to do so. An advantage of this method is that the need for control variables disappears. Furthermore the general method of moments (GMM) estimation method gives further advantages compared to rival methods, as it is free from assumptions of the variable's distribution and its non-linearity.

We find that firm performance improves with higher director owner-

ship and network score, while a larger and more heterogeneous board reduces firm performance. Gender and employee directors are negatively related to firm performance. Thus, our results are consistent with what is observed in other investigations. We subject the results to robustness tests, in that different definitions of e.g. the network variable is used. Still, we find that the results withstand these tests.

A common objection to performance studies is that board characteristics are a result from earlier performance. Hermalin and Weisbach (1998) hold that the board is endogenously chosen. Thus, in their theory, there is a "reverse causation" that runs from firm performance to board characteristics. Furthermore, board characteristics may be internally related, either as complements or as substitutes to each other (Agrawal and Knoeber, 1996). A long-time panel data set alleviates endogeneity problems (Bhagat and Black, 1999), since firm performance is related to different board characteristics across firms at a given time, but also contains variations in these relationships in the same firms across time. Furthermore, most boards are elected in the spring and early summer, and the firm performance recorded at year-end. Thus, the same-year board impact of the board's characteristics should become evident. Nevertheless, we test for endogeneity explicitly in two ways. First, a lagged Tobin's Q is included in the basic regression, and second, important board characteristics are assumed to be dependent.

The tests reveal some endogeneity. In particular, and remembering that a higher network score means better firm performance, we find that well-performing firms tend to attract well-connected directors. We also find that board characteristics are complements rather than substitutes, if they are internally related. However, when we include the preceding period's performance none of the earlier results are materially upset, indicating that the reverse causation hypothesis receives confirmation to a minor degree only.

Our results have relevance for the ongoing debate about corporate governance in many countries. In particular, we find no economic argument for mandating independence or diversity, such as requiring by law or code that a minimum fraction of directors are independent, employees, or of a given gender. If anything, regulatory implications are the opposite of what is argued in the public domain: Regulators should encourage more owners in the boardroom, more directors with multiple seats, fewer employee directors, less gender diversity, and smaller boards. Independence is already at its optimal level and needs no regulatory pressure

of the type which is currently introduced worldwide. In fact, regulation aimed at preventing costly scandals in a small number of firms may end up destroying more value in the vast majority of firms.

1.3 Better firm performance with labour on the board?

While the "Aligned, informed, and decisive" paper presents a broad overview of board issues, the second paper looks at the relationship between firm performance and employee directors in more detail. Although codetermination (employee board representation) exists in many European countries, the issue is under-researched. Jensen and Meckling (1979) predict that codetermination needs backing in laws, and this is indeed the case for Norway, where codetermination was enacted in 1972 (Aarbakke et al., 1999).

The central idea of the paper is that the presence of employees on the board has both a direct and indirect effects upon firm performance. The indirect effects come about when shareholders adjust unregulated governance mechanisms in order to compensate for perceived negative consequences of employee representation. Buchanan and Tullock (1962) predict such an outcome in the political arena, and in Germany much effort has been done to avoid codetermination effects, for instance, by limiting the number of meetings in the supervisory board.

Former studies mostly find a negative relationship between firm performance and employee board representation. This applies to Germany (FitzRoy and Kraft, 1993; Schmid and Seger, 1998; and Gorton and Schmid, 2000) and to Canada (Falaye et al., 2006), in addition to our own results in the "Aligned, informed, and decisive" essay. However, Fauver and Fuerst (2006) report a positive effect in information-intensive industries in Germany. None of the studies investigate the indirect effects employee directors may have upon other governance variables, and only our own uses panel data. Also, compared to the German and Canadian experience the Norwegian institutional setting offers some advantages. First, employee directors sit on the board, while they are present in the rarely convening and little informed supervisory board only in Germany. Second, the employee directors are elected due to their employment in the firm, not because they are owners as in Canada, or as union representatives, as in Germany where one third of the labour representation is reserved for union representatives. Third, in all size classes and in all industries a dichotomy arises between those firms that have employee directors and

those that have none. This is useful for testing as it allows the creation of sub-samples with e.g. codetermined firms with more than 200 employees. In all, the Norwegian institutional framework should give a sharper picture of the employee director effect than former studies.

The relationship between employee directors and firm performance is treated in different strands of literature? From a property rights perspective Becht et al. (2003) argue that board representation can be a guarantee against shareholders' expropriation of employees' rents through their "urge to dismiss", and that this may bring forth employees' investments in firm-specific human capital and the cessation of industrial action. The firm-specific human capital makes the employee a residual claimant on par with investors. The stakeholder theory position is that employees are superior monitors of management, since they observe day-to-day action (Blair and Stout, 1999). Board representation implies that owners may get access to the information. Both these positions would predict a positive relationship to firm performance.

A negative relationship may result from the collective choice problems that parties with divergent interests induce in decision-making (Tirole, 2001 and Hansmann, 1996). The shareholders' objective is to maximise firm value, while the employees' objectives are to maximise wages and to protect firm-specific human capital. The resultant mixed firm objective means longer decision time and compromise decisions. The CEO tends to be a compromise maker rather than a shaper of the firm under a clear objective (Tirole, 2002). The implied consensual decision model in co-determination means that the firm pursues stability and predictability instead of bold new moves (Siebert, 2005).

Furthermore, Pistor (1999) and Hopt (1998) point out that employees' monitoring may not be truthfully revealed, as in economising on the supply of internal information to the board, and also in leakage of sensitive board information. Employees may also use moral arguments against for instance plant closures or high management pay. The shareholder elected directors may have trouble withstanding such arguments, since they may experience large personal costs and small personal gains from taking adverse employee decisions (Baker et al., 1988). Thus, even though the employees are in a minority position in the board, they may influence board decisions to their advantage.

When shareholders fear such effects of co-determination, they may adjust governance mechanisms in order to neutralize the codetermination impact imposed through regulation by placing a heavier weight on the

unregulated (Buchanan and Tullock, 1962). The employee directors variable's effect upon board characteristics is one such neutralizing action, another is to increase leverage so as to give the CEO less scope for wastage (Easterbrook, 1984 and Jensen, 1986). These previously unexplored indirect effects make a simultaneous equations approach necessary. I term this relationship the *co-determination hypothesis*.

The model tests the hypothesis that codetermination is negatively related to firm performance, but it has relevance for the endogeneity debate as well (see Hermalin and Weisbach, 2003 and Bhagat and Black, 1999). Hermalin and Weisbach (1998) suggest that governance mechanisms are endogenously determined by former firm performance. Thus, a reverse causation is proposed, since the lagged firm performance should have a negative relationship to governance mechanisms. With good firm performance, the CEO has bargaining power to reduce monitoring intensity. A rival endogenous hypothesis is that good firm performance induces even better monitoring, since the firm needs to improve its governance to maintain good performance. I test for this, and term this the *reverse causation hypothesis*.

Finally, a link between the board index and the leverage reveals whether the governance variables are complements or substitutes (Agrawal and Knoeber, 1996).

Instead of using individual board characteristics, I construct a board index from significant variables in the AID essay. The variables directors' ownership, network, board size, and gender receive equal weights in the index, and they keep their estimated sign from the AID essay paper. Following Bertrand and Mullainathan (2001), the variables are standardised to have zero mean and standard deviation of one in order to add them.

The econometric estimation is carried out with simultaneous equations regressions using the three-stage least squares (3SLS)[4] methodology (Greene, 2003). I use fixed effects estimation (Woolridge, 2002) in regressions for the whole sample and for sub-samples of co-determined and shareholder determined firms, and for co-determined firms with more than 200 employees. I also perform robustness tests.

First of all, the co-determination hypothesis finds confirmation in the negative, direct effect upon form performance, and in the indirect impact upon the board index and average wage, which are both positive.

[4]The 3SLS is an instrumental variable estimation method. The instruments are the predicted values of the dependent variable from a regression on all the explanatory variables in the system (Greene, 2003, p. 398). Thus, regressions are undertaken in several steps, or stages, hence the name.

Thus, shareholders try to adjust board characteristics so as to neutralize the harmful direct effect of co-determination. But the indirect effect of the board index turns out to be economically weaker than the direct effect of employee directors, so that the shareholders are only partially able to neutralize the negative direct effect. The overall effect of co-determination is therefore negative. The results become progressively stronger in regressions from the overall sample to the sub-sample of co-determined firms and then to co-determined firms with more than 200 employees.

I also confirm the positive impact of employee directors upon leverage. On the other hand, higher leverage means lower firm performance, a fact that is often found in the empirical literature (Barclay et al., 1995; Rajan and Zingales, 1995; and Brick et al., 2005), but contradicts predictions in theory (Easterbrook, 1984 and Jensen, 1986) that a higher leverage brings better firm performance. Thus, the employee director impact upon firm performance is even more negative when leverage is taken into account.

How do the results for governance mechanisms in co-determined firms compare to those in shareholder determined? It turns out that the board index is positive, and leverage negative, as before. However, leverage is no longer significant. The fewer and weaker results for shareholder determined firms indicate that governance mechanisms are set closer to equilibrium than in co-determined firms.

The reverse causation hypothesis finds confirmation, too. However, these are weak, and contrary to the Hermalin and Weisbach (1998) suggestion. Thus, governance mechanisms are only weakly endogenously determined by former firm performance. Their overall effects upon firm performance are very low. Thus, I find evidence of reverse causation, but the effects are almost negligible.

Robustness tests generally confirm the results. Replacing Tobin's Q as a measure of firm performance with the book return on assets (ROA) and the stock return does not materially upset former findings. I also try the dividend payout rate instead of leverage, but find the variable to have little explanatory power. Dropping the lagged firm performance does not upset coefficient values in other variables much. In general, the robustness tests are very satisfactory.

Finally, I test the Fauver and Fuerst (2006) finding that co-determination plays a positive role in information intensive industries. These are industries requiring high knowledge content, but also firms running complex logistic operations, such as retailing. Estimations are carried out in subsamples of information industries and other industries. It turns out that

the same qualitative pattern of impacts from employee directors turns up in both estimations, although the impact of employee directors is somewhat weaker in the information industries. A Chow test of different coefficient values in the two sub-samples can not be confirmed.

In conclusion, the idea that employee directors could add value to the company does not find support in the data. Co-determination, mandated in law, has costs for the firms, both in shareholder attempts to neutralize the effects, and probably also in terms of a slower, consensus-oriented decision process.

1.4 Board control, turnover and turbulence

The co-determination paper deals with the relationship between owners and employees, and this paper looks at the relationship between owners and the CEO. Agency problems stand at the center of this relationship (Berle Jr. and Means, 1932 and Jensen and Meckling, 1976), and the protection of minority shareholders has come to be seen as a way to reduce the extent of agency costs (Shleifer and Vishny, 1997). In this paper, I argue that the timing of CEO departure relative to board enlargements and director substitutions can shed light on the relationship, since different board control types give diverging predictions on the relative timing of departures. The present essay is related to the Goyal and Park (2002) study of CEO turnover when the CEO holds the joint office of chairman, and Falaye (2007) who investigates the CEO turnover for staggered boards. CEO-chairman duality and staggered boards may be seen as CEO protection from shareholders' discipline. The Norwegian company law does not allow such protection (Aarbakke et al., 1999). Since the protection of minority shareholders is high, CEO turnover and board changes may be studied unhampered by CEO or director protection.

By itself, CEO turnover is important, since this is one of the board's primary functions (Monks and Minow, 2001, p. 200). Board changes are likewise important. The Berle Jr. and Means (1932) claim is that shareholders have lost control over the company, since they are dispersed, and because the CEO controls the appointment of new directors.

I differentiate between three board control types. The first is the Berle Jr. and Means (1932) CEO control, where the CEO in effect elects his own directors. The Hermalin and Weisbach (1998) model of the "endogenously determined" board shows the CEO in control. Upon turning in good firm performance, the CEO is rewarded a reduction in monitoring intensity,

which they interpret to be a less independent board. This is achieved either by independent directors leaving, to be replaced by inside directors, or by an inside director board enlargement. The implication is that directors leave during the CEO tenure.

One could expect that the Hermalin and Weisbach (1998) model predicts a board independence increase following weak firm performance. Yet the authors disregard shareholders due to the US institutional fact that shareholders are dispersed. But this points to a rival explanation involving the concentration of ownership. The Shleifer and Vishny (1986) and Bolton and von Thadden (1998) proposition says that the higher outside ownership concentration, the higher is monitoring effort. From this it follows that director turnover is higher as well. Given CEO control, outside ownership concentration should have no association with director turnover.

Under the second control type, the board fulfils its primary function of hiring and firing the CEO. I call this "shareholder control". In this case, the turnovers of CEO and directors are unrelated, but board changes should be related to outside ownership concentration and CEO turnover should be unrelated. The third control type is "joint control", when the board and the CEO together form a team, and are jointly responsible for firm performance. Since they are jointly responsible, a prediction is that the CEO and director turnovers will be simultaneous. Thus, the fact that the three control types imply different patterns of timing in CEO turnover and board changes can be used to examine whether the typical director election is under shareholder or CEO control. Also, the three types of board control give different predictions regarding outside ownership concentration.

No earlier authors have utilised the relative turnover timing of CEOs and directors to investigate the potential for agency problems. In recent papers, Farrell and Whidbee (2000); Yermack (2004), and Fich and Shivdasani (2006) all show that *outside* directors are more likely to leave when a new CEO takes office. But none of the authors make the timing of CEO and director departures the central issue of study.

Besides simultaneity and outside ownership I include variables that often appear in turnover studies, such as CEO and director ownership, board independence, and firm performance. I also include the board network. A board with better network connections may be less likely to experience turnover, since such a board turns out create value (Ferris et al., 2003 and Bøhren and Strøm, 2007). However, Fich and Shivdasani (2006) point out that a board with many outside directorships is less likely to discharge the CEO. Besides these, three variables that may be seen as proxies

for either CEO entrenchment or information are in the independent variable set. These are exported CEO, imported CEO, and CEO director, see the AID essay in section 1.2.

Board changes comprise director turnover and board enlargements. I join these in a single measure, called board turbulence. I am unaware if such a measure is already in use. Moreover, CEO turnover is defined in three different ways. The first is all CEO turnovers, the second the CEO departures that coincide with a chairman departure, and the third is the forced departures from Bøhren et al. (2002). The common practice is to use the forced departures, but Yermack (2004) is an example of a study employing all CEO turnovers.

I include all CEO turnovers for the following two reasons. First, the timing of CEO turnover and board turbulence may reveal board control type, for whatever reason the departing CEO left the company. Thus, for this reason alone, all CEO changes belong to the data set. Second, public information on dismissals is likely to emerge only in a minority of cases, probably where the conflict is the most acute, since both the firm and the departing CEO want to defend their reputational capital. Using only this sub-sample of turnovers is, consequently, likely to result in a seriously biased sample.

The panel data structure of Norwegian boards from 1989 to 2002 offers the opportunity to study departures around the time of CEO turnover. I run three types of regressions. In the first, CEO turnover is the dependent variable and a lagged and simultaneous board turbulence are dependent. The second group of regressions comprises the chairman as the dependent variable, and in the third, board turbulence is taken as the dependent, while the lagged and simultaneous CEO turnover are independent. The regressions for the chairman is done due to the position's importance. In addition to the CEO, chairman, and board turbulence variables, the above-mentioned variables enter the regressions.

When the CEO turnover is the dependent variable, I use the so-called probit regression technique. Probit regressions are necessary because CEO turnover is a binary variable. Since the method does not remove firm heterogeneity, I have added 14 year and 19 industry dummies in order to control for as much of the firm's fixed effects as possible. Furthermore, with panel data it is not possible to standardise the variables, although the slope coefficients may be observed at the average of the distribution. These are called average partial effects (APE). Furthermore, the same probit methodology is used in regressions with the chairman departure as

dependent variable.

When board turbulence is the dependent variable, I use GMM estimation in the same manner as in section 1.2, with the exception that lagged explanatory variables enter the regressions.

I focus upon the simultaneity of CEO departure and board turbulence in the three regression groups as well as the role of outside ownership. When the CEO turnover is the dependent variable, I find that the simultaneous and lagged board turbulence are both significant and positive, but the simultaneous is higher than the lagged, that is, the simultaneous APE is higher than the lagged. Thus, the CEO board control type receives little support. Furthermore, the outside ownership concentration is not significant, as is expected under shareholder and joint control. These results hold across various definitions of CEO turnover, and for firm performance being either stock return or return on assets.

The same conclusions emerge when using the chairman as the dependent variable. Now, the CEO turnover variable is simultaneous and lagged. The chairman is removed in the board turbulence measure, and the regression using joint CEO and chairman turnover is removed from the estimations.

The third regression group comprises the board turbulence as the dependent variable. Here, the simultaneous and lagged CEO turnover are both significant, but the lagged is more important. This should indicate CEO control. However, now the outside ownership concentration is significant and positive, as expected when shareholder control is the case.

My main conclusion is that the control type between CEO and directors is one of joint control, that is, the CEO and directors together constitute a team. This supports the friendly board hypothesis of Adams and Ferreira (2007).

Thus, the data do not support the Hermalin and Weisbach (1998) hypothesis that board composition is endogenously determined. It seems that CEO control can only be realised if some protection is given, for instance in the form of CEO-chairman duality or a staggered board, as Goyal and Park (2002) and Falaye (2007) report. The results in this paper show that when such protection is not in place, shareholders are important in choosing directors. By implication, for the CEO to gain control over the board, regulations must favour CEO protection.

1.5 Looking back

Looking back at the essays, three main conclusions seem to emerge. The first is that the board matters for firm performance. Board characteristics play a role for the success of companies, and firms are advised to keep boards small, well informed, and aligned with shareholder interests. The second main conclusion is that endogeneity exists, but compared to the effects of board characteristics, it is of minor importance. The third conclusion is that government regulations matter. This is obvious for the negative effects of co-determination, but also for the strong protection of minority shareholders. This protection allows shareholder discipline to be exercised in the relation to the CEO.

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2

Aligned, informed, and decisive

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Abstract

This paper explores how board composition influences the conflict of interest between principals and agents, the production of information for monitoring and advice, and the board's effectiveness as a decision-maker. Paying particular attention to the board's independence, information production, and diversity, we exploit unusually rich data from an unexplored institutional environment to estimate models that control for endogeneity. We find that the firm's performance is higher when its directors own equity in the firm, have wide information networks to other firms, and when the board has low gender diversity, no employee directors, and small size. No association is found between performance and independence. Board mechanisms are often endogenously determined, both by each other and by the firm's performance. These characteristics of value-creating boards are consistent with theoretical predictions and the limited evidence from other institutional regimes, but lend no support to popular opinion and the current politics of corporate governance.

Keywords: Corporate governance, Board composition, Regulation, Endogeneity

JEL classification codes: G34, G38

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2.1 Introduction

The corporate governance literature argues that the fundamental concerns in board design are to align the interests of principals and agents, to provide information for monitoring and advice, and to foster decision-making effectiveness (Becht et al., 2003 and Hermalin and Weisbach, 2003). However, constructing aligned, informed, and decisive boards involves a number of difficulties. In particular, the task involves a wide set of board mechanisms, but we lack both theory and evidence of how these mechanisms relate to each other and to economic performance (Becht et al., 2003)[2]. This also means that when regulators currently restrict the admissible range of board mechanisms like independence and diversity, they do so without knowing the impact of their actions neither on other board mechanisms nor on the firm's performance. If anything, the limited empirical research mostly questions the validity of the current regulatory practice or has nothing to say about it.

Our paper addresses the board design problem empirically by analyzing an unusually rich set of board mechanisms in an unexplored regulatory regime, using a methodological approach that controls for endogeneity. Because the directors' independence, network, and diversity are often debated in the public, we pay particular attention to these mechanisms, constructing new empirical proxies for independence and network that are more consistent with the existing theory. The regulatory environment of our sample firms allows us to study the economics of compulsory law in place (such as mandatory employee directors), of recent comply-or-explain regulation (such as the OECD codes and national codes for director independence), and the economic rationale for introducing new mandatory rules in the future (such as a minimum fraction of board seats per gender).

The economics of the boardroom involves a wide range of mechanisms, their potential endogeneity is difficult to handle both theoretically and empirically (such as feedback from performance to alignment or from alignment to decisiveness), some of the mechanisms are hard to operationalize (such as independence and network), and the access to high-quality data is limited (such as directors' equity holdings, tenure, and net-

[2]Becht et al. (2003) argue that "... formal analysis of the role of boards of directors and how they should be regulated is almost non-existent. ... In sum, the formal literature on boards is surprisingly thin given the importance of the board of directors in policy debates. This literature mainly highlights the complexity of the issues. There is also surprisingly little common ground between the models."

work). This environment has produced empirical research which often relates corporate performance to a narrow subset of board mechanisms, assumes board mechanisms are exogenous or that endogeneity is limited, and uses empirical proxies with low validity and reliability.

The current politics of board design is driven by governance scandals in a few firms, such as Ahold, Enron, Parmelat, and Skandia. This has produced a series of regulatory restrictions on owners' control rights in the board room, such as the Sarbanes-Oxley act in the US and corporate governance codes in more than 50 countries worldwide. The problem is that these attempts at avoiding what politicians consider the worst outcome (i. e., governance scandals) in a few firms may prevent owners from attaining their best outcome (maximum firm value) in the typical firm, where governance breakdown is an improbable event. First, Hermalin and Weisbach (2006) show theoretically that board regulation can only improve welfare if there is either information asymmetry at the contracting stage, externalities to non-contracting parties, or if regulators have remedies that contracting parties do not have. It is not obvious whether any of these conditions are met in practice. Second, the research literature lends little support to enrouraging more board independence. In fact, Adams and Ferreira (2007) show theoretically that more independence reduces information production, hurts the board's advice function, and may also reduce the value of monitoring. Also, Bhagat and Black (1999) conclude that the US evidence finds no clear link between independence and performance. If anything, the relationship is negative. Third, research on the relationship between performance and board diversity is very sparse and mostly inconclusive. Overall, the limited existing research provides no convincing support for neither current nor planned board regulation.

We try to improve on this situation in four ways. The first contribution is based on the fact that our data set includes an unusually wide set of governance mechanisms. We analyze three alignment mechanisms (inside ownership concentration, outside ownership concentration, and director independence), four information mechanisms (director network, having the firm's CEO on the firms's board, having the firm's CEO on other firms' boards, and having other firms' CEO on the firm's board), and four decisiveness mechanisms (board size, gender mix, age dispersion, and employee directors). The sample covers all non-financial firms listed on the Oslo Stock Exchange from 1989 to 2002, which is a long time series of board data by international standards. This panel of up to fourteen observations per firm allows us to study board dynamics over exten-

sive periods, and to control for unobserved determinants by fixed effects estimation, which is uncommon in the literature. Our ownership structure data are unusually detailed, accounting for every equity holding by every owner in every firm at every year-end.

Our second contribution is new empirical proxies for board independence and for director network. Important parts of the board literature and most countries' corporate governance codes classify directors as dependent if they are affiliated, i.e., have past or present business or family relations to the firm. A possible reason why the literature has produced inconclusive evidence on how performance relates to board independence is that the independence proxy is theoretically ad–hoc. According to the Hermalin and Weisbach (1998) model, what matters for director independence is not affiliation. Rather, it is the relative timing of entry, i.e., whether the director was appointed before or after the current CEO took office. Our independence proxy reflects this characteristic. Similarly, the existing literature measures director network simply by the number of board seats directors hold in other firms. This definition assumes every board seat is equally important as an information source, and it double-counts when more than one of the firm's directors sit on the same outside board. Our network proxy avoids double-counting and treats each seat individually according to its information centrality, accounting for both the direct information effect of sitting on another firm's board and the indirect effect of meeting directors on that board who hold seats in still other boards.

Third, we try to control for endogeneity as efficiently as possible. The endogenous relationship between performance and independence was modeled theoretically by Hermalin and Weisbach (1998), who recently used this framework to show how board design by owners can be understood as a response to regulatory change (Hermalin and Weisbach, 2006). However, whereas endogeneity is difficult to control for with the classic simultaneous equations methodology, equation-by-equation estimation with GMM is a more robust alternative for two reasons. First, because the true system of simultaneous equations is unknown, the coefficients will be biased if the simultaneously estimated system is misspecified. In particular, if one equation is misspecified, the estimates of the remaining equations in the system will be contaminated as well. Unlike in the classic simultaneous equations approach, estimating each regression separately with GMM keeps the misspecification local (Woolridge (2002)). Second, GMM can handle correlation between the error term and the independent vari-

ables, which is typical in endogenous relationships.

Our final contribution comes from the regulatory setting, which offers an opportunity to explore the role of three board mechanisms that are often addressed by regulators and public opinion. These are independence, employee directors, and gender diversity. First, Norwegian corporate law rules that the firm's CEO cannot be its chairman. Thus, decisions on the CEO-chairman duality have been moved from owners to regulators, who mandate separation for all firms. Although not by law, it is an empirical fact that non-CEO members of the management team are never directors in their firm. Even the CEO is not on the board in roughly two thirds of our sample firms. Thus, regulation and a voluntary restriction on board composition jointly produce boards that are at least formally less controlled by management than most boards in other countries. These exogenous restrictions increase the power of tests that relate corporate performance to board independence. The second unusual characteristic is that when a listed Norwegian firm employs more than 200 people, the employees choose one third of the directors. Since roughly 40% of our sample firms have employee directors, the cross-sectional variation of this board characteristic allows us to analyze the performance effect of mandatory employee directors, which is quite unexplored in the literature.[3] Finally, both independence and gender diversity in the boardroom were heavily discussed in the second half of our sample period, and gender diversity was mandated two years after its end.[4] Since we know each director's gender, we can explore whether gender diversity has unexploited economic potential that owners will not capture unless regulators mandate it.

We find that corporate performance as measured by Tobin's Q is significantly higher when insider ownership is high (i.e., aligned) and when directors have wide networks through seats they hold in other firms (informed). Firms with small boards, low gender diversity, and no employee directors are more valuable than others (decisive). These relationships are statistically significant at standard levels, and the economic significance is stronger for the alignment and information mechanisms than for decisiveness. In contrast, we find no evidence that independence relates systematically to performance. These results, which control for endogeneity,

[3]Firms in the newspaper, shipping, petroleum extraction, and financial service industries are exempted. 62% of the sample firms have more than 200 employees, and two thirds of them have employee directors.

[4]A corporate governance code for listed firms issued in 2004 recommends at least 50% independent directors. A law passed in 2004 mandates at least 40% directors of each gender in listed firms from 2006 on.

are robust to alternative model specifications. Consistent with theoretical predictions, we do find that board design mechanisms are endogenous, both relative to each other and to performance. For instance, higher gender diversity increases board size (i.e., mechanisms drive each other), and directors with strong information networks both improve performance and gravitate towards well-performing firms (two-way causation between mechanisms and performance). Moreover, board mechanisms are complements rather than substitutes. For instance, the decisiveness mechanisms show that boards with low gender mix are smaller and have less age diversity, which all contribute to more homogeneity. Also, and as expected, board-external firm characteristics matter for board composition. For instance, higher risk generates lower insider holdings, more networked directors, and less gender diversity. Finally, the finding that several board mechanisms relate significantly to performance in an endogenous system apparently shows that owners do not design their board optimally (Demsetz and Lehn, 1985). Such a conclusion may be premature, since the regulator does not allow the owners of our sample firms to freely design the optimal board. Mandatory employee directors in large firms is an example of such an exogenous, binding restriction on board design.

These findings imply that well-functioning directors are not necessarily independent of the CEO, which runs counter to conventional wisdom behind recent corporate governance regulation. However, it is line with most existing empirical results and also consistent with the theoretical model of Adams and Ferreira (2007). The evidence suggests that owners are able to trade off a director's role as hands-off monitor against the role as hands-on adviser, and that stronger emphasis on independence may hurt not just the advice function, but also the value of monitoring, which is the only function captured by the Hermalin and Weisbach (1998) model and also the one receiving all the attention in current board regulation. Similarly, it seems directors have multiple seats not because they elbow themselves into the board room, but due to the valuable information network they bring along. Also, the negative association between performance and diversity in terms of more gender mix, larger board size, and the use of employee directors does not support the claim that director heterogeneity is an underexploited resource, and that owners will not capture its economic value unless regulators help them. Finally, the endogeneity of board mechanisms is a real-world phenomenon, making both research and regulation of board design more difficult.

The rest of the paper is organized as follows. Section 2.2 reviews the lit-

erature and explains how our methodology deviates from the one used by others. Section 2.3 describes the institutional framework, explains the data selection procedure, and presents the descriptive statistics. We formally test the relationship between board design and economic performance in section 2.4, whereas section 2.5 provides robustness checks. Section 2.6 summarizes and concludes.

