Industry Expert Directors*

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Abstract

We analyze the valuation effect of board industry experience and channels through which industry experience of outside directors affects firm value. Our analysis shows that firms with more experienced outside directors are valued at a premium compared to firms with less experienced outside directors. Additional analyses, including a quasi-experimental setting based on director deaths, mitigate endogeneity concerns. Further tests show that the board industry experience-firm value relation is more pronounced for firms with larger investment programs, larger cash reserves, and during crises. In contrast, it is weaker in more dynamic industries where the value of previously acquired experience is likely to be diminished. We also provide some evidence that corporate governance problems in firms, in particular entrenched CEOs, and a limited supply of industry experts prevent firms from appointing more industry experts to their boards, even though this would be value-increasing. Overall, our findings are consistent with board industry experience being a valuable corporate governance mechanism.

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1. Introduction

A firm's board of directors is expected to perform the pivotal tasks of monitoring and advising top management. The monitoring function – which is to solve the agency problem created by the separation of ownership and control in modern corporations – has traditionally been at the focus of the empirical corporate governance literature. In a nutshell, this extensive strand of literature finds that smaller, outsider-dominated boards are more effective in monitoring management as they make business decisions with less managerial interference as well as reduced free-riding and coordination problems.¹

In contrast, the advising function has received far less attention, although its importance is already emphasized by early survey-based studies such as Mace (1971), who suggests that boards fulfill an advisory role, and Demb and Neubauer (1992, p. 43), who find that “setting the strategic direction of the company” was considered by two thirds of the directors as one of their tasks. Based on an evaluation of minutes of board meetings of Israeli firms, in which the government owns a substantial share, Schwartz-Ziv and Weisbach (2013) characterize boards as “active monitors” and find evidence for both advising and monitoring behavior. Fama and Jensen (1983) also argue that outside directors provide support to top management when dealing with specialized decision problems besides their role as managerial monitors, but suggest that internal managers on the board contribute specific knowledge about the organization's activities to the decision making process. Coles et al. (2008) follow the idea that internal managers provide firm-specific information and find that firms for which the knowledge of the inside directors is more important, e.g., R&D intensive firms, benefit from a higher fraction of inside

¹ For early papers on board size see, for example, Yermack (1996) and Eisenberg et al. (1998). Board independence is studied by Weisbach (1988), Byrd and Hickman (1992), Borokhovich et al. (1996), and Brickley et al. (1994), among others. For a comprehensive overview see Hermalin and Weisbach (2003) and Adams et al. (2010).

directors on the board. Therefore, the two tasks that a board fulfills result in a trade-off: enhanced organizational knowledge provided by inside directors comes at the cost of reduced monitoring resulting from hiring fewer outside directors.²

In this paper, we posit that independent outside directors with specific knowledge of a firm's business combine these desirable characteristics and are thus in a better position to exert both the monitoring and the advising function. Specifically, we propose and empirically test industry experience of outside directors as a measure that captures a board's superior capabilities to provide both monitoring and advice. Most important, we conjecture that board industry experience is one of the most important determinants of a board's ability to perform its role in a manner that enhances shareholder value.

Anecdotal evidence supports our claim. For example, the Sarbanes-Oxley Act of 2002 requires firms' audit committees to consist entirely of independent outside directors. The listing rules of the New York Stock Exchange and Nasdaq require (most) listed firms to have a majority of independent outside directors on their boards. Furthermore, large institutional investors, such as the California Public Employees' Retirement System (CalPERS), recommend the CEO to be the only insider on the board. This regulatory trend, combined with pressure from institutional investors to reduce inside directors on the board, arguably limits the availability of firm-specific knowledge to the board of directors as the firm's main decision making body. Coincidentally, the main focus of shareholder activists, the press, and various corporate governance experts recently shifted from board independence to board industry experience. In particular, in the aftermath of the recent financial crisis, concerns that the industry experience on corporate boards is insufficient have been raised (Pozen, 2010; Bertsch, 2011). Recent survey evidence

² This trade-off is modelled in Raheja (2005) and Harris and Raviv (2008), who show that both board size and the fraction of insiders and outsiders on the board are a function of director and firm characteristics. In Harris and Raviv (2008), shareholders can even be better off with a board fully comprised of inside directors.

among directors suggests that industry experience is seen as the top attribute sought in new directors and one of the most desired skill safeguarding board success in the near future (Deloitte LLC, 2015; Corporate Board Member, 2014). Moreover, the amendments to the Securities and Exchange Commission's disclosure rules introduced in December 2009 intend to increase, among others, director qualifications, thereby also reflecting an increased interest in director qualifications and experience.³ Figure 1 confirms that the fraction of inside directors on the board decreased markedly by 29% (from 23% to 16%) over our 2000-2010 sample period, while the fraction of industry experts among the outside directors increased substantially by 25% (from 23% to 29%).

In our empirical analysis, we estimate board industry experience, defined as the percentage fraction of outside directors with prior work experience in the same two-digit standard industry classification (SIC) code industry, for all industrial firms in the S&P 1500 index from 2000 to 2010. Our results show that firms with more board industry experience are valued at a premium compared to firms with less experienced directors on the board. This valuation effect is statistically significant and economically relevant. In particular, an increase in board industry experience by one standard deviation is associated with an increase of approximately 5% to 7% in firm value. When we control for a comprehensive set of corporate governance and board structure variables, board industry experience turns out to be one of the most important value-influencing corporate governance factors. In addition, when breaking down our board industry experience variable into different types of industry experience, we find the results to be mainly driven by industry experience gained as an inside director and, in particular, by industry experience gained as a CEO.

³ The amendments adopted by the Securities and Exchange Commissions on December 16, 2009 are intended to improve disclosure regarding risk, corporate governance, director qualifications, and compensation to enhance information provided to shareholders (<http://www.sec.gov/rules/final/2009/33-9089-secg.htm>).

Our results survive a battery of robustness tests, including alternative industry classifications and measures of board industry experience on firm-segment level rather than on firm level. We find that our results are neither driven by active affiliations of directors within the same industry nor by general managerial experience. We run a number of additional analyses that provide results inconsistent with an endogenous relationship between board industry experience and firm value driving our results. Most importantly, we use an event-study setup and analyze director deaths that occur randomly and represent an exogenous shock to the board structure. The death of an experienced director is associated with a three-day cumulative abnormal return that is 1.3% to 1.5% lower as compared to the death of a director without industry experience. The economic magnitude of this finding becomes even slightly larger when we restrict our sample to a subset of “sudden” deaths, including strokes, heart attacks, and accidents, which were unlikely to be anticipated by the market. We conclude that board industry experience has a positive causal effect on firm value.

To better understand the channels through which industry expertise affects firm value, we conduct an analysis in which we interact our measure of board industry experience with different firm and general market characteristics. Motivated by prior research, which shows that for corporate boards ‘one size does not fit all’ (Coles et al., 2008), such tests aim at identifying firm characteristics and situations that arguably make industry expert directors more valuable for shareholders. Our results show that industry-experienced boards are particularly valuable to firms with higher investments, especially in R&D. This finding is consistent with the notion that corporate managers overseen by industry experts are more likely to implement shareholder value enhancing long-term investments. Our cross-sectional tests further show that board industry experience materializes into firm value through a positive valuation effect of a firm’s cash reserves, suggesting that industry experienced boards are able to limit potential managerial misuse of corporate cash holdings. We also show that board industry experience is particularly

valuable during crisis times. Finally, and as expected if director industry experience drives our results, industry experience is less valuable in dynamic industries that likely underwent substantial changes since the directors acquired their experience. Moreover, it is noteworthy that the standalone coefficient on industry experience remains positive and significant suggesting that industry experience is significantly positively related to firm value even in firms with no investments or cash, as well as across different market states or industry types. In summary, the results from our cross-sectional tests show that, while valuable to the average firm in our sample, board industry experience is more valuable to some firms than to others. Moreover, the cross-sectional results suggest that board industry experience is associated with both better monitoring (e.g., of the use of corporate cash reserves) and better advice (e.g., in the decision process on corporate investments).

The question arises why firms do not appoint more industry experts to their board of directors. In the final part of our empirical analysis, we provide evidence that limited supply of industry expert directors resulting from non-competition agreements as well as corporate governance problems, in particular powerful CEOs and weak board oversight, are at least partly responsible for firms not hiring more industry experts. These results are robust to accounting for cross-sectional variables affecting the value effect of board industry experience.

Our paper adds to the literature on corporate governance, specifically corporate boards. For example, Yermack (1996) documents that larger boards are associated with lower firm values. Core et al. (1999) find a positive relation between the fraction of outside directors on the board and firm value. Coles et al. (2014) show that directors appointed after the CEO assumed office are weak monitors and thus seem to have allegiance to the CEO. Cremers et al. (2017) find staggered boards to be associated with higher value, particularly in firms where longer-term commitment by directors is more important. Several studies focus on the skills and the expertise of the directors, reflecting the assumption that directors' backgrounds influence their

behavior. Güner et al. (2008), Dittmann et al. (2010), and Minton et al. (2014) analyze bankers, while Baker and Gompers (2003) turn their attention to venture capitalists, and Agrawal and Knoeber (2001) to politically connected directors. Fich (2005) and Fahlenbrach et al. (2010) investigate the role of CEOs as outside directors. Adams and Ferreira (2009) find that more gender-diverse boards are associated with better attendance records and stronger monitoring, but not higher value. Masulis et al. (2012a) find that foreign independent directors at US corporations show poor board meeting attendance and are associated with lower firm values. We add to the literature on board characteristics by showing evidence of a positive relationship between board industry experience, a board characteristic largely unexplored to date, and firm performance. In addition, we identify channels through which directors with industry experience influence firm performance.

Our paper is closely related to the nascent literature on industry experience of corporate executives (Custódio and Metzger, 2013; Huang, 2014) and directors (Masulis et al., 2012b; Cohen et al. 2014; Faleye et al., 2014; Denis et al., 2015; Wang et al., 2015; von Meyerinck et al., 2016; Kang et al., 2017). A more thorough review of this literature is provided in Section 2. Our study differs from the existing literature by first providing a richer analysis of the relation between board industry experience and firm value, which is supported by a battery of robustness tests including a quasi-experimental setting based on director deaths. Second, we establish that board industry experience materializes into firm value via two distinct channels, namely more valuable investments and cash holdings, and is more valuable in difficult market environments. More specifically, our study complements earlier results that industry expert boards are associated with more R&D spending, more patents, and more patent citations (Masulis et al., 2012b; Faleye et al., 2014) by showing that industry experience on the board is associated with more *valuable* investments and cash holdings.

The remainder of our study is organized as follows: Section 2 reviews the related literature. Section 3 describes the data. Section 4 shows our results on the relation between board industry experience and firm value. Section 5 explores factors that exacerbate (or reduce) the positive valuation effect of board industry experience. Section 6 identifies factors that hamper the election of industry-experienced directors to the board. Finally, Section 7 concludes.

2. Literature Review

A number of studies analyze the role of CEO industry experience in corporate transactions. Custódio and Metzger (2013) evaluate the industry experience of the CEO in diversifying acquisitions and find that acquirers' abnormal announcement returns are between 1.2 and 2.0 percentage points higher if the acquirer's CEO possesses experience in the target industry. They also show that this outcome is driven by the industry-expert CEO's ability to capture a larger fraction of the merger surplus by negotiating better deals and paying lower premiums for target firms. Huang (2014) finds that divestiture decisions of conglomerates are more likely to result in sell-offs of divisions that are active in industries in which the CEO does not have work experience. Thereby, these CEOs achieve a better match between their experience and their firms' assets. Following refocusing activities, Huang (2014) documents significant performance improvements, supporting the idea that managerial industry experience matters.

Denis et al. (2015) extend the focus to the board of directors. They find industry experience of directors to be a main characteristic when new firms and their boards are set up in the course of a corporate spinoff, especially if the new CEO has neither been CEO of a unit nor on the board of the pre-spinoff firm. Therefore, they conclude that industry experts on the board facilitate the assessment of CEO ability. Cohen et al. (2014) argue that audit committee industry experience is valuable because accounting guidance, estimates, and oversight of the external auditor are all linked to a company's operations within a particular industry. In fact, they find

that audit committee members, who are both accounting and industry experts, are associated with less earnings management and restatements. They conclude that industry expertise, when combined with accounting expertise, can improve the effectiveness of the audit committee in monitoring companies' financial reporting process. Consistent with Cohen et al. (2014), Wang et al. (2015) show that audit committee industry experience reduces earnings management and the probability of financial fraud. They also find that compensation committee industry experience reduces CEO excess compensation. Finally, they show that greater presence of industry experts on the board increases the CEO turnover performance sensitivity and improves acquirer returns from diversifying acquisitions. Consistent with these results, von Meyerinck et al. (2016) find in an event study setting that the appointments of outside directors with industry experience are associated with significantly higher announcement returns than the appointments of outside directors without industry experience. Moreover, they show that industry experience is the most highly valued director characteristic upon appointment, more important than independence, the number board seats, gender, age, or education, among others.

The studies most closely related to ours are Masulis et al. (2012b) and Faleye et al. (2014). Both studies document a positive valuation effect associated with a higher fraction of experienced outside directors on firms' boards. Masulis et al. (2012b) also show that a higher fraction of industry expert directors on the board are associated with fewer earnings restatements, higher CEO pay-performance sensitivity, higher CEO turnover-performance sensitivity, as well as more patents and patent citations. Faleye et al. (2014) find that a higher fraction of industry experts on the board is related to more R&D spending, more patents, and more patent citations. In contrast, they do not find any evidence of an improved acquisition performance associated with industry experts on the board. Finally, they show that industry experts on the board are

associated with a higher pay-performance sensitivity, but a lower turnover-performance sensitivity. They argue that such a combination of stronger financial incentives and a higher job security encourages corporate investment.

A number of recent studies focuses on directors' current industry affiliation rather than their past industry experience, which is the focus of our analysis. Most important, Dass et al. (2014) document that a higher fraction of directors from upstream (supplier) or downstream (customer) industries is associated with a higher firm value. Dass et al. (2011) find that firms with a higher fraction of directors from related industries on the board benefit from lower accounts receivable, lower inventories, shorter cash conversion cycles, and higher accounts payable. In another related study, Kang et al. (2017) analyze the relevance of directors' experience as a CEO in the same industry and find it to be positively related to firm value. They also show that directors with CEO industry experience particularly enhance value if they are current CEOs and if they are (or were) more successful CEOs.⁴

Finally, there is recent literature that analyzes the importance of prior industry, or more generally, work experience in other domains than corporate boards. Graham et al. (2017) show that M&A advisors specializing in the target firm's industry help acquirers to negotiate better deal terms resulting in higher announcement returns. Specialist advisors in the target industry benefit acquirers most when there is significant information asymmetry surrounding the target. In contrast, Graham et al. (2017) do not find that M&A advisors specializing in the acquirer firm's industry are more valuable than non-specialists. Kempf et al. (2017) show that mutual fund managers outperform in industries in which they have more prior investment experience.

⁴ When splitting our board industry experience variable into contemporaneous and past industry experience, we find positive and significant coefficients on both variables, indicating that both current and past industry experience matters (see Columns 5 to 7 of Table OA2 in the Online Appendix). Similarly, we find our results not to be solely driven by experience gained as a CEO or industry experience gained in a CEO role, although the latter is positively related to firm value (see Table 3 and OA2).

