The Causal Effect of Board Size in the Performance of Small and Medium-Sized Firms*

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Abstract: Boards are endogenously chosen institutions determined by observable and unobservable firm characteristics. Empirical studies of large publicly traded firms have shown a robust negative relationship between board size and firm performance. The evidence on small and medium-sized firms is less clear; we show that existing work has been incomplete in analyzing the causal relationship due to weak identification strategies. Using a rich data set of almost 7,000 small and medium-sized closely held corporations we provide a causal analysis of board size effects on firm performance: We use a novel instrument firmly grounded in the institutional setting surrounding most small and medium-sized firms given by the number of children of the chief executive officer (CEO) of the firms. First, we find a strong positive correlation between family size and board size and show this correlation to be driven by firms where the CEO's relatives serve on the board. Second, we find empirical evidence of a small adverse board size effect driven by the minority of small and medium-sized firms that are characterized by having comparatively large boards of six or more members.

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Abstract: Boards are endogenously chosen institutions determined by observable and unobservable firm characteristics. Empirical studies of large publicly traded firms have shown a robust negative relationship between board size and firm performance. The evidence on small and medium-sized firms is less clear; we show that existing work has been incomplete in analyzing the causal relationship due to weak identification strategies. Using a rich data set of almost 7,000 small and medium-sized closely held corporations we provide a causal analysis of board size effects on firm performance: We use a novel instrument firmly grounded in the institutional setting surrounding most small and medium-sized firms given by the number of children of the chief executive officer (CEO) of the firms. First, we find a strong positive correlation between family size and board size and show this correlation to be driven by firms where the CEO's relatives serve on the board. Second, we find empirical evidence of a small adverse board size effect driven by the minority of small and medium-sized firms that are characterized by having comparatively large boards of six or more members.

1 Introduction

The structure and size of corporate boards have received much attention in the media and in the business community recently, fuelled by the prominent business failures of large companies such as Enron, Worldcom and Parmalat. The general view that board characteristics matter is reflected by an abundance of national and international guidelines for good corporate governance. A survey of the codes of conduct reveals that without exemption, a substantial amount of space is devoted to the specific organization of the corporate board.[1] Nine of the fifty-one codes in the survey even go as far as to recommend specific size limitations on the number of directors. These size recommendations find their support in recent empirical research, which has established a negative relationship between board size and firm performance.

Characteristics of corporate boards are generally viewed as arising endogenously in response to the agency problems inherent in governing any organization (Hermalin and Weisbach, 2003). Board size, in particular, is known to be correlated with a number of observable firm characteristics (e.g. firm size, firm age, industry affiliation). It is also likely to depend on a number of unobserved factors, including factors that are potentially correlated with firm performance such as investment and growth opportunities. This makes a causal interpretation of any observed correlation between board size and performance highly contestable even when it is possible to control for observable determinants of board size. In summarizing the empirical board size literature, Hermalin and Weisbach (2003) conclude that sorting out the appropriate interpretation of the results on board size and corporate performance is an important topic for future research.

The main contribution of the present paper is to provide a thorough causal analysis of board size effects in small and medium-sized firms. We propose an instrumental variable (IV) approach which makes use of a unique dataset that allows us to define a novel instrument for board size, the number of children of the CEO. Given the prevalence of family firms, this instrument is firmly

[1] All codes of conduct for good corporate governance that were available on the homepage of the European Corporate Governance Institute (www.ecgi.org) in January 2005 were collected and analyzed for discussions of the structure and role of the corporate board. The most recently issued code by either a governmental body or the local stock exchange was picked for each country, providing a sample of 51 codes.

grounded in the institutional setting surrounding most closely held corporations.[2] We show that the CEO's number of children is a plausible and valid instrument for board size: We find a strong positive correlation between the CEO's number of children aged 18 or above and board size driven by the subsample of firms where CEO relatives serve on the board. Moreover, we find little evidence to suggest that the CEO's number of children is correlated with unobservable determinants of firm performance; this supports the exclusion restriction. Having established that our instrument satisfies both the identifying and exclusion restrictions allows us to give the observed correlation a causal interpretation: First, we find an overall small negative board size effect. Second, the adverse board size effect is driven by the minority of small and medium-sized firms with comparatively large boards of six or more members. Thus, we find no effect for firms with small boards of three to five directors.

One immediate concern with our results could be their relevance to the general board literature since our analysis is based on small and medium-sized firms in a single country. First, it is worth noticing that we use the *population* of privately held firms in Denmark. Second, a large body of literature shows that the most prevalent firm around the world is privately held *and* controlled by families.[3] Third, using data from Denmark, we obtain results that are consistent with the theoretical contributions by Jensen (1993) and Lipton and Lorsch (1992) and the empirical results in Yermack (1996) on large publicly traded firms in the U.S. Finally, we can replicate the basic results of a previous analysis of board size by Eisenberg et al. (1998) using data on small and medium-sized firms in Finland and illustrate the weaknesses of their identification strategy. This lends credibility to the relevance of our results to broad populations of firms.

The rest of the paper is organized as follows: In the next subsection we provide a brief survey on board size literature focusing on methodological issues involved in giving a causal interpretation to the board size-performance relationship. Section 2 describes the dataset. Section 3

[2]The empirical analysis is based on a sample of small and medium-sized closely held corporations from Denmark for which we obtained detailed information on the CEO and the CEO's nuclear family members. The current papers thereby adds to an emerging literature that uses variation in family characteristics to evaluate the effects of corporate organization on performance. See Bennedsen, Nielsen and Wolfenzon (2004); Bennedsen, Nielsen, Pérez-González and Wolfenzon (2006); and Bertrand, Johnson, Samphantharak and Schoar (2005).

[3]See La Porta, Lpez-de-Silanes and Shleifer (1999); Morck, Stangeland and Yeung (2000); Claessens, Fan and Lang (2000); Faccio and Lang (2002)

establishes in detail the source of exogenous variation in board size, which we derive from the CEO's family characteristics. In Section 4 a standard OLS based approach is used, the instrumental variable is introduced and finally we show that the negative board size effect is driven by the minority of firms with a comparatively large board. We conclude and discuss our findings in Section 5.

1.1 A Brief Overview of the Board Size Literature with a Focus on Causality

Theoretically, based on Mancur Olson's arguments from his study on the problems of collective actions, Jensen (1993) and Lipton and Lorsch (1992) have argued that large corporate boards may be less efficient due to difficulties in solving the agency problem among the members of the board. These authors conclude that large boards create less value than small boards.[4] This conclusion is summarized in the recent survey by Hermalin and Weisbach (2003 - p. 13, their emphasis):

> 'The idea is that when boards become *too* big, agency problems (such as director free-riding) increase within the board and the board becomes more symbolic and less a part of the management process.'

