Do Independent Directors Cause Improvements in Firm Transparency?

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Abstract: Recent research finds that firms characterized by high corporate transparency have a greater proportion of independent directors. The direction of the causality of this relation, however, is unclear. One branch of the governance literature takes corporate transparency as fixed and shows that the effective level of board independence is determined by exogenous variation in the information environment. Another branch argues that independent directors can instigate changes in transparency. We examine a regulatory shock that substantially increased board independence for some firms, and find that information asymmetry, and to some extent management disclosure and financial intermediation changed at firms affected by this shock. We also examine the lead/lag relation between changes in board structure and changes in corporate transparency, as well as whether these effects vary as a function of management entrenchment, information processing costs, and when changes to audit committee independence are required. Our results suggest that corporate transparency can be altered to suit the informational demands of a particular board structure.

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1. Introduction

We examine whether firm transparency adjusts to an increase in the proportion of independent directors. Independent directors, as outsiders to the firm, must acquire and process a substantial amount of firm-specific information to effectively perform their advising and monitoring duties. When the corporate information environment is opaque, and there are significant costs to acquire and process detailed information about their firm's operating, financing, and investing activities, independent directors are less effective. Further, management has a fiduciary responsibility to keep both independent directors and shareholders informed about the firm's activities and management's performance, and this transparency can be impaired when boards are dominated by insiders. We document that corporate transparency, as measured by proxies for information asymmetry, disclosure, and information intermediation, generally improves following a required increase in the proportion of independent directors. We also examine the lead/lag relation between changes in board structure and changes in corporate transparency, as well as whether these effects vary as a function of management entrenchment, information processing costs, and when changes to audit committee independence are required. When interpreted in the context of existing literature, our results highlight simultaneity in the evolution of board structure and corporate transparency, and suggest that transparency can be altered to suit the informational demands of a particular board structure.

A growing literature documents that a firm's information asymmetry and transparency influence attributes of its board structure in general, and the degree of independence in particular. This literature argues that independent directors have difficulty performing their advising and monitoring roles when information asymmetry and information transfer and processing costs are high, and therefore that firms with high information asymmetry choose to have relatively few

independent directors (e.g., Linck et al., 2008; Lehn et al., 2008). Consistent with this prediction, several recent papers find a negative relation between board independence and both information asymmetry and information transfer costs.[1] These papers, however, generally assume that corporate transparency is exogenous with respect to board structure. That is, these studies do not consider that managers and directors may be able to lower information transfer costs by committing to various financial reporting and disclosure policies.[2] If corporate transparency is endogenous in this way, then the interpretation of a negative relation between information asymmetry and board independence becomes more complicated (and may stem from board structure influencing information asymmetry as well as information asymmetry influencing board structure).

The notion that a firm's board structure, including its proportion of independent directors, can influence various aspects of corporate transparency is not new, at least within the literature on financial reporting and disclosure. For example, Petra (2007) and Ferreira et al. (2011) document positive relations between the proportion of independent directors and accounting quality and earnings informativeness, respectively. Similarly, Beekes, Pope, and Young (2004) and Ahmed and Duellman (2007) find that timely recognition of losses (a commonly used measure of earnings quality) is greater for firms with a higher proportion of independent directors.[3] These authors generally interpret these results as being consistent with independent

[1] See, for example, Boone et al. (2007); Coles, Daniel, and Naveen (2007); Linck et al. (2008); Lehn et al. (2008); Cai, Liu, and Qian (2009); and Ferreira, Ferreira, and Raposo (2011).

[2] Ferreira, Ferreira, and Raposo (2011) examine how stock price informativeness affects board independence. As a sensitivity analysis, they consider the possibility that price informativeness and board structure might be jointly determined, and estimate two- and three-stage least squares regressions to ensure that their results are robust to controlling for potential reverse causality. The focus of this analysis, however, is on controlling for the reverse causality effect, as opposed to exploring its existence and characteristics.

[3] In a related vein, Klein (2002) and Krishnan (2005) find that the proportion of independent audit committee directors is negatively related to the magnitude of discretionary accruals and the incidence of internal control weaknesses, respectively. Goh, Ng, and Yong (2011) examine the cross-sectional association between board independence, accruals quality, management forecasts, analyst coverage, and information asymmetry. They address

directors improving the quality of financial reporting, although as we note in Section 2, these papers generally do not provide evidence on the causality of this relation.

These two literatures suggest different directions of causality in the relation between board structure and corporate transparency. One literature argues that corporate transparency and information transfer and processing costs are primarily exogenous, and are dictated by firm characteristics such as size, growth opportunities, and business environment uncertainty. As such, board independence is, in part, a function of these exogenous firm characteristics. The other literature argues that independent directors can take actions to increase their firm's transparency because lower information asymmetry can aid independent directors in reducing agency conflicts that arise from managers' informational advantage. A variant of this argument is that managers commit to more transparent financial reporting and disclosure practices to attract independent directors, and to make those directors more effective.[4] Thus, these competing, non-mutually exclusive, arguments leave open the question of whether corporate transparency is an exogenous determinant of board structure, or instead whether independent directors (or managers, or even regulators) can actively induce changes in corporate transparency, thereby altering the efficacy of certain board structures.

To provide more definitive evidence of whether firms' information environments adapt to fit the informational needs of a particular board structure, we examine a shock to the proportion of independent directors, and then observe whether and how these firms' information environments change in response to this shock. Similar to Duchin, Matsusaka, and Ozbas (2010), we use regulations issued in 2003 by the NYSE and Nasdaq as an exogenous event that

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the endogeneity of board independence by using board connections, which they define as "the fraction of dependent directors with board connections to boards with a majority of independent directors" as an instrumental variable.

[4] See Engel (2005) for a similar argument in the context of firms committing to high quality financial reporting to attract financial experts to the audit committee of the board of directors.

significantly altered the proportion of independent directors for some firms' boards.[5] These regulations require most listed corporations to have a majority (more than 50%) of independent directors on their boards. In general, firms were required to comply with these regulations by the earlier of: (1) the listed firm's first annual shareholder meeting after January 15, 2004; or (2) October 31, 2004. Some firms already had a majority of independent directors on their boards and therefore complied with these new regulations at the time they were issued; other firms did not. In our sample, the firms that were not in compliance with the majority board independence rule (as of 2000) have a 45% increase in the mean proportion of independent directors, whereas firms that were already in compliance experienced virtually no change in their proportion of independent directors during the same period. We use a model of board structure to identify the expected change in proportion of independent directors based on the minimum change that firms would have to make to their board structure, if any, to comply with the exchange requirements. We then use the predicted change in the proportion of independent directors (over a four-year period from roughly 2000-2004) to identify the effect of this exogenous change in board structure on changes in a variety of information-related variables.

Using board structure data for a broad sample of 1,849 firms, we find that information asymmetry, measured as the information asymmetry component of the bid-ask spread, decreases in response to an exogenous increase in the proportion of independent directors. The typical 18 percentage point average increase in the proportion of independent directors translates to roughly a 6% decrease in information asymmetry. We also explore some of the potential channels through which transparency may be altered to satisfy the informational demands of the board. Specifically, we examine variables related to management forecast frequency and precision, accrual quality, analyst following and consensus, shareholder base, and auditor fees. Our

[5] Duchin et al. (2010) use the 2002 Sarbanes-Oxley (SOX) regulation related to audit committee independence.

evidence suggests that an increase in the proportion of independent directors results in increases in the frequency of management forecasts and analyst following (with marginally significant evidence of increases in management forecast precision, analyst forecast consensus, and institutional following). We also find that auditor fees, a proxy for commitment to stringent internal controls and higher quality financial reporting are somewhat greater for firms that are required to increase the independence of both their full board and their audit committee.

We also explore several predictions regarding cross sectional variation in the relation between increases in board independence and corporate transparency. For example, although a board with a majority of independent directors likely requires a more transparent information environment than an insider-dominated board to govern effectively, management may not willingly relinquish their control over the board. One way for management to limit the monitoring effectiveness of independent directors—particularly those who are new—is to withhold information or otherwise resist efforts by directors to elicit increased transparency. To explore this possibility, we test whether the increase in corporate transparency is muted for firms where managers are likely to be entrenched. Using insider ownership and the proportion of independent directors appointed during the current CEO's tenure as proxies for entrenchment, we find that when management is likely to be entrenched, management forecasts become less precise, and to some extent less frequent, following the mandated increase in board independence. However, we find no significant mediating effects of management entrenchment on the relations between the change in board independence and changes in our other measures of corporate transparency.

Our other cross-sectional analyses examine whether the relation between increases in board independence and corporate transparency varies with audit committee independence,

information processing costs, and whether firms operationalize their compliance with the board structure regulations by adding new independent directors (increasing board size) as opposed to removing non-independent directors (decreasing board size). Our findings indicate that information asymmetry declines more for firms that increase their board size (by adding new independent directors), as well as for firms that are required to simultaneously increase the independence of their audit committee.

Finally, we explore the lead/lag relation between changes in transparency and changes in board independence. We partition our sample of non-compliant firms into those that complied early and late in the sample period, and find some evidence consistent with improvements in transparency both preceding and following compliance with the board independence regulation.

Collectively, our results suggest that firms can and do alter certain aspects of corporate transparency to facilitate the informational demands of independent directors. These results generally support the inferences in a large body of financial reporting and disclosure literature arguing that corporate transparency is endogenous with respect to management and/or board actions. At the same time, our findings also highlight the importance of acknowledging the simultaneous relation between board independence and corporate transparency, and we suggest that caution be exercised when interpreting results that take board independence or corporate transparency as exogenous rather than both being jointly and simultaneously determined.

The paper proceeds as follows: In section 2, we discuss background literature and develop predictions on the relations between board independence and corporate transparency. Section 3 outlines our research design, and section 4 provides information on our sample construction. We present our results in section 5. Section 6 provides concluding remarks.

2. Background and Predictions

As noted above, many authors predict and find a positive relation between corporate transparency and the proportion of independent directors.[6] This relation is interpreted as evidence that firms structure their boards with a high proportion of independent directors only when their information environment is sufficiently transparent to allow these directors to perform their monitoring and advising duties.[7] An assumption that is maintained throughout this literature is that corporate transparency is exogenous with respect to firms' choice of board structure; that is, a firm's board structure is a function of its information environment, but a firm's information environment is not affected by its board structure. In contrast, much of the accounting literature on governance assumes that boards and managers can and do make financial reporting and disclosure choices to alter corporate transparency. In these papers, the board is often viewed as a mechanism that can be used to effect changes in transparency. This research, however, does not test for a causal effect of board structure on transparency, and most of the results in this literature are also consistent with a reverse causality explanation that the degree of corporate transparency drives board structure.