2.2 Theory, evidence, and methodology

Becht et al. (2003) recently concluded that the theory of board design is grossly underdeveloped. This characteristic of a young, immature paradigm is problematic for empiricists. Although the board design problem is multidimensional, each theory is partial and addresses one or a few board design mechanisms. Thus, theory cannot predict what the full set of value-creating board mechanisms looks like in equilibrium. Neither can it specify the expected internal relationship between major mechanisms, such as the endogeneity between insider equity holdings and board size. Consequently, estimated relationships between the mechanisms and how they drive performance should be considered stylized facts rather than tests of well-founded hypotheses.

In the following, we explain our choice of focus and methodology by reviewing the existing literature. We organize the discussion around the three major concerns underlying the choice of any specific board design mechanism, which are to align the interests of principals and agents (section 2.2.1), provide information for monitoring and support (2.2.2), and to enhance the board's effectiveness as a decision-maker (2.2.3).

2.2.1 Interest alignment

Interest alignment in a board context concerns the firm's ownership structure and the degree of independence between monitoring directors and monitored officers.

The theory of corporate governance argues that ownership concentration matters for interest alignment by influencing the principal's incentives and power to monitor the agent (Shleifer and Vishny, 1986). Both properties are stronger the higher the ownership concentration, and inside ownership concentration (equity holdings by officers and directors) is more powerful than outside concentration because inside owners are better informed and have direct access to the firm's decision-making. However, because powerful insiders may entrench themselves and exploit their

outside co-owners, the expected relationship between inside ownership concentration and market value is positive at low concentration levels and declining after a certain point which generally cannot be specified ex ante.

The empirical evidence on the relationship between outside concentration and firm performance is mixed and inconclusive (Gugler, 2001). As for inside concentration, which is the more relevant ownership characteristic in a board setting, the predicted curvilinear relationship has received consistent support by studies that mostly ignore other board design mechanisms than insider ownership. However, this clean result does not carry over to the board literature, where the models include more board characteristics than just insider holdings. Hermalin and Weisbach (1991); Byrd and Hickman (1992); Yermack (1996); Cotter et al. (1997) and Bhagat and Black (2002) all find a positive relationship, but it is only significant in Hermalin and Weisbach (1991) and Yermack (1996). Thus, adding more mechanisms to a board design model than just ownership structure may easily blur the mostly clean empirical relationship between insider ownership and firm performance found in simpler models. Our comprehensive model allows us to study this issue more closely. We measure outside ownership concentration by the Herfindahl index based on all outside owners[5]. Insider ownership is proxied for by the directors' aggregate equity fraction in the firm.

The board literature and existing corporate governance codes argue that monitoring quality is higher the stronger the independence between directors and managers. Such independence is generally thought to reflect the directors' ability to monitor without feeling pressure from the monitored CEO. Arguing that this issue involves more than just outside vs. inside directors, Byrd and Hickman (1992) introduce a finer partition by distinguishing between inside, affiliated outside, and independent outside directors. Only the latter type has no past or present business or family ties to the firm.

The empirical evidence on the relationship between such independence measures and firm performance is inconclusive. Baysinger and Butler (1985) estimate a ten-year lagged positive effect, Hermalin and Weisbach (1991) find no significant link, while the relationship is negative and significant in Yermack (1996); Agrawal and Knoeber (1996); Klein (1998); Bhagat and Black (1999), and Bhagat and Black (2002). One possible reason for this

[5]The Herfindahl index for outside ownership concentration is the sum of squared ownership fractions across all the firm's outside owners. Its maximum value is one (a single investor owns every share held by the outsiders), approaching its minimum value of zero as the ownership structure gets increasingly diffuse.

low consistency is the missing theoretical justification for the affiliation-based independence measure. To increase the power of the test, we base our independence measure on the Hermalin and Weisbach (1998) model, where the CEO's ability to recruit dependent directors increases with the firm's past performance. This model predicts that the longer the history of good performance under the current CEO, the less independent the current board. Thus, the key independence criterion is not affiliation, but whether the director was appointed before or after the CEO took office.[6] Consistent with the Hermalin-Weisbach model, we measure a board's independence as the difference between the average tenure of its non-CEO directors and the tenure of the CEO:

$$\text{Independence} \equiv \frac{1}{n}\sum_{i=1}^{n}\text{non-CEO director tenure}_i - \text{CEO tenure} \quad (2.1)$$

where non-CEO director tenure$_i$ is the number of years since non-CEO director i entered office, and n is the number of shareholder–elected directors. The average director has longer (shorter) tenure than the CEO when expression (2.1) is positive (negative). According to Hermalin and Weisbach (1998), the board is more independent the higher the value of (2.1)[7].

Carter and Lorsch (2004) argue that board independence is driven by the director's absolute rather than relative tenure, and that independence decreases rather than increases as tenure grows.[8] This happens because directors become emotionally more attached to the firm and its management the longer the directors stay. Under this logic, a higher value of (2.1) means less independence rather than more. However, since (2.1) also reflects the tenure of the CEO, which is irrelevant under the Carter-Lorsch hypothesis, we will alternatively use board tenure, CEO tenure, and chair tenure as proxies in our robustness tests.

A very different reason why a positive relationship between indepen-

[6] A second reason for questioning the conventional independence definition in our setting is the institutional framework. The CEO of our sample firms is also a director in just one third of the cases, the CEO cannot chair the board by law, and other members of the management team are never on the board. Thus, although most directors in our sample are independent in the Byrd-Hickman sense, they may not be so according to Hermalin and Weisbach (1998).

[7] Although not based on an underlying theoretical model, Westphal and Fredrickson (2001) did in fact use the fraction of directors appointed after the CEO took office as one of several independence measures.

[8] Absolute rather than relative CEO tenure has also been used as an independence proxy in the strategic management literature (Finkelstein and Hambrick, 1989).

dence and performance is not found in the data is that it simply does not exist. That is, the predictions tested so far may come from theories that miss key components of the full picture. In particular, although directors provide both monitoring and advice, the Hermalin and Weisbach (1998) model only captures monitoring. This means the directors' role as advisors is assumed to be independent of their role as monitors. Similarly, regulation mandating more independence ignores the point made by Bhagat and Black (1999, p. 264) that "Inside directors are conflicted, but well informed. Independent directors are not conflicted, but are relatively ignorant about the company". Adams and Ferreira (2007) formalize this idea in a setting where the quality of both monitoring and advice increases with the information received from the CEO, who dislikes monitoring and likes advice. They show that if independent directors have stronger monitoring incentives than dependent directors, increased independence may hurt the stockholders. This happens because information provision is endogenous to independence: The CEO responds to increased board independence by providing the directors with less information. In fact, the value of both monitoring and advice may decrease as independence grows. Thus, an inverse or no relationship between independence and performance is consistent with a model that captures both the monitoring and advice functions of the board, recognizes the conflict between the two, and lets information provision relate endogenously to independence.

2.2.2 Information

The quality of the board's monitoring and support functions depends on the quality of the information used. Information sources that can be influenced by board design are CEO directorship, the CEO's directorships in other firms (which we call exported CEO director), another firm's CEO on our firm's board (imported CEO director), and non-CEO directors holding board seats in other firms (director network).

Agency theory suggests that due to the value of independence for monitoring quality, the CEO should not be on a board which is supposed to monitor him[9]. In contrast, Carter and Lorsch (2004) posit that since the CEO has superior information about the firm and its environment, he should be a fully voting member in order to increase incentives for infor-

[9]Because the CEO director mechanism involves both alignment and information, it may be classified under either the alignment or the information heading. We choose the latter, but with no implicit assumption about relative importance.

mation production. Because the CEO is a member in about every third of our sample firms, we can explore the validity of these two competing predictions. While the CEO-chairman duality has been analyzed earlier, we are not aware of existing studies of CEO directorships.

Similarly, whereas the agency logic may suggest that the CEO should pay full attention to his firm, the information perspective would argue that the firm may benefit when the CEO is on other firms' boards. We use the exported CEO director variable to capture this design characteristic. Perry and Peyer (2005) show that when agency costs are high, the announcement of a new outside directorship for the CEO is followed by a negative share price reaction. Correspondingly, a CEO from another firm on our board (imported CEO director) may contribute little if he is already a fully committed CEO. Also, Gilson and Kraakman (1991) argue that imported CEO directors are bad monitors because they have the same role in the principal-agent setting as the CEO they are supposed to monitor. Again, the counterargument is the information idea that the imported CEO director brings new perspectives and makes all directors better informed. The net impact of these alignment and information effects can only be determined empirically.

Just like the CEO, non-CEO directors with multiple directorships may bring back information, but may also become overstretched monitors (Ferris et al., 2003, and Fich and Shivdasani, 2006). Fama (1980) argues that the average number of outside directorships held by the firm's directors proxies for the market value of the board's monitoring quality. This simple measure, which is predominant in finance-based board research, is potentially problematic. Although the information benefit may be positively related to the number of directorships, the measure is noisy because it ignores the uniqueness of each seat. Also, it does not distinguish between n direct director links to just one other firm and one direct link per firm to n different firms. Moreover, the Fama measure neglects indirect links created when the firm's director is on a second firm's board with someone who holds a seat in a third firm.

We avoid these problems by applying an information centrality concept from social network analysis (Wasserman and Faust, 1994). This measure captures the firm's direct and indirect links to directors in other firms, treats each seat individually, and avoids double counting. The centrality score increases with the number of direct and indirect paths from our board to other boards, and is higher the shorter the indirect path[10]. The

[10]Network theory uses concepts such as nodes and lines. In our setting, a node is a

higher the board's centrality score, the stronger the predicted information effect of its directors' network.

2.2.3 Decisiveness

The decisiveness mechanisms are supposed to improve the board's effectiveness as a decision-making unit. The mechanisms we explore are board size, director gender, director age, and employee directors.

Yermack (1996) and Eisenberg et al. (1998) document that performance decreases with increasing board size. This is consistent with Gjølberg and Nordhaug (1996), who show theoretically that increased board size is valuable only when new members bring new insights. If not, larger boards take longer time to decide and make more conventional decisions than smaller boards. Thus, performance suffers when increased board size reduces creativity and decisiveness.

A larger board may also produce more diversity, which Cadbury (2002) considers a valuable characteristic. This is why public choice theory tells board designers to trade off the negative effect of longer decision time and stronger pressure on consensus against the positive impact of a wider opportunity set generated by a more diverse board (Buchanan and Tullock, 1962). Thus, the issue is not just whether board size grows, but whether it does with new directors who differ sufficiently from the existing ones. Gender and age are potential ways to create such diversity.

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firm, and a line between two firms represents a joint director in the two firms. We define geodesic g_{jk} as the shortest path between two nodes j and k, and G as the total number of nodes. The node i is designated as n_i. Using Wasserman and Faust (1994, p. 192-197), our information centrality measure is constructed in the following way: Form the $G \times G$ matrix A with diagonal elements $a_{ii} = (1 + \text{sum of values for all lines incident to } n_i)$ and off-diagonal elements a_{ij}, where

$$a_{ij} = \begin{cases} 0 & \text{if nodes } n_i \text{ and } n_j \text{ are not adjacent} \\ 1 - x_{ij} & \text{if nodes } n_i \text{ and } n_j \text{ are adjacent} \end{cases}$$

x_{ij} is the value of the link from firm n_i to firm n_j, that is, 0 or 1. The inverse of A, which is $C = A^{-1}$, has elements $\left\{c_{ij}\right\}$, where we define $T = \sum_{i=1}^{G} c_{ii}$ and $R = \sum_{j=1}^{G} c_{ij}$. The information centrality index for firm n_i is:

$$C_i(n_i) = \frac{1}{c_{ii} + (T - 2R)/G}$$

The index measures the information content in the paths that originate and end at a specific firm.

The empirical evidence on how firm performance correlates with gender is scant and conflicting. Shrader et al. (1997) and Smith et al. (2006) document a negative relationship between female directors and firm performance, whereas Carter et al. (2003) find the opposite. As far as we know, age has not been studied in this setting. We will use the fraction of female directors and the variance of the directors' age to proxy for gender diversity and age diversity, respectively.

The use of employee directors is potentially a mechanism for both alignment, information, and decisiveness. Because employees are stakeholders with contractual claims on the firm's cash flow, the hold-up problem suggests that shared control with employees investing in firm-specific human capital may benefit owners (Hansmann, 1996 and Becht et al., 2003). However, Williamson (1996) posits that since employees have a contractual claim, they should not be residual claimants as well. Because employees will defend their sunk human capital investments, they may oppose decisions which threaten their job security. This is the alignment dimension of employee directorships.

As for information provision, Raheja (2005) argues that inside directors may be valuable because outside directors are better monitors when firm-internal information comes through several channels. Thus, employee directors may supplement the CEO as an internal information source. Employee directors may also matter for decisiveness, as the conflict of interest between owners and employees may increase decision complexity and make the board a less effective decision maker. This is why Cadbury (2002) thinks boards should be unitary.

The limited empirical evidence suggests the net effect of employee directors on owner wealth is negative. FitzRoy and Kraft (1993) and Schmid and Seger (1998) show that German firms with employee directors are less profitable than other firms. Falaye et al. (2006) find that Canadian firms where shareholding employees hold director positions in their company spend less on new assets, take fewer risks, grow more slowly, create fewer new jobs, deviate more from value maximization, have more serious cash flow problems, and are less productive. 41% of our sample firms have employee directors. We measure board-driven co-determination by the fraction of the firm's directors employed by the firm.

To summarize, we want to investigate the following relationship be-

tween economic performance and board design mechanisms:

$$\begin{aligned} Q = {} & \text{Constant} + \beta_1 \text{Directors' holdings} + \beta_2 (\text{Directors' holdings})^2 \\ & + \beta_3 \text{Outside concentration} + \beta_4 \text{Independence} \\ & + \beta_5 \text{CEO director dummy} + \beta_6 \text{Exported CEO} + \beta_7 \text{Imported CEO} \\ & + \beta_8 \text{Network} + \beta_9 \text{Size} + \beta_{10} \text{Gender} + \beta_{11} \text{Board age dispersion} \\ & + \beta_{12} \text{Fraction employee directors} + \gamma_1 \text{Firm size} + \gamma_2 \text{Risk} + u_{it} \end{aligned} \tag{2.2}$$

The empirical proxies are defined in table 2.1, which is organized according to the three major concerns in board design.

Table 2.1

Because the descriptive statistics will show that insider ownership by non-CEO officers and by the CEO are strongly correlated, we use only the directors' aggregate holdings in (2.2). By removing employee directors from the proxies for independence, age diversity, network, size, and gender, we avoid multicollinearity problems and make it easier to separate the effects of shareholder–elected directors from those of employee–elected directors. On the other hand, some predictions do not distinguish between director types, such as the relationship between board size and decisiveness. We return to that issue in section 2.5 by including employee directors in the size, independence, and gender proxies. Our control variables are firm size and risk, which we measure by the log of sales revenues and the equity beta, respectively. Size is included due to its consistent correlation with observed returns in asset-pricing tests (Hawawini and Keim, 2000). Correspondingly, risk controls for the impact of cash flow uncertainty on firm value.

2.2.4 Endogenous board design mechanisms

A board mechanism may be endogenously determined by other variables in our model for two reasons. First, the firm's performance may drive its board composition. Such reverse causation occurs in the Hermalin and Weisbach (1998) model, where the board becomes less independent the better the firm performs. Similarly, Palia (2001) posits that insider ownership increases when performance grows, as equity-based compensation instruments are more often exercised when performance is strong.

Second, a board mechanism is endogenous if it is influenced by other board mechanisms in the model. An early example is Demsetz and Lehn (1985), who argue that when value-maximizing owners can freely choose

their firm's corporate governance system, equilibrium occurs when each governance mechanism's marginal impact on performance equals zero across all mechanisms. This implies that the mechanisms are internally related and that the optimal set is determined by exogenous factors such as the firm's industry, risk, and the stage of the business cycle. A more recent example is Adams and Ferreira (2007), where information provision by the CEO responds to exogenous changes in board independence.

The theory of corporate governance cannot yet offer a comprehensive system of well-specified board design equations. Therefore, we analyze endogeneity by first studying what happens to the relationship between current performance and current board mechanisms when we include past performance as an additional determinant of current performance. Next, letting insider holdings, board independence, director network, gender mix, and board size be alternative dependent variables in addition to contemporaneous performance, we relate these board mechanisms to each other and to contemporaneous performance. Since our panel data gives repeated observations of the relationship between firm performance and governance mechanisms, utilizing the panel structure increases the possibility of revealing stable relationships. Also, since our panel data allows for estimation with fixed effects, we need no instruments to control for unobserved firm characteristics that are stable over time.

2.3 Descriptive statistics

Our sample is all non-financial firms listed on the Oslo Stock Exchange (OSE) at year-end at least once over the period 1989–2002[11]. To reduce censoring bias in the tenure measures, we start collecting director data in 1986. The ownership structure data covers every equity holding by every investor in every sample firm.[12]

Table 2.2 summarizes key properties of the frequency distributions for each board design mechanism. It shows that officers as a group hold on average 6.4% of the equity, and the CEO owns 3.6%. These figures show

[11]The OSE had an aggregate market capitalization of 68 bill. USD equivalents by year-end 2002, ranking the OSE sixteenth among the twenty–two European stock exchanges for which comparable data is available. During our sample period, the number of firms listed increased from 129 to 203, market capitalization grew by 8% per annum, and market liquidity, measured as transaction value over market value, increased from 52% in 1989 to 72% in 2002 (sources: `www.ose.no` and `www.fibv.com`).

[12]The public securities register (*VPS*) provided the ownership data, accounting and share price data is from the OSE, and board data was collected manually from *Kierulf's Håndbok* and a public electronic register.

that powerful owners are mostly absent as inside monitors[13]. The three largest owners as a group have on average simple majority. The average largest outside owner has less than one third of the equity, which means he cannot alone block a charter amendment. This pattern reflects that the ownership concentration of Norwegian firms is low by European standards[14]. The key implication in our setting is that the resulting separation between ownership and control makes the board a potentially important vehicle for reducing agency costs.

Table 2.2

The average value of the independence proxy as defined in expression (2.1) is -0.301, reflecting that the average CEO has slightly longer tenure than the firm's average director. This figure also follows from the difference between the separate tenure figures reported for these two insider types, which are 2.2 and 1.9 years, respectively. Still, the large difference between the extreme values of the tenure variables and the high standard deviation of the independence proxy reflect considerable cross-sectional variation in (2.1), which is necessary to validly test the independence hypothesis. For instance, the average director took office almost 13 years before the CEO in the strongest independence case and more than 10 years after in the strongest dependence case.

As for the board's information function, the CEO is not a director in the firm in 70% of the cases. Every third CEO sits on another listed firm's board (exported CEO), but the median CEO has no outside directorships.

[13]Although not shown in the table, more than 40% of the CEOs do not own shares in the firm they run. The average holdings when the CEO (the directors) does (do) own is 6% (13%). Neither the directors nor the CEO holds equity in 36% of the firms, whereas both do in 44% of the cases, when their average aggregate holding is 20%. Because inside ownership increases the directors' incentives to monitor the CEO, it also reduces outside owners' need to monitor the board. Thus, unlike what would be expected from an agency logic, the observed pattern suggests that the two insider ownership characteristics are used as complementary rather than substitute ways of reducing agency costs. This may reflect a tendency to either overinvest or underinvest in these two alignment mechanisms.

[14]Norwegian firms have a less concentrated ownership structure than in any other European country except the UK. For example, the average largest owner holds close to 50% of voting equity in a continental-European listed firm, and 15% in the UK. The corresponding US figure is 3% (Barca and Becht, 2001). Norway has a civil law regime, which is generally considered less investor–protective than common law. Nevertheless, La Porta et al. (2000) find that Norway's regulatory environment provides better protection of shareholder rights than the average common law country. According to their theory of institutionally determined ownership structures, the strong investor protection is a major reason why Norway's ownership concentration is so low.

Although not reported in the table, it turns out that a CEO sits considerably more often on other firms' boards when he is also a director in the firm he runs (31%) than otherwise (21%). Thus, a potentially problematic principal-agent relationship inside the firm (the agent monitors himself) may make the CEO create the same problem in other firms (one agent by profession monitors another agent by profession).

The director network measure reflects that more direct and indirect links to other boards makes the firm better connected to key parts of the information network. For instance, we find that 66% of the sample firms in 1997 had at least one direct link to another firm through overlapping directorships. The mean score on the network variable in table 2.2 is 0.184, varying between 0.069 and 0.320.

The third section of the table, which deals with mechanisms for influencing the board's decisiveness, reports summary statistics for board size, gender, age, and employee directors. Because employee directors may behave differently than other directors, we measure board size both with and without employee directors (SizeAll and Size, respectively). The average board has six members, and one less if we ignore employee directors. This is a very small board by international standards[15]. The average fraction of women is 4.7% (GenderAll), dropping to 3.4% if we exclude employee directors (Gender). Although not shown in the table, we find that employees elect women considerably more often than the owners (15% vs 3%, respectively). This may suggest that the fraction of women in the workforce is considerably higher than the fraction of women considered qualified for owner-elected directorships. The proportion of female directors increases with board size, and the substitution of male directors by females for given board size occurs over the whole sample period and is particularly strong after 1995. The fraction of female directors is roughly three times higher in the end of the sample period than in the middle.

Like gender, age is a potential source of board diversity. The average CEO is 47 years old and roughly three years younger than the average director. Average age per board varies between 27 and 74 years, and the standard deviation of director age per board is eight years on average,

[15]Wymeersch (1998, p. 1105-1109) reports an average board size of 10.07 in the UK, 12.05 in France, 10.44 in Belgium, 12.00 in Italy, and 6.54 in the Netherlands. The average size of the German supervisory board is 13.25 (Hopt, 1998, p. 248). Carter and Lorsch (2004) find that the average US board has about 12 directors, which is down from 16 in the 1980s. Although the largest boards in our sample become less common over time, the average size is quite stable. For instance, the 25% largest boards have on average 8.97 members in the first half of the sample period and 8.67 in the second.

varying between zero (every director has the same age) and 22 years. As for employee directors, there is about one per board on average when we consider all boards regardless of whether or not they have employee directors. There is at least one employee director in 42% of the firms, declining from a typical value of 50% in the first half of the sample period to less than 40% in the second. This decline may be due to a higher proportion of firms in exempted industries, a relative increase in the fraction of small firms, or a larger proportion of firms organized as holding companies. When employees are represented, they have between one and four seats.

We measure performance by Tobin's Q and operationalize it as the market value of assets per unit book value. The market value of debt is set equal to its book value. Since we will later regress Q on board characteristics while controlling for firm size, we use sales rather than assets to measure firm size[16].

Summarizing the descriptive statistics, outside and inside ownership concentration in our sample firms is low. The board's average independence of the CEO is medium in the sense that the CEO and the average director have roughly the same tenure. The CEO is a director in the firm he manages in less than one third of the cases, and those who are sit on other listed firms' boards more often than others. The information centrality measure shows that boards differ considerably in their information access through their directors' links to other boards. The average board has six directors, female directors are rare, average director age per board varies by almost fifty years across the sample, and there is large age heterogeneity within the board. Less than half the firms have employee directors.

[16] Although many bivariate correlation coefficients in table 2.2 differ significantly from zero at the 5% level, a rule of thumb says the coefficient must exceed 0.7 before multicollinearity causes problems in regressions. Moreover, Hsiao (2003, p. 3-4) argues that multicollinearity problems are unlikely in panel data settings, since this normally involves more data points and larger data variability than a cross-section. Also, our regressions will use definitions of size and gender that exclude employee directors. To illustrate, the Pearson correlation between board size and the fraction of employee directors is 0.65 when employee directors are included in the size measure (SizeAll), dropping to 0.07 when the size measure ignores employee directors (Size). This suggests multicollinearity is not a potential problem in our regressions unless employee directors are included in the size and gender proxies.

2.4 Statistical tests

Since our data set involves repeated observations of the same firm for up to fourteen years, we use the firm level fixed effects (FE) model to handle this panel data setting[17]. The general structure of our FE model as expressed in the logic of Woolridge (2002, p. 251) is:

$$Q_{it} = \theta + \boldsymbol{\beta}(\text{Board mechanisms})_{it} + \boldsymbol{\gamma}(\text{Controls})_{it} + c_i + v_{it} \qquad \begin{cases} i = 1,2,\ldots,N \\ t = 1,2,\ldots,T \end{cases} \tag{2.3}$$

Here, i is the firm, t is the time period, θ is a constant, $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are the coefficient vectors for board mechanisms and controls, respectively, c_i is the unobserved, time-independent and random fixed effect of firm i, and v_{it} is the idiosyncratic error, which varies randomly across firms and time periods. We observe Q_{it} and the explanatory variables representing governance mechanisms and controls, and want to estimate $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ while holding the unobserved individual effect c_i constant. The error term v_{it} is assumed to be uncorrelated with the explanatory variables and c_i.

Since the unobserved c_i is constant over time per firm, the term disappears when we time-demean the variables. Although this FE approach handles unobserved time-independent firm heterogeneity by eliminating it from the data before estimation starts, we include firm size and risk to control for observed firm heterogeneity which varies over time.

We will apply the FE approach in several settings. The basic FE model (2.3) as specified in (2.2) is estimated in section 2.4.1. Section 2.4.2 analyzes endogeneity explicitly by first estimating a dynamic FE model where lagged performance allows for feedback from past performance to current board mechanisms. Subsequently, we estimate a FE model with six equations where the dependent variable is performance, directors' holdings, independence, director network, gender mix, and board size, respectively. As discussed earlier, we prefer GMM to alternative estimation methods

[17] If we ignore the time-series nature of the data and instead use a pooled cross-section approach, we would disregard possible correlation between observable and non-observable variables in general and unobserved heterogeneity between firms in particular. The pooled approach may still try to capture firm heterogeneity by adding control variables such as the firm's age and industry, but this is normally insufficient to control for fixed effects. For instance, two shipping firms founded in the same year may still have different optimal board design mechanisms if the firms have different exogenous characteristics such as location of headquarters, age of the fleet, and stage in their life-cycle. A further advantage of panel methods is that the moments needed for GMM estimation are readily available from the data structure. This property becomes particularly important when analyzing mechanism endogeneity in section 2.4.2.

because it is more suitable for handling endogeneity. Also, it does not require assumptions such as homoscedasticity, serial independence, and normality.

2.4.1 The basic model

Table 2.3 shows the results of estimating model (2.2). The first column reports unstandardized (regular) coefficient estimates, and the second shows the estimates based on the standardized variables. The p-value for statistical significance in the third column is identical for both coefficient types, but the standardized coefficient expresses economic significance in a more transparent way. Because the standardized variable has an expected value of zero and a standard deviation of one, its regression coefficient shows by how many standard deviations performance is expected to change if the board mechanism changes by one standard deviation. Thus, the higher the absolute value of the standardized coefficient, the stronger the economic significance of the board mechanism. We only report standardized coefficients in the following.

Table 2.3

The Hansen J statistic shows that the instruments used to identify the coefficients are relevant, and the overidentification test statistic reflects that the instruments are uncorrelated with the error term. We limit the attention to estimated coefficients with a p-value of 10% or less[18].

For the alignment mechanisms, there is a positive, significant relationship between performance and insider ownership. This is consistent with the extant governance literature, although the familiar, negative sign on the squared insider holdings is not statistically significant. Also, the insignificant effect of outside ownership concentration is in line with several studies in the board literature, which often find that when more board mechanisms than just ownership are included in a regression model, the

[18]The assumption underlying the GMM model in the table is that all board mechanisms and control variables are strictly exogenous. That is, $E(v_{it}|X_{i1},\ldots,X_{iT},c_i) = 0$ when $t = 1,\ldots,T$. These are the moment conditions, from which instruments may be constructed to identify the coefficients. We use the Amemiya and MaCurdy (1986) procedure, which involves the raw, the time-demeaned, and the squared time-demeaned explanatory variables. Furthermore, we include the Breusch et al. (1989) instruments, which are the average and standard deviation of firm-demeaned explanatory variables. Our choice of instruments illustrates the advantage of panel data that modified versions of variables included in the model can also be used as instruments. Variables not included in the model, such as CEO age and chairman tenure, are not used as instruments.

significant relationship between ownership and performance becomes weaker.

The insignificant relationship between board independence and performance is consistent with the hypothesis that although more independence increases monitoring incentives, it reduces the CEO's willingness to share information. The net effect in our sample is zero, suggesting that most boards have optimal independence, reflecting that most boards strike the proper balance between being a hands-off monitor and a hands-on management resource. This finding lends no support to the argument that value creation will improve when board independence is made mandatory by law or strongly recommended by code. The same conclusion follows from board research in other institutional regimes based on different independence proxies. These studies find almost without exception that the relationship between independence and performance is negative or zero.