The survey by Hermalin and Weisbach also emphasizes that the corporate board should be considered an endogenously determined institution and that its organization (e.g. board size) depends on a number of firm characteristics. A number of studies have analyzed the observable determinants of board organization (see Boone, Field, Karpoff and Raheja 2005; Lehn, Patro and Zhao 2004; Linck, Netter and Yang 2005 and Raheja 2005) although these papers have little to say about the link between board size and performance.

The first empirical study of board size effects on performance was done by Yermack (1996) who analyzes a panel of 452 large US firms in the period from 1984 to 1991. Using a fixed effects approach, he shows that there is a negative and significant board size effect on Tobin's Q and that smaller boards fire CEOs more frequently. The negative board size effect on performance has been confirmed in a number of studies on large publicly traded US firms. Other studies

[4] In fact Jensen (1993, p. 865) writes *"When boards get beyond seven or eight people they are less likely to function effectively and are easier for the CEO to control."*

of large US firms provide evidence that the board size effect depends on the organizational form; Adams and Mehran (2002) find a positive board size effect for US banking firms whereas Coles, Daniel and Naveen (2004) show that the negative board size effects does not hold for firms with complex operations. Several studies show that the negative board size effects also exist for publicly traded firms in other countries, for example: Conyon and Peck (1998) in a sample of publicly traded firms in the UK, France, the Netherlands, Denmark and Italy; Mak and Kusnadi (2001) in Malaysia and Singapore; Lodrer and Peyer (2002) in Switzerland; and de Andres, Azofra and Lopez (2005) in a sample of firms from ten OECD countries. In contrast, Jong, DeJong, Mertens and Wasley (2000) report insignificant board size effects in Dutch firms while Black, Jang and Kim (2003) do so in Korean firms. Kiel and Nicholson (2003) find positive board size effects in Australia. Thus with few exceptions, the negative board size effect is well established for large publicly held corporations across countries.

In a frequently cited study, Eisenberg *et al.* (1998) extend the literature on board size effects to include small and medium-sized closely held corporations. Their sample consisted of almost 900 small and medium-sized closely held corporations in Finland. Most of the firms had from three to seven directors on the board. A significant negative board size effect was found even for these small closely held corporations. Moreover, the estimated effect on performance was large: According to their most conservative estimates, an increase in board size, e.g. from 3 to 4 directors, would lower the returns on assets by approximately 11 percentage points on average at the sample mean of 13 percent.

In sum, the negative board size effect has been confirmed by many studies on publicly traded firms and extended to closely held corporations by a single study. This has created a general view in the literature that board size is negatively related to performance for firms and boards of all sizes. Hermalin and Weisbach (2003) conclude: "The data therefore appear to reveal a fairly clear picture: board size and firm value are negatively correlated".[5] This is in contrast to the theoretical literature quoted above, which holds that a negative board size effect should only apply to firms with a relatively large number of directors.

In the following, we re-examine the board size effect in small and medium-sized firms. To the

[5]This tendency was confirmed by tracking papers and articles that discuss board size effects using GOOGLE SCHOLAR. More than 100 articles state the existence of a negative board size effect on large *and* small firms using the Eisenberg *et al.* study as their only reference for the effect in small and medium-sized firms.

best of our knowledge this is the first paper that seeks to thoroughly identify the causal effect of board size on performance. Using an IV approach we address a general concern in the literature that board characteristics could be correlated with inherently unobservable determinants of firm performance. This suggests that board size should be treated as an endogenous regressor in order to estimate its causal effect on performance. Eisenberg *et al.* address this concern by using simultaneous equations estimation and adopt an identification approach which *a priori* hinges on a single restriction, namely the exclusion of the business group affiliation dummy from the performance relationship. The validity of this exclusion restriction is questioned by evidence in the corporate finance literature of lower firm value and performance in business groups (see Classens *et al.* 2002 and Volpin 2002 a.o.). Thus, the Eisenberg *et al.* identifying assumption which is crucial for the causal interpretation of their results, seems unfounded by the literature. Empirically, we show in the current paper that their findings of a large, negative board size effect can be attributed to an omitted negative effect of business group affiliation.

Studies on publicly traded firms have used other exclusion restrictions, for example the implementation of anti-director rights, ownership concentration, ownership by banks and institutional investors, network between boards in financial and non-financial firms (Postma, van Ees and Sterken 2003); the degree of state ownership (Beiner, Drobetz, Schmid and Zimmermann 2003); CEO tenure, CEO age, firm age and the amount of free cash flow (Coles, Daniel and Naveen 2004); and the percentages of outside directors (de Andres *et al.* 2005). The validity of any of these assumptions is contestable and it seems difficult to argue that the variables do not have a direct effect on firm performance, as would be required for valid identification: Numerous studies including Demsetz and Lehn (1985) and Morck, Shleifer and Vishny (1988), show the impact of ownership concentration on firm performance; the efficiency and performance of state owned enterprises have been a major concern in the expansive literature on privatization; the relationship between performance, good governance and the number of outside directors has been central in the debate over the last decade on how to improve the quality of governance in corporations.[6]

While acknowledging the inherent difficulties in a full system analysis of board size and firm performance, we argue in this paper that valid identifying assumptions can be established. In

[6]In our survey of codes of conducts, 47 of 51 codes recommend that corporate boards should include a number of independent directors.

particular, we show that the causal effect going from board size variations to the performance of small and medium-sized firms can be identified from the close family ties that characterize the majority of these firms. In comparison to the system analysis found in the literature, our approach is focused upon the causal performance effect while the determinants of board size are treated as a reduced form.

2 The Data

Our data include all closely held corporations with limited liability in Denmark in 1999. The data originate from the annual reports that all closely held corporations are required to submit to the Danish Ministry of Economic and Business Affairs. The data include financial items from both the income statement and the balance sheet, ownership information, and the name and identity of the CEO and the board members.

Similar to most Western countries, Danish company law distinguishes between two types of closely held limited liability companies, a traditional joint stock company and a less regulated version, denoted 'A/S' and 'ApS', respectively. The latter is the Danish equivalent of the American 'S-Corp' or the German 'GmbH'. The two company types differ substantially in terms of the regulations of boards, since 'A/S'-companies are obliged to have a corporate board with at least 3 members, whereas it is voluntary to establish a board for firms incorporated as 'ApS'. As a result, only the population of consolidated joint stock companies (A/S), totalling 14,909 in 1999, are considered.