Our objective is to determine whether and how corporate transparency adapts to the informational demands of a particular board structure. As we discuss in more detail below, our research design relies on new regulations that mandated substantial increases in the proportion of independent directors for some firms but not others. Specifically, the regulations require that most boards have a majority of independent directors. Therefore, boards with a majority of inside

[6] E.g., Boone et al. (2007); Coles, Daniel, and Naveen (2007); Linck et al. (2008); Lehn et al. (2008); Cai, Liu, and Qian (2009); and Ferreira, Ferreira, and Raposo (2011).

[7] As noted by Bushman et al. (2004), one might alternatively predict a negative relation between transparency and the proportion of independent directors if the monitoring activities of independent directors are more valuable in settings where substantial information asymmetries exist between managers and investors. This negative relation, however, does not appear to be borne out in the data examined in prior studies.

or non-independent directors were required to add more independent directors, remove some inside directors, or some combination of the two. Boards with a majority of independent directors when the regulations were issued were not required to make changes to their board structure. In our sample, firms that were not in compliance with the majority board independence rule experience significant increases in their proportion of independent directors, whereas firms that were already in compliance do not, on average, increase their proportion of independent directors.

Our main hypothesis is that an exogenous increase in the proportion of independent directors will cause an increase in corporate transparency. This hypothesis is premised on the idea that independent directors require a transparent information environment to effectively monitor and advise management. In some cases, management may proactively increase transparency in order to attract independent directors who would otherwise be unwilling to join the board if the information environment were opaque. Alternatively, if transparency has not been adequately increased to satisfy the informational needs of independent directors, then when the proportion of independent directors increases, the board is expected to take action to ensure transparency. Thus, although we predict a positive relation between changes in transparency and changes in board independence, our analysis considers the possibility that the change in transparency may either lead or follow the change in board independence. If corporate transparency cannot be altered to accommodate the information demands of an independent board, then there should be no association between an increase in the proportion of independent directors and changes in transparency.

We emphasize that our predictions and tests focus on public measures of corporate transparency. One might question whether independent directors could instead resolve their

information disadvantage vis-à-vis management using private rather than public channels. For example, independent directors have access to internal budgeting information, reports, and informal communication with managers. It seems unlikely, however, that outside directors rely solely on information supplied by, and filtered through, managers (Adams, Hermalin, and Weisbach, 2010; Armstrong, Guay, and Weber, 2010). Although managers will be forthcoming in sharing certain types of information with independent directors, they are not likely to share information that is detrimental to their own interests (Jensen, 1993; Verrecchia, 2001). Thus, managers are expected to be forthcoming only with information that is relatively unhelpful to independent directors with monitoring.

In light of this concern, independent directors seek financial reporting systems and public information channels that aid their monitoring activities. Bushman et al. (2004) note that public disclosures can carry greater credibility than private communications, in part because these disclosures are subject to SEC rules and enforcement, litigation, and oversight by auditors and others. Information intermediaries such as analysts and the business press scrutinize public disclosures. Analysts can also uncover distortions in information (e.g., Miller, 2006). Other governing entities, such as blockholders and institutional investors use public disclosures in monitoring managers' strategic decisions. Further, because publicly-released erroneous information imposes costs on managers, public information channels enhance the credibility of private information that managers share with directors. For example, a public management forecast of earnings enhances the credibility of non-public budgets that underlie the forecast. We conclude from these arguments and prior literature that public measures of corporate

transparency are likely to play an important role in governance.[8]

Returning to our hypotheses, we note that certain economic forces could complicate our prediction of a positive relation between changes in board independence and changes in transparency. One issue is that when decision rights are taken away from management and inside directors (because the previous majority of inside directors is required to be reduced to a minority), managers may respond by thwarting any attempt to increase transparency, or even actively decreasing transparency. As noted by Holmstrom (2005), Adams and Ferreira (2007), and others, if management believes that a more independent board will monitor their actions and decisions more intensively, they may be reluctant to disclose information that can be used for disciplining purposes. Further, management may not only withhold information from independent directors, but may also seek to entrench themselves by investing in manager-specific projects that increase information asymmetries and limit the board's ability to impose discipline (see Shleifer and Vishny, 1989; Edlin and Stiglitz, 1995). We expect that management's ability to resist the information demands of independent directors increases with the degree to which management is entrenched. In our tests below, we explore this prediction using inside ownership and the proportion of independent directors that have been appointed during the current CEO's tenure as proxies for managerial entrenchment.

Further, managers' ability to withhold information, and the difficulty with which independent directors can elicit information, is expected to be greater when information processing costs are large. The influence of information processing costs on board structure is discussed in detail by Duchin et al. (2010) who emphasize, "when an outsider's cost of acquiring information about the firm is high, outside directors are less effective at monitoring and

[8] Outside directors also have reputations to protect, and public revelation of accounting fraud and misstatements can result in large costs in terms of lost directorships (Gerety and Lehn, 1997; Srinivasan, 2005; Fich and Shivdasani, 2007).

providing advice, than when the cost of information is low." Duchin et al. (2010) further note that because some firms optimally maintain a low proportion of independent directors (e.g., due to high information processing costs), a mandate that all boards have a majority of independent directors is unlikely to be equally beneficial for all firms. And, if the required increase in board independence does not result in a more effective board structure, then any improvement in corporate transparency following the regulation may be muted. Further, it is possible that transparency could even decrease in this latter setting if independent directors make worse project selection decisions due to a lack of necessary information, and uncertainty about the outcome of these decisions leads to greater information asymmetry. This prediction of a muted improvement in transparency when information processing costs are high complements our previous prediction that when control is relinquished to independent directors, high information processing costs may afford managers an increased ability to withhold information and maintain effective control of decision making. In the terminology of Aghion and Tirole (1997), even though "formal authority" (i.e., "the right to decide") may have shifted to the board as a result of the regulatory mandated increase in independence, "real authority" (i.e., "the effective control over decisions") may still reside with management due to their information advantage.

In summary, the discussion above suggests that the effect of a required increase in the proportion of independent directors on corporate transparency and information asymmetry is an empirical issue: independent directors require greater transparency to govern effectively, but managers have incentives to decrease transparency when they are stripped of their formal control rights. The discussion also predicts that any positive relation between a required increase in the proportion of independent directors and corporate transparency will be attenuated for firms that are characterized by greater information processing and transfer costs. In our tests below, we

explore whether the relation between a required increase in the proportion of independent directors and corporate transparency varies with proxies for managerial entrenchment and information processing costs.

3. Research Design and Caveats

3.1 Research design and caveats

We wish to test whether a firm's proportion of independent directors causally determines characteristics of corporate transparency. Therefore, we would ideally estimate the following specification:

$$\textit{Information Variable} = a_0 + a_1 \textit{\% Ind. Directors} + \sum a_2 \textit{*Controls} + \textit{error} \qquad (1)$$

However, as discussed in the previous section, the literature on the relation between firms' governance structures and transparency suggests that board structure and information are jointly determined. If firms' *% Ind. Directors* is endogenously related to corporate transparency, the estimated effect of board structure will be biased. Credible identification of the effect of firms' board structure on transparency therefore requires an instrument that produces exogenous variation in board structure, but that has no *direct* effect on firms' transparency.

Similar to Duchin et al. (2010), we use recent regulations that imposed changes to board structure as a source of exogenous variation in board structure.[9] Specifically, we use NYSE and Nasdaq regulations that require listed corporations to have a majority (more than 50%) of independent directors on their boards. As discussed in Chhaochharia and Grinstein (2009), in

[9] A number of recent papers also rely on the 2003 NYSE and Nasdaq regulations (or some variant) as an instrument with which they have documented causal effects of board structure on firm value (Wintoki, 2007; Duchin et al., 2010), CEO compensation (Chhaochharia and Grinstein, 2009), credit risk (Chen, 2011) and earnings management (Chen et al., 2011). In addition, Black and Kim (2012) use Korean regulations that are analogous to the NYSE and Nasdaq exchange regulations to examine the relation between board structure and firm value in a sample of Korean firms. Collectively, the results in these studies suggest that exchange regulations requiring a majority of independent directors are a powerful instrument that have induced a number of empirically detectable effects.

February 2002, the SEC asked the exchanges to improve their governance listing standards. The NYSE and the Nasdaq proposed the changes requiring majority independence in August 2002 (NYSE) and October 2002 (Nasdaq), and the SEC approved the proposals with minor changes in November 2003. To ensure that our sample period begins prior to any influence of these regulation (or public/private discussion about the pending influence of the regulations), we measure initial board independence as of fiscal years ending between May 2000 and June 2001. About 30% of our sample did not initially comply with this regulation as of 2000, so our sample contains firms that had to change their board structure and other firms for which no change was required. In general, firms were required to adopt these policies by the earlier of: (1) the listed issuer's first annual shareholder meeting after January 15, 2004; or (2) October 31, 2004.[10] It is important to note that exchange regulations produced variation in the *change* in the proportion of independent directors, rather than in the proportion of independent directors *per se*.

To use this instrument, we take first-differences of Eq. (1), which yields the following model of changes in information variables as a function of changes in board structure and changes in controls:

$$\textit{Change in Information Variable} = a_0 + a_1 * \textit{Change in \% Ind. Directors} + \sum a_2 * \textit{Change in Controls} + \textit{error} \qquad (2)$$

Change in %Independent Directors remains endogenous, and we instrument for it with its predicted value from the following regression:

$$\textit{Change in \%Independent Directors}_{2000\text{-}2004} = b_0 + b_1 * \textit{Min \% Change ID}_{2000} + \sum b_2 * \textit{Change in Controls} + \textit{industry indicators} + \textit{error} \qquad (3)$$

[10] Firms with classified boards had until their first annual meeting after January 15, 2005, but no later than December 31, 2005 (Securities and Exchange Commission press release 34–48745, November 4, 2003).

This equation models the change in the proportion of independent directors at each firm between 2000 and 2004, and identifies it with the instrument, the minimum required percentage change in independent directors, *Min % Change ID*. We calculate this variable as follows:

Min % Change ID = 0 if % independent directors in 2000 > 50%

Min % Change ID = (Minimum number of independent directors required for majority independence)/board size if % independent directors in 2000 ≤ 50%

This variable measures the percentage by which firms as of 2000 had to increase their independent directors to comply with the 2003 NYSE and Nasdaq regulations that require more than 50% independent directors. The regulations affect firms with small boards more than large boards, and the construction of our variable captures this effect. For example, consider two boards, one with five directors and the other with twenty. If both boards have 40% independent directors, the board with five directors needs to add one independent director (an increase from two to three independent directors, or 20% of the board) to comply, while the board with twenty directors needs to add three independent directors (an increase from eight to eleven independent directors, or 15% of the board) to comply. We then use fitted values from this regression as the predicted changes in the proportion of independent directors between 2000 and 2004 with which we identify the effect of changes in board structure on changes in firm transparency in the second stage.