They find that trades of more experienced fund managers are better predictors for abnormal stock returns around subsequent earnings announcements. Bradley et al. (2017a) find that analysts making forecasts on firms in industries related to their pre-analyst work experience have better forecast accuracy, evoke stronger market reactions to earning revisions, and are more likely to be awarded the all-star analyst status by Institutional Investor magazine. Bradley et al. (2017b) show that coverage by analysts with pre-analyst industry experience is associated with reduced earnings management, lower probability of earnings restatements, less CEO excess compensation, and higher performance sensitivity of CEO turnover. Accordingly, analysts with prior industry experience seem to be more effective external firm monitors than other analysts.

3. Data and variables

3.1. Sample selection and measures of director industry experience

We start our sample selection process by identifying all industrial firms in the S&P 1500 index during the 2000-2010 period, i.e., we drop utilities and financial firms from our sample (SIC codes 4900-4949 and 6000-6999, respectively). Next, we match these firm-year observations with the ISS (formerly RiskMetrics) database, which results in a sample covering 1,860 distinct firms and 12,271 firm-year observations. For each firm-year's annual meeting, we retrieve the names of all outside directors from ISS. This matching procedure delivers 90,002 firm-year-outside director observations. We build an employment history for each outside director using information from BoardEx.⁵ Every outside director's employment history, or CV, shows, among others, for most positions both the start and the end date, the company name, and a position description. As a result, we obtain a dataset that contains the CV for each firm-year-outside director observation as of each firm-year's annual meeting date.

⁵ We are unable to build a working history for 3,241 firm-year-outside director observations (947 distinct outside directors). These outside directors are kept in our sample, but we define them as having no industry experience. In unreported tests, we drop these directors from the sample and find our results to remain robust.

As experience at the same firm by definition also constitutes industry experience, we distinguish between prior experience at the firm where the director sits on the board and prior experience in the industry (i.e., at other firms in the focal industry). Arguably, both experience at the firm and in the industry of the firm are beneficial for the tasks and responsibilities of an outside director. To isolate the effect of industry experience, we drop all positions at the firm prior to becoming an outside director at the same firm. To this end, we use a firm name-matching algorithm, which identifies and drops firms in the directors' CVs that carry the same name as the firm where the person is active as an outside director. This firm name-matching algorithm matches firm names even if firms changed their name over time.

The directors in our sample worked for 797,168 firms throughout their employment history. To determine whether the directors in our sample have industry experience, we assign SIC codes to the firms in the directors' CVs. In particular, we assign 405,419 SIC codes from the Center of Research in Security Prices (CRSP), 51,318 from COMPUSTAT North America, 5,848 from COMPUSTAT Global, 69,823 from Amadeus, and 2,907 from Datastream. Next, we match the firms from the directors' CVs to their respective two-digit SIC industry by means of the SIC codes. This approach enables us to classify whether a position in a director's CV entails industry experience, namely when the firm he⁶ worked for was active in the same two-digit industry where he sits on the board as an outside director.

We introduce different measures of industry experience on the director level. Our standard measure of director industry experience, *Director ind. exp. (dummy)*, uses a dummy variable that equals one if a director possesses industry experience in the same two-digit SIC industry (and zero otherwise). We alternate this measure by constructing more granular measures of industry experience that estimate director industry experience gained at different hierarchical

⁶ Given that the majority of the directors in our sample are males, we refer to a director as 'he'.

levels using the position descriptions. We introduce a dummy variable that equals one if a director has experience as an employee without being a member of the board of directors, denoted as *Director ind. exp. empl. (dummy)*. Additionally, we define a dummy variable which measures industry experience when being a member of the board, while also being employed by the firm (i.e., being an executive director), and a dummy variable which measures experience as an outside director in the same industry (i.e., being a member of the board of directors without being employed by the firm), labeled *Director ind. exp. exec. dir. (dummy)* and *Director ind. exp. outs. dir. (dummy)*, respectively. We further define a dummy variable which equals one if a director has experience as a CEO in the industry (*Director ind. exp. CEO (dummy)*). In addition, we count the number of different firms a director gained his industry experience in and label this variable *Number of exp. firms*.⁷

Descriptive statistics for industry experience on the director level are shown in Panel A of Table 1. 25.21% of all 90,002 outside directors possess industry experience in the same two-digit SIC code industry. With respect to the hierarchical level of industry experience, 6.75% of all outside directors were active as an executive director in the industry, and 5.21% have industry experience as a CEO. Moreover, 18.10% of all outside directors worked as an outside director in the same industry, and 10.33% of all outside directors possess experience as an employee without being a member of the board. On average, an outside director worked for 0.44 different firms in the same industry. If we focus on the outside directors with industry experience, the conditional mean amounts to work experience at 1.74 firms in the same industry.

In addition, we gather further director characteristics, as shown in Panel B of Table 1. The mean (median) age of a director is 61.12 years (62.00 years), and he holds 0.87 (0.00) other public board memberships. 87.06% of the outside directors are independent, and 12.38% of the

⁷ In the Online Appendix (Columns 1 and 2 of Table OA2), we also report results based on variables measuring the duration of industry experience.

outside directors in our sample are women. Finally, we construct two general director experience measures from the work histories. On average, the outside directors in our sample gained experience in 2.79 different two-digit SIC code industries and worked at 4.76 different firms.

3.2. Measures of board industry experience

So far, director industry experience has only been measured at the director level. By aggregating these measures of industry experience on the firm-year level, we compute our board industry experience measures for each firm-year as of the annual meeting date. The main board industry experience variable used in our empirical analysis, *Board ind. exp. (%)*, measures the percentage fraction of outside directors on the board that possess industry experience. In addition, we measure board industry experience using the different hierarchical categories at the director level. These measures indicate the percentage fraction of outside directors that possess experience as an employee without a board membership (*Board ind. exp. empl. (%)*), the percentage fraction of outside directors that possess industry experience as an outside director (*Board ind. exp. outs. dir. (%)*), and the percentage fraction of outside directors that possess industry experience as an executive director (*Board ind. exp. exec. dir. (%)*). We decompose the latter variable and determine the percentage fraction of outside directors that have industry experience as a CEO (*Board ind. exp. CEO (%)*), and the percentage fraction of outside directors that have executive director industry experience, but outside the role of being a CEO (*Board ind. exp. exec. dir. non-CEO (%)*). Finally, we count the average number of firms in which the outside directors gained their industry experience (*Mean number of exp. firms*).

Descriptive statistics for our board industry experience measures are shown in Panel A of Table 2. The mean (median) board industry experience is 26.02% (20.00%). These numbers are similar to Wang et al. (2015), who document a mean (median) board industry experience of 25.3% (20.0%) for the S&P 500 firm universe from 2000 to 2007 using a similar methodology

to determine industry experience. In the average board in our sample, 11.11% of the outside directors have experience as an employee, 7.16% as an executive director, and 18.37% as an outside director. 5.57% of the outside directors in our sample gathered experience as a CEO in the same industry. The mean number of firms in which a director gained experience is 0.46.

3.3. Additional firm-level financial and corporate governance variables

We collect several additional firm-level financial and corporate governance variables. Following the corporate governance literature, we use Tobin's Q as a proxy for firm value as it incorporates managerial ability to utilize corporate assets in the future (Fracassi and Tate, 2012). Testing the association between firm value and some corporate governance measures, this approach also follows Gompers et al. (2003) and Bebchuk et al. (2009) as well as earlier work by Demsetz and Lehn (1985) and Morck et al. (1988), among many others. Tobin's Q is defined as the market value of total assets divided by book value of assets, where the market value of the firm is computed as the book value of total assets plus the market value of common stock minus the book value of common stock minus the book value of deferred taxes (Gompers et al., 2003; Bebchuk et al., 2009). Our financial control variables include capital expenditures (*CAPEX*), research and development (*R&D*) spending (scaled by property, plant, and equipment and sales, respectively), and return on assets (*ROA*), among others. The construction and sources of all variables are shown in the Appendix. Moreover, we collect a comprehensive set of corporate governance control variables often used in the literature. We use the E-Index proposed by Bebchuk et al. (2009) from ISS, board size, the percentage of independent outside directors on the board, a dummy variable that equals one if the majority of directors holds three or more additional outside directorships, the fraction of outside directors older than 72 years of age, a dummy variable that equals one if the CEO is a member of the nominating committee, the percentage fraction of outside directors that attend less than 75% of the board meetings, and

a dummy variable that equals one if the firm has a combined CEO-Chairman position. We also collect institutional ownership data from Thomson CDA Spectrum and the CEO stock ownership data from COMPUSTAT ExecuComp. Finally, we aggregate our general director experience proxies by estimating the average across all outside directors on the board.

Descriptive statistics for the financial and corporate governance variables are summarized in Panel B of Table 2. The mean (median) firm size measured by total assets is USD 6,745.25 (1,379.56) millions, the mean (median) Tobin's Q is 2.04 (1.59), and the mean (median) ROA is 10.01% (9.70%). The mean (median) E-Index over all firm-years in our sample is 2.70 (3.00), and the mean (median) board independence is 87.14% (90.00%). On average, the outside directors worked for 4.64 different firms and gained experience in 2.66 different two-digit SIC code industries. 58.78% of the firm-years in our sample exhibit a combined CEO-Chairman position, and in 62.45% of the firm-years the firm is incorporated in the state of Delaware.

4. Board industry experience and firm value

4.1. Multivariate analysis

We analyze the relation between board industry experience and Tobin's Q by estimating ordinary least squares (OLS) regressions. Throughout all regressions, we control for a firm's financial and corporate governance structure and additionally include year and two-digit SIC code industry fixed effects in order to control for unobserved year as well as unobserved industry effects. Clustering the standard errors on the firm level adjusts for firm-level effects which are not fixed over time (Petersen, 2009; Coles et al., 2012). The results of our baseline regression are shown in Table 3. We find a positive and statistically significant relationship between our board experience measure, *Board ind. exp. (%)*, and Tobin's Q in Column 1. The estimated coefficient on our board industry experience measure is 0.43, implying that an increase in board industry experience by one standard deviation (0.26; see Panel A of Table 2) is associated with

an increase of 11.16 percentage points in Tobin's Q . Given the sample mean (median) Tobin's Q of 2.04 (1.59), this effect induces an increase of approximately 5.5% (7.0%) in firm value. Overall, the valuation effect of board industry experience is both statistically significant and economically relevant.

Outside directors not only monitor managers, but they additionally represent a source of valuable advice to management if they possess experience in leading positions within an industry. If this is the case, we expect the quality of an outside director's advising to depend on whether his industry experience has been acquired in a leading top management position (as an inside director and, in particular, as a CEO) compared to experience gained while working in a position with less responsibility (as an employee without being member of the board of directors). This notion is consistent with the argument that "CEOs have the most relevant experience and expertise to be effective directors" (Lorsch and McIver, 1989, p. 174). The additional specifications in Columns 2, 3, and 4 of Table 3 include the three measures of board industry experience that estimate industry experience gained at different levels of a firm's hierarchy. As expected, all coefficients are significantly positive. The estimate for the measure of board industry experience as an executive director (*Board ind. exp. exec. dir. (%)*) in Column 3 is higher compared to our overall measure of board industry experience in Column 1 and our other hierarchical measures of board industry experience (*Board ind. exp. empl. (%)* and *Board ind. exp. outs. dir. (%)* in Column 2 and 4, respectively). When including all three measures jointly in Column 5, only the coefficient for board industry experience as an outside director remains significantly positive.⁸

⁸ We are cautious in interpreting the coefficients in regressions that include all three variables jointly due to multicollinearity problems. It is plausible that if a director possesses detailed (valuable) industry experience, he has experience in all three categories gained by rising through the ranks during his career: first, as an employee without a board membership, second as an executive director, and finally as an outside director. Therefore, the conclusion that can be drawn from the estimated coefficients is that all three variables contribute to the positive relationship between firm performance and board industry experience.

To evaluate in more detail whether industry experience gained as an executive director matters most, we further decompose our board industry experience variable that measures industry experience as in inside director. In particular, we use the fraction of outside directors with experience as a CEO (*Board ind. exp. CEO (%)*), while at the same time controlling for experience as an executive director outside the role of a CEO (*Board ind. exp. exec. dir non-CEO (%)*). If board industry experience as an executive director matters more than experience gained as an outside director or an employee, we expect the coefficient to be highest for board industry experience of outside directors gained at the CEO level, since serving as CEO allows gaining the most detailed operational experience (Fich, 2005; Fahlenbrach et al., 2010). The results are shown in Column 6 of Table 3. The impact of CEO board industry experience on Tobin's Q is highly positive and statistically significant. The magnitude of the CEO board industry experience coefficient is higher compared to the other board industry experience variables used in the regression models shown in the previous columns; thus, it seems that the results of the model in Column 3 are largely driven by CEO board industry experience of the outside directors. This finding is in line with Kang et al. (2017), who argue that industry experience gained while working as a CEO improves firm-value.

Next, we investigate whether this finding reflects the positive valuation effect of having CEOs as outside directors, as documented by Fich (2005) and Fahlenbrach et al. (2010), rather than having outside directors with industry experience gained in a CEO position. To this end, we reestimate the regression and additionally include the percentage fraction of outside directors on the board with a contemporaneous CEO position at another corporation as additional control variable (Column 7 of Table 3). The coefficients on both industry experience variables remain qualitatively unchanged when compared to the results in Column 6 of Table 3, while the coefficient on the percentage fraction of outside directors on the board with a contemporaneous CEO position is close to zero (-0.001 , t -value = -0.004). Overall, our results suggest that

industry experience among a firm's outside directors enhances firm value. This effect is mostly driven by industry experience gained as an outside director and as a CEO, thus corroborating our conjecture that experienced boards both advise and monitor senior management.

Turning to the other control variables, we observe that most corporate governance variables enter the regression models with their predicted signs. For example, the coefficient on board size is negative and significant in almost all specifications. This result indicates that firms with larger boards of directors exhibit lower firm values (Yermack, 1996). The coefficient on Bebchuk et al.'s (2009) entrenchment index, or E-Index, is also negative and significant in all specifications. The E-index comprises the six provisions that drive the results of the governance index, or G-Index, of Gompers et al. (2003). In previous studies, both indexes are found to negatively affect Tobin's Q , confirming a positive correlation between shareholder rights and firm value (Gompers et al., 2003; Bebchuk et al., 2009; Cremers and Ferrell, 2014). The dummy variable indicating whether the CEO is a member of the nominating committee is also significant throughout all specifications, indicating that more entrenched CEOs exert a negative impact on firm value (Shivdasani and Yermack, 1999). The coefficient on the variable indicating a board's busyness (*Busy board (dummy)*) is positive and significant in all specifications (Field et al., 2013).

4.2. Robustness tests

One concern with our results could be that there is a structural break in our data, which affects the firm value-board industry relationship and is not captured by the year fixed effects. The passing of the Sarbanes-Oxley Act (SOX) of 2002 might represent such a structural break as it substantially altered the market for corporate directors: directors' workload and liability risk increased, which reduced supply, while firms were simultaneously required to increase the number of outside directors, which increased demand (Linck et al., 2009). To this end, we split

our sample into pre- and post-SOX periods. In Columns 1 and 2 of Table 4, the sample split is based on whether a firm-year's meeting date took place before or after SOX was signed into law (July 30, 2002). Most importantly, we find that the coefficient on our board industry experience proxy remains positive and statistically significant across both sub-periods. However, the coefficient obtained for the pre-SOX period (Column 1) is larger than the one for the post-SOX period (Column 2), with the difference being statistically significant (see test statistic at the bottom of the table). A shortcoming of this analysis is that there is no clear "event date" as companies were given time until April 15, 2005, to comply with SOX. Therefore, we alternatively split our sample at this later date. The results, reported in Columns 3 and 4 of Table 4, are similar to those in Columns 1 and 2, but the difference between the two sub-samples is reduced and only borderline significant at the 10% level.