We comply with the standard selection criteria for performance evaluations by excluding regulated industries and financial intermediaries from the analysis, thereby reducing the number of firms to 8,225.[7] A number of extremely small firms (primarily firms that were recently established) and firms that have changed industry or reporting standards are also excluded. As a result, 7,496 firms represent the population for this analysis.

Our main strategy in identifying the causal effect of board size on firm performance relies on the CEO's family characteristics. We use a sample of 6,850 firms for which we can access the

[7] *Inter alia*, utilities, financial intermediaries, business services, community, social and personal service activities that are likely to be regulated industries are excluded. Our sample consists of firms with primary industry affiliation within NACE groups 10 through 36 and 45 through 63.

CEO's family characteristics.[8] To access the family records in the official Danish Civil Registration System (CPR), we have obtained the CEO's social security number (CPR number) from a database from the Danish Commerce and Companies Agency (Erhvervs- og Selskabsstyrelsen) at the Ministry of Economic and Business Affairs. This dataset reports both the names and CPR numbers of the founders, management and board members of all firms with limited liability.[9] The name and CPR number of each CEO was submitted to the Danish Civil Registration System (CPR), the government agency responsible for administrating social security numbers. The agency then provided the family relations, including names and CPR numbers of all nuclear family members. Thus, by combining the data sets obtained from these three sources, we obtain a unique dataset with both firm and CEO family characteristics.

The CEO family characteristics sample of 6,850 firms has an average board size of 3.7, mean assets of 20.9 million DKR (2.8 million EUR) and a mean firm age of 18.1 years. Thus, our sample consists mainly of small and medium-sized firms. It complements the samples used by Yermack (1996) and others to study board size effects in large publicly traded firms which in general have much larger boards. The main variables in the gross and CEO family characteristics samples and their relationships to board size can be compared in Table 1. It is clear from the table that small and medium-sized firms dominate both samples and that the number of directors is positively related to firm size as measured by assets.

Table 1 also provides evidence on the raw relationship between performance and board size. For both samples, there are no noticeable differences between the average RoAs of firms with 3, 4 or 5 directors. Firms with six or more board members have lower RoAs on average. This pattern is confirmed when we industry-adjust RoA on the two-digit NACE level (the European industry classification system). In conclusion, Table 1 illustrates that there is some evidence of increased board size associated with lower returns on assets, but only for firms with comparatively large boards.

[8] We cannot track the family characteristics of foreign CEOs who have not become naturalized. As Danish nationality law prevents adults from holding multiple citizenships our sample will by construction exclude foreign CEOs.

[9] Under Danish corporate law firms are required to file with the Ministry any change in CEO or board positions within two weeks of the actual date of occurrence.

3 Family Size as Exogenous Variation in Board Size

We argue in the following that exactly the fact that many small and medium-sized firms have strong family ties provides a valuable source of variation in their governance characteristics, which can be claimed as exogenous in terms of corporate performance.[10] Specifically, we use information on the family relationships of the CEO to establish a valid instrument for the relationship between corporate performance and corporate board size. The candidate source of exogenous variation in board size is the CEO's number of children. We treat board size as being potentially endogenous in the performance relationship and control for a rich set of observable determinants of current performance.

Two conditions must be satisfied for the instrumental variable estimation strategy to work. First, a systematic relationship should be established between the CEO-related instrumental variable and the size of the corporate board. Secondly, the CEO-related information in itself should be exogenous, that is, not related to firm performance given the set of observable determinants of performance controlled for. Each condition is considered in turn and evidence is provided to substantiate this identification strategy.

First, due to the significant overlap between ownership and control in small and medium-sized firms the bulk of CEOs are controlling owners. In fact, more than 75 percent of the CEOs are also owners of the corporation. We regard the CEO's number of children at or above the age of eighteen[11] as being positively related to the size of the relevant 'pool' of director candidates. We expect such a correlation to be most pronounced in family-related businesses. Our prior is therefore that the relationship is statistically significant in firms where CEO relatives serve on the board, but less so in firms without family-board relations.

Table 2 shows the mean board size as a function of the CEO's number of children aged eighteen or above. The table indicates a general tendency toward a positive relationship between board size and CEO family size. We can reject the equality of means between individual family size categories. Specifically, in firms where the CEO has no children the average board size is 3.57 compared to an average of 4.32 for firms where the CEO has four or more (adult) children

[10] Bennedsen, Nielsen and Wolfenzon (2004) estimate—using a 50 percent control threshold—that between 80 and 90 percent of all small and medium-sized firms in Denmark are controlled by families.

[11] The age at which people are legally eligible to become board members.

(this difference is significant at the one percent level). The underlying correlation coefficient between board size and the CEO's number of children aged 18 or above is 0.13 (significant at the one percent level). In accordance with the argument outlined above, the correlation is stronger (with a correlation coefficient of 0.18) in the subsample of firms where CEO relatives serve on the board.[12] In contrast, the correlation between the instrumental variable and the return on assets is small: -0.004 for RoA and -0.011 for industry-adjusted RoA with p-values of 0.75 and 0.34, respectively. While no firm conclusions can be drawn at this stage, this can be seen as consistent with our exclusion restriction.

To further validate our claim that the number of CEO's children provides a source of systematic variations in board size across firms, Table 3 reports the identity of board members. We report the number of directors who are either the CEO, relatives of the CEO, other owners, other owners' relatives, or outsiders (the residual). We define relatives of the CEO such that we only count relatives who are not owners of the firm. Likewise we define other owners' relatives as people related to other owners but unrelated to the CEO. Finally, outsiders is the residual group of directors that are neither the CEO, owners nor their immediate family members.[13]

From Table 3 it is evident that 32.4 percent of all board members are CEOs, whereas CEO relatives occupy 19.5 percent of all board seats. Thus, in total the CEO and their relatives account for more than 50 percent of all directorships. Other owners and relatives account for 14 percent, whereas outsiders occupy the remaining 34 percent of the board seats. As a measure of the quantitative importance of our instrumental variable, the number of CEO children, we note that among the CEO relatives the children account for 31.8 percent of the family board seats, corresponding to 6.2 percent of all board seats and 11.3 percent of board seats not occupied by managers or owners. Moreover, in firms with CEO-relatives on the board, the CEO and relatives account for almost two-thirds of the total board seats. Among these firms, the CEO's children account for 12.8 percent of all directorships. In sum, we provide evidence consistent with our identification strategy: CEOs and their relatives are frequently appointed as board members of

[12]The results reported below for the first stage of the 2SLS-IV procedure shows that a significant relationship between the number of the CEO's children and board size can also be established when controlling for other determinants of board size.