The information centrality measure, which reflects direct and indirect information links created when the firm's directors meet directors on other boards, is supposed to pick up information sources for the board with beneficial economic effects. According to the table, it does so in terms of a positive association between director network and performance.

Every coefficient estimate under board decisiveness is negative and significant except for age dispersion. Although the inverse relationship between board size and performance is in line with the existing literature, it is remarkable that this pattern turns up in our sample as well, which has very small boards by international standards. This result suggests that optimal board size is indeed very moderate. Adding the finding that gender diversity is inversely associated with performance, it seems that the homogeneous, small board is superior to the heterogeneous, large one. Finally, the use of employee directors is negatively associated with performance. This finding supports the theoretical arguments and also the empirical findings from Germany and Canada that employee directors successfully defend their interests at the expense of owners and creditors. It also shows that from the capital providers' point of view, mandating employee directors causes an over-optimal use of them.

In terms of economic significance, the standardized coefficients show that among the estimates with a p-value of 10% or less, insider ownership is the most powerful variable, followed by network, employee directors, size, and gender. To illustrate, table 2.2 shows that the average firm has a Tobin's Q of 1.482 and directors' holdings of 6.4%, the standard devi-

ations being 1.105 and 19%, respectively. Along with the standardized coefficients from table 2.3, this implies that if insider holdings increase by one standard deviation from its mean value of 6.4% to a new level of 25.4%, expected Tobin's Q increases from 1.482 to 1.655, i.e., by 12%. Reducing gender diversity by one standard deviation from the sample mean increases expected Q from 1.482 to 1.542, i.e., by 4%[19].

2.4.2 Endogeneity

We explore endogeneity explicitly by means of two different models, which we call the dynamic performance model and the integrated mechanism model, respectively.

The dynamic performance model rests on the idea that reverse causation between performance and board mechanisms (i.e., performance drives board design) can be partially captured by including lagged performance as a determinant of current performance in (2.2). The required assumption is that lagged performance and the other explanatory variables are predetermined relative to current performance (Arellano, 2003, p. 144)[20]. Since this assumption allows for feedback from past performance to current board design, it means that if the dynamic model produces different coefficient estimates for board mechanisms than the basic model in table 2.3, these board mechanisms are at least partially driven by performance.

[19]To explore whether panel data estimation is required in our setting, we used OLS to estimate (2.2) on the pooled (i.e., un-demeaned) sample. This approach ignores both individual effects and time effects by assuming that the error term is identical across all firms and time periods. We found several noticeable differences. First, unlike our panel data model, pooled OLS reproduces the classic result in the ownership structure literature of a positive and quadratic relationship between insider holdings and corporate performance. Also, outside ownership concentration is inversely related to performance in a significant way. Second, the negative exported CEO effect becomes significant, and the significant coefficient of the network effect is higher. Third, only employee directors is significant among the decisiveness mechanisms, but its sign is reversed and its significance weaker. As expected, the importance of the control variables increases considerably, and the R^2 is below one fifth. Overall, these findings show that unless we can ignore the panel structure in our data set, the pooled model is seriously misspecified. ANOVA analysis of the the pooled OLS regression shows that the pooled model is indeed misspecified. 54% of the sum of squares in the estimated OLS error term is driven by fixed firm effects, 4% is due to time effects, and 40% is random. The remaining 2% is driven by joint individual and time effects.

[20]Thus, lagged performance may be correlated with the lagged error term, but not with the contemporaneous and future error terms. This assumption is the so-called sequential moment condition, which can be expressed as $E(v_{it}|X_{i1},\ldots,X_{it},c_i) = 0$ when $t = 1,\ldots,T$, where lagged performance is one of the explanatory variables.

We specify the dynamic model as:

$$Q_{it} = \theta + \alpha Q_{i,t-1} + \beta(\text{Board mechanisms})_{it} + \gamma(\text{Controls})_{it} + c_i + v_{it} \quad (2.4)$$

where α is the coefficient of lagged performance and β and γ are the coefficient vectors of the board mechanisms and control variables, respectively.

The standardized coefficient estimates of the dynamic performance model are shown in the first column of results in table 2.4. The results strongly support the findings in the static model in table 2.3, whose estimates are repeated in the second column of results in table 2.4. The only difference is that the linear insider holding term becomes more significant both statistically and economically and that its non-linear component becomes statistically significant. These results show that endogeneity in terms of reverse causation from past performance matters because past performance influences the effect of current board mechanisms on current performance. However, this reverse causation from past performance is still moderate, as every result from the base-case model survives.

Table 2.4

The second model consists of six equations and is called the integrated mechanisms model in table 2.4. The first equation is the static model from table 2.3. Each of the five other equations have a board mechanism as dependent variable, which is Directors' holdings, Independence, Network, Gender, and Size, respectively.

The estimates of the integrated mechanisms model reflect two-way contemporaneous causation between performance and four of the five mechanisms. The performance equation shows that boards with high directors' holdings, networked directors, low gender diversity, and small size produce higher performance. As shown by the directors' holdings, network, gender, and size equations, respectively, better performance feeds back to these four board mechanisms by producing lower insider holdings, more networked directors, less gender diversity, and reduced board size. Thus, directors with high equity stakes improve the firm's expected performance (from the performance equation), but tend to sell off or be replaced by non-owning directors as performance improves (from the directors' holdings equation). Busy directors improve performance (the performance equation), but are also attracted to well-performing firms (the network equation). Lower gender diversity reduces performance (the performance equation), but high-performing firms tend to establish boards with

less gender diversity (the gender equation). Finally, smaller boards improve performance (the performance equation), but firms with high performance tend to reduce board size (the size equation). Overall, these findings show that improved performance makes boards less aligned, better informed, and more homogenous.

Turning to the internal relationship between board design mechanisms within each of the three groups (i.e., the alignment, information, and decisiveness mechanisms), five of the six significant coefficients are positive. This means mechanisms are mostly complements rather than substitutes. Firms with high inside ownership concentration also have high outside ownership concentration (alignment), boards with well networked directors also export their CEO to other boards (information), and boards with low gender diversity are smaller and have less age diversity (decisiveness). The relative economic significance of the mechanisms resembles what we found for the determinants of performance: Ownership and network mechanisms are not only the strongest drivers of performance, but also of other board mechanisms.

Four of the five mechanisms modeled in the table are significantly related to either firm size, firm risk, or both, which are the two board-exogenous determinants in our model. Large firms have better networked directors, and risky firms have lower insider holdings, better networked directors, and lower gender diversity. The negative association between risk and gender mix is consistent with Adams and Ferreira (2004), who find that firms more often choose male directors when uncertainty increases. This is in line with the argument that higher uncertainty makes firms rely more on the trust inherent in homogenous teams than on the more noisy performance-based incentives in heterogenous teams (**?**).

The finding that several board design mechanisms are internally related and driven by board-external variables supports the equilibrium hypothesis of Demsetz and Lehn (1985) that governance mechanisms are optimally adjusted to each other. On the other hand, the equilibrium hypothesis is apparently falsified by our finding that several mechanisms are also significant variables in a performance equation that controls for endogeneity. We hesitate to conclude this way, since the institutional environment of our sample firms does not allow owners to freely design the board. Mandatory employee directors in firms with more than 200 employees is the most obvious example of such a restriction.

Summarizing, the empirical tests in this section have shown that owners on the board as well as multiple directorships are positively related to

performance. This is consistent with the hypotheses that directors with high ownership stakes have stronger monitoring and advice incentives than other directors and that well-connected directors create extra value through the network they bring along to the boardroom. In contrast, more diversity produced by larger board size, more gender mix, and more employee directors is always negatively associated with performance. This suggests heterogenous boards are less effective decision makers than homogeneous boards. All these relationships are statistically significant, and the economic significance is stronger for insider ownership and networked directors than for the decisiveness mechanisms.

Several board design mechanisms are endogenous, both relative to performance and to each other. For instance, directors with wide networks produce high performance and gravitate towards well-performing firms, and networking declines when gender diversity increases. Moreover, board mechanisms are much more often complements than substitutes.

In terms of policy implications, these findings provide no economic argument for mandating more independence or more diversity, such as requiring by law or recommending by code that a minimum fraction of directors be independent, employees, or of a particular gender. The fact that the relationship to performance for employee directors and gender diversity is statistically and economically significant may reflect that these mechanisms are not at their optimal level, whereas the insignificance for the independence mechanism reflects that it is. This means that if anything, the regulatory implication is the opposite of what has been argued in the public: Regulators should mandate more director owners and more networked directors, less employee directors, less gender diversity, and smaller boards. The independence mechanism needs no regulatory assistance.

2.5 Robustness

Whereas table 2.1 specifies alternative empirical proxies for several theoretical concepts, every regression model in section 2.4 uses just one set. This section explores the robustness of our findings to alternative ways of empirically measuring the theoretical constructs of board independence, director network, gender mix, and board size.

The independence measure defined in expression (2.1), which we developed from the Hermalin and Weisbach (1998) logic, is based on the

tenure of non-CEO directors vs. the tenure of the CEO. As discussed, however, Carter and Lorsch (2004) argue that board independence is a matter of absolute rather than relative tenure, and that independence decreases rather than increases as tenure grows. We test this competing hypothesis by alternatively operationalizing independence as board tenure, CEO tenure, and chairman tenure. Under the Carter-Lorsch hypothesis, the expected relationship to performance is negative for board and chairman tenure and zero for CEO tenure.

The second alternative operationalization is for the director network variable. Unlike our more elaborate proxy, existing papers simply use the average number of outside directorships. We expect the estimated coefficient of this more coarse measure to have the same sign as our proxy, but to be less significant both economically and statistically.

Table 2.5 shows the results of re-estimating the fixed effects model (2.2) under alternative proxies for independence (models (1)-(3)), director network (model (4)) and for one combination of the two (model (5)). Model (6) is the base–case model from table 2.3.

Table 2.5

Comparing the estimates of the base-case model (6) to those using alternative empirical proxies in models (1)-(5), the results are almost identical. According to the five statistically significant mechanisms in (6), the estimated sign and statistical significance for four of them (directors' holdings, network, gender, and employee directors) are fully consistent across the models. The only difference is the loss of significance for board size when network is measured by the number of outside seats rather than information centrality. Notice also that this conventional definition of network reduces the economic significance of the network effect on performance by 45%. This suggests the economic content of our measure and the conventional measure is indeed different.

It may be argued that if we are concerned with the performance effect of board size or gender diversity, it does not matter whether the directors are elected by shareholders or employees. Due to potential multicollinearity and the desire to distinguish between stockholder-driven and employee-driven explanations, however, we have so far ignored employee directors in the gender and board size variables. To explore the effect of lifting this restriction, table 2.6 reestimates the base-case model from table 2.3, letting these two board characteristics reflect all the board's directors rather than only those elected by stockholders.

Table 2.6

Two changes occur. Under alignment, the importance of directors' holdings becomes slightly weaker. The p-value increases from 8.8% to 12.7%, but the economic significance remains the largest of all the mechanisms. The second change occurs for the decisiveness mechanisms, where employee directors and gender both become insignificant, and the significant size variable becomes slightly weaker. This is as expected, since the performance effect of what used to be in the employee directors variable only (model A) is now spread out over three variables (model B), watering out the separate effects of employee directors, gender, and size. Thus, including employee directors in the definition of size and gender prevents us from telling whether it is these board characteristics *per se* that interact with performance or whether we measure the effect of employee directors working indirectly and mixed up with stockholder elected directors through size and gender.

Overall, the robustness tests have shown that alternative ways of operationalizing independence, information network, gender diversity, and board size have no fundamental effect on the interaction between performance and board composition. This strengthens our belief in the base-case model in table 3 and the integrated mechanisms model in table 4.

2.6 Summary and conclusions

We find that board composition matters for value creation because it influences the alignment of interest between principals and agents, the production of information for monitoring and advice, and the board's effectiveness as a decision-maker. Owners on the board and directors with multiple directorships relate positively to performance, suggesting that directors with high ownership stakes have stronger monitoring and support incentives and that well-connected directors bring a valuable network into the boardroom. Increased diversity produced by larger board size, more gender mix, and more employee directors is always negatively associated with performance. This is consistent with the argument that heterogenous boards are less effective decision makers, and that employees successfully protect their interests in the boardroom at the expense of capital providers. All these relationships are statistically significant, and the economic significance is stronger for insider ownership and networked directors than for size, gender, and employee directors. In contrast, we find no significant link between independence and performance, which supports the

hypothesis that although more independence increases monitoring incentives, it reduces management's willingness to share private information with the board. The net effect of these two opposing forces for the typical firm is zero, which means most firms in the sample have boards with optimal independence. That is, owners design boards with the proper mix of hands-off monitors and hands-on advisers.

Many board design mechanism in our sample firms are endogenously determined, both by performance and by each other. For instance, directors with wide networks produce high performance and gravitate towards well-performing firms, and networking declines when gender diversity increases. However, such endogeneity does not invalidate the estimated relationship between board mechanisms and performance as summarized above, since our methodology controls for endogeneity in single-equation estimation. Nevertheless, endogeneity makes it more difficult to separate cause from effect, which is a well-known, chronic problem in corporate governance research. Moreover, endogeneity makes regulation more challenging because restrictions which are supposed to limit the admissible range of one board mechanism, such as independence, influences the use of unregulated mechanisms, such as board size.

Several of our findings are politically controversial (such as the questionable role of diversity in the boardroom), run counter to key components of most countries' current corporate governance regulation (such as the problematic role of independent directors), and point to directions for board research that differ from those implied by conventional wisdom (such as the importance of having stockholders rather than other stakeholders on the board). In particular, we find no economic argument for mandating independence or diversity, such as requiring by law or code that a minimum fraction of directors be independent, be employees or be of a given gender. If anything, regulatory implications are the opposite of what is argued in the public domain: Regulators should encourage more owners in the boardroom, more directors with multiple seats, fewer employee directors, less gender diversity, and smaller boards. Independence is already at its optimal level and needs no regulatory pressure of the type which is currently introduced worldwide. In fact, regulation aimed at preventing costly scandals in a small number of firms may end up destroying more value in the vast majority of firms.

It seems to us that board design has been shaped rather strongly by practitioners and regulators based on their personal experience, political agendas, and more recently by a concern with the prevention of corporate

governance scandals. This suggests a need for more academic research and less popular opinion on the characteristics of value-creating boards. Our findings support such a claim, which is also in line with the observation by Becht et al. (2003) that board research is still in its infancy.

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2.7 Tables

Table 2.1 The empirical proxies.

Variable	Definition
Alignment	
Dir.s' holdings	Fraction of equity owned by the board of directors
CEO holdings	Fraction of equity owned by the firm's CEO
Ownership concentration	Measured by the Herfindahl index, which is the sum of squared equity fractions across all the firm's outside owners
Largest owner	Fraction of equity held by the firm's largest outside owner
Three largest owners	Fraction of equity held by the firm's three largest outside owners
Independence	The average tenure of the non-employee directors minus the tenure of the CEO
Board tenure	The average number of years since non–employee directors took office
CEO tenure	The number of years since the CEO took office
Chair tenure	The number of years since the chairman took office
Information	
CEO director	Dummy variable which equals 1 if the CEO is a member of his company's board and zero otherwise
Exported CEO	The number of outside directorships held by the firm's CEO
Imported CEO	The proportion of CEOs from other companies on the board
Outside directorships	A director's average number of directorships outside the firm
Network	Non-CEO director information centrality as defined in footnote 10
Decisiveness	
SizeAll	The number of directors
Size	The number of non–employee directors
GenderAll	The proportion of female directors
Gender	The proportion of shareholder elected female directors
Board age dispersion	The standard deviation of board age
Employee directors	The fraction of employee directors, measured as the number of employee directors divided by the number of directors
Controls	
Firm size	The natural logarithm of sales revenues
Risk	The firm's equity beta, estimated as the standardized covariance with the OSE total index, using daily stock returns data over the past two years
Performance	
Q	Market value of assets divided by its book value

Table 2.2 Summary statistics for board design mechanisms, controls, and performance in all non-financial firms listed on the Oslo Stock Exchange 1989-2002.

Variable	Mean	Stdev	Median	Min	Max	N
Alignment						
Directors' holdings	0.064	0.190	0.000	0.000	1.000	1861
CEO holdings	0.036	0.140	0.000	0.000	1.000	1865
Ownership concentration	0.176	0.201	0.111	0.003	1.000	1784
Largest owner	0.293	0.233	0.220	0.003	1.000	1718
Three largest owners	0.498	0.220	0.478	0.047	1.000	1735
Independence	-0.301	2.110	0.000	-12.857	10.333	2205
Board tenure	1.886	1.695	1.500	0.000	11.333	2204
CEO tenure	2.161	2.445	1.000	0.000	16.000	2205
Chair tenure	1.874	2.321	1.000	0.000	16.000	2205
Information						
CEO director	0.296	0.457	0.000	0.000	1.000	2207
Exported CEO	0.348	0.747	0.000	0.000	6.000	2207
Imported CEO	0.281	0.538	0.000	0.000	4.000	2207
Outside directorships	0.536	0.547	0.400	0.000	4.333	2207
Network	0.184	0.077	0.203	0.069	0.320	2207
Decisiveness						
SizeAll	6.024	1.961	6.000	2.000	15.000	2207
Size	5.087	1.330	5.000	2.000	15.000	2207
GenderAll	0.047	0.097	0.000	0.000	0.556	2207
Gender	0.034	0.090	0.000	0.000	0.667	2207
Board age dispersion	8.004	3.163	7.789	0.000	21.920	2207
Number of employee directors	0.938	1.206	0.000	0.000	4.000	2207
Employee directors	0.123	0.155	0.000	0.000	0.500	2207
Controls						
Firm size	13.313	2.029	13.074	5.366	23.006	1635
Risk	0.772	0.657	0.709	-0.994	8.127	1733
Performance						
Q	1.482	1.105	1.138	0.361	9.465	1678

The table shows descriptive statistics for the board design mechanisms, the control variables, and the performance measure. The board design mechanisms are classified according to their primary function (interest alignment, information provision, and decisiveness) as discussed in section 2.2. The variables are defined in table 2.1.

Table 2.3 Firm performance explained by board design mechanisms and controls in the base-case model.

	Coefficient estimate		
	Unstand-ardized	Stand-ardized	p-value
Directors' holdings	0.916*	0.157	0.085
Directors' holdings sqrd	-0.806	-0.124	0.139
Ownership concentration	0.159	0.031	0.202
Independence	-0.005	-0.010	0.754
Information			
CEO director	0.009	0.004	0.870
Exported CEO	-0.001	-0.001	0.867
Imported CEO	-0.008	-0.001	0.992
Network	1.387**	0.126	0.000
Decisiveness			
Size	-0.049**	-0.058	0.005
Gender	-0.672**	-0.054	0.001
Board age dispersion	0.004	0.011	0.590
Employee directors	-0.814**	-0.116	0.005
Controls			
Firm size	-0.209**	-0.163	0.000
Risk	0.033	0.020	0.377
N	1515	1515	
p-value, J	0.972	0.972	
p-value, over-ID	0.943	0.943	

The table shows estimates of the base-case fixed effect regression model in expressions (2) and (3) as estimated with GMM. The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Every variable is time demeaned by subtracting a given firm's observation in a given year from the firm's overall mean across the years. Instruments are the raw, the time-demeaned, and the squared time-demeaned explanatory variables, the average and standard deviation of firm-demeaned explanatory variables. The first column reports unstandardized (regular) coefficient estimates. The second column shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation. The p-values in the third column are identical for both coefficient types.

Table 2.4 Endogeneity of board design mechanisms.

	Dynamic performance model	Integrated mechanisms model					
Variable	Performance	Performance	Directors' holdings	Independence	Network	Gender	Size
Alignment							
Directors' holdings	0.224**	0.157*		0.024	0.091	-0.152**	0.019
Directors' holdings sqrd	-0.163**	-0.124		0.001	-0.089	0.163**	0.031
Ownership concentration	0.010	0.031	0.100**	-0.037	-0.140**	0.033	-0.078
Independence	0.008	-0.010	0.003		-0.015	0.021	0.663**
Information							
CEO director	0.004	0.004	-0.030	-0.039	-0.047*	-0.043**	0.131**
Exported CEO	-0.001	-0.001	0.031*	-0.130**	0.044**	0.029	0.006
Imported CEO	-0.017	-0.001	-0.005	-0.032	-0.005	-0.035**	-0.003
Network	0.115**	0.126**	0.097**	-0.006		-0.041**	0.784**
Decisiveness							
Size	-0.062**	-0.058**	0.014	-0.094**	0.101**	0.057**	
Gender	-0.035**	-0.054**	-0.022	0.022	-0.091**		0.087**
Board age dispersion	0.020	0.011	-0.054**	0.092**	0.000	0.059**	0.024
Employee directors	-0.097**	-0.116**	-0.066	-0.029	0.062	-0.065	-0.476
Controls							
Firm size	-0.186**	-0.163**	-0.062	-0.047	0.093*	0.025	0.172
Risk	-0.004	0.020	-0.056**	0.041	0.052*	-0.054**	-0.055
Past performance							
Tobin's Q lagged	0.108**						
Performance							
Tobin's Q			-0.689**	-0.015	0.204**	-0.056**	-0.191**
N	1294	1515	1515	1515	1515	1515	1515
p-value, J	0.091	0.972	0.987	0.858	0.233	0.628	0.266
p-value, over-ID	0.128	0.943	0.920	0.790	0.716	0.492	0.412

The table explores mechanism endogeneity by means of two models. In the dynamic performance model in the first column of results, firm performance is the dependent variable, and lagged performance is added as an independent variable to the basic model in (2.2). The second model, termed the integrated mechanisms model, consists of five equations. The first equation is the base-case performance model (2.2) from table 2.3. Each of the five other equations have a board mechanism as the dependent variable, which is Directors' holding, Independence, Network, Gender, and Size, respectively. The six equations in the second model are estimated one by one. The instruments correspond to those used table in 2.3. Performance is measured as Tobin's Q , which we operationalize as the market value of the firm over its book value. All variables in all models are time-demeaned, which means that for each firm and each variable, we subtract a given year's observation from the firm's overall mean across the years. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation. Significant results at the 5% (10%) level are marked with ** (*).

Table 2.5 Alternative empirical proxies for board independence and director network.

	(1) Board tenure	(2) CEO tenure	(3) Chair tenure	(4) OD	(5) BT OD	(6) Base case
Alignment						
Directors' holdings	0.156*	0.157*	0.164*	0.159*	0.161*	0.157*
Directors' holdings sqrd	-0.124	-0.123	-0.129	-0.120	-0.123	-0.124
Ownership concentration	0.033	0.032	0.031	0.031	0.032	0.031
Independence	-0.008	0.004	-0.015	-0.015	-0.017	-0.010
Information						
CEO director	0.005	0.003	0.006	0.004	0.006	0.004
Exported CEO	0.001	0.003	0.000	-0.030	-0.027	-0.001
Imported CEO	-0.002	0.000	-0.001	-0.025	-0.026	-0.001
Network	0.124**	0.126**	0.125**	0.138**	0.136**	0.126**
Decisiveness						
Size	-0.056**	-0.057**	-0.057**	-0.032	-0.031	-0.058**
Gender	-0.056**	-0.056**	-0.056**	-0.062**	-0.063**	-0.054**
Board age dispersion	0.009	0.010	0.010	0.015	0.012	0.011
Employee directors	-0.114**	-0.115**	-0.112**	-0.089**	-0.084**	-0.116**
Controls						
Firm size	-0.147**	-0.164**	-0.153**	-0.167**	-0.144**	-0.163**
Risk	0.021	0.020	0.019	0.019	0.020	0.020
N	1515	1515	1515	1515	1515	1515
P-value, J	0.956	0.962	0.959	0.994	0.984	0.972
P-value, over-ID	0.906	0.930	0.927	0.997	0.992	0.943

The table shows the results of using alternative operationalizations for board independence in models (1)-(3), director network in model (4), and a combination of the two in model (5). Model (6) is the base-case model from table 2.3. OD is the average number of outside directorships held by the firm's board members, and BT is the board tenure proxy from model (1). The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Each variable is time demeaned in the regressions. For each firm and each variable, we time demean by subtracting a given year's observation from the firm's overall mean. The regressions use the same instrument set as in table 2.3, but with new variable definitions. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation. Significant results at the 5% (10%) level are marked with ** (*).

Table 2.6 Including employee directors in the empirical proxies for board size and gender diversity.

	(A)	p-value	(B)	p-value
Alignment				
Directors' holdings	0.138	0.127	0.157	0.085
Directors' holdings sqrd	-0.136	0.098	-0.124	0.139
Ownership concentration	0.036	0.140	0.031	0.202
Independence	-0.007	0.580	-0.010	0.754
Information				
CEO director	-0.002	0.910	0.004	0.870
Exported CEO	0.006	0.699	-0.001	0.867
Imported CEO	0.002	0.920	-0.001	0.992
Network	0.120	0.000	0.126	0.000
Decisiveness				
Size	-0.049	0.068	-0.058	0.005
Gender	-0.029	0.213	-0.054	0.001
Board age dispersion	0.011	0.516	0.011	0.590
Employee directors	-0.050	0.223	-0.116	0.005
Controls				
Firm size	-0.173	0.000	-0.163	0.000
Risk	0.011	0.593	0.020	0.377
N	1515		1515	
P-value, J	0.691		0.972	
P-value, over-ID	0.873		0.943	

The table shows estimates of the base-case model from table 2.3 when including (model (A)) and not including (model (B)) employee directors in the definition of board size, gender diversity, and board independence. The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Each variable is time demeaned in the regressions. For each firm and each variable, we time demean by subtracting a given year's observation from the firm's overall mean. The instrument set is as in table 2.3, except that the new variable definitions replace the ones from table 2.3. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.

3

Better firm performance with employees on the board?

Abstract

This paper[1] explores the relationship between employee directors and firm performance. Shareholders recognise that employee directors bring more heterogeneity to the board, and try to neutralise their value-reducing effects by adjusting the board characteristics and the leverage. Board characteristics and leverage are then endogenously determined by the presence of employee directors. The lagged firm performance represents another endogeneity influencing board characteristics and leverage. The relations are modelled in a simultaneous equations framework, allowing an estimation of the relative importance of the endogeneity effects relative to the direct effects of the variables. Panel data of all non-financial Norwegian listed firms from 1989 to 2002 enter the fixed effects estimation. The negative employee director association with firm performance comes out very clearly, and shareholders' compensatory actions to neutralise the employee director influence are clearly visible. Reverse causation running from the lagged firm performance to the board characteristics and the leverage is confirmed. Yet the endogeneity effects are economically small compared to the direct effects of board characteristics and leverage. Overall, the paper rejects any beneficial effects of one group of stakeholders – the employees – on company boards.

Keywords: Corporate governance, Employee directors, Board composition, Regulation, Endogeneity

JEL classification codes: G34, G38

[1]I have benefited from comments from Øyvind Bøhren, Ole Gjølberg, Roswitha King, Gudbrand Lien, participants at the 7th workshop on Corporate Governance and Investment, Jönköping 2006, and the 2nd International Business Economics Workshop, Majorca 13-14 September 2007. Pål Rydland and Bernt Arne Ødegaard have guided me to data.

3.1 Introduction

This paper deals with the impact of co-determination[2] upon firm performance. Two conflicting views on the benefits of co-determination exist. One says that co-determination increases firm performance, either because employee directors supply outside directors with information they would otherwise not have access to (Freeman and Reed, 1983 and Blair, 1995), or because co-determination is a safeguard against dismissal inducing employees to invest in firm-specific human capital (Zingales, 2000 and Becht et al., 2003). The other view is that owners' and employees' interests are not aligned, and therefore, allowing employees into the boardroom means that conflicting goals are pursued. When decision makers with different objectives share in the board's decisions, its focus may become unclear (Tirole, 2001), its decision time longer (Mueller, 2003), and its decision quality inferior[3]. The prediction is that firm performance will be lower than it could otherwise be.

Even though co-determination is important in many European countries[4], few firm-level studies have been made of its firm performance impact. This paper is an attempt to bring more academic research to the still under-researched (Goergen, 2007) comparison of firm performance in shareholder determined companies and co-determined companies. Earlier studies give mixed results, showing a negative impact in German firms (FitzRoy and Kraft, 1993; Schmid and Seger, 1998; and Gorton and Schmid, 2000), Canadian (Falaye et al., 2006), and Norwegian (Bøhren and Strøm, 2007), but a positive impact in a later German study (Fauver and Fuerst, 2006).

Compared to former literature the simultaneous equation estimation of the relationship between firm performance and explanatory variables

[2]Co-determination is defined as employee board representation (Jensen and Meckling, 1979 and Furubotn, 1988).