The question arises whether there is a general time trend in the industry experience-value relationship in our sample. For example, the decrease in the fraction of insiders on the board with both firm- and industry-specific knowledge, depicted in Figure 1, could result in a more important role of outside directors with industry experience, suggesting a stronger valuation effect of board industry experience later in our sample. In contrast, the increase in the fraction of outside directors with industry experience on the board, also shown in Figure 1, might suggest that firms move towards the optimal fraction of industry experts on the board and that the variance of this variable decreases, thereby resulting in a weaker valuation effect later in our sample. The results from unreported tests reveal that neither of these two simple time trends show up in our sample, but suggest that industry experience is more valuable in difficult market environments, as brought about by crises such as the burst of the dot-com bubble at the start of this millennium or the great recession of 2007-2009 (see Section 5).

In another set of robustness tests, we examine whether our board industry experience measure captures general managerial experience rather than industry experience. In Column 5

of Table 4, we augment our baseline regression from Column 1 of Table 3 by including the mean age of the outside directors, the mean number of firms the directors worked for, and the mean number of two-digit SIC code industries the outside directors worked in as additional control variables.⁹ The results show that the coefficient on the board industry experience variable remains positive and significant. In addition, the coefficient on the mean number of firms the outside directors worked for is positive and significant, while the coefficient on the mean number of industries in which the outside directors were active in is negative and significant, indicating that experience gained across more firms is valued by shareholders, while more industries are associated with a valuation discount. In Column 6, we transform the three general board experience measures using the natural logarithm of one plus the respective experience measure to account for the skewness of these variables. The results remain virtually unchanged.

Next, we test whether more extensive industry experience at the director level is valued by shareholders. To this end, we make use of the variable *Mean number of exp. firms*, which was introduced in Section 3.2 and is defined as the natural logarithm of one plus the mean number of distinct firms in which the directors on the board gained industry experience. In Column 7 of Table 4, we find that the coefficient on this variable is positive and statistically significant, which is consistent with the conjecture that more industry experience is favored by investors. As shown in Column 8, this result is robust to the inclusion of the natural logarithm of the mean number of firms the outside directors on the board worked for, arguably a measure of general experience of the board. The results are also robust to using the median number of firms in both measures (not reported for space reasons). In summary, our results in Table 4 suggest that board industry experience remains value-relevant across different sample periods

⁹ In contrast to the baseline regression, we drop the variable *% of directors older 72* due to collinearity with the variable that proxies for the mean age among the outside directors.

or when we account for other measures of (general) managerial experience. Further, more extensive industry experience gained at different firms is value-enhancing.

We also implement several robustness tests to mitigate concerns regarding the construction of our board industry experience proxy. We only provide a brief summary here and relegate a detailed description of the alternative measures and the results of these tests to the Online Appendix (Section 2 and Tables OA2 and OA3). The first test is a variation of the analysis in Column 7 of Table 4 and quantifies industry experience in years. Specifically, we replace our main board industry measure with a measure that estimates board industry experience as the mean years of within-industry work experience across all outside directors and find very similar results. Second, we find that our results hold if we replicate our baseline regression using an indicator variable that equals one if the majority of the outside directors possess industry experience. Third, we find that our results remain unchanged if we use a board industry experience measure that combines experience gained at both public and private firms. Fourth, we split our board industry experience proxy into contemporaneous industry affiliations and past industry experience in order to address concerns that our results are purely driven by contemporaneous affiliations to firms in the same industry. Consistent with the notion that industry experience captures more than just contemporaneous industry affiliations, both coefficients turn out positive and statistically significant. Finally, we test whether our results hold if we vary the industry definition when determining board industry experience. Our results are robust for board industry proxies based on different granularities of the SIC scheme, different granularities of the Hoberg and Phillips (2010; 2016) industries, and industry measures that rely on segment-level rather than company-level industry classifications. We conclude from these additional tests that our results remain in place if we use alternative board industry experience proxies or rely on alternative industry classification schemes to estimate board industry experience.

4.3. *Endogeneity concerns*

Our results so far establish a robust positive relationship between board industry experience and firm value. It is possible, however, that endogeneity concerns plague our empirical analysis of this relationship. It could be the case, for example, that our results arise due to reverse causality, reflecting the fact that more highly valued companies attract directors with industry experience. Our findings could also be driven by unobservable (omitted) variables, which affect both firm value and industry experience on boards. In the following, we provide six pieces of evidence inconsistent with a pure endogeneity explanation of our results, suggesting that at least part of the experience-firm value relationship is causal. Our first five tests, which are variants of our main regression specification, are only briefly described, while an in-depth description is provided in the Online Appendix (Section 3 and Tables OA4 and OA5).

First, we test whether our results are driven by industry shocks that lead investors to value industry experience during certain time periods in certain industries by estimating regressions including industry $\times$ year fixed effects. Second, we address the possibility that reverse causality could be a driver of our results by analyzing whether a firm's past valuation (i.e., lagged Tobin's Q) explains the change in board industry experience, while at the same time controlling for all other lagged explanatory variables (see Cremers et al., 2017). Third, we run a firm fixed effects model that controls for a potential correlation between the error term and board industry experience due to omitted (time-invariant) variables. Fourth, we use a Heckman selection model that controls for the endogeneity of the decision to appoint industry experienced directors. Fifth, we replace the potentially endogenous board industry experience variable with its initial value, thereby forcing board industry experience to remain constant (Dittmar and Mahrt-Smith, 2007; Bebchuk et al., 2009). The results of all these tests suggest that causality runs from industry experience to firm value, and not vice versa.

Finally, we implement an altogether different (quasi-experimental) empirical framework to deal with possible endogeneity concerns and analyze stock market reactions to marginal changes in the board structure using event study methodology. The most intuitive and most frequently occurring board structure change is the addition of a new director to the board. However, as Hermalin and Weisbach (1988; 1998; 2003) point out, board structure and firm characteristics are simultaneously determined. A positive stock market reaction around the election of a director with industry experience could therefore also be caused by the need for change in the appointing firm rather than by the industry experience possessed by the elected director. In addition, director appointments arguably depend on career concerns as well as the availability and preferences of the newly appointed directors.

Therefore, we focus on director deaths in our event study setup, which occur randomly and represent an exogenous shock to the board structure. A small but growing strand of literature uses executive or director deaths as an identification strategy to mitigate endogeneity concerns.¹⁰ Extending the analysis in von Meyerinck et al. (2016), we construct a sample of director death events and search for directors dying in office in our 11-year S&P 1500 sample. To increase sample size, we include additional board seats which our sample directors hold at other listed US non-financial and non-utilities companies. We identify 215 deaths of directors holding 300 directorships in 272 listed US firms. The approach explained in Section 3.1 is again used to determine the industry experience of deceased directors. The independent variable in our event study regressions that indicates director industry experience, denoted *Director ind. exp. (dummy)*, is a dummy variable that equals one if the deceased director possesses industry experience (and zero otherwise). In 93 of the 300 events (30.6%), the deceased director has industry experience in the same two-digit SIC code industry. Daily abnormal returns are estimated as

¹⁰ Johnson et al. (1985), Worrell et al. (1986), Bennedsen et al. (2010), and Fracassi and Tate (2012) analyze CEO and executive deaths, Slovin and Sushka (1993) the death of inside blockholders, and Nguyen and Nielsen (2010) and von Meyerinck et al. (2016) the deaths of outside directors.

the daily realized return minus the expected daily return under the market model. The market model is estimated over a 200-day period from $t = -220$ to $t = -21$, where $t = 0$ represents the announcement date. If director industry experience is valuation-relevant, we expect to observe significantly more negative cumulative abnormal returns (CARs) around the deaths of experienced directors as compared to the deaths of inexperienced directors.

The results from regressions of three-day CARs (from $t = 0$ to $t = 2$), which are winsorized at the 1 and 99 percentile, on a number of director and firm-level control variables are shown in Table 5.¹¹ As expected, we find a significantly negative coefficient on the industry experience indicator variable (Column 1) even if we control for deceased director (Column 2) and both deceased director and firm-level characteristics (Column 3). In particular, the death of an experienced director is associated with a three-day CAR that is 1.3 to 1.5 percentage points smaller compared to the death of a director without experience.

As a robustness test, we narrow our death sample by attempting to capture sudden deaths only. Arguably, these events are not anticipated by the market. As there is no unambiguously accepted definition of a sudden death, we follow previous literature in the classification of sudden deaths (Nguyen and Nielsen, 2010; Falato et al., 2014). Specifically, we classify a death as sudden when the cause of death is indicated to be a heart attack, a stroke, or an accident. Moreover, we classify a death as sudden when the specific cause is unreported, but the death is described as either unexpected, unanticipated, or sudden. In Column 4 of Table 5, we reestimate Column 3 for the subset of 83 sudden deaths. While the coefficient increases in magnitude to a 1.9% difference in announcement returns between deaths of industry experienced and unexperienced directors, the coefficient is close to statistical significance at conventional levels. However, the inclusion of 2-digit SIC code level industry fixed effects results in very few degrees

¹¹ White (1980) heteroskedasticity-robust standard errors are used in Table 5. Clustering of the standard errors on the firm or director level yields similar results.

of freedom in this regression. Therefore, in Column 5, we replicate the regression in Column 4 but omit the industry fixed effects. The results suggest that the death of an industry experienced director is associated with a three-day CAR that is 1.7 percentage points smaller compared to the death of a director without experience, and this result is significant at the 10% level.

In summary, the results from our event study confirm previous findings that directors with industry experience enhance firm performance. Our event study analysis further mitigates endogeneity concerns and indicates that board industry experience causes higher firm values.

5. How does board industry experience affect firm value?

All tests carried out in the previous section led us to conclude that industry experience among outside directors enhances firm value. In this section, we attempt to shed some light on the channels through which industry experience affects firm value. By doing so, we also aim at identifying firm characteristics and situations where industry expert directors are arguably more valuable for shareholders. These tests are motivated by prior research showing that, for corporate boards, ‘one size does not fit all’ (Coles et al., 2008). Finally, these cross-sectional tests also allow us to differentiate between a monitoring and an advice channel through which the board industry experience transmits into higher company values.

The empirical setting in this section relies on our baseline regression model in Column 1 of Table 3, which we augment by interaction terms between our board industry experience measure and a variable for the examined channel. The first channel we consider is corporate investment. Arguably, one of the tasks faced by corporate boards is to evaluate and decide on investments proposed by the management team. When evaluating potential investments, a number of firm-specific factors have to be taken into account, for example specifics related to the production process. Moreover, industry knowledge facilitates identifying risks and rewards of potential investments. A board staffed with industry experts is therefore expected to be better

suited to assess the value of any investment for shareholders as industry experts are more familiar with the products, the production technologies employed, and the company's environment. It follows that industry experience puts an outside director in a position where he serves as a source of knowledge, which in turn allows him to add value by providing advice to senior management on the intended investment program.

To test whether industry experience on the board is related to more valuable investments by our sample firms, we construct an aggregate measure of investment as the sum of capital expenditures (CAPEX), research and development spending (R&D), and merger and acquisition expenses (M&A) scaled by sales. The results from estimating a regression which includes an interaction term between industry experience and this measure of aggregate investment, controlling for board industry experience and the level of investment, is reported in Column 1 of Table 6. The coefficient on the interaction term is positive and significant, confirming our hypothesis that board industry experience materializes into firm value via an investment channel.

The value of industry experts reviewing, approving, and advising on investment proposals is arguably most important for projects whose payoffs and risks are either difficult to quantify and/or require specialized knowledge. This applies mostly to R&D projects, as they are often long-term investments associated with substantial uncertainty and opaqueness. Next, we thus interact our board industry experience proxy with R&D spending scaled by sales. The results in Column 2 of Table 6 confirm our conjecture that a larger fraction of industry experts on the board is associated with more valuable R&D investments. These results are consistent with Masulis et al. (2012b) and Faleye et al. (2014), both documenting that industry experience allows directors to better evaluate and implement innovative activities.

The second channel we consider are cash holdings. A number of studies show that corporate governance affects both corporate cash holdings and the value of cash (e.g., Pinkowitz,

Stulz, and Williamson, 2006; Dittmar and Mahrt-Smith, 2007; Harford et al., 2008). Cash holdings are important for two reasons. First, cash holdings make up a substantial fraction of the value of a firm, regularly exceeding 10% of either firm sales or assets. Second, cash reserves are the corporate resources most easily misused by management, as they are mostly at managerial discretion, thereby triggering agency problems between shareholders and managers (Jensen, 1986). Industry experts on the board may be well-qualified to serve as a “gate-keeper” against managers’ misspending of corporate liquidity. Arguably, their knowledge of the firm’s business permits them to act as superior monitors by means of a better evaluation of managerial proposals for the use of liquid funds, which ensures that cash reserves are used efficiently.

We test the conjecture that industry-experienced boards affect firm value through their monitoring of cash management and spending by augmenting our regression with an interaction term between industry experience and cash reserves scaled by sales (Harford, 1999; Harford et al., 2008). The results are reported in Column 3 of Table 6 and show a positive and significant coefficient on the interaction term, supporting our hypothesis that the monitoring of cash reserves is one of the channels through which industry experience affects value.¹²

Next, we explore whether firms with industry experts on the board show a better performance during crises times. Crises represent a difficult market environment in which the advisory role of the board is expected to be crucial. To test this, we augment our regression with an interaction term between our industry experience measure and a crisis dummy variable that is equal to one in the years 2000-2002 and 2007-2009, and zero otherwise, and omit year fixed effects. The results in Column 4 of Table 6 show that the coefficient on the interaction term is

¹² In unreported tests, we also use the empirical setting of Pinkowitz, Stulz, and Williamson (2006). When we run their value of cash regressions separately for above and below median board industry experience samples, we find that the market value of cash is significantly higher for firms with more industry experts among the outside directors. Finally, we extend the empirical framework of Dittmar and Mahrt-Smith (2007) by an interaction term of excess cash and board industry experience while controlling for the level of board industry experience and excess cash. Again, we find that industry experience has a positive impact on the value of the firm via the market value of cash holdings. Both tests therefore confirm the results reported in Table 6.

positive and significant, confirming our hypothesis that industry experience is particularly valuable in a difficult market environment.

Finally, as a plausibility check to our results, we test whether the value of board industry experience depends on industry dynamics. If in fact industry experience of outside directors drives our results, we would expect the value of such experience to be reduced if the industry likely underwent fundamental changes since the director acquired this experience. To test this conjecture, we apply the dynamism index proposed by Coles et al. (2015). The index is defined as the sum of four indicator variables, each constructed per industry (based on two-digit SIC codes) and year: (i) a dummy whether the average annual sales growth of all firms in the industry is above the 50th percentile, (ii) a dummy whether the average R&D expenses to total assets at the industry level are above the 75th percentile, (iii) a dummy whether the average of the fluidity score of Hoberg et al. (2014) is above the 50th percentile, and (iv) a dummy whether the average number of mergers per firm is above the 50th percentile. The index takes on discrete values between zero and four, with higher values indicating higher industry dynamism. Column 5 of Table 6 reports the results from a regression which includes an interaction term between our industry experience measure and the dynamism index. Consistent with our conjecture, the coefficient on the interaction term is negative and statistically significant, suggesting that board industry experience is less valuable in more dynamic industries.