[13]We define relatives as nuclear family members. Thus, Table 3 provides a lower bound on the estimated family influence on boards of small and medium-sized firms.

small and medium-sized firms. This evidence adds credibility to the core of our identification argument.

Table 4 reports the first stage regression, where we control for an array of firm characteristics.[14] We find a strong positive effect of the CEO's number of children aged eighteen or above on board size. On average, the board size increases by 0.08 members for each adult offspring, an effect which is significant at the one-percent level. The effect is robust against controlling for ownership characteristics in Column II. In Column III we condition on whether CEO relatives are serving on the board. Consistent with our identification strategy we find a larger effect of CEO children on board size in the sub-sample of firms where our story predicts the strongest link. Finally, in Column IV we restrict the sample to CEOs with at least one child aged 18 or above. The coefficient on the number of children increases to around 0.14, which is almost twice as large as the coefficient obtained in the full sample (Column II). Thus, the identification of board size is not driven by CEOs without children as we find a stronger correlation for the sub-sample of CEOs with (adult) offspring.

The second condition for the validity of our identification strategy is the requirement that CEO family characteristics are indeed exogenous and excludable from the performance relationship. Two types of endogeneity problems figure prominently in the literature: Reverse causation and omitted variable bias. Reverse causation in this context would imply that CEOs make fertility decisions based on the performance of the firm. We note that the fertility decision and subsequent firm performance are well separated in time with firms being observed in 1999 and the CEO offspring being born in 1981 at the latest. Moreover, we present an alternative specification that employs the number of *founders'* children as an instrument for board size in a robustness check in Section 4. In the founder sample, fertility decisions and business decisions are even longer separated in time to an extent that makes reverse causation highly unlikely.

In terms of omitted variables, the basic exogeneity claim is that—conditionally on observable determinants of current performance—there should be no correlation between the instrumental variable, the CEO's number of children, and unobservables affecting current firm performance. The claim is supported first of all by the fact that we are able to control for a rich set of current firm characteristics. Secondly, while a small negative correlation between the number of CEO

[14]We will introduce each of the control variables in Section 4. Summary measurements of the variables included in the regressions are found in Table 5.

children and firm performance was identified above, this can be attributed to the reduced-form relationship going via board size and thus fully consistent with the exclusion restriction. While the exclusion restriction remains contestable we will address some immediate concerns regarding omitted variables.

First, the innate ability of the CEO in managing the firm is a potential omitted variable and (positively) related to fertility. However, there is also a potential negative effect of having more children due to the trade-off between time invested in child-bearing activities and in acquiring managerial skills. While the likelihood that time-intensive child-care activities have an impact on firm performance reduces due to the long time-lag between births and current firm performance, there is *a priori* no definite sign apparent for any correlation related to ability and fertility decisions. Second, a prime candidate for an omitted variable in the context of small and medium-sized firms is 'family conflict'. Bennedsen, Nielsen and Wolfenzon (2004) argue that the likelihood of family conflict increases in the number of children and show that conflict impacts business decisions and, thereby, potentially affects firm performance negatively. If this bias is prevalent our IV estimates of the board size effect will be negatively biased. Third, a potential source of correlation could be derived from the process of CEO choice in family firms. In particular, Bennedsen, Nielsen, Pérez-González and Wolfenzon (2006) show that the *departing* CEO's family size is positively correlated with appointing a family heir as the new CEO, which is shown to be harmful to post-succession performance. However, here we measure the family size of the *current* CEO. Thus, any effect of the current CEO's family characteristics on performance again seem ambiguous. We further control for direct performance effects by including a dummy for firms where the CEO is an owner. Moreover, the majority of firms in our sample are fairly young with a median firm age of 14 years. Few will therefore have undergone any generational change in management. Again, the net impact, if any, on firm performance via a family CEO channel appears ambiguous.

In sum, we will conclude that there is little evidence that our instrument does not satisfy the basic exclusion restriction. Any effect of CEO's family relationships on current performance runs via the size of the corporate board and not through current but unobserved aspects of the management of the firm.

4 The Link between Board Size and Firm Performance

This section reexamines the empirical relationship between board size and firm performance. In addition to the IV-results we estimate the OLS relationship to facilitate comparisons. We proceed by reporting the OLS results as well as the second stage of the IV analysis using the CEO's number of children as an exogenous source of variation in board size. We then show how the differences between our results and the results in Eisenberg *et al.* most likely can be attributed to their identification strategy. Based on the conclusions from the IV analysis, we provide additional insights on the composition of the board size effect. The final subsection provides robustness checks to our identification strategy by using the number of founders' children as an instrument for board size.

4.1 OLS and Instrumental Variable Results

The dependent variable in the performance equation is the operating return on assets (RoA) of the firm in 1999. This performance measure is known to be quite noisy, although few good alternatives exist when analyzing the performance of closely held firms. The variable of main interest, the number of board members, enters linearly in the basic specification. Other studies have imposed a log transformation, e.g. Yermack (1996), or even used a twice log-transformed version, as in Eisenberg *et al.* (1998). It is noted that the range of variation in board size is narrow and, if anything, the unconditional relationship between board size and performance in Table 1 suggests smaller effects of absolute changes in the lower range of board sizes than in comparatively large boards, not larger effects as would be implied by a log transformation. None of our basic findings are affected by the choice of a simple linear specification.

The following standard set of controls[15] for firm performance is employed throughout the empirical analysis: Firm size (log. to assets); the age of the firm; and a dummy for firms operating in multiple business segments as well as a dummy for being in a business group.[16] Summary measurements of the variables included in the regressions are found in Table 5.

Variables related to ownership are also available due to the richness of the data set, particu-

[15] Industry dummies at the two-digit NACE level are included throughout.

[16] Both Yermack (1996) and Rajan, Servaes, and Zingales (2000) find evidence that more diversified firms are less profitable. See the survey by Stein (2003).

larly information on the number of owners. Ownership distribution - and especially the number of owners - may have a direct impact on performance, since it is the main mechanism aligning the interest of controlling and non-controlling owners (Bennedsen and Wolfenzon 2000). We control for the ownership distribution by including an indicator variable that takes the value one when the firm has multiple owners, thereby using single-owned firms as the reference category. We further add a dummy for whether the CEO is an owner, to control for differences in performance between firms with a family CEO and firms with an outside CEO.

Table 6 reports the results from the OLS and IV-regressions. The regressions in Columns I and II include only board size and the standard controls, whereas Column III and IV add ownership variables. Most effects of standard controls are consistent across the specifications. Firm size has an increasing although concave effect on performance. The multiple business segment dummy is insignificant, whereas firms with a business group affiliation have a significantly lower performance. Older firms seem slightly less profitable than younger firms.