[3]Tirole (2002, p. 118) argues that these "... (c)onflicts of interest among the board generate endless haggling, vote-trading and log-rolling. They also focus managerial attention on the delicate search for compromises that are acceptable to everyone; managers thereby lose a clear sense of mission and become political virtuosos." In a similar vein, Hansmann (1996, p. 44) states that "... because the participants [i.e. stakeholders] are likely to have radically diverging interests, making everybody an owner threatens to increase the costs of collective decision making enormously."

[4]According to the European Industrial Relations Observatory On-line full employee representation is found in Austria, the Nordic countries, and Germany, while the Netherlands and France have systems closer to a consultative function for employee representatives.

is the distinctive feature of this paper. The need for simultaneous modelling arises from the fact that the presence of employee directors may induce shareholders to adjust other governance mechanisms, notably board composition and leverage, in order to neutralize the co-determination effects (Buchanan and Tullock, 1962). Employee directors may have a direct impact upon firm performance, but also an indirect effect. This also means that board composition is at least partly determined by employee directors. Thus, the paper necessarily also relates to the board endogeneity issue (Hermalin and Weisbach, 2003). And since the data cover several periods, it is possible to test the reverse causation hypothesis that firm performance determines board composition (Hermalin and Weisbach, 1998). The simultaneous equation setup allows not only the discovery of endogeneity in governance mechanisms, but also a quantification of its importance compared to direct effects. I am unaware of former literature containing a measure of the endogeneity effects.

The paper's results come from a panel data set of non-financial firms spanning the fourteen years from 1989 to 2002, containing financial information, data on ownership, and board composition data. Employee representation was mandated by law in 1972 in Norway, and regulations have remained almost unchanged since (Aarbakke et al., 1999). The data on employee directors seems to be superior to those pulled from German and Canadian institutional frameworks. While the employee director in a German board may be elected from the national labour union, and the Canadian evidence is from firms where employees have considerable shareholdings, in Norway the employee director must be employed in the company. Furthermore, because the mandatory employee director rules only apply to certain firms, some firms have employee directors, others have none. Thus, the study avoids the Dow (2003, p. 87) objection that empirical investigations on the effects of employee directors suffer from a lack of control group. Thus, unlike previous studies, the Norwegian institutional framework allows comparison between similar firms with and without employee directors. This setting allows for sharper estimates of the co-determination effects.

The paper has relevance for the emerging regulation literature on boards (Hermalin, 2005). Because the sample includes both co-determined (by regulation) and the shareholder determined kind, I can study the effects of governance regulation by comparing the two sub-samples.

Compared to the related Bøhren and Strøm (2007), I introduce a number of new features. I construct a board structure index that captures

many standard board characteristics in the same manner as Bertrand and Mullainathan (2001), I add financial leverage and average wage as new explanatory variables, perform a system estimation rather than a single-equation estimation, and I make separate regressions for various sub-samples, for instance employee-director firms only. These steps should yield better estimations of the employee director impact than the partial regressions in Bøhren and Strøm (2007), and should also, subject the co-determination hypothesis to more severe robustness tests. Furthermore, I confirm their results when using individual board characteristics instead of the board index.

In order to fully utilize the information in the panel data, I use the fixed effects model (Woolridge, 2002), employing a three-stage least squares (3SLS) methodology in system estimations. With the fixed effects method, I am able to remove firm heterogeneity as did Palia (2001). Therefore, few (if any) control variables are needed.

Using Tobin's Q as the measure of firm performance, the results confirm the employee directors' negative relationship to firm performance in earlier studies, but also show a positive indirect effect to the board index and leverage. This reflects endogeneity, but the economic significance of the indirect effects turn out to be much smaller than the direct. The reverse causation hypothesis also finds confirmation, since lagged firm performance is significant both regarding the board index and leverage. But again, the indirect effects of the lagged firm performance are low compared to the direct. I find clear differences in the various board characteristics' impact upon firm performance in sub-samples of co-determined and shareholder determined firms. This means that regulations have costs, both in relation to firm performance, and in the remaking of boards. The results stand up to a number of robustness tests, including alternative performance measures (stock return and accounting return on assets), and also to dividends replacing leverage.

The paper proceeds as follows. In the next section, a brief review of the literature is given. Then, in section 3.3 testable implications are spelled out. Section 3.4 contains data sources and institutional background, while the following section, 3.5, discusses estimation methodology. Then section 3.6 shows results, in 3.7 robustness checks are undertaken, and the final section, 3.8, concludes.

3.2 Literature review

Few empirical studies of co-determination have been undertaken. Evidence in FitzRoy and Kraft (1993); Schmid and Seger (1998) and Gorton and Schmid (2000) shows that co–determination has a negative economic effect upon firms in Germany, where employees have the right to equal representation in the *Aufsichtsrat* with shareholders. Recently, Fauver and Fuerst (2006) find a positive relationship to performance in a 2003 sample of German companies in information intensive industries. In the regressions with all industries, however, the relationship is not significant. The German data often contain two kinds of employee directors, some elected from among the employees in the company, while others may be national union representatives. In contrast, the Norwegian system is such that only persons employed in the company may be elected. Thus only a company and not a national, union representative may sit on a Norwegian board. Presumably, company employed persons are more authentic stakeholders than their national union representatives.

Using Canadian data, Falaye et al. (2006) find that firms giving employees a greater voice in corporate governance spend less on new capital, take fewer risks, grow more slowly, create fewer new jobs, deviate more from value maximisation, show greater cash flow problems, exhibit lower labour and total factor productivity. This paper is set in a different institutional environment. The Canadian employee directors are elected in their capacity as owners of company shares. The influence of these directors on firm performance thus picks up two effects, one as a supplier of labour services, the other as owner. None of these studies use panel data or simultaneous data estimations.

Using Norwegian data, Bøhren and Strøm (2007) show that the employee director variable has a negative impact upon Tobin's Q. They also find evidence of interdependencies among board characteristics. However, they do not explore the indirect effects of co-determination, neither do they carry their analyses into sub-samples of co-determined and shareholder determined firms. In this paper, the analysis is extended to include effects upon average wage, leverage is a new governance variable, the board index defined; I employ simultaneous equations modelling, and perform regressions in sharply defined sub-samples. The robustness tests are also more extensive, as I use return on assets and stock return as new dependent variables, and also vary the definition of the board index.

3.3 Theory and hypotheses

3.3.1 Stakeholder or interest group?

Board decisions include the formulation and control of strategy, larger investments and disinvestments, and the determination of the company's organization. Employee directors' influence upon these decisions may have long-time impact upon firm performance. Therefore, an analysis over a long period of time is needed to detect the effects. The impact upon firm performance could be positive, non-significant, or negative.

One possibility may be that the firm performance and employee link is positive. Blair and Stout (1999) view stakeholders as members in a team production. Since stakeholders invest in firm-specific investments, it is in their interest to co-operate. The firm-specific human capital investments make the employees residual claimants to much the same extent as shareholders (Zingales, 2000 and Becht et al., 2003). The upshot is that employees should be represented on the board, and that this co-determination will lead to improved firm performance. The conclusion rests on the argument that the stakeholders', including the shareholders', interests are aligned.

How could this be manifested in the board? Employee directors could have a dual informational role in bringing inside information to the board Blair (1995, p. 16), but also in relating board information to the employees (Freeman and Lazear, 1995). Since employees are in the middle of the day-to-day running of the company, they may bring valuable operational knowledge to the board. The information may expand on or contrast with information from the CEO. Thus, the information set available to the outside directors is enlarged. This comes close to viewing the employee director in the same role as the insider in the Raheja (2005) theory, although in this model the insider is willing to furnish the outside directors with information only if this furthers his own career interests. Secondly, the role as messengers of board information to the employees at large could be of particular value in the case of personnel reductions or plant closures, when the board may want to instil an understanding for the need for drastic measures among employees. The dual informational role of employee directors should lead to better firm performance (Fauver and Fuerst, 2006).

Another possibility is that co-determination has no significance for firm performance. This may come about through co-optation (Pfeffer, 1981, p. 166-173). In the board employee directors are exposed to fiduciary duties and conformity pressures to accept the shareholder value logic.

Also, by making the employee director co-responsible for decisions with adverse outcomes for employees, the decisions carry higher legitimacy among employees. If co-optation is the case, interests are again aligned, but this time because employee directors have taken on the views of shareholders. The effect upon firm performance should be non-significant.

The third possibility is that the co-determination impact upon firm performance is negative. It may be hard to accept the premise that stakeholder interests are aligned. If this were so, co-determination would be an efficient economic organisational mode, and firms would adopt this mode voluntarily (Jensen and Meckling, 1979 and Hansmann, 1996). But while shareholders seek to maximize residual income, employees want to maximize pay and the protection of firm-specific human capital[5], that is, a part of the residual income. The inconsistency of these two objectives makes the board decision process longer and more difficult (Mueller, 2003). The firm's objectives may become unfocussed, and the CEO may develop capabilities as a compromise maker rather than a shaper of the firm under a clear objective (Tirole, 2001, 2002). The implied consensual decision model in codetermination means that the firm pursues stability and predictability instead of bold new moves (Siebert, 2005). If employee directors are successful, they should influence the average wage positively. The unfocussed decision structure should result in weaker firm performance. I call this the interest conflict model for reference, and hypotheses stemming from the model are set forth in the next section.

When objectives diverge, shareholders and employees may game against each other so as to further their own interests. Employees may furnish information strategically to further their own interests (Pistor, 1999 and Hopt, 1998), and they may use moral arguments in parallel. Information strategising could take the form of economising on the supply of internal information to the board. For instance, employee directors may not inform of low productivity units in the organisation. Another form could be information leakage from the board[6]. Employee directors will hardly inform their fellow workers only on matters that owners and management find in their interests to inform about. Stakeholder theorists seem to assume only the beneficial information dissemination through employee

[5]In a recent booklet, the long-time employee director Svein Stugu (2006) says that the main objective is to prevent plant closures. Mergers, takeovers, and outsourcing must also be prevented.

[6]Stugu (2006, p. 63) says that opposition to plant closures was organized in cooperation with representatives of the local community, but that this could only be done effectively if labour representatives had access to internal information.

directors. Furthermore, moral arguments against for instance plant closures or high management pay may be put forward, too. The shareholder elected directors may have trouble withstanding such arguments, since they may experience large personal costs and small personal gains from making decisions that affect employees adversely (Baker et al., 1988). Taking the issue to the public attention could make the decision even harder for the shareholder elected directors. Thus, even though the employees are in a minority position in the board, they may influence board decisions to their advantage. Their access to board information seems to be vital in this respect.

But the presence of employee directors may have indirect effects upon the use of other governance mechanisms as well. Shareholders may adjust governance mechanisms in order to neutralize the co-determination impact. This is analogous to the situation Buchanan and Tullock (1962) point out, that when an exogenous regulation is imposed upon a (political) committee, it will try to compensate for the regulatory effect by placing a heavier weight on the unregulated. These previously unexplored indirect effects make a simultaneous equations approach necessary. In the remainder of this section governance mechanisms and hypotheses about interactions are explained.

3.3.2 Simultaneity and endogeneity

In a simultaneous equations system some variables are endogenous, others exogenous. In the present setup, the exogenous variables are the fraction of employee directors, the lagged firm performance, the firm size, and firm risk. Since employee directors are imposed from outside the firm, they must constitute an exogenous variable. These variables determine firm performance and average wage, but also the intervening governance variables, the board characteristics and leverage. Thus, the intervening governance variables and the average wage are at least partly determined by the employee directors and lagged firm performance. The simultaneous setup gives the researcher the opportunity to recognise the governance variables' endogeneity, but at the same time also to measure the magnitude of the effect relative to their direct effects upon firm performance.

Specifically, the *co-determination hypothesis* says that the mechanism of employee directors has a negative relationship to firm performance, but a positive to average wage, the board characteristics, and leverage. The *reverse causation hypothesis* says that lagged firm performance is associated with governance variables and average wage, but that signs are uncertain.

The remainder of this section concerns explanations of variables and their relationships.

In this paper, shareholders may adjust the board characteristics and the leverage. In order to achieve a reliable measure, and in the interest of economy, I build an index by including board characteristics that have proven to be important in board studies. The index is[7]:

$$\text{Board index} = \text{Directors' holdings} + \text{Board network} - \text{Board size} - \text{Gender} \quad (3.1)$$

The board index construction follows the Bertrand and Mullainathan (2001) procedure, as each index variable in (3.1) is standardized to have average zero and standard deviation 1 before summation. The sum is then standardised. This gives a continuous variable, in contrast to the Gompers et al. (2003) type of index. Their governance index is based upon a subjective allocation of categorical points for reasons that restrict shareholder rights, and then summed over all characteristics. Since all variables in (3.1) are continuous, the resulting index is continuous as well, and this is an advantage in estimations. Another advantage is that the index is likely to be more stable in sub-samples than the individual variables. The interpretation is that the higher the board index, the better is the board structure. It should be positive towards firm performance and negative towards average wage. If it is complementary to leverage, a positive sign will appear.

The choice of variables in the index reflects important board characteristics that are decision variables for shareholders. Directors' ownership represents the need for the board to be aligned with shareholders, the network variable the need for the board to be informed, the board size and gender diversity the need for the board to be decisive. The signs in (3.1) are common findings in the literature. The ownership literature (Morck et al., 1988 and McConnell and Servaes, 1990) confirms the positive sign on directors' ownership share, and so does studies taking other board characteristics into account, e.g. Bøhren and Strøm (2007)[8]. The network variable is little used in studies of boards, but Bøhren and Strøm (2007) find a posi-

[7]The variables are defined as follows. Directors' holdings is defined as the fraction of equity owned by the board of directors; Board network is the information centrality, constructed from network theory (Wasserman and Faust, 1994), see footnote 9; Board size is the number of shareholder elected directors; Gender is the proportion of shareholder elected female directors.

[8]I keep only a linear specification in the board ownership relation, despite evidence in Morck et al. (1988) and McConnell and Servaes (1990) pointing towards a concave relationship. The Bøhren and Strøm (2007) study finds no significance in the squared term, may be due to the inclusion of other board characteristics.

tive sign[9]. It comprises direct and indirect connections to other listed non-financial firms stemming from directors' multiple board seats. A variety of studies, e.g. (Yermack, 1996 and Eisenberg et al., 1998), document that performance decreases with increasing board size. The relationship between gender and firm performance may be more controversial, as Shrader et al. (1997); Smith et al. (2006), and Bøhren and Strøm (2007) report a negative relationship, whereas Carter et al. (2003) find the opposite. I perform robustness tests with other definitions, described in section 3.5, to test the choice of index.

Next, I include leverage. A higher leverage will decrease the firm's free cash flow, and will, therefore, limit the potential for agency costs (Easterbrook, 1984 and Jensen, 1986). Perotti and Spier (1993) model how the lower free cash flow may be used as a bargaining tool against employees, implying better firm performance and lower average wage. Both effects should point to higher firm performance from higher leverage.

However, the complexity of leverage leads to an indeterminate prediction. On the one hand, given the presence of employee directors, owners may fear higher debt may bring even higher decision costs. If, as Easterbrook (1984) supposes, higher leverage brings the lender into closer oversight of the firm, the firm may end up with three decision makers with potentially divergent interests. Furthermore, if the leverage is also used to signal investment prospects (Myers, 1977), a high leverage used to discipline employees can be taken to signal weak investment opportunities in

[9]Network theory uses concepts such as nodes and lines. In our setting, a node is a firm, and a line between two firms represents a joint director in the two firms. We define geodesic g_{jk} as the shortest path between two nodes j and k, and G as the total number of nodes. The node i is designated as n_i. Using Wasserman and Faust (1994, p. 192-197), our information centrality measure is constructed in the following way: Form the $G \times G$ matrix A with diagonal elements $a_{ii} = (1 + \text{sum of values for all lines incident to } n_i)$ and off-diagonal elements a_{ij}, where

$$a_{ij} = \begin{cases} 0 & \text{if nodes } n_i \text{ and } n_j \text{ are not adjacent} \\ 1 - x_{ij} & \text{if nodes } n_i \text{ and } n_j \text{ are adjacent} \end{cases}$$

x_{ij} is the value of the link from firm n_i to firm n_j, that is, 0 or 1. The inverse of A, which is $C = A^{-1}$, has elements $\left\{c_{ij}\right\}$, where we define $T = \sum_{i=1}^{G} c_{ii}$ and $R = \sum_{j=1}^{G} c_{ij}$. The information centrality index for firm n_i is:

$$C_i(n_i) = \frac{1}{c_{ii} + (T - 2R)/G}$$

The index measures the information content in the paths that originate and end at a specific firm.

the firm. Another aspect is that, as Tirole (2006, p. 51-53) points out, higher leverage may cause costs related to illiquidity and bankruptcy. This complexity of leverage means that the sign is uncertain. It could be the case that shareholders in co-determined firms adjust the leverage in an effort to neutralize employee directors to a greater extent than they do in shareholder determined firms. In a simultaneous equations setup, Brick et al. (2005) find a negative relationship.

Thus, I expect employee directors to be associated with better board composition and higher leverage. If these are successful from the shareholder point of view, a positive indirect effect may compensate for the negative direct employee director effect upon firm performance. In the stakeholder theory, the employee director should be a welcome addition to the board, and thus carry a positive sign to firm performance, while the indirect effects should not appear.

In addition to the endogeneity induced by employee directors, the reverse causation hypothesis says governance mechanisms may be at least partly determined by past performance (Hermalin and Weisbach, 1998, 2003). The signs on the board index and the leverage may be difficult to set out. In the Hermalin and Weisbach (1998) bargaining model the CEO bargains over pay and monitoring intensity. Good past firm performance gives the CEO a better bargaining position, which he would use to reduce monitoring. This means that the association between past firm performance and governance mechanisms should be negative. However, it may well be that governance mechanisms are improved after a good performance, for instance, since the firm learns good practices. Since shareholders may adjust either board composition or leverage, or both, leverage and board composition may be either complements or substitutes (Agrawal and Knoeber, 1996). Thus, the sign is ambiguous.

I study the direct and indirect effects of employee directors in a simultaneous setup. Since the lagged firm performance is included, the system is dynamic. Taken together, and with constants suppressed, this results in the system of equations

$$
\begin{aligned}
FP &= \underset{(+)}{p_1}\, FP_{t-1} + \underset{(-)}{w_1} W + \underset{(+)}{b_1}\, BI + \underset{(+)}{l_1}\, DE + \underset{(-)}{d_1}\, ED + f_1 FS + r_1 FR \\
W &= \underset{(+)}{p_2}\, FP_{t-1} + \underset{(-)}{b_2}\, BI + \underset{(-)}{l_2}\, DE + \underset{(+)}{d_2}\, ED + f_2 FS + r_2 FR \\
BI &= \underset{(+/-)}{p_3}\, FP_{t-1} + \underset{(-)}{w_3} W + \underset{(+/-)}{l_3}\, DE + \underset{(+)}{d_3}\, ED + f_3 FS + r_3 FR \\
DE &= \underset{(+/-)}{p_4}\, FP_{t-1} + \underset{(-)}{w_4} W + \underset{(+/-)}{b_4}\, BI + \underset{(+)}{d_4}\, ED + f_4 FS + r_4 FR + u_{it}
\end{aligned}
\tag{3.2}
$$

where FP is firm performance, and FP_{t-1} indicates one period lag; W stands for the average wage, BI is the board index, DE is the leverage (debt to equity), ED is employee director, FS is firm size, and FR is firm risk. u_{it} is the error term. The main hypotheses are summarized below the coefficients. Thus, the co-determination hypothesis is set out in the ED column.

3.4 Data and institutional background

The sample comprises all non-financial firms listed on the Oslo Stock Exchange (OSE) at year-end at least once during the period 1989 to 2002.[10] Board data is collected from the handbook *Kierulfs Håndbok* for the first years, and from the national electronic register at Brønnøysund from 1995. The register provides information on name, date of birth, and director status (chairman, vice-chairman, ordinary member, and employee director). The CEO's name and date of birth are recorded as well. The CEO or director name gives gender information. Data on board and CEO ownership, as well as outside ownership concentration is pulled from the public securities register, while share price and accounting data come from OSE's data provider (*Oslo Børs Informasjon*). The ownership structure data covers every equity holding by every investor in each sample firm. By international standards, the size and quality of the data are considerable.

The data for this paper spans the period from 1989 to 2002. During this period, the law regulating the governance of the companies is from 1972, with amendments in 1987 ("Aksjeloven"), and a new law in 1997 ("Allmennaksjeloven"). The regulations for representation have been unchanged since 1987. In this respect, there is no before-and-after situation, as with the "Cadbury committee" report in the UK, in the sample period.

As a general rule, firms with more than 200 employees must have at least two employee directors, or at least one third of the board[11]. In the size brackets 31 to 200 employees, the firm must have labour board seats if a majority of the employees vote in favour, first with one representative

[10] The OSE had an aggregate market capitalization of 68 bill. USD equivalents by year-end 2002, ranking the OSE sixteenth among the twenty–two European stock exchanges for which comparable data is available. During the sample period from 1989 to 2002, the number of firms listed increased from 129 to 203, market capitalization grew by 8% per annum, and market liquidity, measured as transaction value over market value, increased from 52% in 1989 to 72% in 2002 (sources: `www.ose.no` and `www.fibv.com`).

[11] The main sources are Bråthen (1982); Aarbakke et al. (1999) and NOU 1985:1. In order to maintain readability, specific references have been dropped in tables and text.

in the 31 to 50 bracket, then two in the 51 to 200. The employee director must be employed in the company. A number of important Norwegian industries are exempted from these rules, that is, the employees have no rights of representation in these industries. These include newspapers, news agencies, shipping, oil and gas extraction and financial firms. The characteristics of employee board representation mean that some firms have employee directors, others do not, and also that co-determined firms have different fractions of employee directors. Thus, an implication of the regulations is that comparisons of two sets of differently governed, but otherwise similar firms can be made, and that further analyses can be carried out in sub-samples of, say, co-determined firms with more than 200 employees. This data property answers the Dow (2003, p. 87) objection that the study of co-determined firms lacks a proper control group. I define the employee director variable as the fraction of employee directors, unlike most former studies that only use employee directors as a dummy variable.

This institutional framework offers advantages over the German and Canadian studies referred to in section 3.2, since the Norwegian employee directors represent an authentic stakeholder group. The German regulations are such that one third of the employee representatives on German boards need to be labour union officials (Siebert, 2005). Presumably, the union officials are supposed to look after the interests of workers in general, not only those in the firm. No such minimum is required in Norway, and the employee directors need to be employed in the firm. The Canadian co-determination comes about when workers are also shareholders in the company. This might cause a conflict of interest, when the optimal policy from the shareholder point of view is detrimental to the optimal policy for workers. In Norway, employee directors are elected in their capacity as workers in the firm, not their shareholdings.

The initiative for employee representation came from a joint committee of the Labour Party and the major employee union (*LO*) in the early '60s. However, concurrent to this initiative, LO and the employer association (*NAF*) ran a "co-operative project" together with researchers to study co-determination in selected companies. This was in the consensus and co-operation spirit that arose from common war-time experience. The question was not only about co-determination, but also about new production methods. Later, the need for co-determination in order to improve productivity was the guiding principle of the official document NOU 1985:1, whose recommendations were unanimous, as opposed to the original 1971

report. The insider information argument was behind the codification of employee board representation in Norway. Thus, it seems as if the lawmakers were familiar with stakeholder theory. Bråthen (1982, p. 14) interprets the law on co-determination to imply that profit maximisation is no longer the single objective of the company. Employees' interests now become one of several objectives the firm has to consider. Thus, a harmony of interests model is behind the regulations on co-determination in Norway.

Next, I report some descriptive statistics on employee directors. Table 3.1 shows the number of employee directors in firms according to employment size.

Table 3.1

The table shows the percentage of firm-year observations of employee directors in various employment sizes. It turns out that in firms where employees may demand representation, few do so. In the 101-200 employees category, 61.5 per cent do not have employee directors. Furthermore, in the highest category, where representation is compulsory, if the industry is not exempted, employees have no board seats in about one third of the companies. Among the firms that do have employee directors, the law's minimum, two representatives, is found in the majority of cases. Very few have four employee board seats. Thus, the Jensen and Meckling (1979) conjecture that co-determination requires law backing seems to be supported in our Norwegian data.

Next, table 3.2 shows the distribution of employee directors according to industry, and also the percentage of firms with no employees on the board in each year.

Table 3.2

Exempted industries such as Energy and Transport (including shipping) have no employee directors to a higher degree than average. The low representation in Hotels, Restaurants and Entertainment is perhaps due to high labour turnover. The two industries Health Care Equipment and Supply as well as Software and Services also have a lower than average representation. These are industries where the human capital element should be above average, and co-determination of extra value, according to stakeholder theory. Yet obviously, employees do not demand board seats to a great extent. The time trend is that firms with no employee

directors increase in relative importance. Thus, nothing in the overall descriptive statistics shows that co-determination is a preferred organisational mode. Firms seem to avoid it if they can, and keep it to a minimum if they cannot.

Variable definitions are shown in table 3.3, which also shows the main characteristics of variables in the analysis in the two main sub-samples of co-determined and shareholder determined firms.

Table 3.3

The table shows that a large number of variables are distributed differently in the two sub-samples. The firm performance variables Tobin's Q and stock return are not significantly different, while the ROA in co-determined firms is significantly higher than in shareholder determined. Apart from directors' holdings, all other variables are significantly different at the 5.0% level or better. Obviously, the two types of firms are different.

The table shows that the fraction of employee directors is 0.301, or slightly below the minimum requirement for the 200+ employee size group. Similarly to findings in table 3.2, this is evidence that the firms attempt to minimize the employee director importance.

The two firm groups differ in background variables, notably firm size. The co-determined firms are larger on average. This warrants paying a particular attention to the largest firm size groups in regressions, in order to control for firm size biases.

3.5 Estimation and method

I estimate the relationships in (3.2) with simultaneous equations regressions on the full samples as well as sub-samples. The equations spell out behavioural relationships between variables. Since the equilibrium model of governance is not known, reduced form estimation is not possible (Greene, 2003, section 15.2). The equations are behavioural, but not structural in the sense of belonging to an equilibrium model.

The fixed effects methods (Woolridge, 2002) is common to all regressions. Fixed effects estimation amounts to removing the individual heterogeneity of firms contained in the fixed effect c_i[12]. Remember the error

[12]For every individual firm, an overall average is constructed. Then, from each company observation the overall, individual average is subtracted.

term in the system (3.2) is u_{it}, which contains the fixed effect c_i and a idiosyncratic effect v_{it}, which varies over time and companies. i refers to firm number i, and t is the time period. When demeaning the variables, the fixed effect element disappears. So does the constant term.

I use the three-stage least squares (3SLS) methodology in estimations. The 3SLS is an instrumental variables estimation method where the instruments are the predicted values of the dependent variable in a regression on all the explanatory variables in the system (Greene, 2003, p. 398). The predicted values are found from GLS regressions, and iterations are taken until convergence is achieved. Meaningful overall measures, such as R^2 in OLS regressions, are not available. Instead, I include a Wald test (Greene, 2003, p. 107) to study whether all coefficients in a given equation are zero.

The danger in simultaneous equation estimation lies in the model specification (Greene, 2003). If, for instance, a misspecification has occurred in the first equation, the mistake may contaminate all other equations as well. To investigate if this propagation of misspecification is a serious problem, I perform several robustness tests, see below.

I perform estimations in the full sample and for sub-samples. First, the model (3.2) is estimated on the full sample with Tobin's Q as firm performance, and then on sub-samples of co-determined and shareholder determined firms. The sub-sample tests will reveal whether results from the overall sample really apply to co-determined firms alone, or if the employee director effect is merely due to difference in sampling. I further partition the sample to include only firms with more than 200 employees, when co-determination is compulsory. This will remove firm size effects.

In robustness tests, I perform an estimation with all index variables included individually (the right hand side of (3.1)), as well as an estimation of a wider definition of the board index[13], this time including non-significant effects in Bøhren and Strøm (2007) as well. Further robustness tests include replacing Tobin's Q with ROA and stock return as dependent variable, and replacing leverage with the dividend payout rate. Also, I remove the lagged firm performance in order to investigate whether param-

[13]In addition to the variables in (3.1), I include Outside owner concentration, Independence, CEO director, Exported and imported directors, and board age dispersion. Outside owner concentration is the sum of squared equity fractions across all the firm's outside owners; Independence is the board tenure of the non-employee directors minus the tenure of the CEO; CEO director equals 1 if the CEO is a member of his company's board and zero otherwise; Exported CEO is the number of outside directorships held by the firm's CEO; Imported CEO is the proportion of CEOs from other companies on the board; Board age dispersion is the standard deviation of board age.

eter estimates remain stable. The last robustness test is a test of the Fauver and Fuerst (2006) information hypothesis, which I interpret to mean that in information intensive industries firm performance is improved with co-determination. This regression should show if their positive employee director result is also the case in Norway.