As we discuss in more detail below, we measure changes in the proportion of independent directors and other variables over the period 2000 and 2004, where 2004 is the first year that firms were required to comply with the regulations, and 2000 is the latest year in which the new regulations could not have been reasonably anticipated.

Our second-stage empirical specification is as follows:

$$\begin{aligned} \textit{Change in Information Variable}_{2000\text{-}2004} &= a_0 \\ &+ a_1 * \textit{Change in \% Ind. Directors}_{2000\text{-}2004}\textit{(predicted)} \\ &+ \sum a_2 * \textit{Change in Controls}_{2000\text{-}2004} + \sum a_3 * \textit{Controls}_{2000} \\ &+ \textit{industry indicators} + \textit{error} \end{aligned} \quad (4)$$

As dependent variables, we examine three categories of variables that measure various aspects of firm transparency: 1) a comprehensive measure of information asymmetry between informed and uninformed shareholders, as measured by changes in the information asymmetry component of the bid-ask spread; 2) disclosure choices by management that can influence transparency, as measured by changes in the frequency and precision of management forecasts, and accruals quality; and 3) information intermediation that may have changed as a consequence of the change in transparency, as measured by changes in analyst following and consensus, institutional holdings, the number of shareholders, and audit fees. We view these latter two categories of dependent variables as potential mechanisms through which boards and managers can influence transparency. For example, the incidence and accuracy of management forecasts and earnings quality are considered to be discretionary information channels that managers use to influence corporate transparency. We describe how we measure these information variables in more detail below.

In both the first- and second-stage regressions, we control for contemporaneous changes in (1) the natural logarithm of total assets, (2) research and development expenditures, (3) leverage, (4) the natural logarithm of the number of business segments, (5) the natural logarithm of firm age, (6) return volatility, (7) the natural logarithm of share price, and (8) the book-to-market ratio. For completeness, although the specification in (2) does not require them, we also include the initial value (i.e., as of 2000) of each control variable, and industry fixed effects to control for the possibility that the effect of a change in board structure on firm transparency

depends on their initial level of transparency and other features of their initial governance structure.

4. Sample and Variable Measurement

4.1. Sample

We specify a sample period that starts just before the exchange regulations would have been anticipated and ends just after the first time firms were required to comply with the regulations. As noted above, firms that were not initially compliant with the regulations were required to change their boards by the earlier of (1) the firm's first annual shareholders meeting after January 15, 2004; or (2) October 31, 2004. For example, a December fiscal-year-end firm needed to comply with the regulations by its Spring 2004 annual meeting. As another example, a firm that typically holds its annual meeting in November would need to comply either at its November 2003 annual meeting or at a special meeting held before November 2004. These examples illustrate that most firms were required to comply by their annual meetings between November 1, 2003 and October 31, 2004, and we use this period as the ending point for our sample. Because the annual meeting generally occurs between four and six months following a firm's fiscal year-end, at the ending point, the sample firms have fiscal years ending between May 2004 and June 2005.

To determine the starting point for the sample, we match the ending point sample firms to the same firms four years earlier. The starting point then consists of firm-years with fiscal years that end between May 2000 and June 2001, and with annual meetings between October, 1999 and December, 2000.[11] We note that this starting period is before the Enron collapse in 2001,

[11] The months of the annual meetings for the starting period and ending period are not necessarily the same because firms do not always have their annual meetings in exactly the same month each year.

SOX in 2002, and the NYSE and Nasdaq regulations in 2003. For convenience, we refer to the starting period as the "2000 starting period" and the ending period as the "2004 ending period." See Figure 1 for a summary of timing.

To be included in our sample, we require that a firm has non-missing data on board independence at both the starting point and ending point of the sample period (as defined above). We begin with a sample of firms for which we have board independence data in 2004. Following Chhaochharia and Grinstein (2009), we delete firms that are not members of the NYSE or Nasdaq. We eliminate foreign private issuers following Berger, Li, and Wong (2011). We also exclude "controlled companies," which we define as those with dual class shares, or for which more than 50% of the company's voting power in electing directors is held by an individual, a group, or another company.[12] As noted above, foreign private issuers and controlled firms are exempt from a number of the exchanges' governance rules, including the requirement of having a majority of independent directors.

This leaves a sample of 1,846 firms with board independence data in 2004. We obtain board data primarily from RiskMetrics, and supplement these data with additional observations available from the Corporate Library and Equilar. RiskMetrics provides data on board independence for 1,301 of these firms in 2000; the remaining board independence data for 2000 we collect by hand. Consistent with prior research (e.g., Linck et al., 2008; Duchin et al., 2010) and with NYSE/Nasdaq regulations, we define a director to be independent if he or she is an outsider with no material relationship with the firm. We follow Chhachharia and Grinstein's (2009, p.238) procedure for identifying gray directors. We reclassify directors labeled as "gray"

[12] We identify firms with dual class shares using the data set described in, and provided by, Gompers, Ishii, and Metrick (2010).

as independent if more than three years have passed since the director was employed by the firm (if applicable) and the director has only a *de minimis* business relationship with the firm.

All our tests require the board data, data from Compustat and CRSP to estimate the controls in Eqs. (3) and (4), and data to estimate the information asymmetry component of the bid-asked spread (*IAC_spread*). Our sample size varies between 1,428 and 1,849 firm-observations depending upon the specific test. This variation occurs because we only require data for the necessary variables for a firm to be included in a given test.

4.2. Corporate transparency variables

4.2.1. IAC_spread

IAC_spread measures the extent to which unexpected order flow affects prices and is increasing in information asymmetry. This variable measures the effect of information asymmetry on a firm's stock price (i.e., the price impact or adverse selection that results from information asymmetry between informed and uninformed shareholders). We measure *IAC_spread* following Madhavan, Richardson, and Roomans (1997), as modified by Armstrong et al. (2011). The procedure yields an estimated adverse selection component as a percentage of price, which we label *IAC_spread*. We measure *IAC_Spread* each month using all intra-day data for that month for each firm in the sample. We then average the monthly estimate of *IAC_spread* over the six months centered on each firm's fiscal year end (i.e., from three months before to three months following) to derive the measure *IAC_spread* that we use in our tests.

One concern with *IAC_spread* in our research setting is that the NYSE and Nasdaq exchanges completed the decimalization of share prices on January 29, 2001 and April 9, 2001, respectively. Driven in part by this institutional change, bid-ask spreads substantially decreased during our sample period (see Table 1, Panel A). To ensure that our tests do not capture spurious

effects that are attributable to any systematic difference in the average reduction in bid-ask spreads between compliant and non-compliant firms, we also use the ranked value of *IAC_Spread*. In particular, we use the average of the monthly rank of the adverse selection component of the bid-ask spread during the six months centered on the firm's fiscal year end. Changes in this ranked measure capture *relative* changes in *IAC_spread* for our sample firms.

4.2.2. Management disclosure variables

We define the number of management forecasts, *log(1+Management Forecasts)*, as the natural logarithm of one plus the number of annual earnings per share forecasts issued by management during the six months centered on the fiscal year end. We also measure the precision of these management forecasts, *Avg. Mgt. Forecast Precision*, using the five category approach of Rogers and Van Buskirk (2009): We assign forecast precision of 4 for point estimates, 3 for range estimates, 2 for open-ended estimates, 1 for qualitative estimates, and 0 for no forecast. Management forecast data are obtained from the First Call Company Issued Guidelines (CIG) database.

We use the accruals quality measure proposed by Dechow and Dichev (2002) and modified by Francis et al. (2005) as a measure of firms' accounting quality. We estimate accruals quality using residuals from cross-sectional regressions of total current accruals on lagged, current, and one-year-ahead cash flows and the change in revenue and property, plant, and equipment. Thus, accruals quality is higher when accruals are more highly correlated with the current and adjacent years' cash flows. Prior research (e.g., Aboody et al., 2005; Francis et al., 2005) suggests that when the variance of the residuals from this regression is higher, earnings quality is lower, and information asymmetry is higher. We estimate the accruals regressions at the Fama-French 48 industry level, with the requirement that there are no fewer than ten

observations in the industry regression. Much research estimates accruals quality as the standard deviation of five years of residuals, but because we measure changes over a four-year period, this convention is not appropriate in our setting. Instead, as a proxy for changes in the standard deviation, we compare the absolute value of the residual in 2000 with its counterpart in 2004 (*MDD Absolute Accruals*).[13]

4.2.3. Information intermediary variables

We construct four variables to proxy for changes in intermediaries that are expected to be related to changes in transparency. The number of analysts, *log(1+Number Analysts)*, is the natural logarithm of one plus the number of analysts on IBES that issued a one-year ahead earnings per share forecast during the six month period centered on the fiscal year end. Prior research documents that analysts tend to cover more transparent firms (e.g., Bhushan, 1989; Lang and Lundholm, 1996; Healy, Hutton, and Palepu, 1999; Bushman, Piotroski, and Smith, 2005). *Analyst Consensus*, is the natural logarithm of one plus the standard deviation of the most recent IBES consensus earnings per share forecast (prior to the earnings announcement date) scaled by total assets per share averaged over the six months centered on the fiscal year end. Institutional holdings, *log(Inst. Holdings %)*, is the natural logarithm of the percentage of the firm's shares held by institutional investors either on, or as of the end of the most recent quarter after the fiscal year end. Institutional ownership data are obtained from the Thomson-Reuters Institutional Holdings (13F) Database. Healy, Hutton, and Palepu (1999) and Bushee and Noe (2000) find higher institutional ownership at firms with greater disclosure. Finally, we measure

[13] An alternative proxy for accruals quality is the absolute value of discretionary accruals estimated using the modified Jones Model. Absolute accruals from this model can be considered as a proxy for earnings management, which independent directors might seek to limit as argued by Chen et al. (2011). However, it is also plausible that these accruals proxy for managers' conveying information (e.g., Watts and Zimmerman, 1986, and empirical papers by Guay, Kothari, and Watts, 1996; Tucker and Zarowin, 2006; Bowen et al., 2008), which independent directors might seek to enhance. Given the ambiguity about what discretionary accruals captures, we do not examine this proxy.

Log(Number Shareholders) as the natural logarithm of the number of shareholders as of the fiscal year end. Grullon et al. (2004) find that measures of firm size and investor recognition (e.g., advertising expense, market value, and firm age) are positively associated with the number of shareholders.

We note that although our intermediation variables are expected to proxy for corporate transparency, we are agnostic as to the direction of causality. That is, it may be that independent directors improve transparency, and this attracts more analysts, institutions, and shareholders, or instead that more of these intermediaries improve transparency. For example, independent directors may encourage greater analyst following or more institutional investors, which could, in turn, improve transparency. Consistent with this simultaneity, Brennan and Subrahmanyam (1995) show that a reduction in information asymmetry increases the number of analysts, but that that causality also runs in the opposite direction in that an increase in the number of analysts reduces information asymmetry. Likewise, Grullon et al. (2004) and Armstrong et al. (2011) suggest that one consequence of more shareholders is improved transparency.