The OLS estimate of the performance effect of board size is negative and, although small, highly significant. Adding ownership information does not change that conclusion. The consistency of the OLS results and their *ceteris paribus* interpretation clearly rely on the exogeneity of all regressors in the performance equation, including the board size variable. The IV regressions examine the empirical validity of this assumption.

The main issue is whether board size variations are endogenous in the performance equation and whether any resulting inconsistencies matter substantially for the estimated board size effect. As argued in the introduction, unobserved performance determinants may exist that are also related to board size. If so, the OLS results do not identify the causal effect of board size variations on performance. To further investigate the exogeneity issue, the proposed instrumental variable, the CEO's number of children, is employed as a source of exogenous variation in board size.[17]

Columns II and IV in Table 6 report IV estimation results based on the extended specification of the structural performance equation. The performance equation is estimated in a two-stage least squares procedure. The first stage is a reduced-form regression of board size

[17] As discussed extensively in Section 3, our main identifying argument is that once we have controlled for a rich set of potential performance determinants, including ownership variables, then the variations in the CEO's number of children is unrelated to unobserved firm characteristics.

on the instrumental variables and on all the other exogenous variables in the model.[18] The second-stage regression includes the predicted value of board size from the first-stage regression along with the exogenous determinants of performance.

The effect of board size is negative and larger in numerical value than in the OLS regression, but is insignificantly different from zero. On the other hand, even with the inflated standard errors we can safely reject any negative board size effects in the order of magnitude of 11 percentage points found by Eisenberg *et al.* (1998).

The relative precision of the instrumental variables estimates clearly relies on the strength of the instrument applied here. A test of the validity of the instrument can provided by testing the significance of the reduced-form relationship between the potentially endogenous regressor, board size, and the instrumental variable, the CEO's number of children, conditional on the set of included exogenous regressors in the performance equation. In the case of no significance, a "weak instruments" problem exists. In order for an instrumental variable not to be weak, Staiger and Stock (1997) argue that F-tests of significance should be at least five and preferably ten. The CEO's number of children qualify as a valid instrument based on this criterion with a F-test of identification of 54.7 and 53.8 in Column II and IV, respectively. Thus, our exogenous variation in board size, the CEO's number of children, appears as a strong instrument in both specifications.

Having established a significant correlation between the proposed source of exogenous variation and the size of the board, the instrumental variable can then be used to address the question if the board size effect estimated by a simple OLS regression is substantially biased or not. Table 6 reports the Hausman test.[19] The test is based on adding the residual of the first stage regression to the structural performance equation and testing its significance. of the significance of the differences between the OLS estimates (which are consistent and efficient if board size turns out exogenous) and the IV results (which are consistent in any case). Based on the CEO's number of children instrument there is no evidence that the OLS estimates are significantly biased, as the Hausman test has a $p-$value of 51 percent. Thus, the OLS results are

[18]The corresponding first-stage regressions of board size were reported in Columns I and II in Table 4, respectively.

[19]The particular form of the test performed here is a residual-addition test, see e.g. Davidson and MacKinnon (1993) or Wooldridge (2002).

preferable on the grounds of efficiency.[20] A similar conclusion emerge from Column IV where we have added ownership controls.

In conclusion, the CEO's number of children has been established as a valid instrument for the performance equation. Based on the Hausman test, OLS results are preferred to the IV-estimates. Thus, we find a negative board size effect although of a significantly lower order of magnitude than the findings of the existing study by Eisenberg *et al.* (1998). To explain this difference we proceed by replicating the Eisenberg *et al.* identification strategy in our sample of Danish small and medium-sized firms.

4.2 Replication of the Eisenberg *et al.* identification strategy

Eisenberg *et al.* address the endogeneity concern by using a simultaneous equations approach. They model board size as a function of performance, size, age and whether or not the firm belongs to a business group.[21] The performance equation, on the other hand, models the return on assets (RoA) as a function of board size, board member payment disturbances, the size and age of the firm, and the change of total assets as a measure of growth opportunities. The identification of board size effects in the performance relationship *a priori* hinges on a single restriction, namely the exclusion of the business group dummy from this relationship.

We already noted in the introduction that there is ample empirical evidence to counter such a restriction. Likewise, we found strong and negative effects of business group affiliation in Table 6. Nevertheless, in order to replicate the Eisenberg *et al.* findings on our data we will follow their identifying strategy and impose the exclusion restriction. The results are reported in Table 7 together with OLS results to facilitate a comparison with our results. We report the results without (Column I and II) and with ownership variables as controls (Column III and IV) as ownership information is absent in the Eisenberg *et al.* study.

The OLS results again show a small negative board size effect comparable to the results we obtained in Table 6 where the business group affiliation dummy was included. In contrast, the IV results differ dramatically as we now find a negative board size effect of 11 percentage points.

[20] OLS can be seen as a special case of IV where no instruments are used. When all the regressors are in fact exogenous, the OLS estimator is efficient in this class of estimators, see Wooldridge (2002, page 97) for further discussion.

[21] See Table 3 of Eisenberg *et al.*

Thus, when replicating the identification strategy we obtain results which are very similar to the Eisenberg *et al.* result: Increasing the board size by one from three to four directors will lead to 11 percentage points lower return on assets.

Having replicated their identification strategy we have shown that the extremely large board size effect is an artifact of the Eisenberg *et al.* identification strategy. From Table 4 it is evident that business group affiliation is positively and significantly correlated with board size. Thus, the business group dummy meets the first out of the two necessary conditions for a valid instrument. However, there appears to be a strong and significantly negative direct effect of business group affiliation on performance as shown in Table 6. Thus, the proposed instrument violates the exclusion restriction, due to the well-documented negative effect of business group affiliation on performance (see Claessens *et al.* 2002 and Volpin 2002 a.o.). Eisenberg *et al.* thereby erroneously attribute the negative effect of business group affiliation to board size due to the direct effect of business group affiliation on operating performance.

4.3 Additional Insights on the Negative Board Size Effect

In the current sub section we examine how different board sizes contribute to the overall result of a small negative board size effect, which we established in the previous sections. In particular, we are interested in whether small and medium-sized firms with comparatively large boards dominate the negative effect as suggested both by the theory on corporate boards (Jensen, 1993; Lipton and Lorsch, 1992) and by our unconditional means in Table 1.

We apply two approaches. The first approach uses the fact that board size is an integer to construct dummy variables for boards of four, five, six and seven (or more) members, while the second approach uses a piecewise linear approach similar to that applied by Morck, Shleifer, and Vishny (1988). It specifies a linear relationship between board size and RoA, but allows for different slopes in small (five or fewer members) and large boards (six or more members). The effects of other performance determinants are largely unaltered by introducing a flexible board size specification. They are therefore not reported in Table 8.