Overall, our results in this section show that the positive value effect of board industry experience is exacerbated in firms with larger investments and cash holdings as well as in more difficult market environments. In contrast, industry experience is less valuable in dynamic industries that likely underwent substantial changes between the time at which director's industry experience was acquired and the present board seat. We note that the standalone coefficient on

industry experience remains positive and significant across all specifications. Therefore, industry experience is significantly positively related to firm value even in firms with no investments, no cash, and across different market states and industry types.

While we established in Section 4.2 above that endogeneity is unlikely to drive the industry experience-value relationship and both the crisis and industry dynamism measures are plausibly exogenous, we may nevertheless face an endogeneity problem in our investment and cash reserve regressions. To mitigate – even though not eliminate – such endogeneity concerns, we reestimate the investment and cash reserve regressions in Table 6 replacing industry by firm fixed effects. By using firm fixed effects, we account for the potential bias resulting from omitted time-invariant variables at the firm level. However, firm fixed effects impose another problem in our empirical framework: most corporate governance variables are largely time-invariant, rendering fixed effects techniques ineffective (Zhou, 2001; Fahlenbrach, 2009; Coles et al., 2012).¹³ Our board industry experience measure also shows little time-series variation with both the 25th and 75th percentile annual changes being equal to zero, reducing the power of the firm fixed effects approach. Results are reported in Table OA6 in the Online Appendix and show that the coefficients on the interaction terms remain positive and statistically significant across all three specifications. The coefficient on board industry experience is reduced by about one third when compared to the results in Table 6, and is not quite significant at conventional levels. This estimate may either indicate that absent any investments and cash holdings the positive valuation effect of industry experience indeed vanishes, or simply is an artifact of the simultaneous inclusion of a slowly moving variable (board industry experience) and its interaction term with another variable of limited time variability (investments or cash holdings). Nonetheless,

¹³ For example, the E-Index is updated every two or three years only, and at each update, the median change is zero (see Fahlenbrach, 2009). A fixed effects regression would thus attempt to identify the coefficient for the E-Index from very few observations.

together with our extensive set of identification tests in the previous section, these results give us confidence that our cross-sectional results cannot fully be explained by endogeneity.

6. Why do firms not hire more industry expert directors?

Our results suggest that board industry experience is a valuable board characteristic. Therefore, the question arises why firms do not attempt to profit from higher valuation levels by appointing more industry experts to their board of directors. One explanation could be based on industry expert directors' role as strong monitors: If industry experts are in fact better monitors than other directors, poorly governed firms with powerful and entrenched CEOs may prefer not to hire industry experts to their boards. Director supply side frictions offer another explanation, for example, as a result of non-competition agreements, which prevent industry-experienced individuals from serving on the board of a competitor.

We examine whether the propensity to hire industry expert directors depends on the firms' corporate governance by running regressions of our board experience measure, *Board ind. exp.* (%), on various financial and corporate governance variables. The results are reported in Table 7. We are mostly interested in the corporate governance variables and, in particular, those related to CEO power. Consistent with the hypothesis that powerful CEOs prevent the appointment of industry expert directors, our results in Column 1 show that a larger board, a combined CEO-chairman position, larger shareholdings by the CEO, and a larger fraction of old directors on the board are all associated with a lower percentage of industry experts on the board. All these variables have been shown to be associated with higher CEO power. In contrast, larger institutional ownership and incorporation in the state of Delaware is associated with a larger percentage of industry experts on the board, supporting the hypothesis that better-governed firms are more likely to appoint industry experts as outside directors. The percentage of female directors on the board is negatively related to the percentage of industry expert directors. A

reason for this finding may be that female directors are less likely to be industry experts than male directors (mean female director industry experience is 20.09% vs. 25.99% mean male director industry experience; the t -value of the difference is 13.41). Finally, these tests show that the fraction of inside directors on the board is significantly and negatively related to the fraction of industry experts among the outside directors, which is consistent with the idea that outside directors with industry experience serve as a substitute for inside directors which (by definition) provide industry-specific knowledge.

In the second column of Table 7, we add variables that proxy for the local supply of directors with relevant industry experience. Specifically, we use the variable that captures local director supply, i.e., the number of nearby peers firms. In addition, we include the non-competition enforcement index of Garmaise (2009) for the state where a firm is headquartered. Garmaise (2009) introduces a score-based index, measuring non-competition agreement enforcement in 50 states and the DC covering the years 1992-2004. Based on a questionnaire, each jurisdiction receives a score from 0 to 12, with 0 being the lowest level of enforcement and 12 being the highest. The measure is then divided by 12 to generate a score from 0 to 1. To use the index for our sample period (2000-2010), we assume it remains constant after 2004 for each state, which seems justified given that only three states (Florida, Louisiana, and Texas) show time-series variation in the index between 1992 and 2004. The results in Column 2 show a positive and significant coefficient on the variable that proxies for local director supply, indicating that board industry experience is higher when the local supply of directors with experience in the same industry is larger. The negative and significant coefficient on the non-competition enforcement index suggests that firms face difficulties in appointing industry-experienced directors in jurisdictions with stronger enforcement of non-competition agreements. Taken together, these results suggest that supply side effects limit appointments of industry experts to corporate boards.

To mitigate potential endogeneity concerns resulting from reverse causality, we rerun the regression from Column 2 and lag all independent variables by one year in Column 3. The results are very similar, and the estimate on board independence turns positive and significant, strengthening the conjecture that better-governed firms tend to appoint more industry experts. The results in Section 5 suggest that, while board industry experience is generally valuable to our sample firms, there are significant cross-sectional differences in the value provision of industry experience. Therefore, in Column 4 we augment the regression specification by cash holdings and the dynamism index to include all the cross-sectional and market variables employed in Section 5.¹⁴ Again, we find our results to remain virtually unchanged. To account for the censoring of the dependent variable, Column 5 shows replicated results from Column 2 using a Tobit regression. We find that the results from Column 2 hold. In summary, our findings suggest that a limited supply of industry expert directors and corporate governance problems at least partly explain why firms not hire more industry experts.¹⁵

7. Conclusion

In this study, we analyze the valuation effect of board industry experience and channels through which industry experience of outside directors affects firm value. Using a dataset that comprises industrial companies listed in the S&P 1500 during the 2000-2010 sample period, we document a robust positive association between the industry experience of corporate directors and firm value. Several endogeneity tests, including regressions that use firm fixed effects as well as event-study results from director deaths suggest that our results are driven by within-

¹⁴ Note that *R&D / Sales* and *CAPEX / PPE* are already included on the specifications reported in Columns 1-3. In unreported tests, we replace the dynamism index by the crisis dummy and find very similar results.

¹⁵ A general concern with our results is the existence of additional unobservable constraints that prevent certain individuals from serving as an outside director. Specifically, the Clayton Antitrust Act of 1914 prevents individuals from serving as a director or officer in two corporations for which the elimination of competition would trigger a violation of antitrust law. Arguably, experience gained while working for a competitor firm represents the most valuable industry experience, thereby biasing the true impact of board industry on firm value downward. As we cannot determine the impact of the Clayton Antitrust Act empirically but observe a positive and significant effect of board industry experience and firm value, we conjecture that our estimates are rather on the conservative side.

firm variation of board industry experience, and that board industry experience at least partially causes higher firm values.

We also explore the cross-sectional variation in our data and find that the board industry experience-firm value relationship is stronger for firms with larger investment programs, especially into R&D, for firms with larger cash reserves, and for firms whose management faces more difficult decisions in a crisis. In contrast, industry experience is less valuable in dynamic industries that likely underwent substantial changes since the directors acquired this experience. Finally, we provide empirical evidence that a limited supply of industry-expert directors and governance problems in firms are at least partly responsible for firms not appointing more industry experts. We conclude that industry experience among a firm's outside directors constitutes a valuable corporate governance mechanism.

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Table 1: Director industry experience and director characteristics

Panel A reports director industry experience characteristics for the sample of outside directors on the board of all S&P 1500 firms as of the annual meeting during the 2000-2010 sample period, excluding utilities (standard industry classification (SIC) codes 4900-4949) and financial firms (SIC codes 6000-6999). *Director ind. exp. (dummy)* is a dummy variable set equal to one if the director worked in a firm different than the sample firm that is active in the same two digit SIC code industry prior to the annual meeting date. *Director ind. exp. empl. (dummy)*, *Director ind. exp. exec. dir. (dummy)*, *Director ind. exp. outs. dir. (dummy)*, *Director ind. exp. CEO (dummy)* are additional dummy variables that require that the industry experience was gained as an employee without a board membership, as an employee with a board a board membership, as an outside director, or as a CEO, respectively. *Number of exp. firms* counts the number of different firms a director gained his industry experience in. Panel B reports other outside director characteristics. *Age (years)* is the age in years, *Number of additional directorships held* is the number of directorship held at other firms, *Female (dummy)* is a dummy set equal to one if the director is female, *Independent (dummy)* is a dummy variable equal to one if the director is classified as independent in ISS, *Number of industries* counts the number of different two-digit SIC code industries in which the director worked until the meeting date, and *Number of firms* is the number of different firms the director worked for prior to the annual meeting date. Section 3.1 provides a detailed description of all variables.

Panel A: Director industry experience characteristics based on two-digit SIC industry

	Mean	Median	N
<i>Director ind. exp. (dummy)</i>	25.21%	0.00%	90,002
<i>Director ind. exp. empl. (dummy)</i>	10.33%	0.00%	90,002
<i>Director ind. exp. exec. dir. (dummy)</i>	6.75%	0.00%	90,002
<i>Director ind. exp. outs. dir. (dummy)</i>	18.10%	0.00%	90,002
<i>Director ind. exp. CEO (dummy)</i>	5.21%	0.00%	90,002
<i>Number of exp. firms</i>	0.44	0.00	90,002

Panel B: Other director characteristics

	Mean	Median	N
<i>Age (years)</i>	61.12	62.00	89,784
<i>Number of additional directorships held</i>	0.87	0.00	90,002
<i>Female (dummy)</i>	12.38%	0.00%	89,784
<i>Independent (dummy)</i>	87.06%	100.00%	90,002
<i>Number of industries</i>	2.79	2.00	90,002
<i>Number of firms</i>	4.76	4.00	90,002

Table 2: Board industry experience, financial, and corporate governance characteristics

This table reports characteristics of all S&P 1500 firms during the 2000-2010 sample period, excluding utilities (standard industry classification (SIC) codes 4900-4949) and financial firms (SIC codes 6000-6999). Panel A exhibits board industry experience characteristics. Panel B contains financial and corporate governance characteristics. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively. The definitions and data sources of all variables are provided in the Appendix.

Panel A: Board industry experience characteristics based on two-digit SIC industry

	Mean	Median	SD	N
<i>Board ind. exp. (%)</i>	26.02%	20.00%	25.81%	12,271
<i>Board ind. exp. empl. (%)</i>	11.11%	0.00%	16.18%	12,271
<i>Board ind. exp. exec. dir. (%)</i>	7.16%	0.00%	11.67%	12,271
<i>Board ind. exp. outs. dir. (%)</i>	18.37%	12.50%	22.24%	12,271
<i>Board ind. exp. CEO (%)</i>	5.57%	0.00%	10.17%	12,271
<i>Board ind. exp. exec. dir. non-CEO (%)</i>	3.93%	0.00%	8.31%	12,271
<i>Mean number of exp. firms</i>	0.46	0.25	0.62	12,271

Panel B: Financial and corporate governance characteristics

	Mean	Median	SD	N
<i>Tobin's Q</i>	2.04	1.59	1.39	11,690
<i>Total assets</i>	6,745.25	1,379.56	27,271.98	12,266
<i>CAPEX / PPE</i>	0.24	0.20	0.17	12,179
<i>R&D / Sales</i>	0.09	0.00	2.23	12,266
<i>(R&D + CAPEX + ACQ) / Sales</i>	0.23	0.09	4.56	12,197
<i>ROA (%)</i>	10.01%	9.70%	8.88%	12,266
<i>Cash / Sales</i>	0.31	0.08	3.94	12,263
<i>Financial leverage</i>	0.19	0.18	0.16	12,266
<i>Delaware (dummy)</i>	62.45%	100.00%	48.43%	12,267
<i>E-Index</i>	2.70	3.00	1.36	11,379
<i>Institutional own. (%)</i>	75.69%	79.14%	19.75%	11,183
<i>Board size</i>	8.96	9.00	2.27	12,271
<i>Board independence (%)</i>	87.14%	90.00%	15.65%	12,271
<i>Inside directors (%)</i>	18.80%	15.38%	10.19%	12,271
<i>Female directors (%)</i>	11.40%	12.50%	11.07%	12,271
<i>CEOs among outside directors (%)</i>	8.14%	0.00%	11.33%	12,271
<i>Directors older 72 (%)</i>	7.73%	0.00%	12.87%	12,271
<i>Mean age among outs. dir.</i>	60.99	61.13	4.45	12,271
<i>Mean number of firms among outs. directors</i>	4.64	4.50	2.00	12,271
<i>Mean number of industries among outs. directors</i>	2.66	2.57	1.18	12,271
<i>Busy board (dummy)</i>	0.95%	0.00%	9.72%	12,271
<i>Director non-attend. (%)</i>	1.55%	0.00%	5.15%	12,271
<i>CEO stock own. (%)</i>	2.54%	0.35%	6.69%	11,362
<i>CEO in nom. com. (dummy)</i>	1.51%	0.00%	12.19%	12,271
<i>CEO-chair (dummy)</i>	58.78%	100.00%	49.22%	12,271
<i>Non-competition enforcement index</i>	3.86	4.00	2.25	11,985
<i>Number of nearby peer firms</i>	4.69	1.00	12.77	12,267
<i>Dynamism</i>	1.59	2.00	1.19	12,271

Table 3: Pooled ordinary least squares (OLS) regressions of Tobin's Q on board industry experience measures

This table reports the results from pooled OLS regressions of Tobin's Q on the fraction of experienced outside directors. Column 1 presents regression results where industry experience is estimated as the fraction of experienced outside directors to all outside directors. The remaining columns show regression results where industry experience is defined based on different hierarchical levels: Column 2 considers only industry experience gained as an employee, Column 3 only industry experience gained as an executive director, and Column 4 only industry experience gained as an outside director. Column 5 introduces all three hierarchical measures jointly. Column 6 uses the fraction of outside directors that possess industry experience gained as a CEO as well as industry experience gained as an executive director outside the role of the CEO. Column 7 shows reestimated regression results of the regression shown in Column 6 but additionally includes the fraction of outside directors that serve as the CEO of another company as control. All regressions include year and two-digit standard industry classification (SIC) code industry fixed effects. The sample contains all firms in the S&P 1500 during the 2000-2010 sample period, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The t -values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively. Definitions and data sources of all variables are provided in the Appendix.