4.2.4. Auditor fees

Prior research argues that a more thorough audit increases transparency (e.g., Watts and Zimmerman, 1986). We collect data on total fees charged by the auditor (audit fees and non-audit such as audit-related compliance and due diligence fees), and examine whether non-compliant firms spend more on auditor services when they increase director independence.[14] In contrast to our construction of the other dependent variables, for total auditor fees we examine only the amount paid for fiscal year 2004, rather than the change from 2000 to 2004. SOX

[14] In the auditor fee regressions, we include two additional controls. First, we include an indicator that takes a value of one if the firm is audited by a big four auditor, and zero otherwise. Second, we include an indicator that takes a value of one if the auditor is in its first year with the firm, and zero otherwise.

limited the type of non-audit (consulting) services that can be provided by auditors. Consequently, auditor fees in 2004 are unlikely to be comparable to those in 2000.

5. Results

5.1. Descriptive statistics

Table 1, Panel A provides descriptive statistics for our sample firms partitioned into "compliant" and "non-compliant" groups based on whether the firm complied with the new exchange board structure requirement at the start of our sample period. Our sample contains 1,396 compliant firms and 543 non-compliant firms as of 2000. By construction, the compliant firms have a substantially greater fraction of independent directors than the non-compliant firms in 2000 (mean of 72% versus 40%).

Most important for our analysis, however, is the substantial increase in the proportion of independent directors for the non-compliant firms during the sample period from 2000 to 2004 to comply with the listing regulations. For the non-compliant firms, the fraction of independent directors increases significantly from 40% to 58% in 2004, which represents roughly a 45% increase. The proportion of independent directors at the compliant firms, in contrast, remains relatively constant, with a mean of 72% in 2000 and 74% in 2004. This suggests that these firms had a relatively stable board structure during the sample period and represent an appropriate benchmark against which to compare the effects of an increase in independent directors at the non-compliant firms. Thus, the regulations appear to be a powerful instrument for required board structure changes that are sufficiently large to produce detectable changes in firms' transparency.

Panel A of Table 1 also reports other descriptive statistics for the compliant and non-compliant samples as of the year 2000, and changes in these variables from 2000 to 2004.

Consistent with our predictions, non-compliant firms experience a significantly larger decrease in the information asymmetry component of the spread (*IAC_Spread*), and a significantly larger increase in the number of management forecasts, analyst following, and institutional holdings, as compared to compliant firms. We note, however, that the descriptive statistics also indicate that the compliant and non-compliant firms differ along several dimensions. For example, compliant firms are, on average, somewhat larger and older, have more leverage and less volatile stock returns, and have larger boards (with about one more director, on average). Therefore, these univariate findings should be interpreted with caution.

We also provide descriptive statistics on how firms alter their initial board structure to comply with the exchange listing requirements. Because compliance is based on the ratio of independent directors to board size, a non-compliant firm can comply by decreasing board size (and removing inside or gray directors) or increasing board size. Table 1, Panel B, shows that 145 non-compliant firms reduced the size of their board. These firms went from an average of 9.89 directors to 7.88 directors—an average decrease of 2.01 directors. This average overall reduction in board size was the result of adding 0.98 independent directors, but removing 1.63 inside directors and 1.36 gray directors. The second set of columns shows that 308 non-compliant firms increased the size of their board from 7.14 to 8.35 directors, on average. This average increase in board size was the result of adding 2.01 independent directors, and removing 0.28 inside and 0.52 gray directors. Overall, there is substantial cross-sectional variation in how firms adjust the size and composition of their boards to comply with the regulations.

5.2. First-stage model of Change in % Independent Directors

Table 2 presents the results from the first-stage model (Eq. 3 above) predicting the change in proportion of independent directors from 2000 to 2004 as a function of the minimum

required change in the proportion of independent directors. As expected, the minimum required change is a strong positive predictor of the change in independent directors, which is consistent with non-compliant firms being required to increase their proportion of independent directors to avoid being in violation of the new regulations and possibly delisted. The R-squared of the regression is 27.7%, suggesting a reasonably good fit. The partial R-squared of the instrument is 22.0%, and is highly significant.

5.3. The effect of changes in independent directors on corporate transparency

Table 3 presents our second-stage results from estimating Eq. (4). In Panel A, we examine changes in information asymmetry, *IAC_Spread*, as a function of the predicted change in the proportion of independent directors from the first-stage model plus controls. Bid-ask spreads incorporate information from a wide range of sources, and as such, we view *IAC_Spread* as our most comprehensive measure of corporate transparency. In Panel B, we examine changes in the other information variables: number and precision of management forecasts, accruals quality, number and consensus of analysts, institutional holdings, number of shareholders, and total fees paid to the firm's auditor.

In Panel A of Table 3, we find strong evidence that increases in the proportion of independent directors leads to reductions in the information asymmetry component of the bid-ask spread, which is consistent with our conjecture that an increase in the proportion of independent directors requires improved transparency. Given the 18 percentage point average increase in the proportion of independent directors by non-compliant firms during the sample period (from 40% to 58% at the mean), the -0.361 coefficient on the predicted change in the proportion of independent directors in column (1) translates to roughly a 6.3% decrease in information

asymmetry.[15] Column (2) shows that this result is robust to using the ranked value of *IAC_spread*, which should be less affected by absolute changes from the decimalization of share prices on the NYSE and Nasdaq exchanges that occurred during our sample period.

Panel B explores this relation further by testing for changes in more specific determinants of corporate transparency. We find that an increase in the proportion of independent directors leads to significant increases in both the frequency and precision of management forecasts, as well as the number of analysts following the firm. We also find marginally significant increases in analyst forecast consensus. We find no significant relation between the change in the proportion of independent directors and accruals quality, institutional holdings, the number of shareholders, and auditor fees. Overall, these results provide some support for the hypothesis that firms can and do alter their transparency to accommodate an increased proportion of independent directors.

We note that these results are robust to controlling for levels and changes in many firm characteristics, as well as industry controls, as shown in Table 3. We also give consideration to Duchin et al.'s (2010) finding that changes in the proportion of independent directors leads to increases in performance, as measured by Tobin's Q and stock returns. A potential concern with our results could be that increases in corporate transparency are a manifestation of improved performance (since poorly performing firms have been shown to have greater information asymmetry). Because our controls include the change in *book-to-market* and the change in *log(price)*, however, we effectively control for the increases in Tobin's Q (the inverse of *book-to-market*) and stock returns (approximately the change in *log(price)*) documented by Duchin et al. (2010).

[15] The coefficient of -0.361 applies to a change in the natural logarithm of information asymmetry, so an 18% increase in the proportion of independent directors results in a decrease of 6.3% = exp(-0.361*18%) -1.

5.4. Caveats

We note the following caveats about our use of NYSE and Nasdaq regulations as an instrument for changes in board composition. First, there was a trend in regulations aimed at increasing board independence during this period. Other changes by the exchanges and the Sarbanes-Oxley (SOX) Act required that the audit, compensation, and nominating committees consist entirely of independent directors. Our research design implicitly assumes that changes in board independence have more of an effect on firms' transparency than changes in the independence of any of its separate committees. This assumption is consistent with results in Chhaochharia and Grinstein (2009, p. 244), who find that "the requirement for a majority of independent directors, rather than that of compensation committee independence or nominating committee independence, is important to compensation decisions." We examine this assumption below in the context of the audit committee.

Second, in addition to the independence rules, the NYSE and Nasdaq and SOX added other corporate governance requirements. Our research design does not explicitly control for these changes, which may lower our power in the event the changes are not correlated with changes to board structure. Although these governance changes may have also affected firm transparency, these changes should not bias our inferences unless they also happen to be correlated with our instrument. Our tests below for differential effects of changes in the proportion of independent directors across groups of firms (e.g., low vs. high information costs) helps to address this issue.

Finally, many of these regulatory changes were in response to frauds and other accounting irregularities that were thought to have occurred, in part, because of deficient board structures and lax oversight. Although these governance changes may be considered endogenous

for certain firms such as Enron, whose fraud may have prompted certain regulations, we follow prior literature and consider the regulatory changes to be largely exogenous from the perspective of most firms.[16]

5.5. Placebo test using firms that were exempt from exchange regulations

To mitigate the concern that firms with a low proportion of independent directors may have been forced to increase their transparency for reasons other than the exchanges' board compliance requirements, we now conduct a "placebo" test. Our test relies on the fact that controlled firms (firms with a 50% or more owner) were exempt from the exchanges' board independence regulations, which means that they were not required by the exchanges to increase board independence.[17] By contrast, these controlled firms were required to comply with other governance requirements including SOX (Schaumann, 2004, p. 1317).[18]

We match controlled firms to firms that were otherwise similar. With this matching, we hope to isolate the effect of changes required by the exchange rules. We create two groups of firms: one group that is exempt from the exchanges' requirement to increase independence, and another group that is not exempt. We begin with a sample of 363 firms that were exempt from the regulations because they were controlled. We match each of these firms with a firm that is not exempt from the regulations (these are firms that are in our main sample shown in Table 1). We form the matched pairs using propensity scores obtained from a logit model for whether the firm is exempt. We include as explanatory variables all of the variables in Eq. (1) above, one-

[16] Larcker et al. (2011, p. 4) argue that "so long as the regulatory shift is not the result of actions on the part of every individual firm, the regulatory shift can be treated as largely exogenous. For example, many argue that the Enron scandal was the impetus for new regulation. While the resulting regulation might be considered endogenous to Enron, the Enron scandal and ensuing regulations were beyond the control of most firms. Thus, the resulting regulation is largely exogenous." Similarly, although the exchange regulations for board independence represented an endogenous response to perceived governance deficiencies, they were largely exogenous from the perspective of any particular firm.

[17] Source: NYSE Corporate Governance Rules and NASDAQ Corporate Governance Rules.

[18] Foreign firms were also exempt from the independence rules, but we exclude them because they are also exempt from several other transparency requirements of SOX (Iliev, 2010).

digit SIC indicators, and the beginning (fiscal year 2000) values of the transparency variables. Because we form matched pairs without replacement and use a caliper of 0.01, we are unable to match 35 firms. Our final sample therefore consists of 328 matched pairs and a total sample of 656 observations. In untabulated tests, we confirm that the exempt and non-exempt samples are otherwise similar except that the exempt firms are not required to change their boards.

To compare changes in board structure and transparency between the exempt and non-exempt firms, we estimate the following regression, in which the variable of interest is the indicator variable *Non-Exempt*:

$$Change\ in\ Variable_{2000\text{-}2004} = a_0 + b_1 * Non\text{-}Exempt + b_2 * Controls + industry\ indicators + error \quad (5)$$

We include as control variables all of the variables in Eq. (1) above, the beginning (i.e., fiscal year 2000) values of the transparency variables, and two-digit SIC indicators. If transparency changes for reasons other than the exchange requirements, we expect the two groups of firms to show similar increases in transparency, and the coefficient on *Non-Exempt* will not be different from zero. On the other hand, if it is the required change in board structure that causes the change in transparency, then non-exempt firms should have larger increases in transparency than their non-exempt counterparts.