The unrestricted dummy variable specification in Column I suggests no effects of boards of three to five members. Boards with six and seven or more members are associated with a significantly lower RoA. The F-test of excluding dummies for small boards of five or less members is easily accepted. The restricted specification reported in Column II shows a strongly

significant effect of large boards. Boards with six members have a 1.87 percentage point lower RoA, whereas boards with 7 or more members have a 3.29 percentage points lower RoA than firms with small boards. This suggests that the small negative board size effect we encountered in the previous section is an average of no effect for board sizes of five or lower and a larger negative effect for larger boards.

In Column II of Table 8 we cannot reject the null of identical effects of six and seven or more members. In Column III we therefore estimate the joint effect of six of more board members. Finally in Columb IV we use a piecewise linear specification. For the piecewise linear approach, a change in the slope of the board size-performance relationship at six board members is allowed for. The breakpoint between five and six is suggested by the unconditional RoAs reported for each board size in Table 1 and by the results in Column I and II. Again, the effect is found to be insignificant in small boards. Increasing the board size only appears to be associated with a significantly lower RoA in comparatively large boards with six or more members.

In summary, the results of the decomposition of the negative board size effect are thus supportive of the prediction by Jensen (1993) and Lipton and Lorsch (1992) that negative board size effects due to agency problems become relevant in boards with seven or more members. The findings in this paper are also consistent with Yermack's (1996) finding of a negative board size effect in boards of seven or more members.

4.4 Robustness Check: Number of Founders' Children as Exogenous Variation in Board Size

This section analyses the robustness of the results of the main analysis. In particular, we focus on the robustness regarding the validity of the identification strategy. The core identification argument relied on CEO family characteristics to instrument board size utilizing the fact that the vast majority of small and medium-sized firms are family controlled.

Essentially, it is necessary for the instrumental variable not to correlate with current performance, given the observable performance determinants included in the model. As a robustness check we now consider an alternative strategy using the family relations of the *founders* of the firm to identifying the board size-performance relationship. A founder-based strategy is considered conservative in terms of the critical *a priori* argument of exogeneity of the instrumental variable.

Nonetheless, the added credibility of the founder-based instrument comes at a potential cost in terms of the precision of the estimates because it is expected to show a lower correlation with current board size than the alternative, the current CEO's number of children, and is available for a smaller proportion of the firms.

Personal founder information is available for around one-third of the firms in the CEO family characteristics sample of 6,850 firms. The founders of a firm are defined as the one or more individuals who filed the forms and officially registered the firm with the Danish Commerce and Companies Agency. In most cases the founders are one or more of the original owners. In any case, the founders can be held liable for the firm's activities until the company is formally incorporated.

There is a substantial reduction in the number of observations due to the fact that founder information is available only for firms incorporated in 1986 or later. Similarly, the information is not available on firms registered by other corporations, law firms, etc. The requirement that all founders are individuals leave a sample of 2,087 observations with the necessary founder information.[22]

The construction of the sample explicitly imposes a time lag between fertility decisions affecting founder-related information and the earliest establishment date of any firm in the sample, which thereby limits the relevance of "reverse causation" considerations. Specifically, because the founder data only include firms established in 1986 or later, the fertility decision was taken at least 5 years before the firm was established as we only count children aged 18 or above 1999 (i.e. children born in 1981 or before).[23]

Column II in Table 9 reports the results from the IV estimates using number of founders' children aged 18 or above as the instrument for board size. In addition to the controls used throughout the paper, we control for the number of founders of the firm, since the number of

[22]Approximately one third of the firms with personal founders have a single founder and approximately 90 percent of the firms have three or less founders. Firms with ten or less founders only are considered in order to limit the importance of special ownership arrangements with a very large number of individual owners or founders. This excludes less than .4 per cent of the firms with available founder information.

[23]The time lag also solves any potential identification problems arising from board organization being "sticky", i.e. the fact that changes in board organization are rare. The presence of stickiness implies that current board organization may be related to lagged determinants. However, due to the lag between fertility decisions and firm establishment any lagged variable affecting current board size will be subsequent to our choice of instrument.

persons who founded the firm is correlated with firm characteristics already included in the regression, in particular the size of the board.

Again, the basic insights from the main analysis are confirmed. Board size has a negative, although insignificant effect on performance. The test of identification reveals that the number of founders' children is not a weak instrument for board size, whereas the test for whether board size is endogenous remains insignificant. We therefore prefer the OLS results in Column I, which confirms the small negative board size effect, on the grounds of efficiency. Thus, our results remain unchanged when we apply a more conservative instrument in terms of fulfilling the exclusion restriction.

5 Discussion

A primary contribution of this paper is to produce estimates of the effect of board size on performance that can be given a causal interpretation. Moreover, we find that standard OLS results provide valid and precisely estimated small negative board size effects.

Based on these findings, we separated the effect of (comparatively) large versus small boards. First, no performance effects were found when varying the board size at levels below six directors, the typical range of board size in small and medium-sized firms. Second, a significantly negative effect was found when increasing the size of boards with six or more members. This is consistent with the findings in Yermack (1996) on listed US corporations and shows that a negative board size effect extends to small and medium-sized closely held firms, but only to the minority of firms with comparatively large boards. The performance of the great majority of closely held firms shows no signs of being adversely affected by small increases in the size of their boards.

Overall, our analysis challenges the existence of a large negative board size effect for small boards in closely held corporations. As theory suggests, there are good reasons not always to choose the minimum board size. Given that board organization and the optimal number of directors occupy such a prominent place in many guidelines for good corporate governance and are discussed intensively in the business media and within many corporations, we believe our analysis, together with the well-established negative board size effect in large publicly traded firms, contains a clear policy message: Finding the right number of directors is a trade off between the benefits of having sufficient competencies represented and the cost arising from

increased free riding among board members. Each firm must find the best trade off, and for most small and medium-sized firms this will be anything from three to five board members.

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Table 1: Board Size and Return on Assets

This table reports the mean and median of book value of *assets*, operating return on assets (*RoA*) and *industry adjusted RoA* for board size categories ranging from 3 to 7+. Medians are reported in parentheses. *All firms* is the gross sample of firms, whereas *CEO Family Characteristics Sample* is the sample of firms for which we were able to obtain information on the CEO's family characteristics (see Section 2 for further details).