<i>Dependent variable</i>	<i>Tobin's Q</i>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Board ind. exp. (%)</i>	0.431 *** (3.936)						
<i>Board ind. exp. empl. (%)</i>		0.441 *** (2.794)			0.160 (0.860)		
<i>Board ind. exp. exec. dir. (%)</i>			0.671 *** (2.583)		0.281 (0.984)		
<i>Board ind. exp. outs. dir. (%)</i>				0.563 *** (4.323)	0.465 *** (3.833)		
<i>Board ind. exp. CEO (%)</i>						0.956 *** (3.068)	0.956 *** (3.021)
<i>Board ind. exp. exec. dir. non-CEO (%)</i>						-0.220 (-0.755)	-0.220 (-0.756)
<i>CEOs among outside directors (%)</i>							-0.001 (-0.004)
<i>ln(Total assets)</i>	0.002 (0.116)	0.011 (0.572)	0.006 (0.342)	-0.005 (-0.248)	-0.001 (-0.073)	0.007 (0.404)	0.007 (0.400)
<i>ROA</i>	6.373 *** (15.818)	6.311 *** (15.415)	6.298 *** (15.569)	6.394 *** (16.030)	6.417 *** (16.182)	6.303 *** (15.602)	6.303 *** (15.612)
<i>R&D / Sales</i>	0.045 *** (2.854)	0.045 *** (2.807)	0.044 *** (2.769)	0.045 *** (2.860)	0.045 *** (2.874)	0.044 *** (2.770)	0.044 *** (2.768)
<i>CAPEX / PPE</i>	1.579 *** (8.146)	1.599 *** (8.066)	1.613 *** (8.232)	1.582 *** (8.226)	1.561 *** (8.088)	1.613 *** (8.212)	1.613 *** (8.207)
<i>Financial leverage</i>	-0.819 *** (-4.925)	-0.846 *** (-5.106)	-0.850 *** (-5.172)	-0.812 *** (-4.880)	-0.811 *** (-4.924)	-0.845 *** (-5.145)	-0.845 *** (-5.148)
<i>E-Index</i>	-0.077 *** (-5.251)	-0.075 *** (-5.073)	-0.077 *** (-5.215)	-0.078 *** (-5.300)	-0.078 *** (-5.271)	-0.078 *** (-5.290)	-0.078 *** (-5.285)
<i>Board independence (%)</i>	0.197 (1.475)	0.212 (1.569)	0.200 (1.495)	0.184 (1.383)	0.183 (1.375)	0.198 (1.480)	0.198 (1.476)
<i>Inside directors (%)</i>	0.122 (0.557)	0.102 (0.466)	0.102 (0.462)	0.127 (0.579)	0.137 (0.628)	0.117 (0.531)	0.117 (0.528)
<i>ln(Board size)</i>	-0.287 ***	-0.302 ***	-0.299 ***	-0.294 ***	-0.277 ***	-0.298 ***	-0.298 ***

	(-2.891)	(-2.977)	(-3.031)	(-2.987)	(-2.800)	(-3.042)	(-3.042)
<i>CEO-chair (dummy)</i>	-0.015	-0.023	-0.022	-0.019	-0.014	-0.023	-0.023
	(-0.444)	(-0.657)	(-0.629)	(-0.557)	(-0.397)	(-0.656)	(-0.659)
<i>CEO in nom. com.(dummy)</i>	-0.286 ***	-0.282 ***	-0.282 ***	-0.293 ***	-0.290 ***	-0.280 ***	-0.280 ***
	(-3.134)	(-3.081)	(-3.061)	(-3.200)	(-3.181)	(-3.009)	(-3.009)
<i>CEO stock own. (%)</i>	-0.309	-0.332	-0.329	-0.299	-0.284	-0.315	-0.315
	(-0.965)	(-1.044)	(-1.028)	(-0.918)	(-0.878)	(-0.983)	(-0.986)
<i>Institutional own. (%)</i>	-0.018	-0.008	-0.013	-0.009	-0.025	-0.012	-0.012
	(-0.184)	(-0.076)	(-0.130)	(-0.092)	(-0.257)	(-0.122)	(-0.122)
<i>Directors older 72 (%)</i>	0.074	0.054	0.053	0.050	0.080	0.055	0.055
	(0.417)	(0.305)	(0.301)	(0.284)	(0.455)	(0.312)	(0.314)
<i>Director non-attend. (%)</i>	0.275	0.265	0.271	0.289	0.265	0.261	0.261
	(1.056)	(1.004)	(1.026)	(1.118)	(1.021)	(0.994)	(0.994)
<i>Busy board (dummy)</i>	0.303 **	0.326 **	0.315 **	0.291 *	0.296 **	0.310 **	0.310 **
	(2.060)	(2.277)	(2.186)	(1.955)	(1.997)	(2.143)	(2.135)
<i>Delaware (dummy)</i>	0.022	0.035	0.031	0.016	0.015	0.030	0.030
	(0.524)	(0.840)	(0.764)	(0.401)	(0.371)	(0.724)	(0.725)
<i>Female directors (%)</i>	0.175	0.125	0.150	0.171	0.195	0.134	0.134
	(0.958)	(0.679)	(0.823)	(0.942)	(1.081)	(0.732)	(0.732)
<i>Year fixed effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry fixed effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	10,033	10,033	10,033	10,033	10,033	10,033	10,033
<i>R-squared</i>	0.414	0.411	0.412	0.415	0.416	0.413	0.413

Table 4: SOX analysis and alternative experience proxies

This table depicts regression results comparing the board industry valuation premium pre- and post-Sarbanes-Oxley and tests including additional board experience proxies. Columns 1 and 2 repeat the baseline regression for two subsamples depending on whether the meeting date took place before (Column 1) or after (Column 2) SOX was signed into law (cutoff date is July 30, 2002). Columns 3 and 4 repeat the baseline regression for two subsamples depending on whether the meeting date took place before (Column 3) or after (Column 4) all firms had to comply with SOX (cutoff date is April 15, 2005). Tests for differences between board industry coefficients obtained from regressions shown in Columns 1 and 2 as well as 3 and 4 are shown at the bottom of the Table. Regression results shown in Columns 5 and 6 include additional board experience proxies (mean age of the outside directors, mean number of distinct industries the outside directors worked for and mean number of distinct firms the outside directors worked for). Columns 7 and 8 show regression results for an alternative industry experience proxy, which uses the mean number of firms where the outside directors gained industry experience. The financial and the corporate governance controls (not reported for space reasons), abbreviated *Financial controls* and *Corporate governance controls*, respectively, are the same as in Table 3 of the Paper: *ln(Total assets)*, *ROA*, *R&D/Sales*, *CAPEX/PPE*, *Financial leverage*, *E-Index*, *Board independence (%)*, *Inside directors (%)*, *ln(Board size)*, *CEO-Chair (dummy)*, *CEO in nom. com. (dummy)*, *CEO stock own. (%)*, *Institutional own. (%)*, *Directors older 72 (%)*, *Director non-attend. (%)*, *Busy board (dummy)*, *Delaware (dummy)*, *Female directors (%)* except for regression shown in Column 5 and 6, which leave out *Directors older 72 (%)* due to correlation with the mean age among the outside directors. All regressions include year and two-digit standard industry classification (SIC) code industry fixed effects. The sample contains all firms in the S&P 1500 during the 2000-2010 sample period, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The *t*-values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively. Definitions and data sources of all variables are provided in the Appendix.

Dependent variable	Tobin's Q							
	Pre SOX signed	Post SOX signed	Pre SOX comply	Post SOX comply	Full	Full	Full	Full
Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Board ind. exp. (%)	0.856 *** (3.613)	0.268 *** (2.711)	0.560 *** (3.463)	0.320 *** (3.041)	0.333 *** (3.043)	0.314 *** (2.830)		
Mean age among outs. dir.					-0.003 (-0.591)			
Mean number of industries among outs. directors					-0.087 ** (-2.185)			
Mean number of firms among outs. directors					0.071 *** (3.021)			
ln (1+Mean age among outs. dir.)						-0.248 (-0.693)		
ln (1+Mean number of industries among outs. directors)						-0.332 ** (-2.293)		
ln (1+Mean number of firms among outs. directors)						0.439 *** (3.445)		0.140 ** (2.097)
ln (1+Mean number of exp. firms)							0.441 *** (4.837)	0.379 *** (4.058)
Financial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corporate Governance controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,256	7,777	4,378	5,655	10,033	10,033	10,033	10,033
R-squared	0.411	0.484	0.404	0.499	0.417	0.417	0.417	0.418
Test for differences of Board ind. exp. (%) coefficients		0.588 ***		0.240 *				

Table 5: Ordinary least squares (OLS) regressions of cumulative abnormal returns (CARs) around outside director deaths on industry experience dummy

This table reports results from cross-sectional OLS regressions of the event returns on a dummy variable indicating whether the deceased outside director possesses industry experience. The sample comprises deaths of outside directors that occurred in the year following a meeting date from our initial sample selection process. In addition, the sample was supplemented by events where the director also serves as an outside director on the board of a US non-financial and non-utilities firm outside of our initial sample. The independent variable are the cumulated abnormal returns (CARs), which are calculated as the observed return minus the expected return that is estimated using a market model over a 200-day estimation window from $t = -220$ to $t = -21$. The CARs are aggregated over a three-day event window from $t = 0$ to $t = 2$ and winsorized at the 1% and 99% level. In Column 1, only an indicator variable that equals one if the director has industry experience and zero otherwise (*Director ind. exp. (dummy)*) is used as an independent variable. Column 2 additionally includes a set of director control variables, where *Age* is the age of the deceased director, *Age squared* is the age of the deceased director squared, *#Add. directorships* is the number of additional directorships held by the deceased director, *Male (dummy)* is an indicator dummy which equals one if the deceased director is a male and zero if the director is a female, *CEO (dummy)* is an indicator variable, which equals one if the deceased director has been the CEO of another firm at his death, and *Independent (dummy)* is an indicator variable, which equals one if the deceased director is independent (compared to gray). Column 3 adds firm controls. In Columns 4 and 5, the sample is restricted to sudden deaths classified as in Nguyen and Nielsen (2010). Column 4 replicates Column 3 for the subset of 83 sudden deaths. Columns 1-4 include industry fixed effects based on the two-digit standard industry classification (SIC) code industry classification and year fixed effects. Column 5 replicates Column 4 but omits the industry fixed effects. The *t*-values are based on White (1980) heteroskedasticity-robust standard errors (reported in parentheses). ***, **, * denotes statistical significance at the 1%, 5%, 10% level.

Dependent variable	CAR (0;2)				
	(1)	(2)	(3)	(4)	(5)
<i>Director ind. exp. (dummy)</i>	-0.013 *** (-2.638)	-0.014 *** (-2.735)	-0.015 *** (-2.916)	-0.019 (-1.426)	-0.017 * (-1.998)
<i>Age</i>		-0.000 (-1.337)	-0.004 (-1.157)	-0.018 * (-1.974)	-0.011 (-1.592)
<i>Age squared</i>		0.000 (1.331)	0.000 (1.120)	0.000 * (1.845)	0.000 (1.543)
<i># Add. directorships</i>		-0.000 (-0.304)	-0.001 (-0.778)	-0.001 (-0.278)	-0.001 (-0.489)
<i>Male (dummy)</i>		0.015 (1.504)	0.014 (1.311)	0.069 (1.310)	0.041 *** (3.996)
<i>CEO (dummy)</i>		-0.004 (-0.470)	-0.003 (-0.298)	0.030 (1.199)	0.001 (0.040)
<i>Independent (dummy)</i>		0.009 (1.283)	0.008 (1.059)	0.012 (0.264)	0.038 ** (2.576)
<i>ln(Total assets)</i>			-0.002 (-1.111)	-0.001 (-0.242)	-0.002 (-0.843)
<i>ROA</i>			-0.026 (-0.815)	-0.008 (-0.126)	0.012 (0.246)
<i>R&D / Sales</i>			0.001 (0.861)	0.002 (0.854)	0.001 (0.854)
<i>Market-to-book</i>			-0.000 (-0.013)	0.001 (0.540)	-0.000 (-0.108)
<i>Year fixed effects</i>	Yes	Yes	Yes	Yes	Yes
<i>Industry fixed effects</i>	Yes	Yes	Yes	Yes	No
<i>Observations</i>	300	291	291	83	83
<i>R-squared</i>	0.193	0.209	0.227	0.547	0.246

Table 6: Cross-sectional tests: Investments, cash holdings, dynamism, and crises performance

This table reports results from pooled ordinary least squares (OLS) regressions of Tobin's Q on interaction terms between board industry experience and alternative firm, market, and industry variables. In Column 1, board industry experience is interacted with $(R\&D + CAPEX + ACQ) / Sales$, in Column 2 with $R\&D / Sales$, in Column 3 with Cash holdings scaled by sales ($Cash / Sales$), in Column 4 with a crises indicator variable, and in Column 5 with Dynamism from Coles et al. (2015). We set the *Crises (Dummy)* equal to one if the meeting date took place in the years 2000-2002 and 2007-2009 and zero otherwise. The financial and the corporate governance controls (not reported for space reasons), abbreviated *Financial controls* and *Corporate governance controls*, respectively, are the same as in Table 3 of the Paper: $\ln(Total\ assets)$, ROA , $R\&D/Sales$, $CAPEX/PPE$, $Financial\ leverage$, $E-Index$, $Board\ independence\ (\%)$, $Inside\ directors\ (\%)$, $\ln(Board\ size)$, $CEO-Chair\ (dummy)$, $CEO\ in\ nom.\ com.\ (dummy)$, $CEO\ stock\ own.\ (\%)$, $Institutional\ own.\ (\%)$, $Directors\ older\ 72\ (\%)$, $Director\ non-attend.\ (\%)$, $Busy\ board\ (dummy)$, $Delaware\ (dummy)$, $Female\ directors\ (\%)$, except in Column 2, where $R\&D/Sales$ and $CAPEX/PPE$ are left out due to correlation with $(R\&D + CAPEX + ACQ) / Sales$. All regressions include two-digit SIC code industry fixed effects and (except for Column 4) year fixed effects. The sample contains all firms in the S&P 1500 during 2000-2010, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The t -values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively. Definitions and data sources of all variables are provided in the Appendix.

Dependent variable	Tobin's Q				
	(1)	(2)	(3)	(4)	(5)
<i>Board ind. exp. (%)</i>	0.338*** (3.138)	0.321*** (3.153)	0.214*** (2.206)	0.704*** (3.849)	0.210* (1.889)
$(R\&D + CAPEX + ACQ) / Sales$	0.592*** (6.833)				
$\times Board\ ind.\ exp.\ (\%)$	-0.081*** (-5.743)				
$R\&D / Sales \times Board\ ind.\ exp.\ (\%)$		0.632*** (6.519)			
$R\&D / Sales$		-0.071*** (-4.567)			
$Cash / Sales \times Board\ ind.\ exp.\ (\%)$			0.413*** (5.074)		
$Cash / Sales$			-0.059*** (-2.888)		
$Crises\ (Dummy) \times Board\ ind.\ exp.\ (\%)$				0.356*** (3.423)	
$Crises\ (Dummy)$				-0.034 (-1.095)	
$Dynamism \times Board\ ind.\ exp.\ (\%)$					-0.198** (-2.273)
$Dynamism$					-0.172*** (-4.494)
<i>Financial controls</i>	Yes	Yes	Yes	Yes	Yes
<i>Corporate Governance controls</i>	Yes	Yes	Yes	Yes	Yes
<i>Year fixed effects</i>	Yes	Yes	Yes	No	Yes
<i>Industry fixed effects</i>	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	10,049	10,033	10,031	10,033	10,033
<i>R-squared</i>	0.407	0.432	0.437	0.395	0.415

Table 7: Pooled ordinary least squares (OLS) and Tobit regressions of board industry experience on financial and corporate governance characteristics

This table reports the results from pooled OLS (Columns 1 to 4) and pooled Tobit (Column 5) regressions of the fraction of experienced outside directors on various financial and corporate governance variables. All explanatory variables in Columns 3 and 4 are lagged by one year. All regressions include year fixed effects and two-digit standard industry classification (SIC) code industry fixed effects. The sample contains all firms in the S&P 1500 during the 2000-2010 sample period, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The *t*-values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively. Definitions and data sources of all variables are provided in the Appendix.