The results of the placebo test are presented in Table 4. In the first row, we find that non-exempt firms increased their proportion of independent directors significantly more than their exempt counterparts. This finding corroborates the power of our instrument for inducing non-exempt firms to alter their board structure. Relative to their exempt counterparts, non-exempt firms experienced a significantly greater decrease in *Log(IAC_Spread)*, and a significantly greater increase in the number of analysts and analyst forecast consensus. We also find consistently greater increases in transparency across the other proxies, although none of the other

differences is individually significant at conventional levels. Overall, our results from this analysis are consistent with the exchanges' board independence requirements rather than some other contemporaneous event inducing the changes in firm transparency documented in Table 3.

5.6. Cross-sectional effects

The above research design estimates the unconditional effect of changes in board structure on changes in transparency. However, the relation between required changes in board independence and transparency is not expected to be the same across all firms.

To test for cross-sectional effects, we identify proxies for the predicted cross-sectional relations and construct indicator variables (*Indicator*) that measure whether each variable is high or low. We then interact the indicators with *Min. % Change ID* and estimate the following modified version of Eq. (4):

$$\begin{aligned} \textit{Change in Information Variable}_{2000\text{-}2004} = {} & a_0 + a_1\textit{*Min. \% Change ID*Indicator} + \\ & + a_2\textit{*Min. \% Change ID*(1-Indicator)} + a_3\textit{*Indicator} + \\ & + \sum a_4\textit{*Change in Controls}_{2000\text{-}2004} + \sum a_5\textit{*Controls}_{2000} \\ & + \textit{industry indicators} + \textit{error} \end{aligned} \quad (6)$$

Note that we use *Min. % Change ID* rather than the predicted change in independence. For comparison purposes, Panel A of Table 5 shows that inferences from using the instrument rather than the predicted value are identical to those in Table 3. We use the instrument because our interest is in the interaction, and to highlight that these regressions are not 2SLS.[19] Our main interest is in comparing the coefficient a_1, which captures the effect of required changes in the proportion of independent directors for high values of the indicator, with a_2, which captures the effect of required changes in the proportion of directors for low values of the indicator.

[19] We obtain similar results when we use the predicted change (untabulated), which is not surprising given the relatively high partial R-squared of *Min. % Change ID* compared to the total variation explained when estimating Eq. (3) (22.0% compared to 27.7%).

For our first predicted cross-sectional relation, we examine whether firms with non-independent audit committees had greater improvements in transparency to accommodate the arguably greater information demands of new independent directors who would serve on that committee. During our sample period, regulations were passed that required firms to not only have a board with a majority of independent directors, but also to have an audit committee with 100% independent directors (Duchin et al., 2010). We conjecture that firms requiring adjustments to both their full board and to their audit committee will require larger improvements in transparency.

We collect data on audit committee independence and construct an indicator that takes a value of one if the firm's audit committee consisted entirely of independent directors at the beginning of the sample period, and zero otherwise. The results in Panel B of Table 5 indicate that information asymmetry decreases more for firms that were required to make larger changes in board independence and were also required to increase their audit committee independence. The results also indicate that these firms increased total auditor fees by more than firms with fully independent audit committees. These results suggest that improvements in transparency are even more important for firms that must increase both full board independence as well as audit committee independence, and also that independent directors may view increased audit fees as a mechanism that commits managers to greater internal control and compliance with respect to financial reporting.

In Panel C, similar to Duchin et al. (2010), we examine whether the initial level of information asymmetry affects the efficacy of independent directors. We construct a measure of inherent information processing costs, which we expect to constrain the ability of independent directors to induce changes in their firm's transparency (or constrain managers' ability to

improve transparency prior to the change in board structure). Because prior studies have used a number of proxies to capture this construct, we use Principal Components Analysis (PCA) to reduce the dimensionality and produce a scalar measure that is more amenable to our research design.[20] We use the first principal component as our measure of firms' inherent information processing costs, which we label *IA_factor*.

We find that only the relation between the change in the proportion of independent directors and the number of shareholders in Column 8 is significantly stronger for firms with low information processing costs (the coefficients for analyst following and analyst forecast consensus are considerably larger for low information processing firms, but the differences are only marginally significant). The other columns, however, show no significant differences, and overall the results provide only modest evidence that high information processing costs attenuate the effects in Table 3.

There could be variation in the extent to which firms' directors who, although technically independent, are actually independent of the CEO. We follow prior literature (e.g., Core, Holthausen, and Larcker, 1999) and measure the proportion of firms' independent directors who were appointed during the CEO's tenure to isolate directors that were likely selected by the CEO.[21] In Panel D, we find that the relation between the change in the proportion of independent

[20] Specifically, we use the following variables (Compustat data labels in parentheses) measured at the beginning of our sample period (i.e., 2000) in our PCA: (1) the natural logarithm of the firm's total assets, (2) annual research and development expenditures scaled by total annual sales and set to zero if annual research and development expenditures are missing, (3) leverage, (4) the natural logarithm of the total number of business segments, (5) the natural logarithm of the firm's age (measured using the first year during which appears in the CRSP database), (6) the standard deviation of monthly stock returns during the previous 24 months, and (7) the book-to-market equity ratio.

[21] We calculate the proportion of the firm's independent directors who were appointed after the CEO assumed office. Prior studies (e.g., Core, Holthausen, and Larcker, 1999) suggest that independent directors who are appointed under the CEO's leadership may be beholden to the CEO, and are therefore less independent. We have machine readable data on the date directors joined the board for about 55% of our sample companies; for the remainder we impute the fraction appointed under the CEO. To do this, we estimate a regression of the fraction of directors appointed under the CEO on CEO tenure, and use these estimates and CEO tenure to predict the missing

directors and management forecast frequency and precision are stronger for firms where fewer independent directors have been appointed during the current CEO's tenure (the former being marginally significant and latter being significant at conventional levels).

In Panel E, we predict that there will be variation according to the fraction of shares owned by insiders (i.e., officers and directors). When insiders have greater voting control, they may be reluctant to increase transparency for the benefit of independent directors, and/or independent directors may be less effective in changing corporate transparency. We use inside ownership data gathered by Fahlenbrach and Stulz (2011), which is measured about one month before the proxy date, and is scaled by the total number of shares outstanding at that time. We find that the effect of a change in independent directors on management forecast precision is significantly larger for firms with less than 20% inside ownership (the relation with management forecast frequency is again marginally significant). The other columns show no significant differences.

The fact that the results show relations between entrenchment and management forecasts, but not the other transparency proxies, may reflect the relative ease with which management can alter the properties of their forecasts vis-à-vis the other transparency measures. Overall, we interpret the evidence as providing modest support for the information processing costs and managerial entrenchment hypotheses.

Finally, we examine whether non-compliant firms that decrease board size have differential changes in corporate transparency. As noted above, non-compliant firms that decrease their board size (by removing inside and gray directors) retain mainly the same set of independent directors. These remaining independent directors may now have a greater ability to

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values. Because the dependent variable is a fraction ranging from zero to one, we estimate a fractional logit model following Papke and Wooldridge (1996).

address any transparency problems because inside control of the board has diminished. On the other hand, non-compliant firms that choose to add independent directors (and therefore increase the size of the board) may need to commit to a level of transparency necessary to satisfy the demands of the new independent directors.

We create an indicator for firms that decreased the size of their board, and present results in Panel F. The results are somewhat consistent with a greater change in transparency for firms that increase their board size. Firms that became compliant by increasing the number of directors (*Min % Change* ID_{2000}***Board Size Up*) experienced a significant decrease in the information asymmetry component of their bid-ask spread (*IAC_Spread*). Further, this decrease is significantly greater than the coefficient on *IAC_Spread* for firms that decreased their board size. For the other transparency variables, the coefficients are not significantly different between firms that increased and decreased their board size. An important caveat to these results is that the choice to decrease board size is not exogenous in that firms are expected to consider the various costs and benefits when deciding how to comply with the board independence regulations.

5.7. Timing and method of compliance

In this section, we explore whether changes in transparency are made in anticipation of increasing board independence, or whether the changes occur only after board independence increases. As noted above, existing directors and managers may improve the information environment in order to attract new, relatively uninformed, independent directors. Alternatively, if management is unwilling or unable to improve the information environment, improvements in transparency may not occur until after new independent directors join the board, or after some of the inside directors are removed from the board.

As an initial step, we examine the timing of changes in transparency over our four-year sample period. To do this, we estimate the following modified version of Eq. (4), in which we compute changes in both the information environment and controls over the first half of the sample period (2000 to 2002):

$$\begin{aligned} \textit{Change in Information Variable}_{2000\text{-}2002} = {} & a_0 \\ & + a_1 * \textit{Min \% Change ID}_{2000} \\ & + \sum a_2 * \textit{Change in Controls}_{2000\text{-}2002} + \sum a_3 * \textit{Controls}_{2000} \\ & + \textit{industry indicators} + \textit{error} \end{aligned} \quad (7)$$

If changes in transparency occur uniformly throughout the full sample period, the coefficient on *Min % Change ID*$_{2000}$ in the first half of the sample period should be about 50% of the full-sample period coefficient. Alternatively, if the changes in transparency occur mainly in the first (second) half of the sample period, then coefficient on *Min % Change ID*$_{2000}$ in the first half of the sample period should be significantly more (less) than 50% of the full sample period coefficient.

Panel A of Table 6 presents the results of this test. (Because we use a single cross-section in 2004 for auditor fees, we exclude auditor fees from Table 6). For parsimony, we report only coefficient estimates on *Min % Change ID*$_{2000}$, and asterisks indicating the level of statistical significance. The first row repeats the full sample estimates of the coefficient on *Min % Change ID*$_{2000}$ from Table 5. The second row shows the estimated coefficient on *Min % Change ID*$_{2000}$ during the 2000 to 2002 period. The third row shows the ratio of the coefficients from the first half and the full period. For seven of eight variables, the ratio is greater than 50%, and the ratios for management forecast precision and analyst following are significantly greater than 50%. Collectively, these results in Panel A suggest that more of the increase in transparency occurs during the first half of the 2000 to 2004 period.

In Panel B, we examine how changes in transparency relate to the timing of compliance by the noncompliant firms. Recall that Table 1 shows that 40% of the noncompliant firms become compliant by 2002, which suggests that the increase in the proportion of independent directors for the non-compliant firms occurs gradually during the sample period. If improvements in corporate transparency occur after (before) the increase in board independence, then we expect the coefficients on *Min % Change* ID_{2000} will be greater in the latter (earlier) half of the sample period for those firms that became compliant earlier (later) in the sample period.