The explanatory variables are assumed to be simultaneous with firm performance. Since board members are predominantly elected in the late spring, the new board should also have had some time to make a noticeable impact upon firm performance, measured at year-end. This assumption is reasonable given some market efficiency.

3.6 Econometric evidence

Do employee directors improve firm performance, and are governance mechanisms at least partly endogenously determined?

This section reports simultaneous regression results of the model (3.2). I estimate for the whole sample and then turn to sub-samples of co-determined and shareholder determined companies, and for firms with more than 200 employees. All regressions are done with standardized values. This means that comparisons of economic importance can be read off from coefficient values.

I start with estimations of the model (3.2) for the entire sample. Table 3.4 shows the estimation results.

Table 3.4

The Wald tests show that no equation supports the null hypothesis that all coefficients are zero. Comparing the two sections of the table, signs and coefficient values are very much the same. Thus, I restrict comments to the case of systematic risk in the upper section.

The co-determination hypothesis says that the employee director variable is negative to firm performance, and positive to the board index and leverage. Table 3.4 confirms this except for the leverage, where only the sign is as predicted. Furthermore, the co-determination hypothesis implies a positive impact on average wage. Here too, only the sign is confirmed. This weaker result may be due to pay being determined by external market conditions. Thus, the direct and indirect effects of co-determination are partly confirmed. Consequently, employee directors carry a negative association with firm performance, and shareholders tend to take

compensatory actions to alleviate the influence of employee directors. The board index is at least partly endogenously determined.

Are the board index and the leverage positively related to firm performance and negatively to average wage? For the board index, this is confirmed for firm performance, but only the sign is as expected for average wage. Thus, a better composed board will improve firm performance. On the other hand, leverage is against the free cash flow hypothesis expectations in both firm performance and average wage. A higher leverage indicates a lower firm performance and higher average wage. In conclusion, the governance hypothesis is not fully confirmed.

The negative association between leverage and firm performance confirms findings in empirical studies (Barclay et al., 1995; Rajan and Zingales, 1995; and Brick et al., 2005). I offer two alternative explanations to the free cash flow hypothesis; the fear of higher decision costs in a situation with three decision makers, that is, shareholders, employees, and banks; and the negative signalling effect of a high leverage (Myers, 1977).

Also note the complementarity between the board index and leverage (Agrawal and Knoeber, 1996). The sign is negative and significant. Thus, the two governance mechanisms are substitutes rather than complements.

The Hermalin and Weisbach (1998) reverse causation hypothesis is only partly confirmed, as the board index is positive and leverage is negative. Lower leverage should bring lower monitoring intensity. The results are significant, indicating that good performance leads to a better board index, and to an easier debt burden. In all, endogeneity is confirmed, as both the board index and the leverage are at least partly determined from the presence of employee directors and from past performance.

Are shareholders able to neutralize the employee director by adjustments in the board index and the leverage, taking the employee director relationship to average wage into consideration as well? Since the variables are standardised to have average zero and standard deviation 1.0 in regressions, coefficients can be compared. They show that the direct effect is stronger than the indirect to the board index. For the negative direct employee director effect is now 0.119, while the indirect effect upon the board index is positive and 0.314. Since the board index is now 0.122 to firm performance, the positive, indirect impact of employee directors through the board index is only 0.038 ($= 0.122 \times 0.314$), or 31.1% of the direct board index effect. The shareholders are able to compensate 31.9% of the negative direct effect of employee directors through adjustments to board characteristics. Furthermore, the employee director also impacts

positively upon average wage, which is negatively related to firm performance. Even though the average wage is not significant in the overall sample, it is for co-determined firms, as I shortly report. The same applies to leverage. Likewise, the economic significance of the indirect effects from the lagged firm performance is very low, being 0.01 for both the board index and the leverage.

Thus, the economic magnitude of the indirect effects from employee directors or past firm performance upon firm performance is small compared to the direct effect of the board index and the leverage. Endogeneity matters, but not very much.

The volatility measure in the lower section of table 3.4 gives two interesting relationships in the board index and the leverage equations. It turns out that only leverage has the expected positive and significant sign. The Raheja (2005) theory of board composition implies that the board index is positively related to firm risk. For volatility the opposite sign obtains.

Next, the model is studied in sub-samples. If regulation plays a role, a less than optimal board composition is likely to follow. Therefore, we should observe stronger and more significant coefficients in the co-determined firms than in the shareholder determined. Table 3.5 is a report on the two sub-samples of firms.

Table 3.5

Note that the Wald test shows rejection of the null hypothesis that all variables have zero significance. Furthermore, a Chow dummy variable test rejects the hypothesis that the coefficients of the sub-samples are equal to the those in the overall sample. Thus, there is a difference between co-determined and shareholder determined firms.

In the co-determination sub-sample the employee director effects are even more pronounced than in the overall sample. The negative employee director impact upon firm performance is about 45% higher than in the overall sample and the indirect effect on the board index increases even more. Now, the employee director variable is significant in relation to leverage and to average wage. Thus, the co-determination hypothesis is even more strongly confirmed in the sub-sample of only co-determined firms than in the overall sample.

The board index and the free cash flow hypotheses come out more in line with expectations in the co-determined firms too. Now a significant result for the board index towards average wage appears. Leverage turns out to be negative and significant towards average wage, while positive in

the overall sample. In shareholder determined firms, significant results are fewer and of different sign. Leverage is positively correlated with average wage, in contrast to the co-determined firms.

In both sub-samples the board index and leverage are negatively related. Thus, the substitution result from the overall sample is confirmed in sub-samples. We also see that the past firm performance endogeneity hypothesis gains less support in the sub-samples than in the overall. In fact, only the negative leverage result in the co-determined sub-sample is significant.

Another difference exists for firm size. Firm size is negative and significant in the firm performance equation in shareholder determined firms, while positive in co-determined. Also, in the leverage equation the signs are reversed, and significant in shareholder determined firms only. The latter confirms "stylized facts" about the positive relationship between firm size and leverage (Harris and Raviv, 1991).

An interpretation of the difference in sub-samples is that in shareholder determined firms the board composition is closer to the optimal, and therefore, exogenous characteristics such as firm size play a larger role. The large differences between samples confirm the Buchanan and Tullock (1962) theory.

Are the results arrived at so far driven by a firm size effect? Table 3.6 shows regressions for all firms with more than 200 employees in the upper part, while the lower part is limited to the largest co-determined firms.

Table 3.6

The 200+ employee sample shows results very similar to those in the entire sample in table 3.4 in the upper part, and for the co-determined in table 3.5 in the lower. Thus, the former results are not due to some firm size effect. In fact, even among firms where co-determination is compulsory, the main co-determination hypothesis is confirmed.

Looking back, the co-determination and governance hypotheses are confirmed. Tests in sub-samples do not overturn these conclusions, on the contrary, they add to their strength. For instance, while the employee director is negative for leverage in the overall sample, it is positive in the co-determined sub-sample, as the hypothesis predicts. Thus, having representatives of one stakeholder group, the employees, in addition to shareholders on the board does not improve firm performance, as a stakeholder (Freeman and Reed, 1983; Blair, 1995) or a new economy position (Zingales, 2000; Becht et al., 2003) implies. Instead, the results point to conflict

of interests among the stakeholders. Furthermore, evidence of substitution between the board index and leverage is present in all regressions. I also find evidence of endogeneity (or reverse causation) from past firm performance, but with opposite signs to those predicted in Hermalin and Weisbach (1998). However, the indirect effects of employee directors and past firm performance upon firm performance through the board index and leverage are small compared to the direct effects from the board index and leverage. Endogeneity counts, but has low economic significance.

The negative relation between employee directors and firm performance is in agreement with FitzRoy and Kraft (1993); Schmid and Seger (1998); Gorton and Schmid (2000); Falaye et al. (2006) and Bøhren and Strøm (2007), but at odds with Fauver and Fuerst (2006). None of these studies contain simultaneous equations models, and only the Bøhren and Strøm (2007) paper investigates the endogeneity of board mechanisms. I will return to the Fauver and Fuerst (2006) and Bøhren and Strøm (2007) articles in the following robustness section.

3.7 Robustness checks

I perform robustness checks on the definitions of the board index, firm performance, and leverage. In addition, I check for the absence of serial dependence of the firm performance, that is, whether lagged firm performance is zero. Finally, I check the Fauver and Fuerst (2006) results in two sub-samples of information industries and other industries. With simultaneous equations, changes in one place are likely to propagate throughout the system. Thus, different coefficient values and significance from the original formulation are quite likely to appear. Fortunately, the results largely confirm those in section 3.6.

Do the co-determination results survive when the individual board mechanisms are used in place of the board index? Table 3.7 shows simultaneous regressions results when all four board characteristics making up the board index enter the regressions individually.

Table 3.7

Former results for co-determination largely apply. The employee director variable is negative to Tobin's Q, and positive to average wage and leverage. For the board characteristics, only the relation to board size is significant. On the other hand, the hypotheses on governance variables are upheld for all board characteristics but the gender variable. It turns

out to be non-significant in the Tobin's Q relation. The other variables are as expected, and their coefficients are close to those Bøhren and Strøm (2007) find in partial GMM estimations. They also discuss endogeneity. Even though the estimations are not directly comparable, none of the significant results in table 3.7 conflict with the endogeneity results in Bøhren and Strøm (2007). The second endogeneity effect from lagged firm performance is significant in the leverage, but not in any of the board variables. However, the signs on the individual board variables conform to the positive sign of the board index in earlier tables.

Besides these main points, table 3.7 contains many new details, which it is beyond this paper to explore. For instance, the substitution effect between the board index and leverage in former tables now turns out to concern network, while leverage is a complement to board size and gender. Thus, overall the results are well in line with former findings, except for the lagged firm performance relationship to governance variables.

In the next table 3.8 I have modified the board index to include all board variables used in Bøhren and Strøm (2007) as specified in footnote 13 to check if the board index is sensitive to the selection of board characteristics.

Table 3.8

The overall Wald tests are strong and the significance of the coefficients are almost similar to what earlier full sample results in table 3.4 show. We note that the impact of the employee director variable is less in the new board index, and is now significant in its positive relationship to average wage. Thus, the co-determination hypothesis is supported with this new board index, although with lower coefficient values. The endogeneity effect of a lagged firm performance loses significance in the board index relation. The same happens when individual board characteristics replace the board index, and also disappear in the shareholder determined subsample. Thus, a preliminary conclusion is that the reverse causation in the board index relation seems to be sensitive to the specification of the index and in sub-samples.

The conclusion from the discussion of the two last tables is that the results are upheld, in particular, the co-determination hypothesis is confirmed.

Now I turn to variations on firm performance, using the stock return and ROA instead of Tobin's Q. The stock return and ROA may be seen as two extremes in performance measurement, the one only market based,

the other only accounting based. Bhagat and Jefferis (2002) argue in favour of accounting measures, noting that market measures may contain an anticipation bias, since accounting numbers may be manipulated during a given year. Since our data span fourteen years, this accounting manipulation should be a minor concern. These two measures of firm performance should together provide an adequate framework for robustness tests.

The results for the full sample are given in table 3.9. Since the results in sub-samples largely parallel those found for the full sample, the subsample results are not reported.

Table 3.9

The results in table 3.9 largely replicate those already found for Tobin's Q in table 3.4. The co-determination and the governance hypotheses show the same confirmations. As before, leverage is negative in the firm performance equation. Again, the board index and leverage are substitutes. Endogeneity (or reverse causation) is evident in both firm performance specifications, although at different variables. For the stock return the lagged stock return is significant in firm performance and leverage, as before. One would expect this to happen with accounting numbers due to earnings management or conservative accounting practices (Watts, 2003), which would induce serial correlation. However, lagged performance is significant for only the board index for the accounting measure ROA. Overall, table 3.9 supports earlier findings.

The upshot is that alternative performance measures do not upset conclusions reached with Tobin's Q. Therefore, further robustness tests may well proceed with Tobin's Q as the dependent variable.

Next, table 3.10 shows results when the dividend payout rate replaces the leverage, and Tobin's Q is the firm performance in the upper part, while in the lower part the lagged firm performance is removed. Dividend payout rate is gauged as the annual dividend as a fraction of the earnings before interest, taxes, depreciation, and accruals (EBITDA). During the period of study, share buybacks were illegal in Norway.

Table 3.10

The striking results are first that the dividend payout rate is nowhere significant as an independent variable, and second, as a dependent variable no variable in the system is related in a significant way. In fact the Wald test cannot reject the hypothesis that all coefficients in the dividend

payout rate equation are zero. An exclusion test (not reported) for the dividend payout rate cannot confirm that the variable coefficient is different from zero. Thus, the dividend payout rate is an inferior substitute for the leverage. Second, the results for the other variables are not affected, even though changes in one part of a simultaneous system may bring about new values in other parts. Therefore, the results in table 3.10 increase the confidence in the original model.

The lower part of table 3.10 shows results when the lagged firm performance is left out. The reason for the removal is that lagged firm performance induces bias (Hsiao, 2003, p. 71-2), since the errors are no longer independent of the regressors. The smaller the bias, the larger is the number of periods in the panel and the closer to zero is the auto-correlation coefficient on lagged firm performance. Furthermore, if the explanatory variables apart from the lagged firm performance have very persistent elements, the bias will not disappear. This persistence can be a concern in governance studies. For instance, the firm's board size is likely to be fairly stable. To test for the seriousness of this bias, I include static system regressions, that is, with no lagged performance.

Comparing the results from the no lagged firm performance regression to the original estimates in table 3.4 we see that practically all signs are maintained, and also that coefficient values are quite similar. The co-determination hypothesis is confirmed. For average wage on firm performance, the variable is significant in the static specification but not in the dynamic. But overall the results from the dynamic estimations are upheld. Apparently, the low auto-correlation coefficient, the rather long time period and small persistence in the explanatory variables warrants the use of the dynamic specification in table 3.4.

I also run a regression (not reported) with all explanatory variables lagged one period for the entire sample. This regression shows far fewer significant results, and although the signs are the same as before, this specification is far inferior to the main regression in table 3.4. Again, this points to a contemporaneity in governance mechanisms.

Finally, I run a test for the Fauver and Fuerst (2006) information hypothesis in sub-samples. The authors assume information significance to trade, transportation, and manufacturing industries. Using the same GICS industry classification as in table 3.3, I allocate Capital goods, Transport, Consumer articles, Retailing, Food and staples retailing, Health care equipment and supplies, and Telecommunications to the information intensive industries, while the rest is in other industries. Co-determined

firms are distributed in the two sub-samples almost as in the total population, with 61.1 per cent without employee directors in the Other industries category against 57.4 in the full sample. A test for the Fauver and Fuerst (2006) information hypothesis is that the employee director variable is positive in the information intensive industries. Table 3.11 shows results.

Table 3.11

The main interest is in the employee director, that is, the co-determination hypothesis. Both sub-samples show a negative and significant coefficient on the employee director variable. The Chow test shows that the two sub-samples are different, but the main Fauver and Fuerst (2006) hypothesis is not supported.

Overall, the results for the robustness test do not invalidate the results found in table 3.4.

3.8 Conclusion

In this paper I pose the question whether board representation of one group of non-owner, the employees, improves firm performance. I conclude it does not. The conclusion runs counter to claims from stakeholder theorists (Freeman and Reed, 1983; Blair, 1995) and some financial economists (Zingales, 2000 and Becht et al., 2003) that co-determination improves firm performance. Instead the results support most former findings in the empirical literature FitzRoy and Kraft (1993); Schmid and Seger (1998); Gorton and Schmid (2000); Falaye et al. (2006) and Bøhren and Strøm (2007) that employee board representation reduces firm performance.

The Norwegian regulations on co-determination provide the institutional framework. Co-determination is required by law for firms with more than 200 employees, and is an option if an employee majority demands so in firms having between 30 and 200 employees. A number of industries are exempted, and in all industries employees exercise their option. Thus, testing can take place using sub-samples, for instance in co-determined and shareholder determined sub-samples. For the whole sample, nearly 60 per cent do not have employee directors. The percentage has been rising during our period from 1989 to 2002. For firms with more than 200 employees, two thirds have employee directors. The resultant data set is of a panel nature.

I estimate a system of simultaneous equations where employee directors, firm size (sales), firm systematic risk, and one period lagged Tobin's

Q are the exogenous variables, and Tobin's Q, average wage, board index, and the leverage are endogenous. The board index is constructed from important board characteristics, that is, directors' holdings, the board's network, board size and the female fraction. The free cash flow hypothesis (Easterbrook, 1984 and Jensen, 1986) warrants the use of the leverage.

The setup allows the testing of direct and indirect employee director effects upon firm performance. The indirect effects constitute a test of endogeneity (Hermalin and Weisbach, 2003). The lagged firm performance gives a test of the reverse causation hypothesis (Hermalin and Weisbach, 1998) that past firm performance determines current governance. Furthermore, it allows testing of complementarity between the two governance variables board index and leverage (Agrawal and Knoeber, 1996).

Regressions are performed on the whole sample, the sub-samples of co-determined and shareholder determined firms, and then for the subsamples of firms with more than 200 employees. I use a fixed effects model implemented in a three-stage least squares (3SLS) estimation.

In all regressions, the estimated coefficients for employee directors is significantly negative. Moreover, the economic importance becomes larger as regressions proceed from the overall sample to the sub-sample of co-determined firms, and then to co-determined firms with 200 employees or more. The result is at odds with Fauver and Fuerst (2006), who find a positive relationship when a dummy employee director variable is interacted with information intensive industries. In sub-samples of information intensive and other industries I confirm the negative employee director correlation to Tobin's Q. Overall, the results support agency theory and reject stakeholder theory.

The indirect effects are also present. Employee directors are positively associated with average wage, the board index, and, in co-determined samples, with leverage. For the board index, this means that shareholders improve board composition so as to neutralize the negative employee director effect, as Buchanan and Tullock (1962) predict. However, this neutralising effect falls far short of the negative direct employee director effect. The lagged firm performance is significantly positively related to the board index and negatively to leverage. This result runs counter to the Hermalin and Weisbach (1998) reverse causation theory that earlier firm performance determines board composition. Thus, the results show endogeneity effects, but the economic significance falls far below the importance of the direct effect. The negative direct effect of employee directors is only partially compensated for by a better board. Endogeneity matters,

but not very much.

Furthermore, leverage turns out to be negatively related to firm performance, contrary to the free cash flow hypothesis (Easterbrook, 1984 and Jensen, 1986). The negative association to firm performance confirms findings in empirical studies (Barclay et al., 1995; Rajan and Zingales, 1995; and Brick et al., 2005).

Jensen and Meckling (1979) argue that co-determination can only survive if supported by law. The long-term data set employed here supports this view. Evidently, owners have good economic reasons for not choosing the co-determination form of organisation if they can. This also implies that there are costs to maintaining co-determination required by law. First, I document the negative impact of employee representation upon firm performance. Second, shareholders try to work around the regulations by strengthening aspects of board characteristics that are left unregulated. Thus, co-determination, supported by law, has costs. Therefore, these results are relevant for the emerging literature on board regulation (Hermalin, 2005).

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3.9 Tables

Table 3.1 The percentage of firms with zero or more employee directors by employment size

	Employee directors					
Employees	0	1	2	3	4	*N*
0-30	98.4	0.5	0.5	0.5	0.0	190
31-50	95.8	2.1	2.1	0.0	0.0	48
51-100	73.5	5.3	18.6	2.7	0.0	113
101-200	61.5	4.5	24.4	9.6	0.0	156
200+	33.5	8.1	30.0	27.1	1.3	1006
Total	49.5	6.3	24.0	19.3	0.9	
N	749	96	363	292	13	1513

The table shows the percentage of firms having employee directors according to employment categories. *N* is the number of firms in the employee directors or the number of employees category. The number of employees category reflects the regulations on co-determination (Aarbakke et al., 1999). With more than 200 employees co-determination is compulsory. In the 31 to 200 bracket co-determination is realised if an employee majority demands it, with a larger proportion of representation with a larger workforce. In all categories, including the above 200 employees, firms in some industries are exempted from the rules.

Table 3.2 The percentage of firms with zero or more employee directors by industry and the percentage with zero by year. The Global Industry Classification Standard (GICS) is used

	Employee directors					% of			% No	
Industry	0	1	2	3	4	total	*N*	Year	Empdir	*N*
Energy	77.7	1.1	8.2	12.7	0.3	16.0	354	1989	50.5	95
Materials	17.8	8.5	39.5	34.1	0.0	5.8	129	1990	49.5	99
Capital goods	34.5	2.8	35.3	27.0	0.4	11.4	252	1991	48.4	93
Commercial services	49.4	8.9	25.3	16.5	0.0	3.6	79	1992	45.3	95
Transport	77.1	5.8	5.6	11.6	0.0	18.8	414	1993	48.4	91
Autos and components	0.0	4.3	69.6	26.1	0.0	1.0	23	1994	52.4	103
Consumer articles, clothes	24.0	18.0	48.0	10.0	0.0	2.3	50	1995	61.3	186
Hotels, Rest., Entertainm.	90.9	0.0	9.1	0.0	0.0	2.5	55	1996	60.9	192
Media	24.3	8.1	35.1	21.6	10.8	3.4	74	1997	62.8	215
Retailing	46.2	6.2	24.6	23.1	0.0	2.9	65	1998	59.0	217
Food & Staples Retailing	50.0	0.0	50.0	0.0	0.0	0.4	8	1999	57.3	213
Beverages	36.4	0.0	36.4	27.3	0.0	3.5	77	2000	58.4	209
Health Care Equip./Supp.	75.0	0.0	5.0	20.0	0.0	0.9	20	2001	60.9	202
Pharmaceuticals Biotech.	55.2	3.4	24.1	13.8	3.4	1.3	29	2002	61.8	199
Real Estate	88.5	3.1	8.5	0.0	0.0	5.9	130			
Software & supplies	71.4	5.8	15.3	6.9	0.5	8.6	189			
Hardware & equipment	40.2	14.5	23.2	20.7	1.2	10.9	241			
Telecom.	15.8	5.3	31.6	47.4	0.0	0.9	19			
Total %	57.4	5.7	20.0	16.3	0.7	100.0	2208		57.4	2209

The table shows the distribution of employee directors across industries. Some or whole parts of the industry may be exempted, for instance the Energy (hydro power and petroleum) sector. Transport contains the important shipping segment. Media is exempted as well, but in some firms co-determination comes about through union negotiations.
"Empdir" is short-hand for employee directors.

Table 3.3 The main statistical properties of various board measures

	Shareholder determined				Co-determined				F
	Mean	Median	Std	N	Mean	Median	Std	N	sign.
Tobin's Q	1.461	1.105	1.156	867	1.501	1.162	1.064	773	0.459
Stock return	16.109	-1.700	121.515	774	17.666	2.520	78.204	724	0.770
ROA	3.272	6.220	18.840	838	6.531	8.210	13.883	771	0.000
Average wage	558.442	340.878	1516.360	677	355.909	316.306	222.129	762	0.000
Directors' holdings	0.065	0.000	0.189	966	0.063	0.000	0.187	825	0.828
Network	0.180	0.198	0.115	1264	0.191	0.208	0.075	942	0.015
Size1	4.834	5.000	1.330	1267	5.341	5.000	1.271	942	0.000
Gender1	0.024	0.000	0.078	1267	0.045	0.000	0.101	942	0.000
Board index	0.192	0.233	1.877	965	-0.271	-0.078	1.956	825	0.000
Leverage	2.387	1.165	5.955	857	1.903	1.044	3.216	761	0.046
Div. payout rate	0.197	0.000	0.747	960	0.261	0.085	0.564	822	0.042
Empdir	0.000	0.000	0.000	1267	2.282	2.000	0.707	942	0.000
Empdirfrac	0.000	0.000	0.000	1267	0.301	0.300	0.082	942	0.000
Firm size	5.427	5.462	0.788	905	6.071	6.021	0.725	801	0.000
Systematic risk	0.828	0.724	0.749	888	0.707	0.690	0.535	794	0.000
Volatility	0.918	0.646	1.200	885	0.738	0.584	0.597	788	0.000

Tobin's Q is market value divided by book value of assets; Stock return is the raw stock return corrected for dividend and stock split; ROA is accounting profits on book value of assets; Average wage is the logarithm of total wages divided by the number of employees; Directors' holdings is the percentage of directors' ownership; Network is a summary measure of the board's direct and indirect relations to other firms through multiple directorships, (see footnote 9); Size1 is the board size of shareholder elected directors; Gender1 is the fraction of women of the shareholder elected directors; Board index is a summary measure of the above board variables; Leverage is the book value of debt on book value of equity; Dividend payout rate is dividends on net income; Empdir is the number of employee directors divided by the number of directors; Empdirfrac is the fraction of employee directors in the total board; Firm size is the natural logarithm of accounting income; Systematic Risk is the company's exposure to market changes (equity beta); Volatility is the firm's total risk measured as its yearly standard deviation.
The "F sign." shows the significance of the test of the null hypothesis that the two group means are equal, estimated from an analysis of variance (ANOVA). Low values indicate rejection of the null hypothesis. The F value is found by dividing the Between Groups Mean Square by the Error Mean Square (Johnson and Wichern, 1988, p. 235).

Table 3.4 Is co-determination associated with negative firm performance and positive governance mechanisms? Full sample ($N = 1135$) estimations using systematic and firm specific risk.

	Dependent variable			
Independent variable	Tobin's Q	Average wage	Board index	Leverage
Tobin's Q lagged	0.106**	0.028	0.065*	-0.094**
Average wage	-0.035		-0.038	0.204**
Board index	0.122**	-0.030		-0.191**
Leverage	-0.041**	0.145**	-0.171**	
Employee directors	-0.119**	0.072	0.314**	0.044
Firm size	-0.141**	-0.027	-0.060	0.129**
Systematic risk	0.004	0.030	0.010	-0.035
Wald χ^2 test	79.516	39.396	82.612	87.617
p-value	0.000	0.000	0.000	0.000
Tobin's Q lagged	0.105**	0.032	0.062*	-0.082**
Average wage	-0.031		-0.036	0.181**
Board index	0.119**	-0.029		-0.182**
Leverage	-0.034	0.131**	-0.167**	
Employee directors	-0.123**	0.066	0.311**	0.042
Firm size	-0.136**	-0.019	-0.066	0.145**
Volatility	-0.045**	0.028	-0.003	0.116**
Wald χ^2 test	85.137	36.095	79.369	103.055
p-value	0.000	0.000	0.000	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) with systematic risk (upper part) and firm specific risk (lower part).
The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Variables are defined in table 3.3. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
Fixed effects estimation in 3SLS framework with standardized variables. All non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test (Greene, 2003, p. 107) is here a test of the null hypothesis that the coefficients in the given equation are all zero. A low value indicates null hypothesis rejection. If R is the $q \times K$ matrix of q restrictions and K coefficients, $\hat{\gamma}$ the K vector of coefficients, and r the vector of the q restrictions, the Wald $\chi^2(q)$ statistic is $\chi^2(q) = (r - R\hat{\gamma})' \left[R\Sigma_X R'\right]^{-1} (r - R\hat{\gamma})$, where Σ_X is the estimated covariance matrix of coefficients. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level.
Significant results at the 5% (10%) level are marked with ** (*).

Table 3.5 Is firm performance (Tobin's Q) differently related to governance mechanisms in co-determined (upper part) and in shareholder determined (lower part) firms?

	Dependent variable			
Independent variable	Tobin's Q	Average wage	Board index	Leverage
Co-determined firms $N = 639$				
Tobin's Q lagged	0.303**	0.011	0.059	-0.069*
Average wage	-0.089		-0.520**	-0.156**
Board index	0.118**	-0.175**		-0.274**
Leverage	-0.103**	-0.080**	-0.414**	
Employee directors	-0.173**	0.186**	0.484**	0.140**
Firm size	0.077	-0.001	-0.210**	-0.083
Systematic risk	0.034	-0.010	0.027	-0.035
Wald χ^2 test	112.123	83.056	212.330	89.279
p-value	0.000	0.000	0.000	0.000
Shareholder determined firms $N = 496$				
Tobin's Q lagged	-0.072**	0.030	0.041	-0.101
Average wage	-0.023		0.032	0.272**
Board index	0.121**	0.035		-0.158**
Leverage	-0.018	0.208**	-0.109**	
Firm size	-0.296**	-0.077	-0.021	0.237**
Systematic risk	-0.048	0.060	-0.006	-0.028
Wald χ^2 test	57.543	30.281	9.986	45.030
p-value	0.000	0.000	0.076	0.000
Chow dummy variable test	$\chi^2(7)$:	62.160	p-value	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) with co-determined firms in the upper part and shareholder determined firms in the lower part. The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Variables are defined in table 3.3. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
Fixed effects estimation in 3SLS framework with standardized variables. All non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test is explained in table 3.4. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level, except one where a 7.7% level is required.
The Chow (Greene, 2003, ch. 7) dummy variable test is an exclusion test for the null hypothesis that variables formed by a co-determination dummy variable interacted with each of the explanatory variables are all zero. Low value indicates hypothesis rejection. The test result shows that the hypothesis that the two sub-samples have equal coefficients must be rejected.
Significant results at the 5% (10%) level are marked with ** (*).