Estimator	OLS		OLS		OLS		OLS		Tobit	
Dependent variable	Board ind. exp. (%)									
	(1)		(2)		(3)		(4)		(5)	
Tobin's Q	0.018 *** (4.032)		0.015 *** (3.254)		0.015 *** (2.965)		0.015 *** (2.995)		0.017 *** (2.821)	
ln (1+Number of nearby peer firms)			0.016 ** (2.411)		0.017 ** (2.384)		0.017 ** (2.389)		0.018 ** (2.155)	
Non-competition enforcement index			-0.077 ** (-2.369)		-0.073 ** (-2.110)		-0.073 ** (-2.113)		-0.096 ** (-2.223)	
ln(Total assets)	0.010 ** (2.225)		0.009 * (1.895)		0.006 (1.261)		0.006 (1.254)		0.012 * (1.856)	
ROA	-0.423 *** (-7.252)		-0.380 *** (-6.409)		-0.380 *** (-5.661)		-0.383 *** (-5.755)		-0.446 *** (-5.851)	
R&D / Sales	-0.001 (-1.455)		-0.001 (-1.421)		-0.002 *** (-2.696)		0.001 (0.100)		-0.002 (-1.425)	
CAPEX / PPE	0.127 *** (4.081)		0.112 *** (3.694)		0.105 *** (3.177)		0.105 *** (3.177)		0.159 *** (3.983)	
Financial leverage	-0.078 ** (-2.453)		-0.068 ** (-2.086)		-0.058 * (-1.665)		-0.058 * (-1.669)		-0.053 (-1.197)	
E-Index	0.005 (1.223)		0.005 (1.288)		0.004 (0.972)		0.004 (0.962)		0.007 (1.160)	
Board independence (%)	0.035 (1.273)		0.045 (1.644)		0.056 ** (1.994)		0.056 ** (2.008)		0.068 * (1.709)	
Inside directors (%)	-0.105 ** (-2.036)		-0.105 ** (-2.027)		-0.124 ** (-2.282)		-0.124 ** (-2.277)		-0.223 *** (-2.913)	
ln(Board size)	-0.093 *** (-4.228)		-0.077 *** (-3.492)		-0.074 *** (-3.194)		-0.074 *** (-3.200)		-0.072 ** (-2.264)	
CEO-chair (dummy)	-0.038 *** (-4.542)		-0.038 *** (-4.557)		-0.040 *** (-4.615)		-0.040 *** (-4.611)		-0.049 *** (-4.263)	
CEO in nom. com. (dummy)	0.008 (0.361)		0.008 (0.330)		0.017 (0.730)		0.016 (0.724)		0.006 (0.180)	
CEO stock own. (%)	-0.121 * (-1.815)		-0.107 (-1.580)		-0.128 * (-1.785)		-0.128 * (-1.791)		-0.175 (-1.622)	
Institutional own. (%)	0.078 *** (3.386)		0.082 *** (3.565)		0.073 *** (2.968)		0.073 *** (2.969)		0.116 *** (3.535)	
Directors older 72 (%)	-0.159 *** (-4.942)		-0.171 *** (-5.327)		-0.167 *** (-4.851)		-0.167 *** (-4.857)		-0.249 *** (-5.155)	
Director non-attend. (%)	0.058 (1.072)		0.044 (0.819)		0.063 (1.073)		0.064 (1.105)		0.043 (0.586)	
Busy board (dummy)	0.031 (0.815)		0.033 (0.845)		0.015 (0.414)		0.015 (0.414)		0.042 (0.842)	
Delaware (dummy)	0.041 *** (3.871)		0.033 *** (2.972)		0.032 *** (2.792)		0.032 *** (2.790)		0.042 *** (2.708)	
Female directors (%)	-0.199 *** (-4.352)		-0.193 *** (-4.176)		-0.190 *** (-3.866)		-0.190 *** (-3.869)		-0.275 *** (-4.047)	
Cash / Sales							-0.001 (-0.343)			
Dynamism							0.008 (0.488)			
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes		Yes	
Observations	10,033		9,851		8,017		8,016		9,851	
R-squared	0.341		0.348		0.355		0.355			
Pseudo R-squared									0.417	

Figure 1: The evolution of the percentage of inside directors and industry expert directors on the board

The figure displays the mean percentage of inside directors and the mean percentage of outside directors with industry experience, measured as of the annual meeting during the 2000-2010 sample period for all S&P 1500 firms, excluding utilities (standard industry classification (SIC) codes 4900-4949) and financial firms (SIC codes 6000-6999).

Appendix: Variable definitions

Panel A: Board industry experience

Variable	Definition	Source
<i>Board ind. exp. (%)</i>	Fraction of outside directors with work experience in the same two-digit SIC code industry to all outside directors	
<i>Board ind. exp. empl. (%)</i>	Fraction of outside directors with work experience as an employee without a board membership in the same two-digit SIC code industry to all outside directors	
<i>Board ind. exp. exec. dir. (%)</i>	Fraction of outside directors with work experience as an executive director in the same two-digit SIC code industry to all outside directors	BoardEx / COMPUSTAT
<i>Board ind. exp. outs. dir. (%)</i>	Fraction of outside directors with work experience as an outside director in the same two-digit SIC code industry to all outside directors	NORTH AMERICA / COMPUSTAT GLOBAL/
<i>Board ind. exp. CEO (%)</i>	Fraction of outside directors with work experience as Chief Executive Officer in the same two-digit SIC code industry to all outside directors	CRSP/AMADEUS
<i>Board ind. exp. exec. dir. non-CEO (%)</i>	Fraction of outside directors with work experience as an executive director outside the role of the Chief Executive Officer in the same two-digit SIC code industry to all outside directors	
<i>Mean number of exp. firms</i>	Mean number of firms the outside directors gained their industry experience in	

Panel B: Firm-specific variables

Variable	Definition	Source
<i>Board independence (%)</i>	Fraction of independent outside directors (as opposed to gray outside directors) to all outside directors	ISS/RiskMetrics
<i>Board size</i>	Board size	ISS/RiskMetrics
<i>Busy board (dummy)</i>	Dummy variable equal to one if the majority of board members holds three or more than three additional directorships, zero otherwise	ISS/RiskMetrics
<i>CAPEX / PPE</i>	Capital expenditures / property plant and equipment	COMPUSTATS
<i>Cash / Sales</i>	Cash and cash equivalents / sales	COMPUSTAT
<i>CEO in nom. com. (dummy)</i>	Dummy variable equal to one if the CEO is a member of the nominating committee, zero otherwise	ISS/RiskMetrics
<i>CEO stock own. (%)</i>	Fraction of shares held by the CEO to all shares outstanding	COMPUSTAT ExecuComp
<i>CEO-chair (dummy)</i>	Dummy variable equal to one if the CEO is at the same time the Chairman of the board, zero otherwise	ISS/RiskMetrics
<i>CEOs among outside directors (%)</i>	Fraction of outside directors that currently serve as CEO of another company	BoardEx
<i>Crises (dummy)</i>	Dummy variable equal to one if the meeting date took place in the years 2000, 2001, 2007, 2008, or 2009, zero otherwise	ISS/RiskMetrics
<i>Delaware (dummy)</i>	Dummy variable equal to one if the company is incorporated in the state of Delaware, zero otherwise	COMPUSTAT
<i>Directors older 72 (%)</i>	Fraction of directors older than 72 years of age	ISS/RiskMetrics
<i>Director non-attend. (%)</i>	The fraction of outside directors on the board attending less than 75% of the board meetings	ISS/RiskMetrics
<i>Dynamism</i>	The sum of four indicator variables, each constructed per industry (based on two-digit SIC codes) and year: (i) a dummy whether the average annual sales growth of all firms in the industry is above the 50th percentile, (ii) a dummy whether the average R&D expenses to total assets at the industry level are above the 75th percentile, (iii) a dummy whether the average of the fluidity score of Hoberg et al. (2014) is above the 50th percentile, and (iv) a dummy whether the average number of mergers per firm is above the 50th percentile. The index is based on (Coles et al., 2015).	COMPUSTAT, SDC, and Hoberg and Phillips Fluidity data, retrieved at http://hoberg-phillips.usc.edu/
<i>E-Index</i>	Entrenchment index as proposed by Bebchuk et al. (2009)	ISS/RiskMetrics
<i>Female directors (%)</i>	Fraction of female directors	ISS/RiskMetrics
<i>Financial leverage</i>	(Long term debt + debt due in one year) / total assets; winsorized at 1% and 99% level	COMPUSTAT
<i>Inside directors (%)</i>	Fraction of inside directors on the board	ISS/RiskMetrics
<i>Institutional own. (%)</i>	Percentage ownership of block holders with > 5% ownership	CDA Spectrum
<i>Mean number of firms among outs. directors</i>	Mean number of different firms the outside directors worked for before the day of the annual meeting date	BoardEx
<i>Mean number of industries among outs. directors</i>	Mean number of different two-digit SIC code industries the outside directors worked for before the day of the annual meeting date	BoardEx
<i>Mean age among outs. dir.</i>	Mean age of the outside directors	ISS/RiskMetrics

<i>Non-competition enforcement index</i>	State-level non-competition enforcement index of Garmaise (2009), continued through 2010 using 2004 values for the state where the firm is headquartered	Garmaise (2009) / COMPUSTAT
<i>Number of nearby peer firms</i>	Number of firms that are located in the same 3-digit zip code and share the same two-digit SIC code, but not the same 4-digit SIC code	COMPUSTAT
<i>(R&D + CAPEX + ACQ) / Sales</i>	(CAPEX + acquisition spendings + research and development spendings) / Sales	COMPUSTAT
<i>R&D / Sales</i>	R&D expenses / sales	COMPUSTAT
<i>ROA (%)</i>	Earnings before interest and taxes / total assets; winsorized at 1% and 99% level	COMPUSTAT
<i>Tobin's Q</i>	(Total assets + market value common stock – book value common stock – deferred taxes) / total assets; if deferred taxes are missing in COMPUSTAT, the value is set to zero; winsorized at 1% and 99% level	CRSP/COMPUSTAT
<i>Total assets</i>	Total asset	COMPUSTAT

Online Appendix to Board Industry Experience, Firm Value, and Investment Behavior

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1. Introduction

The purpose of this Online Appendix is to provide details and results of additional tests briefly mentioned in Section 4 of the paper “Board industry experience, firm value, and investment behavior”. In Section 2 of this Appendix, we explain a set of robustness tests and describe additional variables. An overview of these variables, which are alterations of the board industry experience measure used in the main part of the paper, is provided in Table OA1 at the end of this document. The results of these additional tests are reported in Tables OA2 and OA3. In Section 3 of this Appendix, we provide a thorough motivation and interpretation of the endogeneity tests that are only briefly summarized in the main part of the paper. Results of these tests are reported in Tables OA4 and OA5. Finally, Table OA6 contains a replication of Table 6 in the paper in which industry fixed effects are replaced by firm fixed effects.

2. Robustness tests

2.1. Alternative measures of board industry experience

We conduct additional analysis to test whether the extent of director industry experience is value-relevant. To this end, we incorporate information on the start and end date for each position in BoardEx by measuring industry experience on the outside director level in years of work experience in the same two-digit SIC code industry. In Column 1 of Table OA2, the mean years of industry experience among all outside directors on the board (*Mean board ind. exp. (years)*) is used as the board industry experience measure. As expected, the corresponding coefficient is positive and statistically significant. In Column 2, we add the standard deviation of the director industry experience among all outside directors in years for each firm-year (*σ board ind. exp. (years)*) to the model. This specification allows us to determine whether stock market participants reward a heterogeneous or a homogeneous structure of industry experience among a firm’s outside directors (i.e., only one industry experience expert with many years of experience compared to a group of directors with relatively little experience). While the coefficient

on the mean years of industry experience remains positive and significant, the coefficient on the standard deviation of board industry experience is significantly negative. These results suggest that investors prefer a homogeneous structure of industry experience among the outside directors.

We also check whether our results are robust when we use a dummy variable to capture the presence of board industry experience. In particular, we test whether firms that are governed by a board dominated by experienced outside directors are valued at a premium relative to firms where only a minority of outside directors is experienced. Supporting this conjecture, the coefficient on the dummy variable *Maj. of board exp. (dummy)*, which indicates whether the board is composed of a majority of outside directors, is positive and statistically significant (see Column 3 of Table OA2).

2.2. *Industry experience gained at private firms*

The construction of our director industry experience measures requires that we can assign SIC codes to the companies the outside directors worked for in the past. Generally, we rely on a number of financial databases to retrieve Standard Industry Classification (SIC) codes, restricting our sample to experience gained at public firms. To test whether our results hold if we also account for industry experience gained at private firms, we additionally retrieve 149,345 SIC codes belonging to non-listed firms in the work history of our sample directors by manual searches in Factiva and LexisNexis. When we replicate our baseline regression from Column 1 of Table 3 using this augmented board industry experience variable, the results remain qualitatively unchanged (see Column 4 of Table OA2).

2.3. *Active affiliation versus past work experience*

A concern could be that our results are purely driven by active affiliations of the outside directors within the same industry, as suggested by Dass et al. (2011) and Dass et al. (2014), and not by past work experience of the directors. To test whether this is the case, we split our

overall board industry experience measure. While only active industry affiliations at the annual meeting date in a director's CV are considered in one measure (*Current board ind. exp. (%)*), only past industry affiliations are included in the other one (*Non-current board ind. exp. (%)*). Results are reported in Columns 5 and 6 of Table OA2 and show that the coefficients on both measures are positive and statistically significant. These results hold when we include both measures jointly, indicating that director industry experience is a broader concept that includes but is not limited to contemporaneous industry affiliations of the outside directors (see Column 7 of Table OA2).

2.4. *Alternative industry classifications*

There may be concerns that the industry classification used (first two digits of the SIC codes) does not capture the true relatedness of the business model of two companies. We address these concerns by running a series of tests using alternative industry classifications. First, we check whether our results depend on the granularity of the SIC code used to estimate board industry experience by changing the granularity from the two-digit SIC code to the one-digit SIC code (Column 1 of Table OA3) as well as to the three-digit SIC code (Column 2 of Table OA3) and recompute the fraction of experienced outside directors on the board (*Board ind. exp. (%; one-digit)* and *Board ind. exp. (%; three-digit)*, respectively). We include one-digit SIC code industry fixed effects in the regression shown in Column 1, and two-digit SIC code fixed effects in Column 2. In a separate test, we use a combined board industry experience measure that assigns more weight to an outside director with working experience in a more closely related industry (*Combined ind. exp. measure (one – four digit)*) similar to Custódio and Metzger (2013) and two-digit SIC code fixed effects in Column 3 of Table OA3. Specifically, this measure assigns a value of four to an outside director with experience in the same four-digit SIC code industry, a value of three for experience in the same three-digit SIC code industry, a value of two for experience in the same two-digit SIC code industry, a value of one

for experience in the same one-digit SIC code industry, and zero otherwise. On the firm-year level, the measure is computed as the mean score of the weighted industry experience measure. When substituted into our main regression specification, the coefficients on all three variables are positive and statistically significant.