To examine this prediction, we create indicators that partition the non-compliant firms into those that became compliant in the first half of the sample period (*Compliant Early*) and those that became compliant in the second half of the sample period (*Compliant Late*). We then estimate a modified version of Eq. (6) that interacts these indicators with the minimum required change in board independence. The results in the first set of rows in Panel B are somewhat consistent with greater changes in transparency for firms that became compliant earlier in the sample period. The coefficients on *Min % Change* ID_{2000}**Compliant Early* are generally larger than the coefficients on *Min % Change* ID_{2000}**Compliant Late*, although the difference is only significant at the five percent level for the number of shareholders (untabulated).

The results in the remaining rows of Panel B suggest that changes in transparency experienced by early compliers, however, are not concentrated in the first half of the sample period. In particular, the first-half to full-period ratio of the coefficients on *Min % Change* ID_{2000} for the early compliers is greater than 50% for only four of the eight variables, and none of the ratios is significantly greater than 50%. On the other hand, the first-half to full-period ratios for the late compliers suggest that changes in transparency precede changes in board independence at these firms. In particular, the ratio is greater than 50% for five of the eight variables, and the

ratios for accruals quality and analyst following are significantly greater than 50%. These results suggest that firms that comply late may find it difficult to attract directors without first increasing transparency. An important caveat to the analysis in Table 6 is that the timing of compliance is likely to be an endogenous choice and the early compliers may be those that expected to derive the greatest net benefit from complying with the exchange requirements. Accordingly, the results presented in Table 6 do not have the same causal interpretation as those in our earlier analyses. Nevertheless, we believe that the results from this analysis are suggestive and provide some insight into the nuances of how non-compliant firms ultimately became compliant with the board independence requirements.

6. Conclusion

We present results that are generally consistent with the interpretation that an exogenous (required) increase in the proportion of independent directors results in increased corporate transparency. This relation is consistent with our hypothesis that independent directors require transparency to perform their monitoring and advising roles, and that both management and independent directors are expected to take actions necessary to ensure that these directors have the information necessary to carry out their charge. Our results are also nuanced by our findings with regard to how the relation is influenced by whether the firm: (i) has a less than fully-independent audit committee, (ii) has high information processing costs, (iii) has symptoms of managerial entrenchment, and (iv) becomes compliant by adding board members and independent directors (as opposed to removing board members and non-independent directors). Specifically, our results provide some evidence (albeit modest) that an exogenous increase in the proportion of independent directors produces improvements in transparency for firms with fully-

independent audit committees, high information processing costs, entrenched management, and when board independence is increased adding board members and independent directors (as opposed to removing board members and non-independent directors).

Overall, our analysis emphasizes the joint causality in the relation between board structure and corporate transparency, and suggests that it is important to consider the economic and econometric implications of an endogenous information environment in studies of corporate governance. Our study also supports the presumed, but generally untested assumption that is common in the financial reporting and disclosure literature that independent directors can and do influence corporate transparency. Finally, we provide some insight into the specific channels through which managers and independent directors can effect changes in transparency.

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Table 1
Panel A: Descriptive Statistics

	Compliant			***Non-Compliant***			***Test of Differences***	
	Mean	*Median*		*Mean*	*Median*		*t*-stat	*z*-stat
Board Characteristics								
Number of Directors	9.15	9.00		8.03	8.00		7.32	7.60
% Independent Directors	72%	71%		40%	43%		60.37	34.00
Min. % Change ID	0%	0%		22%	18%		-70.53	-36.85
Change in % Independent Directors	2%	2%		18%	17%		-23.25	-19.83
Control Variables								
ΔLog(Total Assets)	27%	27%		27%	28%		-0.25	-0.37
ΔR&D	-0.01	0.00		-0.01	0.00		0.12	-1.99
ΔLeverage	-0.02	-0.02		-0.01	0.00		-0.91	-1.71
ΔLog(Num. Bus. Seg.)	4%	0%		5%	0%		-0.60	-0.28
ΔLog(Firm Age)	32%	24%		41%	37%		-6.37	-7.52
ΔReturn Volatility	-0.20	-0.17		-0.24	-0.21		3.69	3.45
ΔLog(Share Price)	23%	31%		30%	33%		-1.49	-1.14
ΔBook-to-market	-0.04	-0.02		-0.08	-0.06		3.17	2.27
Log(Total Assets)	7.01	6.91		6.36	6.23		6.97	7.00
R&D	0.06	0.00		0.05	0.00		0.15	1.87
Leverage	0.36	0.37		0.31	0.26		4.18	4.50
Log(Num. Bus. Seg.)	0.40	0.00		0.31	0.00		3.03	2.65
Log(Firm Age)	2.65	2.71		2.29	2.20		7.81	7.60
Return Volatility	0.56	0.47		0.64	0.57		-5.71	-6.43
Log(Share Price)	2.79	2.86		2.55	2.61		4.98	4.82
Book-to-market	0.70	0.74		0.70	0.68		-0.19	0.24
Big 4 Auditor	0.92	1.00		0.89	1.00		1.70	1.70
New Auditor	0.05	0.00		0.06	0.00		-0.73	-0.73
Moderating Factors								
Audit Committee Independence	79%	100%		38%	0%		17.55	16.26
IA_Factor	-0.53	-0.56		-0.42	-0.39		-7.88	-7.76
% CEO App. ID	68%	72%		71%	76%		-2.07	-2.36
% Inside Ownership	10.50	6.55		20.30	17.49		-16.06	-14.66

Table 1
Panel A: Descriptive Statistics (cont'd)

Corporate Transparency Measures							
Change in Log(IAC_Spread)	-1.10	-1.06		-1.23	-1.20	4.20	3.71
Change in Log(1+ Management Forecasts)	0.06	0.00		0.13	0.00	-1.91	-1.43
Change in Management Forecast Precision	0.06	0.00		0.10	0.00	-0.38	0.15
Change in MDD Absolute Accruals	-0.01	0.00		-0.01	0.00	1.58	1.23
Change in Log(1+Number Analysts)	0.04	0.00		0.11	0.06	-2.27	-2.51
Change in Analyst Consensus	0.17	0.01		0.31	0.00	-1.07	-0.11
Change in Log(Inst. Holdings %)	0.09	0.08		0.11	0.09	-3.02	-2.26
Change in Log(Number Shareholders)	-0.02	-0.12		0.01	-0.05	-0.72	-2.80
Ending Total Fees	14.36	14.27		14.10	13.99	4.02	3.82
Number of Observations	1,396			453			

This table presents descriptive statistics (mean and median) for our sample of firms. *Compliant* is the subsample of 1,396 firms for which the proportion of independent directors more than 50% in 2000 and *Non-Compliant* is the subsample of 453 firms for which the proportion of independent directors was more than 50% in 2000. *t*-stat is the *t*-statistic from a non-paired test of means assuming unequal variances. *z*-stat is the *z*-statistic from a Wilcoxon rank-sum test of equality of medians. Variables measured as *Change in Log()* are converted into percentage changes with the transformation exp() -1.

Board Characteristics are defined as follows. *Number of Directors* is the number of directors on the board in 2000. *%Independent Directors* is the number of independent directors scaled by the total number of directors in 2000. *Min. % Change ID* equals zero if *%Independent Directors* is greater than 50% in 2000, and equals the minimum number of independent directors required to achieve a majority of independent directors divided by *Number of Directors* if *%Independent Directors* is less than or equal to 50% in 2000. *Change in % Independent Directors* is the change in *%Independent Directors* between 2000 and 2004.

Control Variables include both changes, measured over the period 2000 to 2004, and levels, measured during 2000, and are defined as follows. *Log(Total Assets)* is the natural logarithm of total book value of assets (AT). *R&D* is annual research and development expenditures (set to zero if missing) scaled by total annual sales (XRD / SALE). *Leverage* is the sum of book value of long-term debt and current liabilities scaled by the sum of long-term debt, current liabilities, common equity, and preferred equity ((DLTT + DLC) / (DLTT + DLC + CEQ + PSTK)). *Log(Num. Bus. Seg.)* is the natural logarithm of the number of business segments recorded in the Compustat Segment file. *Log(Firm Age)* is the natural logarithm firm age measured as the earliest date on which it appears in the CRSP database. *Return Volatility* is the monthly standard deviation of the previous 24 months' stock returns. *Share price* is closing market price per share. *Book-to-market* is the book-to-market asset ratio (AT / (LT + (CSHO*PRCC_F))). *Big 4 Auditor* is an indicator that equals one if the firm is audited by a big four auditor, and zero otherwise. *New Auditor* is an indicator that equals one if the auditor is in its first year with the firm, and zero otherwise.

Moderating Factors are measured during 2000 and are defined as follows. *Audit Committee Independence* is the proportion of independent directors on the audit committee in 2000. *IA_Factor* is the first principal component from principal components analysis of the following variables measured during 2000: (1) *Log(Total Assets)*, (2) *R&D*, (3) *Leverage*, (4) *Log(Num. Bus. Seg.)*, (5) *Log(Firm Age)*, (6) *Return Volatility*, and (7) *Book-to-market*. *% CEO App. ID* is the proportion of independent directors who were appointed after the CEO took office if available, and imputed as described in the text if missing. *Inside Ownership* is obtained from Fahlenbrach and Stulz (2008), and is defined as the number of shares owned by insiders as disclosed in the annual report divided by the number of shares outstanding for the month prior to the proxy date.

Corporate Transparency Measures are changes measured over the period 2000 to 2004, and are defined as follows. *Change in log(IAC_spread)* is the change in the natural logarithm of average monthly adverse selection component

of the bid-ask spread during the six months centered on the firm's fiscal year end. *Change in Log(1+Management Forecasts)* is the change in the natural logarithm of one plus the number of earnings per share forecasts issued by management during the six months centered on the firm's fiscal year end. *Change in Avg. Mgt. Forecast Precision* is the change in the average precision of management forecasts issued during the six months centered on the firm's fiscal year end calculated following Rogers and Van Buskirk (2009): 4 for point estimates, 3 for range estimates, 2 for open-ended estimates,1 for qualitative estimates, 0 for no forecast. *Change in MDD Absolute Accruals* is the change in absolute accruals from the modified Dechow-Dichev model. *Change in Log(1+Number Analysts)* is the change in the natural logarithm of one plus the number of analysts that issued a one-year ahead earnings per share forecast during the six months centered on the firm's fiscal year end. *Change in Analyst Consensus* is the change in the natural logarithm of one plus the standard deviation of the IBES consensus earnings per share forecast (prior to the earnings announcement date) scaled by total assets per share during the six months centered on the firm's fiscal year end. *Change in Log(Inst. Holdings %)* is in the natural logarithm of the percentage of the firm's shares held by institutional investors either on, or as of the end of the most recent fiscal quarter after the fiscal year end. *Change in Log(Number Shareholders)* is the change in the natural logarithm of the number of shareholders as of the fiscal year end. Log(*Total Auditor Fees*) is the natural logarithm of total audit and non-audit fees for fiscal year 2004.