Table 3.6 Are the employee director direct and indirect (endogenous) effects upheld in all firms with more than 200 employees and in co-determined firms with more than 200 employees?

	Dependent variable			
Independent variable	Tobin's Q	Average wage	Board index	Leverage ratio
200+ employee firms $N = 814$				
Tobin's Q lagged	0.168**	0.008	0.139**	-0.090*
Average wage	-0.012		-0.101*	0.075
Board index	0.094**	-0.041*		-0.145**
Leverage	-0.065**	0.041	-0.197**	
Employee directors	-0.107**	0.049	0.420**	-0.006
Firm size	-0.083	0.103*	-0.093	0.172**
Systematic risk	0.013	0.045	0.025	-0.101**
Wald χ^2 test	73.709	13.037	85.068	46.726
p-value	0.000	0.042	0.000	0.000
200+ employees co-determined	$N = 565$			
Tobin's Q lagged	0.358**	0.025	0.091*	-0.060
Average wage	-0.111*		-0.478**	-0.359**
Board index	0.047	-0.148**		-0.256**
Leverage	-0.126**	-0.180**	-0.413**	
Employee directors	-0.148**	0.093**	0.522**	0.099**
Firm size	0.008	0.031	-0.248**	-0.028
Systematic risk	0.017	-0.027	0.008	-0.041
Wald χ^2 test	110.682	73.992	190.267	99.414
p-value	0.000	0.000	0.000	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) with all firms larger than 200 employees in the upper part and all co-determined firms larger than 200 employees in the lower part.
The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Variables are defined in table 3.3. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
Fixed effects estimation in 3SLS framework with standardized variables. All non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test is explained in table 3.4. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level, except one, where a 4.3% level is required.
Significant results at the 5% (10%) level are marked with ** (*).

Table 3.7 The employee director direct and indirect (endogenous) effects upon firm performance when the presence of and individual board variables are used instead of the board index. $N = 1135$

Variable	Tobin's Q	Average wage	Directors' holdings	Network	Board size	Gender	Leverage
Tobin's Q lagged	0.106**	0.026	-0.022	0.071	-0.030	-0.027	-0.091**
Average wage	-0.039		-0.049*	0.127**	0.043	0.097**	0.199**
Directors' holdings	0.051*	-0.057*		0.046	0.131**	0.024	-0.038
Network	0.091**	0.061**	0.019		0.070**	-0.067**	-0.090**
Board size	-0.062**	0.052	0.136**	0.175**		0.122**	0.212**
Gender	-0.025	0.124**	0.026	-0.177**	0.129**		0.082**
Leverage	-0.041**	0.140**	-0.023	-0.131**	0.124**	0.045**	
Employee directors	-0.114**	0.102**	0.074	0.043	-0.565**	-0.005	0.108*
Firm size	-0.144**	-0.043	0.082	0.044	0.258	0.006	0.089
Systematic risk	0.001	0.022	-0.104**	0.093**	0.034	-0.041	-0.032
Wald χ^2 test	86.300	65.395	45.170	57.520	301.551	58.640	98.443
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) when the individual variables making out the board index replace the board index. The board index consists of directors' holdings, network, board size, and gender. The definition of directors' holdings is the fraction of ownership for the board as a whole; network is information centrality (Wasserman and Faust, 1994), see footnote 9; the board size is the number of shareholder elected directors; and gender is defined as the number of shareholder elected women over board size.
The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Variables are defined in table 3.3. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
Fixed effects estimation in 3SLS framework with standardized variables. All non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test is explained in table 3.4. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level.
Significant results at the 5% (10%) level are marked with ** (*).

Table 3.8 Does a wide definition of the board index change the relationship between firm performance, employee directors and governance mechanisms? $N = 1135$

	Dependent variable			
Independent variable	Tobin's Q	Average wage	Board Index 2	Leverage
Tobin's Q lagged	0.114**	0.027	0.009	-0.109**
Average wage	-0.031		-0.136**	0.204**
Board index 2	0.091**	-0.102**		-0.083**
Leverage	-0.048**	0.143**	-0.077**	
Employee directors	-0.094**	0.077*	0.152**	-0.004
Firm size	-0.129**	-0.048	-0.218**	0.126*
Systematic risk	0.005	0.030	0.005	-0.037
Wald χ^2 test	65.962	54.197	42.933	56.620
p-value	0.000	0.000	0.000	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) when all individual variables enter the board index, and not just directors' holdings, network, board size, and gender. The added variables are Outside owner concentration, Independence, CEO director, Exported and imported directors, and board age dispersion. Outside owner concentration is the sum of squared equity fractions across all the firm's outside owners; Independence is the board tenure of the non-employee directors minus the tenure of the CEO; CEO director equals 1 if the CEO is a member of his company's board and zero otherwise; Exported CEO is the number of outside directorships held by the firm's CEO; Imported CEO is the proportion of CEOs from other companies on the board; Board age dispersion is the standard deviation of board age.
The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Variables are defined in table 3.3. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
Fixed effects estimation in 3SLS framework with standardized variables. All non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test is explained in table 3.4. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level.
Significant results at the 5% (10%) level are marked with ** (*).

Table 3.9 The employee director direct and indirect (endogenous) effects when the stock return and the return on assets (ROA) define firm performance.

	Dependent variable			
Independent variable	Firm perform.	Average wage	Board index	Leverage
Stock return, $N = 1019$				
Stock return lagged	-0.242**	-0.046**	-0.008	-0.072**
Average wage	-0.056		-0.057*	0.077**
Board index	0.132**	-0.055*		-0.223**
Leverage	-0.232**	0.056**	-0.169**	
Employee directors	-0.165**	0.052	0.302**	0.039
Firm size	-0.112	0.012	-0.026	0.117*
Systematic risk	-0.138**	-0.003	-0.010	-0.043
Wald χ^2 test	123.539	15.975	78.542	61.258
p-value	0.000	0.014	0.000	0.000
ROA $N = 1135$				
ROA lagged	-0.008	-0.043	0.063**	-0.011
Average wage	-0.129**		-0.028	0.106**
Board index	0.066**	-0.022		-0.195**
Leverage	-0.170**	0.077**	-0.183**	
Employee directors	-0.125**	0.062	0.322**	0.060
Firm size	0.033	-0.010	-0.051	0.103
Systematic risk	-0.024	0.014	0.025	-0.048
Wald χ^2 test	68.694	15.739	86.037	57.564
p-value	0.000	0.015	0.000	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) when the stock return replaces Tobin's Q in the upper part and the return on assets replaces Tobin's Q in the lower part.
The dependent variable is the stock return, defined as the raw stock return adjusted for dividend and stock splits; alternatively, as the return on assets, gauged as the accounting profits on book value of assets. Variables are defined in table 3.3. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
Fixed effects estimation in 3SLS framework with standardized variables. All non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test is explained in table 3.4. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level, except for the average wage, where at least a 1.6% level is needed.
Significant results at the 5% (10%) level are marked with ** (*).

Table 3.10 The relationships between firm performance, employee directors and governance mechanisms when dividend payout rate replaces leverage ratio (upper part), and when lagged firm performance is removed (lower part).

	Dependent variable			
Independent variable	Tobin's Q	Average wage	Board index	Dividend payout
Dividend payout rate, $N = 1150$				
Tobin's Q lagged	0.106**	0.014	0.088**	0.035
Average wage	-0.046*		-0.075**	-0.025
Board index	0.125**	-0.059**		-0.021
Dividend payout rate	0.005	-0.011	-0.012	
Employee directors	-0.117**	0.082*	0.317**	0.092
Firm size	-0.178**	0.004	-0.106*	0.022
Systematic risk	0.002	0.028	0.020	-0.066
Wald χ^2 test	79.275	8.236	48.154	4.785
p-value	0.000	0.221	0.000	0.572
	Tobin's Q	Average wage	Board index	Leverage
No lag, $N = 1333$				
Average wage	-0.062**		-0.018	0.201**
Board index	0.131**	-0.014		-0.169**
Leverage	-0.058**	0.152**	-0.161**	
Employee directors	-0.117**	0.058	0.306**	0.029
Firm size	-0.151**	0.021	-0.066	0.100**
Systematic risk	0.027	0.015	0.017	-0.031
Wald χ^2 test	71.943	45.253	85.976	84.992
p-value	0.000	0.000	0.000	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) when the dividend payout rate replaces leverage in the upper part and the lagged firm performance is removed in the lower part.
The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
I use fixed effects estimation in 3SLS framework with standardized variables. The sample comprises all non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test is explained in table 3.4. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level, except for the average wage and the dividend payout relations in the upper part, where I cannot reject the hypothesis. Significant results at the 5% (10%) level are marked with ** (*).

Table 3.11 Is co-determination a positive influence in information intensive industries? Firm performance, employee directors and governance mechanisms in sub-samples of information intensive industries (upper part) and other industries (lower part).

	Dependent variable			
Independent variable	Tobin's Q	Average wage	Board index	Leverage
Information industries $N = 533$				
Firm performance lag	0.277**	0.210**	0.127	-0.240**
Average wage	-0.041		-0.150**	0.440**
Board index	0.015	-0.093**		-0.040
Leverage	-0.024	0.217**	-0.032	
Employee directors	-0.081**	0.182**	0.197**	-0.044
Firm size	0.007	0.167*	-0.060	0.141
Systematic risk	0.003	0.055	0.062	0.009
Wald χ^2 test	60.354	88.323	17.790	61.376
p-value	0.000	0.000	0.007	0.000
Other industries $N = 601$				
Firm performance lag	0.069*	-0.040	-0.036	-0.088**
Average wage	-0.050		-0.113**	0.047
Board index	0.153**	-0.131**		-0.040
Leverage	-0.081**	0.044	-0.033	
Employee directors	-0.117*	-0.033	0.157**	-0.016
Firm size	-0.215**	-0.129*	-0.145**	0.131*
Systematic risk	0.062	0.013	-0.165**	-0.133**
Wald χ^2 test	41.646	14.737	35.541	15.583
p-value	0.000	0.022	0.000	0.016
Chow dummy variable test	$\chi^2(7)$:	28.362	p-value	0.000

The table reports the simultaneous equation estimation of the system of equations in (3.2) when the full sample is sub-divided into informationally intensive industries in the upper part and other industries in the lower. Using the same GICS industry classification as in table 3.3, informationally intensive industries are Capital goods, Transport, Consumer articles, Retailing, Food and staples retailing, Health care equipment and supplies, and Telecommunications, while the rest is in other industries.
The dependent variable is Tobin's Q, which we measure as the market value of the firm over its book value. Each variable is time demeaned in the regressions. For each firm and each variable, I time demean by subtracting a given year's observation from the firm's overall mean. The table shows the estimates based on the standardized variables, which we construct by deducting each observation from its mean value and dividing by its standard deviation.
I use fixed effects estimation in 3SLS framework with standardized variables. The sample comprises all non-financial firms on Oslo Stock Exchange 1989 to 2002.
The Wald test is explained in table 3.4. The test results show that a hypothesis that all coefficients are zero must be rejected in all relations at the 1% level, except for a 2.3% level in the average wage relation in the Other industries estimation.
The Chow dummy variable test is explained in table 3.5. The test result indicates that coefficient values are different in the two sub-samples.
Significant results at the 5% (10%) level are marked with ** (*).

4

Board control and departures

Abstract

I empirically explore[1] CEO turnover and board changes (substitutions and enlargements), their simultaneity, and their relation to outside ownership concentration, firm performance, board independence and to CEO entrenchment variables on a 14 year-long panel data set of all listed non-financial Norwegian firms. The tests may reveal potential agency problems because the sequence of departures of the CEO relative to directors is different when the CEO is in control of the election of directors from the sequence when shareholders are in control. The CEO turnover and board changes provide a natural setting for studying the board endogeneity problem that has not been used earlier. I find little evidence of CEO control, since CEO turnover and board changes tend to be simultaneous; outside ownership concentration influences the election of directors, but not the CEO; and CEO entrenchment variables are either non-significant or have signs pointing away from CEO control. I conclude that joint control of CEO and board is the type of control most typically used in Norwegian firms.

Keywords:
JEL Classification codes: G32, G34

[1]I have benefited from discussions with Øyvind Bøhren. Pål Rydland and Bernt Arne Ødegaard have guided me to data.

4.1 Introduction

A primary function of the board is to appoint and dismiss the CEO (Monks and Minow, 2001, p. 200). When the board is not able to fulfil this function, it increases the potential for agency costs associated with the separation of ownership and control (Berle Jr. and Means, 1932). Therefore turnovers of CEO and directors provide natural settings for studying manifestations of agency problems. Goyal and Park (2002) exploit this in a study of CEO turnover when the CEO holds the joint office of chairman, while Falaye (2007) investigates the CEO turnover for staggered boards. In this paper, I argue that the timing of CEO departure relative to board enlargements and director substitutions can likewise shed light on agency problems, since different board control types give diverging predictions on the relative timing of departures. The data is from Norway, where neither CEO-chairman duality nor staggered boards are allowed (Aarbakke et al., 1999). Thus, CEO turnover and board changes are unhampered by CEO or director protection.

The results in Goyal and Park (2002) and Falaye (2007) indicate that the regulatory conditions give the CEO control over the board, since the turnover of CEOs in the firms is lower than in comparable firms. Hermalin and Weisbach (1998) present a model where the CEO gradually gathers control over the board's composition due to former good firm performances. A prediction in the model is that directors leave during the CEO's tenure, as the CEO is able to negotiate for laxer monitoring. While in the former case the CEO is entrenched due to board regulations, in the Hermalin and Weisbach (1998) model the CEO becomes entrenched due to his former firm performance success. Thus, when regulations favouring the CEO are not in place, we should observe the Hermalin and Weisbach (1998) situation. If we still cannot observe the model's predicted pattern of CEO departures and board changes, control over the board must lie with either shareholders or with the CEO and the board together.

Thus, I differentiate between three board control types. The first is the CEO control, where the CEO in effect elects his own directors. The implication for timing is that board changes occur during the CEO's tenure when firm performance is good. Under the second control type, the board fulfils its primary function of hiring and firing the CEO. I call this "shareholder control". In this case, the turnovers of CEO and directors are unrelated. The third control type is "joint control", when the board and the CEO together form a team, and are jointly responsible for firm performance. Since they are jointly responsible, a prediction is that the CEO and

director turnovers will be simultaneous. Thus, the fact that the three control types imply different patterns of timing in CEO turnover and board changes can be used to examine whether the typical director election is under shareholder, CEO, or joint control.

No earlier authors have utilised the relative turnover timing of CEOs and directors to investigate the manifestations of agency problems. In recent papers, Farrell and Whidbee (2000); Yermack (2004) and Fich and Shivdasani (2006) all show that *outside* directors are more likely to leave when a new CEO takes office. But none of the authors make the timing of CEO and director departures the central issue of study. Of course, many studies deal with the separate CEO and director turnovers. Typically, these are related to firm performance and to board or CEO characteristics. For CEO turnover two results stand out. The first is that weak performance increases the likelihood of CEO dismissals (Coughlan and Schmidt, 1985; Warner et al., 1988; Weisbach, 1988; Kaplan, 1994a,b) and Parrino (1997). The second is that an independent board is more likely to dismiss the CEO than a board filled with corporate insiders (Weisbach, 1988; Borokhovich et al., 1996; Hadlock and Lumer, 1997; Huson et al., 2001; and Dahya et al., 2002). Thus, a time-based test of board and CEO turnover timing and its relation to board control is lacking. In this paper, I deal explicitly with these joint departures.

To do so, data for several periods is needed. Since this paper employs panel data spanning fourteen years (1989 to 2002), I may study board changes in relation to CEO turnover. In order to incorporate both board size changes and director departures, I develop a board turbulence measure. My approach is to study the matter from two angles. First, the lagged and contemporaneous turbulence measure is used in a probit study to predict CEO turnover. Second, director turbulence is regressed against lagged and contemporaneous CEO turnover. Notice that these tests are not merely mirror regressions involving the same variables. In the CEO turnover regression, board turbulence precedes CEO turnover, while in the second, CEO turnover precedes board turbulence.

The different control types yield predictions not only for timing, but also for the monitoring role of shareholders. Under CEO control the shareholders play no role in the election of directors. Thus, if they do the control type must be of the joint control or the shareholder control type. The monitoring role of shareholders is recognised in models such as in Shleifer and Vishny (1986) and Bolton and von Thadden (1998), and confirmed in the empirical literature (Morck et al., 1988; McConnell and Servaes, 1990).

Firm performance (ROA and stock return) and board independence belong to the set of explanatory variables. The Bøhren and Strøm (2007) proxy for board independence, that is, the tenure difference of board and CEO, is used. I include a variable for the board's network from Bøhren and Strøm (2007) taking account of both direct and indirect links to other companies' boards through multiple directorships, relying upon social network theory (Wasserman and Faust, 1994). Last, entrenchment variables such as the number of CEOs on the board may measure CEO-board collusion (Tirole, 2006), for instance the existence of friends on the board (Gilson and Kraakman, 1991). These variables should have a negative relation to CEO turnover in the CEO control type.

The sample comprises all non-financial firms listed on the Oslo Stock Exchange (OSE) at year-end at least twice during the period 1989 to 2002. The public securities register provided the ownership data, accounting and share price data is from the OSE's data provider, and board data was collected manually from *Kierulf's Håndbok* and a public electronic register from 1995.

I find that the evidence supports joint control. CEO turnover and board turbulence are simultaneous; ownership matters in that outside ownership concentration is positively associated with board turbulence, but not with CEO turnover; and that entrenchment variables are either non-significant or have opposite signs to those predicted under CEO control. In a robustness test, I construct a busy director indicator to follow up Ferris et al. (2003) and Fich and Shivdasani (2006). I find that when the board is busy, it is less likely to fire the CEO. Thus, a busy director is a less effective monitor. The results show little variation across specifications of firm performance and CEO turnover. I conclude that board control tends to be of the joint control type.

The paper proceeds as follows. The following section briefly refers to earlier empirical investigations. Section 4.3 discusses theories behind the three control types and spells out specific hypotheses. In section 4.4 I explain the definition of CEO turnover and the construction of the board turbulence variable. Section 4.5 explains the panel data tobit and GMM regressions, and also gives an overview of the data used. Then section 4.6 shows descriptive statistics and figures of CEO-director turnovers. Section 4.7 shows results for CEO turnover, chairman turnover and board turbulence. The section also contains tests of differences in board turbulence between firms that have improved performance after CEO turnover compared to firms that have not. The final section 4.8 presents my concluding

remarks.

4.2 Former empirical literature

Most empirical work in the area has been done on the CEO turnover or the top management team. The top management team is usually defined as CEO and other executives or as CEO and chairman (Warner et al., 1988). The triggering mechanism is usually weak firm performance, beginning with the papers of Coughlan and Schmidt (1985); Warner et al. (1988) and Weisbach (1988), and later Parrino (1997), who controlled for industry homogeneity. The role of the board was taken up in Weisbach (1988); Borokhovich et al. (1996); Hadlock and Lumer (1997); Huson et al. (2001) and Dahya et al. (2002). The results are in general that weak firm performance leads to CEO turnover, and the more independent the board is, the more likely it is to dismiss a CEO. Denis and Denis (1995) downplay the role of the board, observing that over two-thirds of the forced resignations are due to blockholder pressure, takeover attempts, financial distress, and shareholder lawsuits. In fact, Barclay and Holderness (1992) document that only 26% of the original CEOs were retained two years after a blockholding stake had changed hands. They also find that the chairman is changed just as often.

In comparison, few studies have been done on director turnover. An early Hermalin and Weisbach (1988) study of inside and outside director departures around the CEO turnover event finds that inside directors tend to leave, but that the result is not confirmed for outside directors. Kaplan (1994a,b) looked at both CEO and director turnovers in Germany and Japan, but examined both separately, not in conjunction. Other studies of director turnover are often limited to extraordinary circumstances such as company distress (Gilson, 1990) and takeovers (Franks and Mayer, 1996; and Harford, 2003). The Franks and Mayer (2001) study of board turnover in German companies encompasses both a general study of turnover and one related mainly to takeovers. The focus in Farrell and Whidbee (2000) is the career concerns of outside directors who fire a CEO, while Yermack (2004) includes new directors as a control variable to control for any simultaneity effect in CEO turnover. Kaplan and Minton (1994) and Yermack (2004) find that CEO and director turnover are more likely to take place after weak firm performance. Fich and Shivdasani (2006) use a new CEO in regressions of director appointments and departures, yet their focus is not upon directors as such, but upon busy directors. Likewise, they

include busy directors in regressions of forced CEO departures.

Thus, a study that takes the simultaneity of CEO and director turnovers as its primary target of investigation seems to be missing. No study has exploited the information in the sequence of CEO and director departures to differentiate between various CEO-board control types.

4.3 Theory and hypotheses

CEO and director turnovers constitute a natural setting for studying agency problems (Goyal and Park, 2002). This applies both individually and for the relative timing of departures of the CEO and directors. For instance, a board that is unable to dismiss an underperforming CEO, but is instead subjected to changes dictated by the same CEO, is clearly a sign of agency problems. The board is not fulfilling its primary function to "(s)elect, regularly evaluate, and, if necessary, replace the chief executive officer" (Monks and Minow, 2001, page 200). Such a situation has implications for CEO turnover relative to board changes, since directors tend to leave during the CEO tenure. But in other cases the board is fulfilling its primary function, and the timing of CEO turnover relative to board changes is different from the above. Thus, detecting a specific pattern in CEO turnover relative to board changes may show the existence of agency problems. I set out the various implications of timing below.

Director changes encompass both turnover and board size. Together they constitute the measure board turbulence, which is described in section 4.4. I first set out hypotheses regarding CEO turnover and board turbulence in section 4.3.1 and add hypotheses concerning other variables in section 4.3.2.

4.3.1 Board control and timing

In the formal sense, the shareholders elect a board and the board hires or fires the CEO. The board evaluates the CEO and dismisses him or her when necessary. The incumbent CEO is compared to alternatives, and if the rival is judged to be better, the incumbent is replaced. In the Almazan and Suarez (2003) model the size of the incumbent's severance pay and his firm specific investment slow down the decision to replace. A weak board tends to grant a higher severance pay and to demand less firm specific investment. The relationship between the CEO and the board may be termed shareholder control. Here, the CEO leaves independently of

director turnover. When this is so the CEO's scope for extracting private benefits is small.

The other extreme of the CEO-board relationship is CEO control, that is, the state when the CEO effectively appoints the board of directors. Berle Jr. and Means (1932, p. 82) state that this comes about when management appoints the proxy committee that nominates directors. Hermalin and Weisbach (1998) formalised their theory to explain endogenous determination of board composition, endogenous in the sense that board composition comes to depend on the CEO's success. I give a verbal exposition of the model and discuss implications.

A fundamental assumption of the model is that shareholders' influence is disregarded due to the institutional fact of dissipated ownership. Therefore the CEO turnover and board changes are the outcome of the interactions of CEO and the board. The model is initiated when the CEO is hired, and after one period earnings are realised. At this point, the board updates its judgement of the CEO. If performance is weak, the CEO is dismissed, if it is good the board and CEO negotiate over a fixed wage and monitoring intensity, the latter approximated by the fraction of independent directors on the board[2]. If the negotiations fail, the CEO leaves. If they succeed, the continuing board is less independent than the preceding, that is, independent directors leave, or the board is enlarged with inside or gray directors. In the third stage, the board may receive a private signal, and the CEO may be discharged on this new information. Thus, the CEO is supposed to leave at three points; after weak performance, after failed negotiations, and after the board obtains adverse private information. On the other hand, a board member may leave after successful negotiations, that is, after good performance. However, the two never leave at the same time. Alternatively, the CEO uses his negotiating power to enlarge the board with dependent or gray directors. If the CEO continues to turn in good performances, board independence is gradually dissipated. In consequence, we should observe a steady stream of director departures or board enlargements during the CEO's tenure. The board is then endogenously determined by the CEO's negotiating power, induced by a string of good performances. The CEO chooses his own monitors, and is effectively protected against shareholders' discipline, that is, he becomes entrenched.

[2]An independent director is commonly defined as a person without family ties to the CEO and business ties to the firm. Similarly, a director from management is dependent. A gray director delivers business advisory and financing services to the firms, such as management consultants and bankers. An independent board has at least 50 per cent independent directors.

Needless to say, the potential for agency costs is high if this is the case.

When performance is weak, but the CEO's accumulated negotiating position is strong, the absence of owners means that the CEO stays, and that board independence is unchanged. Unchanged board independence is again the outcome when the CEO's negotiating position is weak, but then the CEO may be discharged. One might expect that the board would become more independent after a weak performance, that is, board turbulence would increase after such performance. But the model does not predict such a result, since this would require a third party intervening in the director elections. The third party, shareholders, is disregarded. Thus, the model says that directors leave after the CEO has assumed office, and that the CEO will be discharged after weak performance and when the board is independent.

Hermalin and Weisbach (1998) make the caveat that the assumed equal monitoring intensity for all directors does not hold. If directors free-ride on other directors' diligence, the old board will have an incentive to want diligent new directors. Then the board may remain independent, even though directors leave or the board is enlarged during the incumbent CEO's tenure. However, this caveat does not upset the timing of CEO and director departures.

The authors arrive at their results on the institutional assumption that owners are dissipated and therefore unable to exercise their voice alternative (Hirschman, 1970). But shareholders may also be prevented by a regulatory regime allowing such CEO protection as CEO-chairman duality and a staggered board, studied in Goyal and Park (2002) and Falaye (2007). If CEO control is observed, it is uncertain whether this is due to endogeneity in the Hermalin and Weisbach (1998) sense, or if it is due to CEO protection. However, if CEO protection is not allowed, the endogeneity hypothesis of CEO control may be tested. Since Norway has a low level of CEO protection (Aarbakke et al., 1999), the data in this paper allows such testing.

A middle position between the extremes of CEO and shareholder control is the joint control of CEO and the board. The Adams and Ferreira (2007) model, termed the friendly board, may serve as a point of departure. They do not model CEO or director turnover, but the information exchange between board and the CEO. If the CEO supplies information, the board responds with better advice, but also better monitoring. The CEO appreciates advice, but dislikes monitoring. A balance between the two is found, with the board becoming 'friendly' in not requiring too much infor-

mation. When the CEO and the board share information in this friendly way, they also become jointly responsible for the firm's performance. Joint responsibility should also imply that their departure will be simultaneous. Under joint control, the board gives up some monitoring in exchange for CEO information. Thus, a potential for agency costs is allowed for the greater benefit of a more informed board, and therefore better joint board and CEO decisions.

However, instead of co-operating for the good of the company, the CEO and the board may collude for their own private benefit. Tirole (2006, p. 356) describes collusion as a state when the board is lenient towards the CEO who reciprocates by tunnelling corporate resources to his monitors. But if this is the case, outside ownership concentration should have no impact upon board departures. Thus, if such an association does appear, the joint control is not of the collusion kind.

In summary, under shareholder control the CEO and directors leave independently of each other; under CEO control directors leave after the CEO has assumed office; and under joint control CEO and directors leave simultaneously. Let us look more specifically at CEO turnover. Under shareholder control we should expect no association between CEO turnover and board turbulence. In the case of CEO control lagged or simultaneous board turbulence should show no effect upon CEO turnover. When it comes to joint control, however, board turbulence should predict a simultaneous CEO turnover.

Now we turn to board turbulence. Under CEO control, directors should leave after the CEO has entered office. Thus, a lagged CEO turnover should have a significant impact upon board turbulence. Under board and joint control, this aspect should be absent. Instead, if joint control is the case, a simultaneous effect should be apparent.

4.3.2 Ownership and independence

The discussion in the last section concerns not only the timing of CEO turnover and board turbulence. Also, firm performance, board independence, and ownership belong to the determining variables. I look at these in turn, and then expand my discussion to include related explanations and to control variables.

For reference, table 4.1 reports variable definitions and main statistical properties.

Table 4.1

CEO turnover and board turbulence are explained more fully in section 4.4.

An important feature in the Hermalin and Weisbach (1998) model is the relation between board turbulence and firm performance. Under CEO control, the better the firm performance, the higher board turbulence is expected to be. The prediction is unlike the one for shareholder control, as the better the firm performance, the lower is board turbulence. This last prediction is common with joint control. For CEO turnover, a weaker firm performance implies a higher likelihood of departure.