In a related group of tests, we apply the Hoberg and Phillips (2010; 2016) industry classification both to the firms in the outside directors' work histories and to the firms where the directors currently sit on the board in order to measure a board's industry experience.¹ The industry measures developed and tested in Hoberg and Phillips (2010; 2016) are based on a pair-wise textual comparison of the product descriptions in the annual reports available via the SEC's EDGAR database.² For each sample year, this comparison yields a matrix of product similarity scores for all firms, which Hoberg and Phillips (2010; 2016) use to classify firm-years into time-varying industries of different granularity. We replicate the baseline regression from Column 1 of Table 3 of the paper using board industry experience measures based on the Hoberg and Phillips (2010; 2016) industry classifications for 50 industries (*Board ind. exp. (%; Hoberg-Phillips 50)*), 100 industries (*Board ind. exp. (%; Hoberg-Phillips 100)*), and 200 industries (*Board ind. exp. (%; Hoberg-Phillips 200)*) in Columns 4, 5, and 6 of Table OA3, respectively. We continue to find that board industry experience has a significantly positive effect on Tobin's Q across all these specifications.

¹ The data stems from the Hoberg and Phillips Data library at <http://hobergphillips.usc.edu/>.

² Applying the text-based industry classification introduced by Hoberg and Phillips (2010; 2016) in our setup comes with certain drawbacks. First, the universe of firms for which their industry classifications are provided is limited to firms filing their annual report with EDGAR. Second, the Hoberg and Phillips database starts in 1997 since electronic filing with EDGAR was not required before 1997. Therefore, we are unable to determine whether entries in the directors' work histories offer industry experience for engagements at firms that do not file their annual report with EDGAR or engagements prior to 1997. Therefore, we use the SIC classification for the main results of the paper.

2.5. Conglomerate firms

As a final test to check whether our measure of board industry experience captures the true relatedness of the business model, we merge our firm-year sample with the COMPUSTAT segment file and reestimate the board industry experience measure using segment industry classification data.³ This alternative approach allows us to check whether we misclassify directors as industry experienced and some as not industry experienced by relying on the broader firm-level industry classification. We are able to retrieve segment data from COMPUSTAT for 10,526 of the 12,271 firm-years. Out of these 10,526 firm-years, we classify 3,631 firm-years as diversified, i.e., firm-year observations where the firm has at least two business segments operating in different two-digit SIC code industries. Similar to our standard measure of director industry experience, we then classify an outside director as industry experienced if he possesses working experience in at least one of the two-digit SIC code industries a firm's business segments operate in. The measure *Board ind. exp. (%; Segment)* is calculated as the mean number of segment industry experts among all outside directors. Column 7 of Table OA3 shows the result of the baseline regression using this segment board industry experience measure. As expected, we find the coefficient on the segment board industry experience measure to be positive and statistically significant. In Column 8 of Table OA3 we reestimate the regression using a modified segment board industry experience measure (*Board ind. exp. (%; Segment/Main)*), where we replace the firm-years without coverage in the segment file with our standard measure of firm-level board industry experience (*Board ind. exp. (%)*) and find similar results. This approach effectively assumes that firms not covered in the COMPUSTAT segment database are not diversified. Finally, we use a measure of director industry experience which reflects the

³ As discussed in prior studies, segment data comes with a number of additional problems (see, for example, Berger and Ofek, 1995). Most noteworthy in our context is the fact that firms have some leeway in reporting segments (Berger and Hann, 2003). In some cases, none of the segments reported in a given firm-year is active in the two- or even the one-digit SIC code industry of the company. Furthermore, the sum of the segment sales do not equal the sales reported by the company in many cases. Due to these data deficiencies, we report the results only as a robustness test.

idea that the benefit of an outsider’s working experience in a segment industry depends on the relative importance of the segment for the firm. For each outside director sitting on the board of a firm in a given year, we add up the fractions of segment sales to total segment sales of all segments that operate in two-digit SIC code industries where he has past working experience.⁴ We estimate this measure on the board level as the mean outside director segment sales measure among all outside directors (*Board ind. exp. (% Segment-Sales weighted)*). When we replace the standard board industry experience measure with the mean segment sales-weighted industry experience score and reestimate our standard regression, we find that this alternative measure is again positively associated with Tobin’s Q , as shown in Column 9 of Table OA3.

3. Endogeneity tests

As discussed in the paper, we run five variations of our main panel regression to mitigate concerns that our results are caused by endogeneity problems. The first test addresses the concern that our results might be driven by industry shocks that lead investors to value industry experience during certain time periods in certain industries. We test this hypothesis by replacing industry and year fixed effects with industry $\times$ year fixed effects in our main regression specification. Results remain qualitatively unchanged (see Column 1 of Table OA4).

In our next test, we evaluate the possibility that reverse causality could be a driver of our results. The alternative hypothesis under reverse causality is that the industry experience of the board serves as a quality signal to investors. As a result, firms with a low Tobin’s Q fail to attract experienced directors, rather than experienced directors enhancing a firm’s valuation. We test this alternative hypothesis by analyzing whether a firm’s past valuation (i.e., lagged Tobin’s Q) explains the change in board industry experience, while at the same time controlling

⁴ We estimate the relative importance of a segment using segment sales rather than segment assets because segment assets is missing in the COMPUSTAT segment database for a substantial number of firm-year-segment observations.

for all other lagged explanatory variables (see Cremers et al., 2017). Results of such an OLS regression reveal that lagged Tobin's Q is statistically insignificant and economically negligible, which provides direct evidence against reverse causality being the explanation for our findings (see Column 2 of Table OA4).

Third, we estimate a firm fixed effects model with industry-adjusted Tobin's Q as dependent variable, to adjust for industry effects (Cremers and Ferrell, 2014). The advantage of this specification is that it controls for a potential correlation between the error term and the independent variable (board industry experience) due to unobserved firm-level variables. The disadvantage is that corporate governance variables often do not show sufficient within-firm variation, potentially creating collinearity problems with the firm fixed effect. Hence, we specify a firm fixed effects regression model and add our board industry experience variable, replacing most corporate governance controls with firm fixed effects. The results show that the coefficient on the board industry experience variable remains positive and significant, which indicates that the Q -board industry experience relationship previously documented is at least in part driven by within-firm variation (see Column 3 of Table OA4).

In our fourth test, we use a Heckman selection model to control for the endogeneity of the decision to appoint industry experienced directors. In the first step, we estimate a probit regression with a dummy as the dependent variable that equals one if the number of experienced directors on the board increased compared to the previous year (and zero otherwise). The set of explanatory variables includes the standard firm-level controls used in Table 3 of the paper, the number of non-competing nearby peer firms, the fraction of other firms in the same two-digit SIC industry that increased the number of experienced directors compared to the previous year, the fraction of industry experienced directors on the board of other firms in the same two-digit SIC industry, the mean ROA of the other firms in the same two-digit SIC

industry, and the firm's mean ROA over the past three years. Results from the first-stage regression are reported in Column 4 of Table OA4 and show that the decision to increase board industry experience is positively related to the fraction of industry experienced directors on the board of peer firms and negatively to the percentage of other firms in the industry, which increase the number of industry experienced directors in this year. This latter finding may indicate a potential shortage in the supply of industry expert directors. In the second step, we regress Tobin's Q on the board industry experience variable, the full set of control variables, and the self-selection parameter (or inverse Mills ratio). The second stage results in Column 5 of Table OA4 show that, while there is evidence of self-selection, the coefficient on the board industry experience variable remains positive (significant at the 1% level) and of similar magnitude as in our baseline regression in Column 1 of Table 3 of the paper.⁵

In a final test, we follow Dittmar and Mahrt-Smith (2007) and Bebchuk et al. (2009) and replace the potentially endogenous board industry experience variable with its initial value, thereby forcing the board industry experience to remain constant. The intuition is that governance changes only slowly and future firm value is exogenous. We reestimate all regressions of Table 3 of the paper and find the coefficients on the board industry experience to remain similar (see Table OA5).

The last table in this online appendix, Table OA6, reports the results from reestimating the investment and cash reserve regressions, reported in Table 6 of the paper, by replacing industry by firm fixed effects. To account for industry effects, we follow Cremers and Ferrell (2014) and adjust Tobin's Q for the median Q in the firm's two-digit SIC industry. This analysis and the results are described at the end of Section 5 in the paper.

⁵ The coefficient on the inverse Mills ratio is positive and significant, indicating that there is a positive correlation between a firm's choice to increase industry experience on its board and firm value.

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Table OA1: Additional variable definitions used throughout the Online Appendix

This table reports additional variable definitions and the sources for the variables. Panel A contains the alternative board industry experience variables and Panel B additional firm-level variables. Refer to the Appendix of the main Paper for the definitions of all other variables.

<i>Panel A: Board industry experience</i>		
Variable	Definition	Source
<i>Maj. of board exp. (dummy)</i>	Dummy variable equal to one if majority of outside directors possesses industry experience, zero otherwise	
<i>Board ind. exp. (%; one-digit)</i>	Fraction of outside directors with work in the same one-digit SIC code industry to all outside directors	
<i>Board ind. exp. (%; three-digit)</i>	Fraction of outside directors with work experience in the same three-digit SIC code industry to all outside directors	
<i>Board ind. exp. (%; Hoberg-Phillips 50)</i>	Fraction of outside directors with work experience in the Hoberg and Phillips (2010; 2016) FIC 50 industry to all outside directors	
<i>Board ind. exp. (%; Hoberg-Phillips 100)</i>	Fraction of outside directors with work experience in the Hoberg and Phillips (2010; 2016) FIC 100 industry to all outside directors	
<i>Board ind. exp. (%; Hoberg-Phillips 200)</i>	Fraction of outside directors with work experience in the Hoberg and Phillips (2010; 2016) FIC 200 industry to all outside directors	
<i>Board ind. exp. (%; Segment)</i>	Fraction of outside directors with work experience in the two-digit SIC code industry of at least one business segment to all outside directors	
<i>Board ind. exp. (%; Segment/Main)</i>	Fraction of outside directors with work experience in the two-digit SIC code industry of at least one business segment to all outside directors, but <i>Board ind. exp. (%; Segment/Main)</i> is replaced with the standard board industry experience measure (<i>Board ind. exp. (%)</i>) for firm-year observations without coverage in COMPUSTAT's segment database	
<i>Board ind. exp. (%; Segment-Sales weighted)</i>	Mean segment sales industry experience score among all outside directors. An outside director's segment industry experience score is the sum of the sales to total sales of the segments that operate in two-digit SIC code industries where the outside directors possesses experience	BoardEx / COMPUSTAT NORTH AMERICA / COMPUSTAT GLOBAL/ CRSP/AMADEUS
<i>Combined board exp. measure (one – four digit)</i>	Mean score among all outside directors that equals four for each outside director with work experience in the same four-digit SIC code industry, three for each outside director with experience in the same three-digit SIC code industry, two for each outside director with work experience in the same two-digit SIC code industry, one for each outside director with work experience in the same one-digit SIC code industry, and zero otherwise. This measure is similar to the measure proposed by Custódio and Metzger (2013).	
<i>Mean board ind. exp. (years)</i>	Mean years of work experience in the same two-digit SIC code industry among all outside directors	
<i>σ board ind. exp. (years)</i>	Standard deviation of years of work experience in the same two-digit SIC code industry among all outside directors	
<i>Current board ind. exp. (%)</i>	Fraction of outside directors that work in the same two-digit SIC code industry at financial year's meeting date to all outside directors	
<i>Non-current board ind. exp. (%)</i>	Fraction of outside directors with work in the same two-digit SIC code industry that predates the financial year's meeting date to all outside directors	
<i># of ind. experienced directors increased (dummy)</i>	Dummy variable that equals one if the number of industry experienced outside directors increases compared to the previous year, zero otherwise	
<i>Publ. and priv. board ind. exp. (%)</i>	Fraction of outside directors with work experience in the two-digit SIC code industry of the focal firm. Also takes SIC codes into account that were retrieved using manual searches in Factiva and LexisNexis.	
<i>Panel B: Firm-specific variables</i>		
Variable	Definition	Source
<i>Median industry adjusted Tobin's Q</i>	Tobin's Q – median two-digit SIC code industry Tobin's Q in respective year	CRSP/COMPUSTAT
<i>Past 3-year ROA</i>	Mean ROA over the previous three years	COMPUSTAT
<i>Industry ROA</i>	Mean ROA of all other firms in the same two digit SIC code industry in a given year	COMPUSTAT
<i>Industry board ind. exp. (%)</i>	Mean fraction of outside directors on the board (<i>Board ind. exp. (%)</i>) among all other firms in the same two-digit SIC code industry	BoardEx / COMPUSTAT
<i>% firms in industry increased ind. exp. directors</i>	Fraction of firms in the same two-digit SIC code industry that increased the number of industry experts compared to the previous year	NORTH AMERICA / COMPUSTAT GLOBAL/ CRSP/AMADEUS

Table OA2: Robustness tests using alternative director industry experience measures

This table reports results from reestimating our baseline regression from Column 1 of Table 3 in the paper using alternative board industry experience measures. In Columns 1 and 2, the board industry experience variable is measured in years using the mean years of industry experience among all outside directors. Column 2 additionally includes the standard deviation of the years of director industry experience among all outside board members. In Column 3, a dummy variable that indicates whether the majority of outside directors are experienced is used as the board industry experience variable. In Column 4, we show reestimated results for our standard board industry experience measure when we additionally take work experience at private firms into account by also including SIC codes manually retrieved from LexisNexis and Factiva. In Columns 5 to 7, our standard board industry experience variable is split into two: *Current board ind. exp. (%)* is the fraction of outside directors that currently work for a company that is active in the same two digit SIC code industry and *Non-current board ind. exp. (%)* is the fraction of outside directors that possess work experience with a company that is active in the same two digit SIC code industry but that predates the firm-year's annual meeting date. The financial and the corporate governance controls (not reported for space reasons), abbreviated *Financial controls* and *Corporate governance controls*, respectively, are the same as in Table 3 of the Paper: *ln(Total assets)*, *ROA*, *R&D/Sales*, *CAPEX/PPE*, *Financial leverage*, *E-Index*, *Board independence (%)*, *Inside directors (%)*, *ln(Board size)*, *CEO-Chair (dummy)*, *CEO in nom. com. (dummy)*, *CEO stock own. (%)*, *Institutional own. (%)*, *Directors older 72 (%)*, *Director non-attend. (%)*, *Busy board (dummy)*, *Delaware (dummy)*, *Female directors (%)*. All regressions include year and two-digit SIC code industry fixed effects. The sample contains all firms in the S&P 1500 during the 2000-2010 sample period, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The *t*-values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively.