Table 1 (cont'd)

Panel B: Descriptive Statistics for Non-compliant Firms by Change in Board Size

	Non-compliant firms that Decreased Board Size			Non-compliant firms that Did Not Decrease Board Size	
Variable	*Mean*	*Median*		*Mean*	*Median*
Number of Directors	9.89	9.00		7.14	7.00
Change in Number of Directors	-2.01	-2.00		1.21	1.00
Change in Number of Independent Directors	0.98	1.00		2.01	2.00
Change in Number of Inside Directors	-1.63	-1.00		-0.28	0.00
Change in Number of Gray Directors	-1.36	-1.00		-0.52	0.00
Noncompliant in 2002	0.62	1.00		0.59	1.00
Audit Committee Independence	0.63	1.00		0.62	1.00
Number of Observations	145			308	

Table 2

First-stage Determinants of Change in the Proportion of Independent Directors

This table presents the results from an OLS regression in which the dependent variable is the change in the percentage of independent directors from the 2000 starting period through the 2004 ending period. *Min. % Change ID* equals the minimum percent change in the proportion of independent directors that is required for noncompliant firms to achieve a majority of independent directors, and zero for compliant firms. Δ denotes the change in the respective variable measured over the sample period and the remaining variables are measured at the start of the sample period (the exact timing is described in Section 3). Industry fixed-effects for the 48 Fama and French (1997) industries are included but not reported. *t*-statistics calculated based on robust standard errors clustered at the Fama and French (1997) industry level are reported in parentheses below the coefficient estimates. Statistical significance (two-sided) at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively.

	Change in % Independent Directors	*Change in% Independent Directors*
Min. % Change ID		0.647***
		(19.61)
Δ*Log(Total Assets)*	0.002	-0.001
	(0.13)	(-0.06)
Δ*R&D*	0.015	0.108
	(0.18)	(1.31)
Δ*Leverage*	-0.009	-0.010
	(-0.39)	(-0.50)
Δ*Log(Num. Bus. Seg.)*	0.010	0.007
	(1.02)	(0.77)
Δ*Log(Firm Age)*	-0.020	0.008
	(-0.47)	(0.18)
Δ*Return Volatility*	0.005	0.021
	(0.20)	(0.98)
Δ*Log(Share Price)*	-0.007	0.003
	(-0.82)	(0.40)
Δ*Book-to-market*	-0.052*	-0.004
	(-1.84)	(-0.18)
Log(Total Assets)	0.010***	0.014***
	(3.56)	(6.10)
R&D	-0.148***	-0.004
	(-3.59)	(-0.08)
Leverage	-0.033	-0.034*
	(-1.49)	(-1.72)
Log(Num. Bus. Seg.)	0.010	0.009
	(1.11)	(1.00)
Log(Firm Age)	-0.018	-0.000
	(-1.45)	(-0.00)
Return Volatility	0.044	0.033*
	(1.61)	(1.81)
Log(Share Price)	-0.004	-0.001
	(-0.59)	(-0.25)
Book-to-market	-0.038**	-0.014
	(-2.28)	(-1.07)
Observations	1,846	1,846
R-squared	0.057	0.277

Table 3

Second-stage regressions: Information Variables on Predicted Change in Ind. Directors

This table presents estimates of the second-stage regressions from Equation (4). The dependent variable in column (1) is *Change in Log(IAC_spread)*. The dependent variable in column (2) is *Change in Rank(IAC_Spread)*, which is the change in the of average monthly rank of the adverse selection component of the bid-ask spread during the six months centered on the firm's fiscal year end. The remaining variables are defined in the notes of Table 1. Industry fixed-effects for the 48 Fama and French (1997) industries are included but not reported. *t*-statistics calculated based on robust standard errors clustered at the Fama and French (1997) industry level are reported in parentheses below the coefficient estimates. Statistical significance (two-sided) at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively.

Panel A: Change in Information Asymmetry

	Change in Log (IAC_Spread)	*Change in Rank (IAC_Spread)*
	(1)	(2)
Δ*% Indep. Directors (predicted)*	-0.361**	-0.086**
	(-2.64)	(-2.55)
Δ*Log(Total Assets)*	-0.286***	-0.086***
	(-11.64)	(-11.36)
Δ*R&D*	0.363*	0.125*
	(1.90)	(1.87)
Δ*Leverage*	0.025	0.009
	(0.43)	(0.50)
Δ*Log(Num. Bus. Seg.)*	-0.038*	-0.011*
	(-1.87)	(-1.89)
Δ*Log(Firm Age)*	-0.199	-0.056
	(-1.17)	(-1.34)
Δ*Return Volatility*	-0.130	-0.017
	(-1.51)	(-0.87)
Δ*Log(Share Price)*	-0.395***	-0.103***
	(-12.19)	(-11.75)
Δ*Book-to-market*	0.161	0.065**
	(1.51)	(2.27)
Log(Total Assets)	0.066***	-0.006**
	(5.75)	(-2.03)
R&D	-0.313	-0.042
	(-1.56)	(-0.76)
Leverage	-0.245***	-0.050***
	(-4.49)	(-3.50)
Log(Num. Bus. Seg.)	-0.045***	-0.012***
	(-2.83)	(-3.06)
Log(Firm Age)	0.012	-0.000
	(0.31)	(-0.04)
Return Volatility	-0.119	-0.029
	(-1.36)	(-1.02)
Log(Share Price)	-0.042*	-0.016***
	(-1.84)	(-3.13)
Book-to-market	-0.144*	0.019
	(-1.85)	(0.94)
Observations	1,849	1,849
R-squared	0.594	0.558

Table 3 (cont'd)
Panel B: Changes in Other Corporate Transparency Variables

	Change in Log(1+ Management Forecasts)	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ% Indep. Directors	0.524**	0.728*	0.008	0.333*	1.202	0.053	-0.364	0.110
(predicted)	(2.43)	(1.66)	(0.31)	(1.73)	(1.52)	(1.18)	(-1.06)	(0.47)
ΔLog(Total Assets)	0.092**	0.120	-0.003	0.401***	0.576***	0.053***	0.147**	0.569***
	(2.04)	(1.05)	(-0.83)	(11.57)	(3.03)	(3.85)	(2.12)	(14.16)
ΔR&D	-1.009	-1.473	-0.064	1.147**	-2.847	-0.115	0.480	0.334
	(-0.79)	(-0.73)	(-1.36)	(2.12)	(-1.40)	(-0.84)	(1.01)	(0.53)
ΔLeverage	0.039	0.069	-0.003	-0.107	-0.056	-0.009	-0.134	-0.121
	(0.37)	(0.33)	(-0.36)	(-1.04)	(-0.13)	(-0.52)	(-1.22)	(-0.98)
ΔLog(Num. Bus. Seg.)	-0.033	-0.078	0.004	-0.008	0.188	0.007	-0.067	0.137**
	(-0.69)	(-0.82)	(1.24)	(-0.35)	(1.46)	(0.84)	(-1.04)	(2.62)
ΔLog(Firm Age)	0.471**	1.263**	-0.027**	-0.288**	-0.161	-0.000	-0.417*	0.493***
	(2.17)	(2.65)	(-2.34)	(-2.13)	(-0.25)	(-0.01)	(-1.78)	(2.70)
ΔReturn Volatility	-0.043	0.091	0.016	0.148	-0.280	0.013	0.313	0.488***
	(-0.37)	(0.29)	(1.62)	(1.01)	(-0.42)	(0.47)	(1.17)	(2.89)
ΔLog(Share Price)	0.199***	0.328**	0.004	0.166***	0.868***	0.024*	-0.099	-0.133***
	(3.59)	(2.41)	(0.65)	(3.62)	(3.87)	(1.70)	(-1.57)	(-2.74)
ΔBook-to-market	-0.034	-0.138	0.000	-0.180*	-1.250**	-0.047*	-0.252	-0.607***
	(-0.18)	(-0.34)	(0.01)	(-1.87)	(-2.10)	(-1.74)	(-1.39)	(-4.03)
Log(Total Assets)	-0.019	-0.043	-0.001	0.000	-0.033	0.000	0.046**	0.574***
	(-1.20)	(-1.08)	(-0.44)	(0.01)	(-0.57)	(0.05)	(2.27)	(32.06)
R&D	0.117	-0.351	0.065**	1.088***	0.752	0.025	0.827	-0.427
	(0.14)	(-0.30)	(2.32)	(3.16)	(0.49)	(0.25)	(1.65)	(-1.00)
Leverage	0.147*	0.285	0.003	-0.086	-0.018	0.023	0.106	0.269**
	(1.71)	(1.38)	(0.35)	(-1.08)	(-0.05)	(1.20)	(0.93)	(2.55)
Log(Num. Bus. Seg.)	-0.040	-0.068	-0.003	0.018	0.165	0.009	0.063*	0.189***
	(-0.92)	(-0.76)	(-1.39)	(0.68)	(1.39)	(1.22)	(1.72)	(5.22)
Log(Firm Age)	0.108	0.303**	-0.001	-0.096**	-0.010	-0.013	-0.176**	0.165***
	(1.57)	(2.06)	(-0.40)	(-2.63)	(-0.05)	(-1.32)	(-2.49)	(2.72)
Return Volatility	-0.302**	-0.304	-0.001	0.122	0.079	0.064	0.101	0.770***
	(-2.08)	(-0.87)	(-0.14)	(0.68)	(0.11)	(1.55)	(0.48)	(4.64)
Log(Share Price)	0.059*	0.149	0.007*	-0.010	-0.108	0.002	-0.109**	-0.022
	(1.77)	(1.55)	(1.81)	(-0.28)	(-1.15)	(0.21)	(-2.24)	(-0.80)
Book-to-market	-0.188	-0.286	0.014**	-0.140*	-0.626*	0.017	-0.291***	-0.387***
	(-1.44)	(-0.88)	(2.36)	(-1.92)	(-1.70)	(0.97)	(-2.86)	(-3.81)
Number of Obs.	1,849	1,849	1,428	1,849	1,849	1,849	1,655	1,839
R-squared	0.126	0.072	0.092	0.340	0.223	0.171	0.057	0.754

Table 4
Matched Pair Placebo Test

This table presents the results of our matched pair placebo test. We match controlled firms, which were exempt from the exchanges' board independence regulations, to non-compliant firms that were not exempt from the regulations, but were otherwise similar. We form matched pairs using propensity scores from a logistic regression of an indicator that equals one if the firm is exempt from the exchanges' board independence requirements by virtue of being either foreign or controlled, and equals zero otherwise. We include as explanatory variables all of the variables in Eq. (1) above, one-digit SIC indicators, and the beginning (2000) values of the information variables. After eliminating firms for which adequate covariate balance could not be achieved across the two samples, we obtained 328 matched pairs of firms for which there were no significant differences in the mean of the propensity score variables across the two samples. The presents estimates from Eq. (6). *Non-Exempt* is one if the firm is not exempt from the regulations, and zero if the firm is exempt because it is controlled. The remaining variables are defined in the caption of Table 1. Industry fixed-effects for the 48 Fama and French (1997) industries and additional controls are included but not reported. *t*-statistics calculated based on robust standard errors clustered at the Fama and French (1997) industry level are reported in parentheses below the coefficient estimates. Statistical significance (two-sided) at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively.