	All firms				**CEO Family Characteristics Sample**			
Board Size	N	Assets	RoA	Industry adjusted RoA	N	Assets	RoA	Industry adjusted RoA
3	4,542	10.8 (5.8)	0.067 (0.063)	0.004 (0.000)	4,191	10.6 (5.8)	0.067 (0.063)	0.004 (0.000)
4	1,614	20.6 (7.8)	0.061 (0.061)	-0.001 (0.000)	1,459	18.5 (7.5)	0.063 (0.061)	0.001 (0.001)
5	871	27.4 (12.5)	0.065 (0.066)	0.003 (0.004)	794	26.3 (11.8)	0.066 (0.065)	0.004 (0.004)
6	288	108.9 (25.6)	0.046 (0.050)	-0.016 (-0.011)	251	95.0 (23.7)	0.052 (0.051)	-0.011 (-0.013)
7+	181	183.5 (42.0)	0.035 (0.040)	-0.025 (-0.012)	155	171.3 (39.7)	0.036 (0.041)	-0.023 (-0.008)
All	7,496	22.8 (7.1)	0.064 (0.062)	0.002 (0.000)	6,850	20.9 (6.9)	0.065 (0.062)	0.002 (0.000)

Table 2: CEO Family Size, Board Size and Performance

This table reports the mean board size, operating return on assets (*RoA*) and *industry adjusted RoA* for CEO's number of children aged 18 or above categories ranging from 0 to 4+. We test the equality of means between firms where the CEO has 0 and 4+ children aged 18 or above. Numbers in brackets are p-values, whereas *** denotes significance at 1 percent level.

CEO's number of children aged 18+	N	Board Size	RoA	Industry-adjusted RoA
0	2,377	3.56	6.665	0.056
1	988	3.63	5.610	-0.061
2	2,262	3.66	6.904	0.055
3	906	3.78	5.829	-0.048
4+	317	4.32	6.774	0.045
All	6,850	3.67	6.483	0.002
Difference between 0 and 4+		6.12*** [0.000]	0.02 [0.878]	0.02 [0.887]

Table 3: Board Member Identity and CEO Relatives

This table reports the identity of *All board members* in the CEO family characteristics sample and for *Board members in the sub sample of firms with CEO relatives on the board*. We classify board members into: CEO, CEO relatives, Other owners, Other owners' relatives and Outsiders (the residual). CEO relatives are the relatives of the CEO who are not owners of the firm. We define Other owners' relatives as people related to other owners but unrelated to the CEO. Outsiders is the residual group of directors that are neither CEO, Owner or their immediate family members. Relatives are defined as nuclear family members. We further classify CEO relatives into Spouses, Childen, Siblings and Parents.

	All board members		**Board members in sub sample of firms w/ CEO relatives on board**		
Board member identity	N	%	N	%	% relatives
CEO	8,080	32.4	2,973	24.3	
CEO relatives					
- Spouse	2,755	11.0	2,755	22.5	56.1
- Child	1,560	6.2	1,560	12.8	31.8
- Sibling	34	0.1	34	0.3	0.7
- Parent	560	2.2	560	4.6	11.4
			4,909	40.1	
Other owners	3,163	12.7	829	6.8	
Other owners' relatives	320	1.3	106	0.9	
Outsiders	8,498	34.0	3,410	27.9	
All	24,970	100.0	12,227	100.0	

Table 4: First Stage Regression of Board Size–Firm Performance Relationship

The dependent variable is Board Size. This table reports the first stage from the two-stage-least-squares estimation of board size–firm performance relationship using the CEO's number of children as instrument for board size. Column I and II is the CEO family characteristics sample, Column III is the sub sample of firms with a CEO-relative on the board, whereas Column IV is the sub sample of firms where the CEO has at least one adult offspring. Numbers in parentheses are t-statistics based on robust standard errors. Each equation also includes intercept and industry dummies on the two-digit NACE level. *, ** and *** denote significance at the 10, 5 and 1 percent levels in a two-sided test, respectively.

	(I)	(II)	(III)	(IV)
Estimation Method	OLS	OLS	OLS	OLS
A. Identification				
CEO's Number of Children Aged 18+	0.0847***	0.0814***	0.0944***	0.1384***
	(7.31)	(7.22)	(6.78)	(6.82)
B. Controls				
Firm Size (log. Assets)	0.2635***	0.2191***	0.1747***	0.23***
	(17.6)	(15.1)	(10.5)	(14.0)
Firm Age	0.0022***	0.0027***	0.0021*	0.003***
	(2.75)	(3.27)	(1.91)	(2.77)
Multiple Business Segments	0.0309	0.0271	0.0633**	0.0255
	(1.20)	(1.09)	(2.11)	(0.83)
Business Group	0.3453***	0.3088***	0.1079	0.1936**
	(4.19)	(3.87)	(0.98)	(2.24)
C. Ownership				
Multiple Owners		0.3933***	0.5171***	0.3997***
		(17.4)	(16.8)	(13.7)
CEO is Owner		-0.3459***	-0.217***	-0.3437***
		(9.89)	(-4.83)	(8.26)
Industry Effects	YES	YES	YES	YES
N	6,850	6,850	3,443	4,480
R-squared	0.16	0.21	0.21	0.21

Table 5: Descriptive Statistics on Regression Variables

This table summarizes the mean, standard deviation, 5-percentile (P5), median and 95-percentile (P95) of the variables used in the regressions throughout the paper.

(N = 6,850)	**Mean**	**Std. Dev.**	**P5**	**Median**	**P95**
Return on Assets	0.065	0.128	-0.121	0.062	0.258
Board Size	3.67	3	3	3	6
Firm Size (Assets)	20.8	133.2	1.3	6.9	59.7
Firm Age	18.1	17.1	2	14	42
Multiple Business Segments	0.434	0.496	0	0	1
Business Group	0.060	0.238	0	0	1
Multiple Owners	0.557	0.497	0	1	1
CEO is Owner	0.762	0.426	0	1	1

Table6: OLS and IV Estimates of the Board Size-Firm Performance Relationship

The dependent variable is the operating return on assets (RoA). This table reports the second stage from the two-stage-least-squares estimation of the board size–firm performance relationship using the *CEO's number of children* as instrument for board size (see Section 4 for a motivation of the instrument and Table 4 for the first-stage regressions). *Identification* is an F-test of the significance of the instrument in the first-stage regression. *Hausman* is a test of significant bias in the corresponding OLS estimates. Numbers in parentheses are t-statistics, whereas numbers in brackets are p-values. Both are computed using robust standard errors. Each equation also includes intercept and industry dummies on the two-digit NACE level. *, ** and *** denote significance at the 10, 5 and 1 percent levels in a two-sided test, respectively.