Dependent variable	Tobin's Q						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean board ind. exp. (years)	0.036 *** (4.394)	0.074 *** (3.978)					
σ board ind. exp. (years)		-0.032 *** (-2.760)					
Majority of board exp. (dummy)			0.271 *** (4.197)				
Publ. and priv. board ind. exp. (%)				0.354 *** (3.503)			
Current board ind. exp. (%)					0.960 *** (4.981)		0.822 *** (4.261)
Non-current board ind. exp. (%)						0.396 *** (3.501)	0.198 * (1.752)
Financial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corporate governance controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,033	10,033	10,033	10,033	10,033	10,033	10,033
R-squared	0.361	0.421	0.394	0.412	0.417	0.413	0.413

Table OA3: Robustness tests using different SIC code granularity, Hoberg and Phillips (2010; 2016) industry classifications, and segment industry experience

This table reports results from pooled ordinary least squares (OLS) regressions of Tobin's Q on alternative board industry experience measures. In Column 1, board industry experience is estimated using the one-digit standard industry classification (SIC) code industry classification scheme. In Column 2, board industry experience is estimated using the three-digit standard industry classification (SIC) code industry classification scheme. In Column 3, a combined industry experience measure similar to Custódio and Metzger (2013) is used. This measure assigns a value of four to an outside director if he has industry experience in the same four-digit SIC code, a value of three if an outside director has experience in the same three-digit SIC code industry, a value of two if an outside director has experience in the same two-digit SIC code industry, a value of one if an outside director has experience in the same one-digit SIC code industry, and zero otherwise. The final measure applied takes the mean industry experience score among all outside directors. Columns 4 to 6 show reestimated regression results for the baseline regression but with a board industry experience measure based on the Hoberg and Phillips (2010; 2016) industry classifications with 50, 100, and 200 industries, respectively. Columns 7 to 9 show results for board industry experience measures based on segment level. In Column 7, an outside director is classified as industry experienced if he possesses working experience in at least one of the two-digit SIC code industries a firm's segments operate in. The measure takes the mean score among all outside directors. In Column 8, the board segment industry experience measure is replaced with the board firm industry experience measure for all firm-years without coverage in the COMPUSTAT segment database. In Column 9, an outside director receives a segment sales-weighted industry experience score, which equals the sum of the sales of the segments where an outside director possesses working experience in the two-digit SIC code industry of the segment and relates it to the sum of sales of all segments. The measure then takes the mean score among all outside directors. Financial and corporate governance controls are as in Table 3 of the Paper: *ln(Total assets)*, *ROA*, *R&D/Sales*, *CAPEX/PPE*, *Financial leverage*, *E-Index*, *Board independence (%)*, *Inside Directors (%)*, *ln(Board size)*, *CEO-Chair (dummy)*, *CEO in nom. com. (dummy)*, *CEO stock own. (%)*, *Institutional own. (%)*, *Directors older 72 (%)*, *Director non-attend. (%)*, *Busy board (dummy)*, *Delaware (dummy)*, *Female directors (%)*. Regressions include year and two-digit SIC code industry fixed effects, except Column 2, which uses one-digit SIC code fixed effects. The sample contains all firms in the S&P 1500 during 2000-2010, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The t -values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively.

Dependent variable	Tobin's Q								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Board ind. exp. (%; one-digit)	0.416 *** (4.452)								
Board ind. exp. (%; three-digit)		0.719 *** (5.893)							
Combined ind. exp. measure (one – four digit)			0.122 *** (4.598)						
Board ind. exp. (%; Hoberg-Phillips 50)				0.375 *** (4.109)					
Board ind. exp. (%; Hoberg-Phillips 100)					0.369 *** (3.965)				
Board ind. exp. (%; Hoberg-Phillips 200)						0.453 *** (4.322)			
Board ind. exp. (%; Segment)							0.395 *** (3.681)		
Board ind. exp. (%; Segment/Main)								0.354 *** (3.629)	
Board ind. exp. (%; Segment-Sales weighted)									0.946 *** (3.619)
Financial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corporate governance controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,033	10,033	10,033	10,033	10,033	10,033	10,033	10,033	10,033
R-squared	0.417	0.413	0.413	0.394	0.361	0.421	0.415	0.417	0.420

Table OA4: Identification analysis

This table reports results that address endogeneity concerns. In Column, 1 the regression is the same as in the baseline regression from Column 1 of Table 3 of the Paper, but the two-digit standard industry classification (SIC) code and year fixed effects are replaced with two-digit SIC code $\times$ year fixed effects. In Column 2, the dependent variable is the change in board industry experience year $t-1$ to year t . All independent variables (including *Tobin's Q*) are lagged by one year to mitigate reverse causality problems. Column 3 shows regression results for a specification similar to Cremers and Ferrell (2014), where the dependent variable (median industry adjusted Tobin's Q) accounts for industry effects, and the regression includes firm and year fixed effects. Columns 4 and 5 report the result of a Heckman selection model. Column 4 reports the results from the first stage Probit regression with a dummy variable that equals one if the number of experienced directors on the board increased compared to the previous year and zero otherwise (*# of ind. experienced directors increased (dummy)*) as dependent variable. The regression includes the standard set of control variables as well as the number of nearby peer firms ($\ln(1 + \text{Number of nearby peer firms})$), the fraction of firms in the same two-digit SIC industry that increased the number of experienced directors compared to the previous year (*% firms in industry increased ind. exp. directors*), the fraction of industry experienced directors on the board of other firms in the same two-digit SIC industry (*Industry board ind. exp. (%)*), the mean ROA of the other firms in the same industry (*Industry ROA*), and a firm's mean ROA over the past three years (*Past 3-year ROA*). Column 5 shows results from the second stage of the Heckman selection model with *Tobin's Q* as the dependent variable, including the standard controls from Column 1 of Table 3 of the Paper as well as the inverse Mills ratio from the first stage Probit regression. The regressions in Columns 2, 4, and 5 include year fixed effects and two-digit standard industry classification (SIC) code industry fixed effects. The sample contains all firms in the S&P 1500 during the 2000-2010 sample period, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The t -values are reported in parentheses and based on robust standard errors clustered at the firm level with the exception of the Probit regression in Column 5. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively.

Estimator	OLS			Heckman selection model	
	<i>Tobin's Q</i>	Δ Board ind. exp. (%)	Median industry-adjusted <i>Tobin's Q</i>	First Stage (Probit) <i># of ind. exp. directors increased (dummy)</i>	Second Stage (OLS) <i>Tobin's Q</i>
Dependent variable	(1)	(2)	(3)	(4)	(5)
Board ind. exp. (%)	0.490*** (4.340)	-0.077*** (-13.995)	0.235* (1.741)		0.427*** (4.047)
<i>Tobin's Q</i>		0.001 (1.281)			
$\ln(1 + \text{Number of nearby peer firms})$				0.211 (0.692)	
<i>% firms in industry increased ind. exp. directors</i>				-1.277* (-1.662)	
<i>Industry board ind. exp. (%)</i>				1.448* (1.862)	
<i>Industry ROA</i>				-0.109 (-0.392)	
<i>Past 3-year ROA</i>				0.014 (0.726)	
<i>Inverse Mills ratio</i>					1.906*** (5.391)
$\ln(\text{Total assets})$	0.001 (0.046)	-0.001 (-1.028)	-0.534*** (-8.743)	-0.038** (-2.233)	-0.046** (-2.305)
ROA	6.779*** (15.727)	-0.047*** (-3.514)	3.797*** (11.266)	-0.578** (-1.998)	5.652*** (14.722)
R&D / Sales	0.041** (2.560)	-0.000*** (-4.409)	0.011** (2.465)	-0.029 (-0.962)	0.223*** (2.968)
CAPEX / PPE	1.708*** (8.941)	0.006 (0.898)	0.597*** (2.823)	0.114 (0.851)	1.480*** (8.172)
Financial leverage	-0.765*** (-4.453)	-0.001 (-0.152)	-0.563*** (-3.796)	-0.143 (-1.114)	-1.000*** (-6.146)
E-Index	-0.069*** (-4.644)	-0.001 (-0.820)	-0.015 (-0.844)	-0.037** (-2.385)	-0.116*** (-7.038)
Board independence (%)	0.182 (1.287)	0.020** (2.450)		0.003 (0.024)	0.137 (1.041)
Inside Directors (%)	0.090 (0.396)	-0.013 (-1.041)		-1.722*** (-7.386)	-2.614*** (-4.788)
$\ln(\text{Board size})$	-0.252** (-2.515)	-0.003 (-0.525)		0.682*** (6.967)	0.787*** (3.667)
CEO-chair (dummy)	-0.020 (-0.561)	-0.001 (-0.686)		-0.108*** (-2.871)	-0.197*** (-4.117)

<i>CEO in nom. com. (dummy)</i>	-0.385 *** (-3.731)	0.008 (1.186)		-0.196 (-1.037)	-0.521 *** (-5.408)
<i>CEO stock own. (%)</i>	-0.227 (-0.698)	-0.010 (-0.694)		-0.173 (-0.524)	-0.541 * (-1.734)
<i>Institutional own. (%)</i>	-0.080 (-0.768)	0.002 (0.297)		0.105 (0.977)	0.144 (1.421)
<i>Directors older 72 (%)</i>	0.119 (0.651)	-0.009 (-1.325)		-0.666 *** (-4.278)	-0.922 *** (-3.218)
<i>Director non-attend. (%)</i>	0.296 (1.102)	-0.004 (-0.229)		0.129 (0.351)	0.283 (1.014)
<i>Busy board (dummy)</i>	0.276 * (1.890)	0.004 (0.590)		0.167 (0.935)	0.589 *** (3.412)
<i>Delaware (dummy)</i>	0.026 (0.607)	0.001 (0.364)		0.011 (0.289)	0.035 (0.871)
<i>Female directors (%)</i>	0.157 (0.834)	-0.018 ** (-1.969)		-0.433 ** (-2.269)	-0.496 ** (-2.369)
<i>Year × industry fixed effects</i>	Yes	No	No	No	No
<i>Year fixed effects</i>	No	Yes	Yes	Yes	Yes
<i>Industry fixed effects</i>	No	Yes	No	Yes	Yes
<i>Firm fixed effects</i>	No	No	Yes	No	No
<i>Observations</i>	10,033	8,165	10,827	8,608	8,608
<i>R-squared</i>	0.462	0.054	0.730	-	0.434

Table OA5: Pooled ordinary least squares (OLS) regressions of Tobin's Q on initial values of board industry experience measures

This table reports results from reestimating Table 3 of the paper with the variables that capture board industry experience being replaced with their initial value as observed upon entering our sample (Dittmar and Mahrt-Smith, 2007; Bebchuk et al., 2009). Column 1 presents regression results where industry experience is estimated as the fraction of experienced outside directors to all outside directors, while the remaining columns show regression results where industry experience is defined based on different hierarchical levels: Column 2 considers only industry experience as an employee, Column 3 only industry experience as an executive director, and Column 4 only industry experience as an outside director. Column 5 introduces all three hierarchical measures jointly. Column 6 uses the fraction of outside directors that possess industry experience as a CEO as well as industry experience as an executive director outside the role of the CEO. The financial and the corporate governance controls, abbreviated *Financial controls* and *Corporate governance controls*, respectively, are the same as in Table 3 of the Paper: $\ln(\text{Total assets})$, ROA , $\text{R\&D/Sales}$, CAPEX/PPE , $\text{Financial leverage}$, E-Index , $\text{Board independence (\%)}$, $\text{Inside directors (\%)}$, $\ln(\text{Board size})$, CEO-Chair (dummy) , $\text{CEO in nom. com. (dummy)}$, $\text{CEO stock own. (\%)}$, $\text{Institutional own. (\%)}$, $\text{Directors older 72 (\%)}$, $\text{Director non-attend. (\%)}$, $\text{Busy board (dummy)}$, Delaware (dummy) , $\text{Female directors (\%)}$. In addition to year fixed effects and two-digit standard industry classification (SIC) code industry fixed effects. The sample contains all firms in the S\&P 1500 during the 2000-2010 sample period, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The t -values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively.

<i>Dependent variable</i>	<i>Tobin's Q</i>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Board ind. exp. (%)</i>	0.479 *** (4.686)						
<i>Board ind. exp. empl. (%)</i>		0.698 *** (3.713)			0.369 * (1.665)		
<i>Board ind. exp. exec. dir. (%)</i>			0.853 *** (3.057)		0.403 (1.286)		
<i>Board ind. exp. outs. dir. (%)</i>				0.533 *** (4.380)	0.375 *** (3.163)		
<i>Board ind. exp. CEO (%)</i>						0.984 *** (3.001)	0.981 *** (2.973)
<i>Board ind. exp. exec. dir. non-CEO (%)</i>						0.112 (0.328)	0.113 (0.331)
<i>CEOs among outside directors (%)</i>							0.031 (0.191)
<i>Financial controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Corporate governance controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year fixed effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry fixed effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	10,033	10,033	10,033	10,033	10,033	10,033	10,033
<i>R-squared</i>	0.416	0.414	0.414	0.416	0.419	0.414	0.414

Table OA6: Cross-sectional tests: Investments, cash holdings, dynamism, and crises performance

This table reports firm fixed effects regressions of the cross-sectional investments and cash reserve tests reported in Columns 1 to 3 of Table 6, using a specification similar to Cremers and Ferrell (2014) and Column 3 in Table OA4. The dependent variable is median industry adjusted *Tobin's Q*, to account for industry effects, while industry fixed effects are replaced by firm fixed effects. All variables are defined as in the Appendix of the paper. The sample contains all firms in the S&P 1500 during the 2000-2010 sample period, excluding utilities (SIC codes 4900-4949) and financial firms (SIC codes 6000-6999). The t-values are based on robust standard errors clustered at the firm level and are reported in parentheses. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% level, respectively.

<i>Dependent variable</i>	<i>Median industry-adjusted Tobin's Q</i>		
	(1)	(2)	(3)
<i>Board ind. exp. (%)</i>	0.202 (1.448)	0.210 (1.550)	0.152 (1.124)
<i>(R&D + CAPEX+ ACQ)/ Sales × Board ind. exp. (%)</i>	0.202* (1.720)		
<i>(R&D + CAPEX+ ACQ)/ Sales</i>	-0.029 (-1.467)		
<i>R&D / Sales × Board ind. exp. (%)</i>		0.251** (2.069)	
<i>Cash / Sales × Board ind. exp. (%)</i>			0.204*** (3.569)
<i>Cash / Sales</i>			-0.065 (-1.543)
<i>ln(Total assets)</i>	-0.527*** (-8.774)	-0.527*** (-8.842)	-0.524*** (-8.928)
<i>ROA</i>	4.055*** (12.525)	3.866*** (11.912)	3.896*** (12.010)
<i>R&D / Sales</i>		-0.036* (-1.734)	0.054 (0.863)
<i>CAPEX / PPE</i>		0.616*** (2.848)	0.608*** (2.845)
<i>Financial leverage</i>	-0.587*** (-3.979)	-0.543*** (-3.667)	-0.546*** (-3.698)
<i>E-Index</i>	-0.015 (-0.836)	-0.014 (-0.794)	-0.013 (-0.736)
<i>Year fixed effects</i>	Yes	Yes	Yes
<i>Firm fixed effects</i>	Yes	Yes	Yes
<i>Observations</i>	10,845	10,827	10,825
<i>R-squared</i>	0.729	0.732	0.734