	Δ% Indep. Directors	*Change in Log (IAC_Spread)*	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Non-Exempt	0.030**	-0.069**	0.034	0.012	-0.002	0.075**	0.266*	0.011	0.007	0.089*
	(2.54)	(-2.40)	(0.72)	(0.12)	(-0.43)	(2.04)	(1.67)	(1.04)	(0.07)	(1.68)
Number of Obs.	656	656	656	656	489	656	656	656	573	651
R-squared	0.318	0.766	0.434	0.406	0.145	0.512	0.464	0.378	0.066	0.664

Table 5
Cross Sectional Relations Between Transparency and the Required Change in Independent Directors

This table presents estimates from a modified second-stage regression of alternative measures of corporate transparency for the sample of non-controlled firms. Panel A presents estimates of Eq. (3) using *Min. % Change ID*. Panels B, C, D, and F present estimates from a modified version of Eq. (4) in which proxies for relatively high and low values of five variables are interacted with *Min. % Change ID*. Panel B uses audit committee independence in 2000 as a partition. Panels C and D divide *IA_factor* and *% CEO App. ID* into *High* and *Low* values according to whether they are above or below the sample median, respectively. Panel E divides *Inside Ownership* into *High* and *Low* values according to whether *Inside Ownership* is above or below 20%, respectively. Panel F uses decreases in board size as a partition. The remaining variables are defined in the caption of Table 1. Industry fixed-effects for the 48 Fama and French (1997) industries and additional controls are included but not reported. *t*-statistics calculated based on robust standard errors clustered at the Fama and French (1997) industry level are reported in parentheses below the coefficient estimates. Statistical significance (two-sided) at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively.

Panel A: Full Sample Estimates of Eq. (4) - Minimum Required Change

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Min. % Change ID	-0.228**	0.332**	0.461	0.005	0.211*	0.761	0.034	-0.230	0.095
	(-2.64)	(2.43)	(1.66)	(0.31)	(1.73)	(1.52)	(1.18)	(-1.06)	(0.72)
Number of Obs.	1,849	1,849	1,849	1,428	1,849	1,849	1,849	1,655	1,836
R-squared	0.594	0.126	0.072	0.092	0.340	0.223	0.171	0.057	0.760

Panel B: Audit Committee Composition Interaction

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Min. % Change ID x	-0.003	0.235	-0.175	0.031	-0.070	-0.033	0.059	0.032	-0.277
Audit Committee Indep.	(-0.02)	(0.66)	(-0.30)	(1.05)	(-0.43)	(-0.03)	(1.16)	(0.08)	(-0.90)
Min. % Change ID x	-0.330***	0.336**	0.670**	-0.002	0.263*	1.040**	0.034	-0.315	0.221
Audit Committee Not Indep.	(-3.50)	(2.18)	(2.13)	(-0.11)	(1.66)	(2.04)	(1.05)	(-1.19)	(1.64)
Indep.vs. Not Indep.	-0.328**	0.101	0.845	-0.0328	0.333	1.073	-0.0244	-0.348	0.498
t-stat	(-2.21)	(0.26)	(1.25)	(-1.28)	(1.44)	(0.92)	(-0.41)	(-0.71)	(1.57)
Number of Obs.	1,849	1,849	1,849	1,428	1,849	1,849	1,849	1,655	1,836
R-squared	0.595	0.126	0.073	0.093	0.341	0.223	0.171	0.057	0.761

Table 5 (cont'd)

Panel C: Information Processing Costs Interaction

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Min. % Change ID x	-0.113	0.286	0.083	0.015	0.543**	1.481	-0.001	0.571	-0.170
Low IA_factor	(-0.75)	(1.32)	(0.12)	(0.72)	(2.19)	(1.34)	(-0.01)	(1.38)	(-0.60)
Min. % Change ID x	-0.284***	0.356**	0.591*	0.002	0.094	0.403	0.051	-0.498*	0.221
High IA_factor	(-2.74)	(2.06)	(1.99)	(0.09)	(0.75)	(0.86)	(1.23)	(-1.86)	(1.63)
High vs. Low	0.171	-0.0696	-0.509	0.0127	0.450*	1.078	-0.0516	1.069***	-0.391
t-stat	(1.01)	(-0.26)	(-0.68)	(0.37)	(1.84)	(0.97)	(-0.65)	(2.51)	(-1.35)
Number of Obs.	1,849	1,849	1,849	1,428	1,849	1,849	1,849	1,655	1,836
R-squared	0.594	0.125	0.073	0.092	0.342	0.224	0.170	0.055	0.758

Panel D: Independent Directors Appointed by CEO Interaction

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Min. % Change ID x	-0.256*	0.639***	1.729***	0.023	0.084	0.477	0.012	-0.193	0.194
Low % CEO App. ID	(-1.76)	(2.95)	(3.64)	(1.21)	(0.63)	(0.57)	(0.22)	(-0.67)	(0.77)
Min. % Change ID x	-0.189	0.135	-0.480	-0.017	0.247	1.067	0.066**	-0.052	0.106
High % CEO App. ID	(-1.51)	(0.57)	(-1.03)	(-0.84)	(1.18)	(1.33)	(2.03)	(-0.16)	(0.55)
High vs. Low	-0.0667	0.505	2.210***	0.0403	-0.162	-0.590	-0.0535	-0.141	0.0879
t-stat	(-0.31)	(1.43)	(2.96)	(1.61)	(-0.63)	(-0.47)	(-0.80)	(-0.33)	(0.26)
Number of Obs.	1,805	1,805	1,805	1,397	1,805	1,805	1,805	1,622	1,793
R-squared	0.592	0.128	0.077	0.096	0.343	0.218	0.172	0.054	0.754

Table 5 (cont'd)

Panel E: Inside Ownership Interaction

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Min. % Change ID x	-0.237*	0.599**	1.483**	0.001	0.160	0.582	0.028	-0.164	0.191
Low Inside Ownership	(-1.91)	(2.15)	(2.66)	(0.04)	(0.88)	(0.66)	(0.76)	(-0.47)	(0.90)
Min. % Change ID x	-0.076	0.057	-0.624	0.022	0.297	0.529	0.022	-0.448*	0.184
High Inside Ownership	(-0.57)	(0.38)	(-1.58)	(1.00)	(1.59)	(0.87)	(0.44)	(-1.66)	(1.36)
High vs. Low	-0.161	0.542	2.107***	-0.0209	-0.137	0.0523	0.00625	0.284	0.00697
t-stat	(-0.89)	(1.62)	(2.74)	(-0.74)	(-0.60)	(0.05)	(0.10)	(0.78)	(0.03)
Number of Obs.	1,849	1,849	1,849	1,428	1,849	1,849	1,849	1,655	1,836
R-squared	0.597	0.127	0.076	0.095	0.340	0.224	0.170	0.054	0.758

Panel F: Decrease in Board Size Interaction

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*	*Log(Total Auditor Fees)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Min. % Change ID x	0.331	1.254*	2.084	-0.009	-0.003	0.954	-0.007	-0.054	-0.195
Board Size Down	(1.29)	(1.84)	(1.30)	(-0.28)	(-0.01)	(0.54)	(-0.07)	(-0.07)	(-0.43)
Min. % Change ID x	-0.333***	0.239	0.412	0.006	0.195	0.445	0.028	-0.268	0.262*
Board Size Up	(-2.91)	(1.33)	(1.43)	(0.38)	(1.49)	(0.93)	(0.90)	(-1.04)	(1.97)
Down vs. Up	-0.664**	-1.015	-1.672	0.0153	0.198	-0.509	0.0348	-0.214	0.457
t-stat	(-2.22)	(-1.38)	(-0.99)	(0.42)	(0.49)	(-0.29)	(0.34)	(-0.28)	(0.96)
Number of Obs.	1,849	1,849	1,849	1,428	1,849	1,849	1,849	1,655	1,836
R-squared	0.595	0.127	0.073	0.092	0.341	0.223	0.168	0.052	0.757

Table 6
Changes in Transparency: Relation with Timing of Board Changes

This table presents coefficient estimates on *Min % Change ID* for the full sample period (2000 to 2004), the first half of the sample period (2000 to 2002), and the ratio of the two coefficient estimates. Variables are defined in the caption of Table 1. Industry fixed-effects for the 48 Fama and French (1997) industries and additional controls are included but not reported. *t*-statistics (untabulated) are calculated based on robust standard errors clustered at the Fama and French (1997) industry level. Statistical significance (two-sided) at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2000 to 2004								
Min % Change ID	-0.222**	0.351**	0.451	0.792	0.209*	-0.002	0.045	-0.213
2000 to 2002								
Min % Change ID	-0.170	0.242*	0.780**	0.753**	0.221**	-0.004	0.034	0.033
Ratio of Coefficients								
First Half/Full Period	0.77	0.69	1.73*	0.95	1.06*	2.00	0.76	-0.15

Panel B

	Change in Log (IAC_Spread)	*Change in Log(1+ Management Forecasts)*	*Change in Management Forecast Precision*	*Change in MDD Absolute Accruals*	*Change in Log(1+ Number Analysts)*	*Change in Analyst Consensus*	*Change in Log(Inst. Holdings %)*	*Change in Log(Number Shareholders)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2000 to 2004								
Min. % Change IDxCompliant Early	-0.363***	0.665**	0.879	0.959	0.342	-0.019	0.036	0.392
Min. % Change IDxCompliant Late	-0.158	0.207*	0.254	0.715	0.148	0.008	0.050	-0.490
2000 to 2002								
Min. % Change IDxCompliant Early	-0.109	0.397	1.104*	0.210	0.194	-0.008	0.014	0.445
Min. % Change IDxCompliant Late	-0.198	0.171	0.632	1.003**	0.233*	-0.001	0.043	-0.157
Ratio of Coefficients: (First Half/Full Period)								
Min. % Change IDxCompliant Early	0.30	0.60	1.26	0.22	0.57	0.42	0.39	1.14
Min. % Change IDxCompliant Late	1.25	0.83	2.49	1.40*	1.57*	-0.13	0.86	0.32

Figure 1
Timeline of Sample Alignment

	"2000 starting period"			**"2004 ending period"**	
Annual Meeting Dates	10/99	12/00	2003 Regulations	11/03	10/04
Fiscal year-ends	5/00	6/01		5/04	6/05