As already noted, in the Hermalin and Weisbach (1998) model the shareholders play no monitoring role due to the separation of ownership and control. When this is the case the shareholders' "voice" alternative (Hirschman, 1970) is closed. From a shareholder value perspective this may seem strange, as it removes the ordinary line of authority between shareholders and the board. Furthermore, the underlying assumption that dissipated ownership remains fixed if the firm sees continued weak performance is unrealistic. Such a situation would seem to welcome takeover specialists, who could build a majority stake and then replace the board, whereupon the board replaces the CEO (Scharfstein, 1988; Jensen and Ruback, 1983 and Jensen, 1988). A larger shareholder will internalise more of the benefits of oversight. Therefore a plausible prediction is that the monitoring intensity of shareholders increases with outside ownership concentration as the Shleifer and Vishny (1986) and Bolton and von Thadden (1998) models suggest.

I predict that higher ownership concentration has no effect upon CEO turnover under any control type. For board turbulence, I predict that under CEO control the effect is insignificant, while it is positive under board and joint control. The effects of external ownership concentration are, therefore, important in differentiating between control types.

An independent board may be a monitoring substitute for a large shareholder (Fama, 1980 and Fama and Jensen, 1983). In the literature on CEO turnover the more independent the board is the more likely it is to discharge a CEO. Thus, if independence is important in explaining CEO turnover, it cannot be CEO controlled. This rather increases the case for shareholder control. However, if the board is jointly controlled, board independence should be insignificant in explaining CEO turnover. It is also likely that board turbulence decreases with board independence, since the independent board will perform the monitoring that shareholders are looking for.

Thus, the timing of CEO and director turnover, firm performance, outside ownership, and independence may differentiate between control types. But the CEO and the directors may be entrenched for various reasons. Under CEO control the prediction is that the effects are positive.

First, if the CEO or the board themselves are owners, they are at least partly shielded from shareholders' discipline. Thus, a higher CEO ownership is likely to lead to lower likelihood of own turnover, while a higher board ownership stake should likewise be associated with lower board turbulence.

Second, CEO entrenchment is associated with lower CEO turnover and higher director turnover. I use three indicators of CEO entrenchment from Bøhren and Strøm (2007) to investigate this further. First, independent directors could be friends of the CEO, or at least, have the same background, and therefore, will be less effective monitors (Gilson and Kraakman, 1991 and Tirole, 2006). Alternatively, this 'imported CEO' may carry information from similar business conditions, and as such be a better monitor. Thus, the first is a colluding interpretation, the second an information interpretation of imported CEOs. Second, the CEO may be a director of other firms. The direction of effect may be uncertain here as well. External board directorships in isolation are a private benefit to the CEO and a sign of entrenchment, indicating a lower CEO turnover. But the firm's performance may suffer with a busy CEO and increase his likelihood for dismissal. Third, the CEO may be a member of the board. Goyal and Park (2002) find that when the CEO holds the dual role of chairman, CEO turnover is less sensitive to performance. By law, this duality is not allowed in Norway (Aarbakke et al., 1999). Thus, these entrenchment variables may alternatively be seen as information variables. Under CEO control we should expect the variables to be negatively related to CEO turnover and board turbulence.

Third, I would expect that a well networked board would be less likely to be fired, since such a board has been shown to create shareholder value (Ferris et al., 2003 and Bøhren and Strøm, 2007), but could be more likely to fire the CEO, since it is in a better position to compare outside candidates for the CEO post with the performance of the incumbent CEO. Thus, the networked board is a strong board in the Almazan and Suarez (2003) sense. Notice that all CEOs are eliminated from the network measure, which furthermore is constructed from social network theory (Wasserman and Faust, 1994), and shows direct (to neighbours) and indirect (to neighbours' neighbours) links to other firms through multiple directorships.

Thus, the measure represents the global properties of the whole board network (Conyon and Muldoon, 2006).

The network variable may gauge director busyness rather than information. If this is the case, I expect a higher score on the network variable to be associated with lower likelihood or CEO turnover. Fich and Shivdasani (2006) find that busy outside directors have a lower tendency to replace a non-performing CEO than a board with independent, but non-busy directors. They use the number of other directorships as the measure of busyness, creating a dichotomous variable with a cut-off point at three additional directorships. However, this is different from my network variable. Thus, my variable has more to do with board information than director overstretching. In order to compare, I include measures of the number of other directorships similar to the Fich and Shivdasani (2006) busy directors in separate regressions.

Employees and incumbent managers are natural allies against shareholders in the models of Coffee (1990); Pagano and Volpin (2005) and also in Roe (2003). If this is true, employees can be counted among the managers' friends. In the Norwegian data I may study this aspect, since nearly half of the observations in the sample have employee representatives on the board. This representation is due to legislation stipulating that firms with more than 200 employees are obliged to have employee directors, in the 30 to 200 range they are obliged only if an employee majority vote is in favour, and in both cases only if the industry is not exempted (Aarbakke et al., 1999). Since further compromises with the functioning CEO and board are more likely than with a new, employee directors may be opposed to change. This implies that CEO turnovers and board turbulence are less frequent in co-determined firms.

The higher is the age of the CEO and director, the more likely they are to leave their positions. This variable is routinely included in turnover studies.

Finally, firm size and systematic risk constitute control variables. In probit regressions, year and industry dummies are added. This is further explained in section 4.5.

Thus, the timing of CEO and board turbulence, outside ownership, firm performance, and independence may differentiate between board control types, while the remaining variables are neutral in this regard.

4.4 Variable definitions

I need to define CEO turnover and board turbulence. In table 4.1 three measures of CEO turnover emerge. First of all, I follow Yermack (2004) in considering all departures as relevant. Second, I supplement with a proxy of forced dismissals constructed as the product of CEO and chairman turnover. As is evident from table 4.1, CEO and chairman turnovers are simultaneous in more than 50 per cent of the CEO turnover cases. I suppose that these cases of coincidence signify dismissals. Third, a measure of forced departures for CEOs is obtained from previous work on CEO turnover in Norwegian companies (Bøhren et al., 2002).

I identify four reasons for not concentrating on forced CEO departures alone. First, the timing of CEO turnover and board turbulence may reveal board control type, for whatever reason the departing CEO left the company. Thus, for this reason alone, all CEO changes belong to the data set. Second, public information on dismissals is likely to emerge only in a minority of cases, probably where the conflict is most acute, since both the firm and the departing CEO want to defend their reputational capital. Gilson (1990) shows that directors in defaulting firms have trouble obtaining new directorships. This induces them to keep conflicts between CEO and board, or among board members, out of the public eye. Using only this subsample of turnovers is, consequently, likely to result in a seriously biased sample. To top it all, some studies judge a departure as forced if firm performance in advance has been weak. Then, there is no surprise in finding weak performance to be associated with CEO or director departure. Third, the often-used Parrino (1997) criteria[3] for selecting forced departures include the explicit dismissals, but then assign a turnover to the forced category if the departing CEO is less than 60 years old. In practice, this means that nearly all departures of CEOs less than 60 years of age are forced. This comes close to the all CEO turnover measure. And even though the public announcement may be that the CEO or the director has found new employment or wishes to leave, the protection of reputational

[3]Parrino classifies turnovers as either forced or voluntary, ascertained from the *Wall Street Journal (WSJ)*. The turnover is forced in two main cases: (1) If *WSJ* reported that the CEO was fired, forced from the position, or departed due to unspecified policy differences; (2) If the departing CEO is under the age of 60 and the *WSJ* announcement of the succession (2a) does not report the reason for the departure as involving death, poor health, or the acceptance of another position; or (2b) reports that the CEO is retiring, but does not announce the retirement at least six months before the succession. Searches in other parts of the business and trade press are undertaken for the second group in order to reclassify, if necessary.

capital makes all such announcements untrustworthy. Franks and Mayer (2001) move even one step further, when they define board turnover as the number of directors leaving the board during the year, for reasons other than death or retirement.

Fourth, CEO turnovers in my sample show that departing and arriving CEOs have about the same age distribution, see figure 4.1.

Figure 4.1

As is evident from figure 4.1, almost all departures take place before the CEO reaches the age of 60. But at the same time, some new CEOs join the firm even after the 60 year landmark. Thus, even the 60 year limit seems arbitrary. All in all, I have chosen to keep all turnovers as the main definition in analyses, and to supplement with definitions that are close to those commonly used in the literature.

In order to study the timing of CEO and director turnover, I need a measure that takes into account both the board size changes and the director substitutions. I define **board turbulence** as follows:

$$\begin{aligned} \text{Board turbulence} &= \text{Relative board size change} \\ &\quad + \text{Relative director turnover} \\ &= \left| \frac{\text{Board size}_{t+1}}{\text{Board size}_t} - 1 \right| + \frac{\text{Departed directors}}{\text{Board size}_t} \end{aligned} \tag{4.1}$$

The measure is continuous and always positive and is new to the literature. A value of zero will signify no replacements and no board size change. Table 4.1 shows that the average turbulence is 1.43. Looking ahead, table 4.2 reports that the percentage of new directors on a board is 26.1 on the average Norwegian board. Thus, the turnover of both CEO and directors appears to be high in my Norwegian data. I return to this point in section 4.6.

This paper employs two measures of firm performance; one is the stock return, a market measure, and one accounting measure, the return on assets (ROA). Hermalin and Weisbach (1998) argue that the board will have a greater faith in the accounting measure than in a market measure. The Bøhren and Strøm (2007) measure of independence, that is, tenure difference between the shareholder elected directors and the CEO, is employed.

4.5 Data and methods

4.5.1 Data

My sample comprises all non-financial firms listed on the Oslo Stock Exchange (OSE) at year-end at least twice over the period 1989 to 2002[4]. To reduce censoring bias in the tenure measures, I start collecting director data in 1986. The ownership structure data covers every equity holding by every investor in every sample firm. The public securities register provided the ownership data, accounting and share price data is from the OSE's data provider, and board data was collected manually from *Kierulf's Håndbok* and a public electronic register from 1995.

4.5.2 Methods

Since the CEO turnover is a discrete event, taking two values, 1 for a new CEO and 0 for the continuation of the incumbent, and the board turbulence measure is continuous, different estimation methods are employed. For the CEO turnover the probit model is the estimation vehicle, and I use the general methods of moments (GMM) for the board turbulence. Both relationships are estimated with panel data methods.

I first set out the GMM method. Since the measure of board turbulence is continuous, I may then use fixed effects panel data estimation (Woolridge, 2002). In a panel of firms, the specific firm's heterogeneity will cause residuals to be dependent. Therefore data pooling will lead to biased estimates. Fixed effects estimation has the advantage of removing the dependency in residuals, since each firm's overall average on a particular variable is subtracted from the given year's observation. The transformed observations will be independent. With firm heterogeneity thus removed, the fixed effects method makes it unnecessary to include a host of control variables in regressions. In ordinary least squares estimation on pooled data the objective for the inclusion of control variables is, of course, to remove firm heterogeneity. In the regressions that follow, I retain only the control variables firm size and risk.

[4]The OSE had an aggregate market capitalization of 68 bill. USD equivalents by year-end 2002, ranking the OSE sixteenth among the twenty–two European stock exchanges for which comparable data is available. During my sample period from 1989 to 2002, the number of firms listed increased from 129 to 203, market capitalization grew by 8% per annum, and market liquidity, measured as transaction value over market value, increased from 52% in 1989 to 72% in 2002 (sources: `www.ose.no` and `www.fibv.com`).

The fixed effects estimations are implemented with GMM, whose great advantage over other methods is that few assumptions are needed. For instance, OLS needs assumptions of homoskedasticity and absence of serial independence. The consistency of the GMM estimator follows only from the fact that it satisfies certain moment conditions (Davidson and MacKinnon, 1993, page 585). When these are satisfied, instruments are given naturally. In this paper, the instruments are constructed from the explanatory variables. Using Davidson and MacKinnon (1993, page 584), the expected value of the dependent variable y_t given the information set Ω_t is written

$$E(y_t|\Omega_t) = \boldsymbol{X}_t\boldsymbol{\beta} \qquad t = 1,\ldots,n \tag{4.2}$$

where $\boldsymbol{X}_t$ is a vector of explanatory variables, and $\boldsymbol{\beta}$ the vector of k corresponding coefficients. Since (4.2) provides the conditional moment condition $E(u_t|\Omega_t) = 0$, it follows that for any vector $\boldsymbol{W}$ with elements $w_t; t = 1,\ldots,n$ such that $w_t \in \Omega_t$, the unconditional moments $E(w_t(y_t - \boldsymbol{X}_t\boldsymbol{\beta})) = 0$. Now, the regressors $\boldsymbol{X}_t$ belong to the information set Ω_t, and there are precisely k of them. The practical implication is that the k regressors define k unconditional moment conditions. I have gone one step further and added transformations of the explanatory variables as instruments (see below). This means that I have more than the necessary k instruments for identification.

The transformations are as follows. First, I use the raw (Amemiya and MaCurdy, 1986), the time-demeaned, and the squared time-demeaned explanatory variables. Furthermore, I include the average and standard deviation of firm-demeaned explanatory variables (Breusch et al., 1989). Finally, the panel data structure allows the inclusion of contemporary as well as lagged instruments. Since explanatory variables are lagged, I use lagged instruments.

Next, I want to estimate the probability that the CEO is new. For this purpose, the probit method, applied to panel data, is used. Early studies (Hermalin and Weisbach, 1988 and Kaplan and Minton, 1994) employ the logit model on pooled data. Panel data methods for the study of CEO and director turnover have only recently come into use, one example being Fich and Shivdasani (2006).

With panel data, the unobserved effects probit model is in general

$$\begin{aligned} P(\text{CEO Turnover}_{it}) &= 1|(\text{Explanatory variables})_{it}, c_i \\ &= \Phi((\text{Explanatory variables})_{it}\boldsymbol{\beta} + c_i) \qquad t = 1,\ldots,T \end{aligned} \tag{4.3}$$

where P is probability, c_i is unobserved firm i heterogeneity, and $\boldsymbol{\beta}$ is the

vector of coefficients to the explanatory variables. The Φ symbol indicates the standard normal distribution. Two common assumptions are added to (4.3). The first is that the CEO turnover variable is independently distributed across time t, conditional on the explanatory variables and unobserved firm heterogeneity. The second assumption is that unobserved firm heterogeneity is normally distributed with zero mean and a fixed standard deviation $\left(c_i \sim \Phi\left(0, \sigma_c^2\right)\right)$. With these assumptions in hand, I estimate the relationship with maximum likelihood methods.

For panel data the probit models meet with the *incidental parameters problem* (Woolridge, 2002, page 484) when assuming a fixed effects model and performing within transformations, leading to inconsistent estimates. For this reason, the fixed effects model is dropped, and instead I add 14 year and 19 industry dummies to control for firm heterogeneity as much as possible. The dummy coefficients are not reported. Since unobserved firm heterogeneity cannot be removed, the coefficient values will be biased. However, the coefficients will show the correct direction of impact of each explanatory variable. Furthermore, since the bias is known, the slope coefficients are observable at the average of the distribution, that is, when $c_i = 0$ given the assumptions for (4.3). These so-called average partial effects (APE) β_c are estimated as $\beta_c = \beta / \left(1 + \sigma_c^2\right)^{1/2}$. I report the most important in the text.

4.6 Descriptive evidence

The objective in this section is to give some stylized facts about CEO turnover and board turbulence. First, I report some overall statistics, and then turn to the simultaneity of CEO, chairman and director changes around the CEO turnover event.

Table 4.1 in section 4.3.2 shows the main characteristics of the various definitions of turnover. It is plain that overall CEO turnover is about 20 per cent. This is higher than in American data, where Fich and Shivdasani (2006) report a departure rate of 11.28 per cent. The contemporaneous departure of CEO and chairman takes place at an average rate of 11 per cent. Identified forced CEO dismissals happen at an average rate of approximately 4 per cent. In Fich and Shivdasani (2006) the forced CEO dismissals are 18 per cent of all dismissals, that is, comparable to the proportion in our data. Thus, my proxy for forced dismissals implies a high simultaneous CEO and chairman turnover. As will become evident, this is repeated for board turnover as well.

Do CEO, chairman and director changes occur with different intensities over the period? Table 4.2 shows changes in each year of my sample.

Table 4.2

Clearly, the changes happen with different intensities over the period. At the lowest, 10.3 per cent of CEOs are new (1995), while the highest is in 2001 at 28.3 per cent of CEOs. The result for the CEO confirms the Huson et al. (2001) finding that CEO firings have been trending upwards during the sample period, although the influx of new directors is at its lowest in the middle. The variation in changes affects the CEO, the chairman and the directors usually in the same year.

In the same table, firm performance, expressed as stock return and return on assets (ROA), is set out for each year. The expectation is that turnover is high in years of low firm performance, but low in years of high firm performance, as former studies show. Yet, it is hard to detect any pattern. These summary statistics show no such definite relationship.

The simultaneity of CEO and chairman departures is shown in figure 4.2.

Figure 4.2

It turns out that most of the chairman changes occur simultaneously with the change of new CEO. Furthermore, notice that changes are fairly symmetric around the year of CEO turnover, with slightly more chairman changes taking place *before* the CEO turnover.

Figure 4.3 shows the director changes around the CEO turnover event.

Figure 4.3

The same-year spike shows up for director turnover as it does for the chairman. New directors arrive either because they substitute old, or because the board size is enlarged. Again changes are distributed around the CEO turnover year, but this time is clearly higher *before* CEO turnover than after. The values at the tails of the distribution are less reliable, since fewer observations appear here.

The conclusion to this simple overview is that chairman and director turnover tend to occur simultaneously with CEO turnover, and when they do not, they occur before rather than after the new CEO is in place. This contradicts the CEO control hypothesis, and supports the joint control hypothesis. Thus, the board and the CEO seem to form a team.

4.7 Econometric evidence

Is the simultaneity in CEO and board departures in figures 4.2 and 4.3 also present in a multivariate setting? This section tests for this and for the effects of other variables. Section 4.7.1 reports the results for CEO turnover. Chairman turnover and board turbulence are shown in 4.7.2, and section 4.7.3 repeats the board turbulence analysis, but this time with dummies indicating whether former firm performance is high or low.

4.7.1 CEO turnover

The starting point is the multivariate probit estimation of CEO departure given the simultaneous and lagged board turbulence. I perform regressions for the three definitions of CEO turnover, that is, all turnover, CEO turnover simultaneous with chairman turnover, and forced turnover. Stock return and ROA are the measures of firm performance in each turnover definition. In this section, estimations of busy directors instead of the network variable are undertaken.

Table 4.3 shows results of regressions of CEO turnover, with the different definitions, and the two specifications of firm performance.

Table 4.3

The Pseudo-R^2 shows satisfactory results in all regressions, indicating relevant model selection. Notice that all explanatory variables are lagged one period, unless otherwise indicated.

The simultaneous board turbulence is positively and significantly associated with CEO turnover in all regressions, while the lagged turbulence is significant for the all CEO turnover category only. This pattern is common to both the stock return and ROA. In the all CEO turnover category, the economic significance of the simultaneous is higher than the lagged, since the contemporaneous average partial effects (APE) is 0.25 and the lagged is 0.09 for the stock return, and 0.23 and 0.09 for ROA. Thus, CEO turnover comes with a higher rate of substitution of board members and relative change in board size. This indicates that the CEO-board relationship is of the joint control type. The friendly board (Adams and Ferreira, 2007) type comes to mind.

I run an exclusion test for the board turbulence variables. The null hypothesis that the coefficients of the two variables are zero is rejected. This further strengthens my conclusion that CEO turnover and board turbulence are related, and that joint control is the most common control type.

At the same time, this is also a powerful test of the shareholder control hypothesis that CEO turnover and board turbulence are unrelated. The results of the exclusion test mean rejection of the shareholder control hypothesis.

Now look at the other explanations of CEO turnover. The negative effect of firm performance conforms to the evidence found from the earliest (Coughlan and Schmidt, 1985; Weisbach, 1988; and Warner et al., 1988) and to the latest (Parrino, 1997; Huson et al., 2001; Dahya et al., 2002; and Fich and Shivdasani, 2006) studies. Thus, the general result is that higher performance reduces the likelihood of CEO turnover. The result confirms the prediction common to all board control types. However the effect is economically rather weak, with both coefficient values and APEs close to zero, and not always significant. But again agreeing with former studies, the effect is stronger in regressions of forced dismissal than in all CEO turnover regressions. This is to be expected. The forced dismissals are likely to appear more often in crisis situation than the all CEO turnover category, even though we have noticed the difficulty of drawing a line between the two. The results hold for both stock market and ROA, contrary to the Hermalin and Weisbach (1998) argument that accounting information is the more reliable.

Outside ownership concentration is significant in only one regression and its sign is not consistent in the regressions. This confirms the expectation for all control types.

The results of board independence are contrary to expectations for all board control types and also at variance with the extant literature. It has a negative sign in all regressions, indicating that higher board independence leads to a *lower* likelihood of CEO turnover. This applies to all turnover as well as to forced dismissals. Its APE is -0.01 in the all CEO turnover in both the stock return and the ROA regressions, and closer still to zero in the forced turnover regressions. Thus, the longer the average board tenure relative to the CEO's tenure, the less likely the board is to discharge the CEO. Denis and Denis (1995) find that board independence has less importance when controlling for blockholder pressure, takeover attempts, financial distress, and shareholder lawsuits. It is possible that a similar effect appears when including board turbulence in the regressions. The odd result for independence may of course be due to the fact that the independence measure here is the tenure difference between the board on average and the CEO.

Among the CEO entrenchment variables only the imported CEO is

consistently significant in all regressions, and with a sign consistent with an information interpretation rather than a colluding board interpretation. An increase in the fraction of CEOs from other companies means a markedly higher likelihood of CEO turnover. Looking at the stock return case, the APE is 0.33 for the regression for all CEO turnovers. Thus, having friends on the board in the Gilson and Kraakman (1991) sense does not seem to make the board friendly towards the CEO. This refutes the hypotheses for entrenchment made under the assumption of CEO control.

I find that the CEO's age has an impact in all turnover regression, but not in forced dismissals. However, the APE is close to zero in both. This indicates that resignations are to some extent voluntary.

My results for the network variable have no counterpart in the literature. The higher the board network measure, the less likely the board will be to dismiss the CEO. The APE for both the stock return and the ROA case is -0.23 in the regression using all CEO turnovers, and -0.10 in forced turnover. This is contrary to the shareholder control prediction that a better networked board is better able to compare potential CEO candidates. Fich and Shivdasani (2006) obtained a similar result for busy directors. I make a more detailed comparison below, see table 4.4.

Are busy directors less likely to dismiss the CEO? A main result in Fich and Shivdasani (2006) answers in the positive. My network variable is not directly comparable, since it takes account of both direct and indirect director connections to other firms, but the results in table 4.3 point in the busy director direction. The Fich and Shivdasani (2006) measure is a dummy variable showing 1 if the board has more than half busy directors. A director is termed busy if he or she holds three or more board positions in other listed firms. In order to compare, I have constructed busy director variables in the same manner, but I have set two more cut-off points, one at zero and the other at 1 outside directorships in addition to the cut-off at three. The results are shown table 4.4.

Table 4.4

Only coefficients for the busy director dummy variables are reported. Overall statistics and other explanatory variables' coefficient values and their significance remain highly similar to the results in table 4.3. Table 4.4 shows that the dummy variables replacing the network variable are only significant at the cut-off of three other directorships. The sign and significance is the same as for the network variable in the three or more directorships category. Here, the APE is -0.35 for both stock return and return on assets for the busy director specification, compared to -0.23 for the

network variable. Thus, a board filled with busy directors is less likely to dismiss the CEO, and the conclusion is very much in line with the results for the network variable. This confirms the Fich and Shivdasani (2006) result that really busy directors are less likely to terminate the CEO's contract.

Together, the joint board control type finds support in the regressions on CEO turnover. The conclusion rests on the confirmation of the simultaneity of CEO turnover with board turbulence joint control type prediction, and it is further confirmed by the entrenchment variables' low significance or reverse sign. Thus, the CEO and the board work as a team, as modelled in Adams and Ferreira (2007). The conclusion is confirmed in regressions with definitions of CEO turnover ranging from the all turnover to forced turnover, and with definitions of firm performance being either the stock return or ROA.

4.7.2 Chairman turnover and board turbulence

Can CEO turnover predict later board turbulence? This is the prediction under CEO control of the board, while under joint control it is not lagged, but contemporaneous CEO turnover that should predict board turbulence. Till now I have studied the CEO turnover and impacts from board turbulence before the turnover. Now, I look at what happens to board turbulence in the same year and the year following a CEO appointment. My testing strategy is first to perform probit analyses of chairman turnover, and second to use board turbulence as a dependent variable, while CEO turnover is among the explanatory variables. The importance of the chairman position warrants a separate analysis.

The testing procedure for the problem of chairman departure is multivariate probit estimations as it is for CEO turnover. As before, all probit regressions are performed with a full set of time and industry dummies. The simultaneous CEO/chairman turnover dependent variable is ignored here, since this has a definition close to the new chairman dependent variable. Chairman turnover has likewise been removed from the turbulence measure. Table 4.5 shows the results.

Table 4.5

Table 4.5 is easily summarised. Chairman turnover tends to be contemporaneous with board turbulence and with CEO turnover. Lagged board turbulence is significant in the stock return regressions, but lagged

CEO turnover is not significant in any. Apart from this, firm performance has little influence upon chairman's turnover. The APEs show that the effects are economically significant, except for the firm performance variable. Other board characteristics have no impact. Again, the joint control of board and CEO emerges as the defining characteristic of the CEO-board relationship.

Next, the investigation turns to the effects of CEO turnover and other variables upon board turbulence. Table 4.6 gives estimates.

Table 4.6

Table 4.6 shows that the positive, contemporaneous association between CEO turnover and board turbulence is confirmed in most regressions. However, the impact is higher for the lagged CEO turnover variable. In the regressions containing forced dismissals, the contemporaneous effect is not significant. The diverse results for this extreme case may be due to the board dismissing the CEO and staying on to a greater extent than in all CEO turnover. Overall, the results give some support to the CEO control hypothesis inferred from Hermalin and Weisbach (1998) that board turnover happens after the new CEO has taken office. However, since significance is found for the contemporaneous effect as well, confirmation of the hypothesis is not clear-cut.

The CEO control hypothesis obtains no confirmation among the remaining variables. Firm performance turns out to be unrelated to board turbulence. As in earlier regressions, the value is close to zero, and significant in only one regression. This is perhaps surprising. If shareholders are dissatisfied with the firm's performance, they should seek the 'voice' alternative (Hirschman, 1970) to replace the existing board. If the board control is of the CEO control type, we should expect a positive and significant sign for the lagged firm performance. Thus, the result does not confirm the CEO control hypothesis on this point.

Outside ownership concentration is an important variable for board turbulence as opposed to CEO turnover. This variable shows significance in all regressions. The sign is positive, indicating that a higher outside ownership concentration leads to higher board turbulence. The result confirms the Shleifer and Vishny (1986) and Bolton and von Thadden (1998) proposition that monitoring effort increases with higher outside ownership concentration. Similar results do not emerge for CEO and chairman turnovers in tables 4.3 and 4.5. This may indicate that outside owners wield their influence through the election of directors to the board. Thus,

board turbulence is a result of shareholders' actions, while they do not influence CEO turnover. Director tenure depends more upon shareholders than CEO tenure. This piece of evidence does not confirm the CEO control type either.

Board independence is negatively associated with board turbulence. Thus, there is a tendency to keep an independent board. This is against the CEO control hypothesis, since the CEO would aim to reduce board independence.

CEO entrenchment should increase board turbulence. Consistent with the CEO turnover regressions, this cannot be confirmed, as few significant results are forthcoming and the significant result for the CEO director is contrary to expectation. Thus, these variables point towards other board control types than CEO control as well.

Moreover, board average age is negatively associated with board turbulence, an expected result. Equally expected is the employee directors result. Co-determination is related to lower board turbulence.

The evidence in this section is not as unequivocal as in the last. The CEO control hypothesis receives support for the lagged CEO turnover variable, but all other results point in a different direction. In particular, the result for outside ownership concentration rejects the CEO control hypothesis. Shareholder control must be rejected, since CEO turnover and board turbulence are related. Again the joint control hypothesis emerges as the most plausible explanation.

4.7.3 Board turbulence and firm performance

In the case of CEO control, the CEO gets to select the board after showing good firm performance. Till now, I have treated all turnover equally with regard to effects upon board turbulence. But actually, I should differentiate between turnovers leading to better firm performance and those leading to worse. Then the Hermalin and Weisbach (1998) hypothesis should imply that board turbulence increases after the CEO turnover in firms with improved performance. In case of bad performance, the CEO should be changed. Thus, the implication is that board turbulence is unchanged with weak performance after a new CEO enters office.