	(I)	(II)	(III)	(IV)
Estimation Method	OLS	IV	OLS	IV
A. Board Variables				
Board Size	-0.0068***	-0.0161	-0.0059***	-0.0178
	(-4.56)	(-1.12)	(-4.03)	(-1.27)
B. Controls				
Firm Size (log. Assets)	0.0145***	0.0170***	0.0148***	0.0178***
	(8.30)	(4.00)	(8.47)	(4.48)
Firm Age	-0.0005***	-0.0005***	-0.0006***	-0.0005***
	(-6.19)	(-5.62)	(6.40)	(-5.67)
Multiple Business Segments	-0.0011	-0.0008	-0.002	-0.0015
	(-0.35)	(-0.25)	0.63	(-0.47)
Business Group	-0.0324***	-0.0292***	-0.0323***	-0.0284***
	(-5.84)	(-4.00)	5.84	(-4.00)
C. Ownership				
Multiple Owners			0.0227	0.0252
			(1.37)	(1.51)
CEO is Owner			0.0124***	0.0079
			(2.94)	(1.15)
Industry Effects	YES	YES	YES	YES
Identification		54.7***		53.8***
		[0.000]		[0.000]
Hausman Test		0.53		0.72
		[0.514]		[0.395]
N	6,850	6,850	6,850	6,850
Root Mean Squared Error	0.13	0.13	0.13	0.13

Table 7: OLS and IV Estimates of the Board Size-Firm Performance Relationship Using the Eisenberg et al. (1998) Identification Strategy

The dependent variable is the operating return on assets (RoA). This table reports the second stage from the two-stage-least-squares estimation of the board size–firm performance relationship where we replicate the Eisenberg et al. identification strategy by using *Business Group Affiliation* as the instrument for board size. *Identification* is an F-test of the significance of the instrument in the first-stage regression. *Hausman* is a test of significant bias in the corresponding OLS estimates. Numbers in parentheses are t-statistics, whereas numbers in brackets are p-values. Both are computed using robust standard errors. Each equation also includes intercept and industry dummies on the two-digit NACE level. *, ** and *** denote significance at the 10, 5 and 1 percent levels in a two-sided test, respectively.

	(I)	(II)	(III)	(IV)
Estimation Method	OLS	IV	OLS	IV
A. Board Variables				
Board Size	-0.0074	-0.1127	-0.0071	-0.1271
	(-4.97)	(-3.85)	(-4.70)	(-3.56)
B. Controls				
Firm Size (log. Assets)	0.0123	0.0447	0.0124	0.0433
	(7.56)	(5.12)	(7.52)	(4.83)
Firm Age	-0.0005	-0.0004	-0.0006	-0.0003
	(-6.27)	(-2.43)	(-6.39)	(-1.64)
Multiple Business Segments	-0.001	0.0044	-0.0018	0.004
	(-0.32)	(1.03)	(-0.55)	(0.89)
C. Ownership				
Multiple Owners			0.0073	0.0576
			(2.22)	(3.90)
CEO is Owner			0.0150	-0.0303
			(3.57)	(-2.23)
Industry Effects	YES	YES	YES	YES
Identification		18.2***		15.2***
		[0.000]		[0.000]
Hausman Test		33.5***		33.7***
		[0.000]		[0.000]
N	6,850	6,850	6,850	6,850
Root Mean Squared Error	0.13	0.16	0.13	0.17

Table 8: Flexible OLS Estimates of the Board Size-Firm Performance Relationship

The dependent variable is the operating return on assets (RoA). The models include control and ownership variables even though they are not reported. Each equation also includes intercept and industry dummies on the two-digit NACE level. Numbers in parentheses are t-statistics, whereas numbers in brackets are p-values. Both are computed using robust standard errors. *, ** and *** denote significance at the 10, 5 and 1 percent levels in a two-sided test, respectively.

	(I)	(II)	(III)	(IV)
Estimation Method	OLS	OLS	OLS	OLS
A. Dummy specification				
Dummy for Board Size = 4 (BS4)	-0.0046			
	(-1.16)			
Dummy for Board Size = 5 (BS5)	-0.0049			
	(-1.00)			
Dummy for Board Size = 6 (BS6)	-0.0209**	-0.0187*		
	(-2.14)	(-1.93)		
Dummy for Board Size ≥ 7 (BS7+)	-0.0354***	-0.0329***		
	(-3.61)	(-3.41)		
Dummy for Board Size ≥ 6 (BS6+)			-0.0239***	
			(-3.26)	
B. Piecewise linear specification				
Small Boards (SBS = Min[Board Size,5])				-0.0027
				(-1.20)
Large Boards (LBS = Board size * BS6+)				-0.0033***
				(-3.08)
Joint F-test, exclude BS4 and BS5	0.98			
	[0.375]			
F-test, BS6 = BS7+		1.20		
		[0.273]		
C. Controls	YES	YES	YES	YES
D. Ownership	YES	YES	YES	YES
Industry Effects	YES	YES	YES	YES
N	6,850	6,850	6,850	6,850
R-squared	0.04	0.04	0.04	0.04

Table 9: Robustness of IV Estimates of the Board Size-Firm Performance Relationship

The dependent variable is the operating return on assets (RoA). The dependent variable is the return on assets (RoA). This table reports the second stage from the two-stage-least-squares estimation of the board size–firm performance relationship using the *number of founders' children* as instrument for board size. *Identification* is an F-test of the significance of the instrument in the first-stage regression. *Hausman* is a test of significant bias in the corresponding OLS estimates. Numbers in parentheses are t-statistics, whereas numbers in brackets are p-values. Both are computed using robust standard errors. Each equation also includes intercept and industry dummies on the two-digit NACE level. *, ** and *** denote significance at the 10, 5 and 1 percent levels in a two-sided test, respectively.

	(I)	(II)
Estimation Method	OLS	IV
A. Board Variables		
Board Size	-0.0110***	-0.0131
	(-3.26)	(-0.39)
B. Controls		
Firm Size (log. Assets)	0.0171***	0.0174***
	(4.83)	(2.54)
Firm Age	-0.0001	-0.0001
	(-0.81)	(-0.80)
Multiple Business Segments	-0.002	-0.0021
	(-0.34)	(-0.35)
Business Group	-0.0336**	-0.0333**
	(-2.39)	(-2.32)
C. Ownership		
Multiple Owners	0.0007	0.0013
	(0.11)	(0.11)
CEO is Owner	0.032***	0.0316***
	(3.39)	(2.57)
D. Founders		
Multiple founders	0.0153	0.0155
	(2.48)	(2.16)
Identification		14.5
		[0.000]
Hausman		0.57
		[0.210]
N	2,087	2,087
Root Mean Squared Error	0.13	0.13