To perform a test, I categorise firm performance as "improved" or "reduced" in the following way. First, stock returns are year and industry adjusted. I calculate the adjusted stock return $R_{ijt} = \left(r_{ijt} - r_{jt}\right) / |r_{jt}|$, where r_{ijt} is the stock return of firm i in industry j in year t, and r_{jt} is the average stock return in industry j in year t. Second, a firm is classified as

"improved" if the two-year average adjusted stock return following the CEO turnover year is higher than the two-year average stock return before turnover, that is, if $1/2\left(R_{ij1} + R_{ij2}\right) > 1/2\left(R_{ij-1} + R_{ij-2}\right)$. Correspondingly, the firm falls in the "reduced" category if the adjusted stock return is lower than before turnover, calculated in the same manner as the improved. Thus, the measure excludes year 0 when a new CEO is recorded. This is done in order to avoid observations that the new CEO may for example initiate a "big bath", whereby the firm's financial position is made to look unfavourable, or contrarily, whereby he or she tries to increase shareholder expectations to the firm leading to higher stock return. Murphy and Zimmermann (1993) document evidence of such behaviour.

Figure 4.4 shows board turbulence around the year of CEO turnover for improved and reduced firm performance companies.

Figure 4.4

It turns out that in firms with improved stock return, the board turbulence increases *before* the turnover year, and falls thereafter. Except for high values in the tails, the board turbulence is highest in the turnover year. The same general pattern is repeated in firms with reduced stock return. Again excepting the high values in the tails, the turnover year has the highest turbulence in this category as well. Also, the level of board turbulence is about the same in the two types of firm, although they may differ in particular years. No pattern emerges from the difference in average board turbulence between the two types. Thus, a striking similarity is evident for both types of firms.

This is very much against the CEO control hypothesis. Instead CEO and directors tend to leave together. They appear to be a team, that is, the case of joint control is confirmed.

I make a rigorous test by creating dummy variables for firms that experience an improved performance after the CEO turnover and firms that have weaker performance. Given the information in figure 4.4, I should expect the effects to be negligible for both variables. Table 4.7 shows results.

Table 4.7

Again overall statistics of the regressions are satisfactory. As expected from figure 4.4, the dummy variables are not important. They are not significant in any regression. The exclusion restriction test further confirms

this conclusion. The test says that no confirmation of non-zero coefficients can be given. I cannot confirm the CEO control hypothesis that good performance leads to higher board turbulence following CEO turnover.

A comparison of the coefficient values in table 4.7 to the corresponding values in table 4.6 shows a very close similarity. The same variables as before are the significant ones. The only noticeable difference is that the employee directors variable has become significant to a greater extent. Thus, having employee directors on the board reduces board turbulence among shareholder elected directors.

4.8 Conclusions

The CEO appointments and dismissals are part of the board's primary functions (Monks and Minow, 2001). When the board is unable to fulfil this task for some reason, the potential for agency cost increases. Berle Jr. and Means (1932) described how the CEO in effect chooses his own board, which comes about when ownership and control are separate. The monitored CEO elects his own monitors. The board becomes "endogenously determined" (Hermalin and Weisbach, 1998). Therefore the CEO and director turnover constitute a natural setting for studying manifestations of agency problems. This has been exploited in the empirical literature for CEO-chairman duality (Goyal and Park, 2002) and a staggered board (Falaye, 2007), and both imply a lower CEO turnover. The fact that company law bans both CEO-chairman duality and staggered boards in Norway (Aarbakke et al., 1999) makes the institutional setting favourable for the study of the relative timing of CEO turnover and board changes, and may reveal whether CEO control needs some form of regulatory protection to be realised.

In this paper, I use the timing of CEO turnover relative to director substitutions and board enlargements to characterize the distribution of control between the CEO and the board. I differentiate between three forms of control. CEO control happens when the CEO chooses his own board. Then the CEO stays and directors are substituted, or new are added. Shareholder control is the case when the board fulfils its primary functions of hiring and firing the CEO. When this is so, CEO turnover tends to be unrelated to director turnover. The third case is joint control, when the CEO and the board together constitute a team and are jointly responsible for firm performance. Then CEO turnover tends to be simultaneous with director turnover. Thus, the timing of CEO and director turnover should

reveal the board control type, and thereby the seriousness of agency costs.

The shareholders have no part to play in the choice of directors under CEO control. Therefore shareholders' influence over the election of directors varies from none in the case of CEO control to high in the cases of shareholder and joint control. At the same time, if the election and hiring processes are functioning correctly, owners should have no influence over the choice of CEO. Thus, the influence of ownership on the election of directors and the hiring of a CEO can further differentiate between types of board control.

CEO turnover is the dependent variable in one type of regressions, with former and simultaneous board turbulence as explanatory variables together with other variables. In the other type of regressions, the roles are reversed, with board turbulence as the dependent. Now the simultaneous and former CEO turnovers are explanatory variables. The regressions show that simultaneity is important and significant in both types of regressions. However, the most important in the board turbulence regressions is the former CEO turnover, indicating that board changes take place after the CEO has taken office. These results hold across different specifications of CEO turnover, from the all CEO turnover to forced, and across definition of firm performance, that is, stock return and return on assets. Thus, the CEO turnover and the board turbulence regressions do not give a clear-cut answer regarding the location of board control.

However, the results for outside ownership concentration point towards joint or shareholder control. Higher outside ownership concentration implies that board turbulence increases, while no significant relation to CEO turnover can be detected. Thus, the shareholders wield their influence through the board. A more independent board is less likely to fire a CEO and is itself less likely to be changed. Consistent with Fich and Shivdasani (2006) busy directors are less likely to fire the CEO. The joint control result is further confirmed from the entrenchment variables, as these turn out to be either non-significant, or the reverse of expectations for the imported CEO in the CEO turnover regressions. Both the results for the individual variables, and the fact that they all point in the same direction indicate that the board control is of the joint control type.

My main conclusion is that the control type between CEO and directors is one of joint control, that is, the CEO and directors together constitute a team. This supports the friendly board hypothesis of Adams and Ferreira (2007).

Thus, the data do not support the Hermalin and Weisbach (1998) hy-

pothesis that board composition is endogenously determined. It seems that CEO control can only be realised if some protection is given, for instance in the form of CEO-chairman duality or a staggered board, shown in Goyal and Park (2002) and Falaye (2007). The results in this paper show that when such protection is not in place, shareholders are important in choosing directors. By implication, for the CEO to gain control over the board, regulations must favour CEO protection.

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4.9 Figures

Figure 4.1 The age of arriving and departing CEO

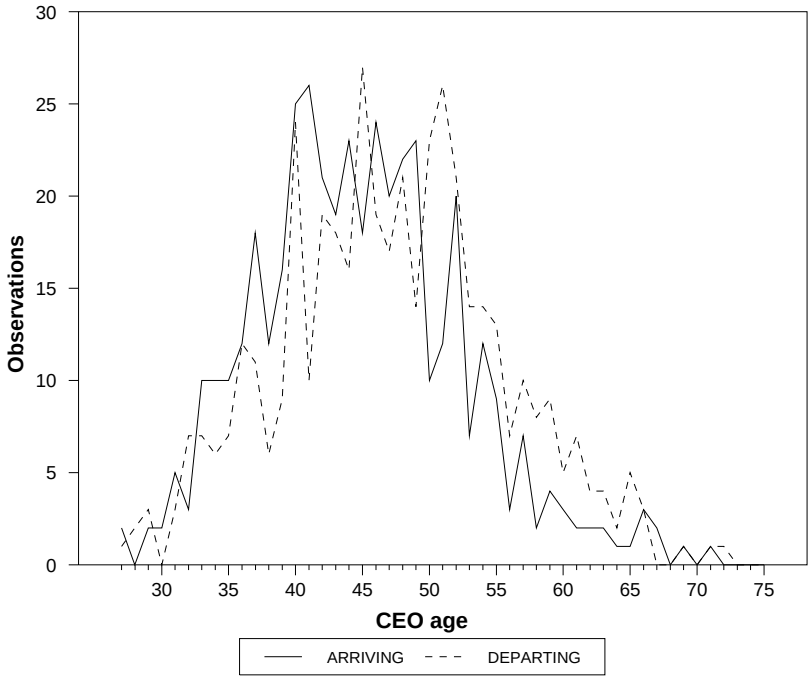


Figure 4.2 The percentage chairman change relative to CEO change. The line represents the chairman changes, while bars are the number of observations in a given year (right hand scale).

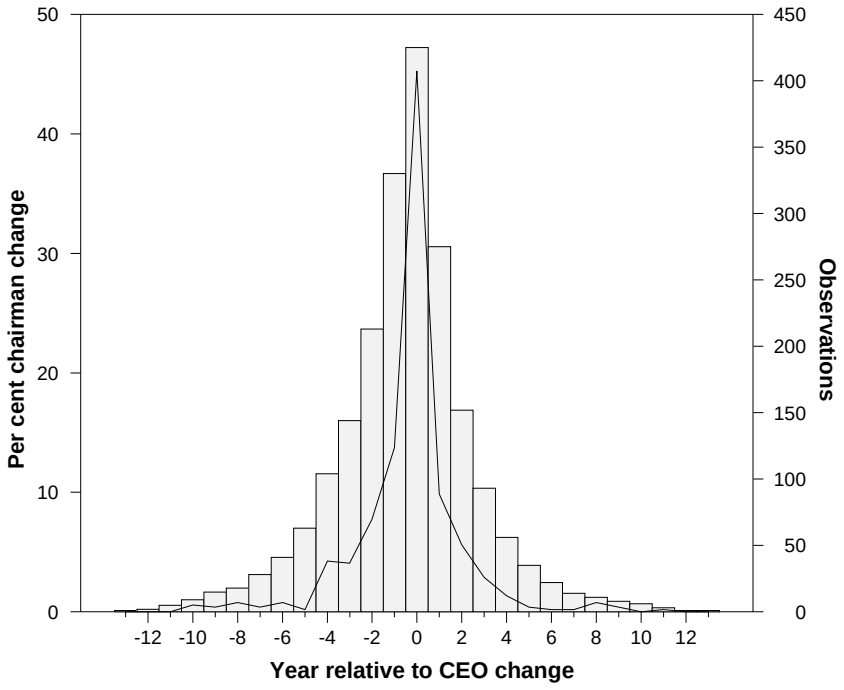


Figure 4.3 The average number of new shareholder elected directors relative to CEO change. The line represents the director changes, while bars are the number of observations in a given year (right hand scale).

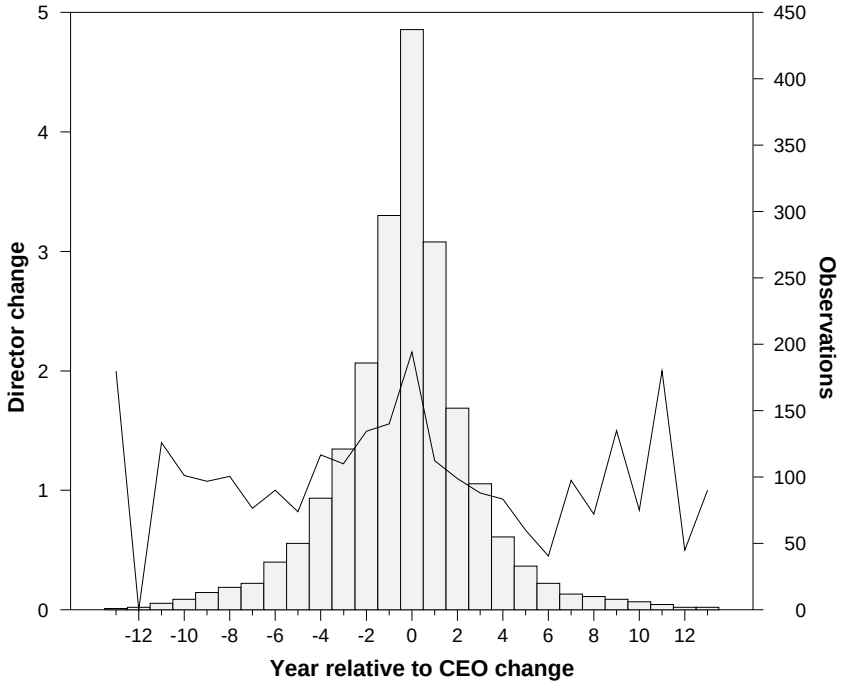
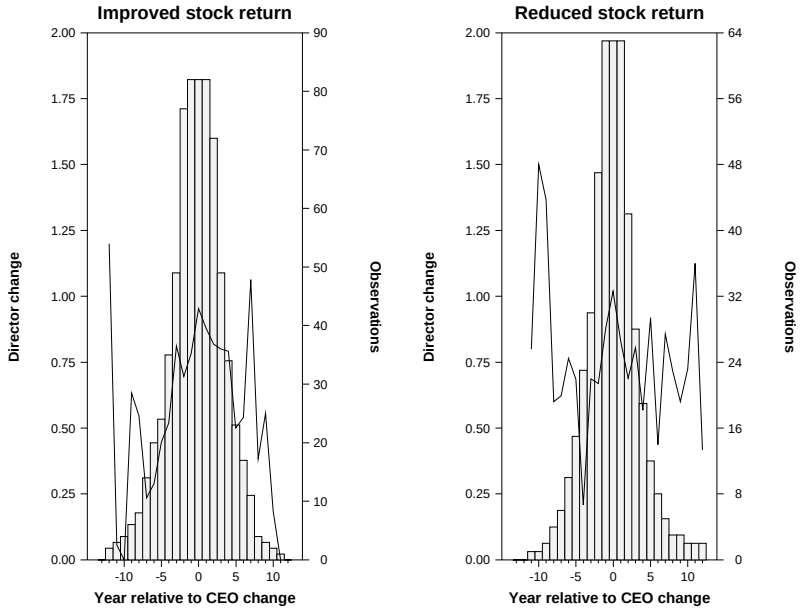


Figure 4.4 Board turbulence in firms experiencing an improved stock return subsequent to a CEO turnover and firms with reduced stock return. Board turbulence is drawn as a line, observations as bars.



4.10 Tables

Table 4.1 Definitions of variables used in the analysis and their main statistical properties

Variable	*N*	Mean	Std	Min	Max	Explanation
CEO turnover	2203	0.20	0.40	0.00	1.00	All CEO turnovers; equals 1 if the CEO is new
CEO/chair turnover	2203	0.11	0.31	0.00	1.00	All CEO and chairman turnovers, equals 1 if both are new
Forced turnover	2203	0.04	0.20	0.00	1.00	Forced CEO dismissals, equals 1 if CEO is forced from office
Chair turnover	2203	0.24	0.42	0.00	1.00	All chairman turnovers, equals 1 if chairman is new
Board turbulence	2025	1.43	1.50	0.00	8.00	Sum of proportions of director substitutions and board size change on board size
Return on assets	1643	4.93	16.74	-96.51	119.74	Earnings before interest, taxes and extraordinary items on the book value of assets
Stock return	1503	16.99	102.84	-98.93	2328.57	The yearly stock return adjusted for dividends and stock splits
Directors' holdings	1859	0.06	0.19	0.00	1.00	Proportion of equity owned by the board of directors
CEO holdings	1863	0.04	0.14	0.00	1.00	Proportion of equity owned by the firm's CEO
Outside owners	1795	0.17	0.22	0.00	1.00	The sum of squared equity proportions across all the firm's outside owners
Independence	2206	-0.31	2.14	-12.86	10.33	The average tenure of the non-employee directors minus the tenure of the CEO
CEO dir	2201	0.30	0.46	0.00	1.00	Equals 1 if the CEO is a member of his company's board and zero otherwise
Exported CEO	2201	0.35	0.75	0.00	6.00	The number of outside directorships held by the firm's CEO
Imported CEO	2201	0.05	0.10	0.00	0.67	The proportion of CEOs from other companies on the board
Network	2201	0.18	0.08	0.07	0.32	Information centrality (Wasserman and Faust, 1994)
CEO's age	2195	47.02	7.71	24.00	72.00	The CEO's age
Board age	2209	50.18	5.51	27.20	73.50	The average age of shareholder elected directors
Employee dir.	2207	0.13	0.16	0.00	0.50	The number of employee directors divided by the number of directors
Firm size	1937	5.66	0.86	2.15	9.43	The natural logarithm of accounting income
Risk	1733	0.77	0.66	-0.99	8.13	The company's exposure to market changes
Other dir'ships	2201	0.54	0.55	0.00	4.33	A board's average number of outside directorships

In all board characteristic definitions (such as Network), employee directors are removed.

Table 4.2 The annual percentage frequency of new CEOs and chairmen, the average number of new directors and its standard deviation, and the average yearly percentage stock return and return on assets (ROA) and their standard deviation on all non-financial Norwegian firms 1989-2002

	New	New	New directors				Stock return			ROA		
Year	CEO	chair	*N*	Avg.	Std.	*N*	Avg.	Std.	*N*	Avg.	Std.	*N*
1989	13.8	13.8	94	27.9	28.1	95	62.7	75.8	88	10.3	12.4	88
1990	20.4	17.3	98	21.8	29.0	99	-3.3	41.4	82	8.1	10.9	88
1991	21.7	22.8	92	25.6	27.8	93	-17.7	36.7	80	5.3	9.1	80
1992	14.7	20.0	95	17.7	23.3	95	-22.9	50.9	75	3.3	14.6	91
1993	20.9	22.0	91	19.3	23.1	91	123.6	125.7	84	8.0	8.4	96
1994	10.8	18.6	102	21.5	27.4	102	10.0	57.8	92	8.2	12.7	106
1995	10.3	14.1	185	16.1	27.7	186	40.8	98.2	97	9.5	10.3	106
1996	18.8	25.0	192	32.1	32.9	192	50.8	74.2	102	7.3	14.7	116
1997	11.7	16.8	214	25.0	31.5	215	31.0	70.6	115	7.2	19.7	149
1998	23.6	26.9	216	29.5	29.6	217	-34.6	31.9	151	5.4	18.5	163
1999	23.9	30.0	213	28.8	30.4	213	72.2	222.2	146	3.9	16.9	151
2000	26.3	32.5	209	32.0	33.3	209	4.6	63.6	127	2.2	21.8	145
2001	28.2	25.7	202	28.4	29.0	202	-18.2	42.0	131	-2.1	19.9	140
2002	26.1	26.6	199	26.4	27.8	199	-30.8	48.7	133	-2.3	19.9	124
Avg.	20.1	23.3		26.1	29.8		17.0	102.8		4.9	16.7	
Total	443	514	2202			2208			1503			1643

"New CEO" is the percentage of new CEOs in the population of firms, "New chairman" is the percentage of new chairmen in the population of firms, and "New directors" is the percentage of new directors. "Avg." is the average size of the change in e.g. the number of new directors, "Std." is the standard deviation to the change, and "*N*" is the number of firms for the respective variable. "Stock return" is defined as the yearly stock return adjusted for dividends and stock splits. ROA is earnings before interest, taxes and extraordinary items on the book value of assets. Stock return and ROA averages and standard deviations are unweighted.

Table 4.3 Is CEO turnover simultaneous with board turbulence? CEO turnover as binary dependent variable in regressions with board turbulence, firm performance, and board characteristics as independent variables.

	FP is Stock return			FP is Return on assets		
Lagged variables	All CEO turnover	CEO and chairman turnover	Forced turnover	All CEO turnover	CEO and chairman turnover	Forced turnover
Constant	-0.648	-0.680	-23.701**	-1.033	-0.837	-5.368**
Turbulence, same year	1.039**	1.683**	0.549**	0.951**	1.584**	0.493**
Turbulence	0.382**	-0.056	0.011	0.361**	0.075	-0.008
Firm performance (FP)	-0.001**	-0.002*	-0.002*	-0.009**	-0.001	-0.011**
Outside owner	0.009	0.224	-0.618	-0.103	0.164	-0.713*
Independence	-0.043**	-0.036	-0.066**	-0.046**	-0.037	-0.064**
CEO ownership	0.180	0.458	-0.447	0.182	0.449	-0.476
Imported CEO	1.374**	1.477**	1.185*	1.389**	1.250**	0.911
Exported CEO	0.002	-0.048	0.079	0.005	-0.039**	0.083
CEO director	-0.055	0.266*	-0.216	-0.015	0.265	-0.272
Network	-0.963**	-0.795	-1.559**	-0.953**	-0.826*	-1.449**
CEO age	0.016**	0.003	0.010	0.016**	0.003	0.005
Employee directors	-0.006	0.430	-0.274	0.127	0.410	-0.223
Firm size	-0.071	-0.102	0.110	-0.044	-0.098	0.148*
Risk	0.090	0.126	0.080	0.079	0.098	0.013
N	1147	1147	1147	1227	1227	1229
Pseudo-R^2	0.539	0.599	0.428	0.506	0.559	0.382
Exclusion Turbulence	0.000	0.000	0.002	0.000	0.000	0.006

Probit estimations using maximum likelihood, see (4.3) and explanations there.
"CEO turnover" is defined as all turnovers, simultaneous turnover of CEO and chairman, and as forced dismissal. "Firm performance" is specified as either stock return or return on assets. Pseudo-R^2 is calculated as $1 - \mathcal{L}_{ur}/\mathcal{L}_o$ (Woolridge, 2002, page 465) where $\mathcal{L}_{ur}$ is the log-likelihood function for the estimated model, and $\mathcal{L}_o$ is the the log-likelihood function in the model with only an intercept. In board turbulence, the chairman's impact has been removed in CEO and chairman turnover regressions. All regressions contain full sets of unreported year and industry dummies.
The exclusion turbulence test (Greene, 2003, p. 102) is a test of the null hypothesis that the board Turbulence coefficients are both zero.

Table 4.4 Are busy directors less willing to dismiss the CEO? Dummy variables showing that half or more of the board are labelled busy directors have replaced the Network variable in table (4.3). Only coefficients of new dummy variables are reported along with the original network results.

At least half of board are busy directors when each hold	All CEO turnover	Stock return CEO/Chair turnover	Forced turnover
more than 0 other directorships	-0.008	0.040	-0.013
more than 1 other directorships	0.092	-0.036	0.122
more than 3 other directorships	-6.119**	-5.533**	-5.386**
Network	-0.963**	-0.795	-1.559**

The same probit model as in table 4.3 is estimated here, except that lagged dummy variables showing various definitions of busy directors have replaced the lagged Network variable.

Table 4.5 Chairman turnover following or contemporaneous with CEO turnover? Probit estimations using maximum likelihood.

	Stock return		Return on assets	
Lagged variables	All CEO turnover	Forced turnover	All CEO turnover	Forced turnover
Constant	-2.498**	-2.215**	-2.125**	-1.846**
Turbulence, same year	2.930**	3.016**	2.930**	3.005**
Turbulence	-0.352**	-0.300*	-0.202	-0.160
CEO turnover, same year	0.649**	0.320	0.709**	0.376*
CEO turnover	-0.108	0.138	-0.127	0.134
Firm performance (FP)	-0.001**	-0.001**	0.004	0.003
Outside owner	0.119	0.174	0.237	0.276
Independence	-0.010	-0.024	-0.009	-0.026
Board ownership	0.091	0.130	0.054	0.099
Imported CEO	0.611	0.729	0.638	0.748
Exported CEO	-0.040	-0.043	-0.068	-0.068
CEO director	0.167	0.203	0.139	0.178
Network	0.256	0.159	0.138	0.062
CEO age	-0.002	0.003	-0.005	0.001
Employee directors	0.457	0.469	0.348	0.409
Firm size	0.109	0.064	0.078	0.032
Risk	-0.085	-0.048	-0.053	-0.018
N	1147	1147	1227	1227
Pseudo-R^2	0.667	0.655	0.643	0.628
Exclusion Turbulence	0.000	0.000	0.000	0.000

"Firm performance" is specified as either stock return or return on assets.
Pseudo-R^2 is calculated as $1 - \mathcal{L}_{ur}/\mathcal{L}_o$ (Woolridge, 2002, page 465) where $\mathcal{L}_{ur}$ is the log-likelihood function for the estimated model, and $\mathcal{L}_o$ is the the log-likelihood function in the model with only an intercept. In board turbulence, the chairman's impact has been removed. All regressions contain full sets of year and industry dummies. These are not reported.

Table 4.6 Higher board turbulence following CEO turnover? GMM estimation with board turbulence as dependent variable, and varying with different definitions of CEO turnover and firm performance. All listed non-financial firms at Oslo Børs 1989 to 2002.

	FP is Stock return			FP is Return on assets		
	Stock return			Return on assets		
Lagged variables	All CEO turnover	CEO and chairman turnover	Forced turnover	All CEO turnover	CEO and chairman turnover	Forced turnover
CEO turnover, same year	0.106**	0.317**	0.055	0.115**	0.327**	0.068
CEO turnover	0.192**	0.132**	0.104*	0.192**	0.148**	0.125**
Firm performance (FP), same year	0.000	0.000	0.000	-0.001	0.000	-0.001
Firm performance (FP)	0.000	0.000	0.000	-0.001	-0.001	-0.001*
Outside owner	0.443**	0.530**	0.619**	0.508**	0.433**	0.699**
Independence	-0.074**	-0.064**	-0.054**	-0.076**	-0.066**	-0.053**
Board ownership	-0.179	-0.177	-0.150	-0.157	-0.096	-0.144
Exported CEO	0.007	0.017	0.004	0.009	0.018	0.017
Imported CEO	-0.104	-0.076	-0.007	-0.110	-0.046	-0.105
CEO director	-0.100	-0.079	-0.140**	-0.114*	-0.081	-0.187**
Network	-0.025	-0.093	0.004	-0.043	-0.051	-0.078
Board average age	-0.021**	-0.019**	-0.021**	-0.022**	-0.020**	-0.025**
Employee directors	-0.691	-0.904**	-0.819*	-0.897**	-0.970**	-1.007**
Firm size	-0.029	-0.021	-0.010	-0.051	-0.041	-0.038
Risk	-0.060	-0.034	-0.053	-0.064	-0.039	-0.063
N	1135	1135	1135	1237	1237	1237
Hansen J, p-value	0.528	0.519	0.305	0.510	0.642	0.488
Over ID test p-value	0.080	0.123	0.046	0.207	0.407	0.285

A full set of year and industry dummies are included as instruments in all regressions in addition to instruments from the explanatory variables and transformations.

Table 4.7 Higher board turbulence following successful CEO turnover? GMM estimation with board turbulence as dependent variable, and varying with different definitions of CEO turnover and firm performance. All listed non-financial firms at Oslo Børs 1989 to 2002. Dummy variables indicate improved or reduced performance with new CEO.

	FP is Stock return			FP is Return on assets		
Lagged variables	All CEO turnover	CEO and chairman turnover	Forced turnover	All CEO turnover	CEO and chairman turnover	Forced turnover
CEO turnover, same year	0.107**	0.316**	0.052	0.113**	0.324**	0.063
CEO turnover	0.188**	0.134**	0.099*	0.189**	0.147**	0.123**
Improved FP dummy	0.279	0.467	0.578	0.306	0.439	0.529
Reduced FP dummy	0.321	0.519	0.632	0.352	0.492	0.591
Firm performance, same year	0.000	0.000	0.000	-0.001	0.000	-0.001
Firm performance	0.000	0.000	0.000	-0.001	-0.001	-0.001*
Board ownership	-0.182	-0.140	-0.152	-0.163	-0.094	-0.148
External owner	0.450**	0.406**	0.635**	0.518**	0.427**	0.715**
Independence	-0.073**	-0.064**	-0.054**	-0.075**	-0.066**	-0.053**
CEO director	-0.093	-0.047	-0.133*	-0.112	-0.064	-0.182**
Exported CEO	0.006	0.014	0.003	0.010	0.017	0.018
Imported CEO	-0.095	-0.064	-0.001	-0.109	-0.029	-0.103
Network	-0.028	-0.104	-0.006	-0.042	-0.059	-0.089
Board average age	-0.021**	-0.020**	-0.022**	-0.023**	-0.020**	-0.026**
Employee directors	-0.697	-0.936**	-0.815*	-0.888**	-1.017**	-0.999**
Firm size	-0.026	-0.020	-0.006	-0.052	-0.046	-0.035
Risk	-0.060	-0.035	-0.053	-0.063	-0.041	-0.058
N	1134	1134	1134	1235	1235	1235
Hansen J, p-value	0.533	0.522	0.298	0.544	0.645	0.503
Over ID test p-value	0.088	0.164	0.056	0.267	0.412	0.319
Exclusion FP dummies	0.739	0.766	0.724	0.737	0.941	0.686

A full set of year and industry dummies are included as instruments in all regressions in addition to instruments from the explanatory variables and transformations. 'Improved FP dummy' is a binary variable taking the value 1 if the CEO turnover has resulted in an improved firm performance (FP). 'Reduced FP dummy' is a binary variable taking the value 1 if the CEO turnover led to reduced firm performance. 'Exclusion FP dummies' is an exclusion test (Greene, 2003, p. 102) of the two firm performance dummies for improved or reduced firm performance subsequent to CEO turnover.