Do Directors Respond to Stock Mispricing? Evidence from CEO Turnovers

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Abstract

This paper shows that stock mispricing affects the probability of CEO turnover. A 10% decline in firm's market value triggered by an uninformative stock price shock increases the likelihood of CEO turnover by 5%–11%. This effect is stronger for firms with a large fraction of independent directors, and a quasi-natural experiment further supports that finding. In line with extant models of director reputation: (i) boards whose independent directors are concerned about the labor market respond the most to mispricing; (ii) independent directors responding to mispricing are rewarded on the labor market; and (iii) independent directors trade against mispricing.

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1. Introduction

Do stock prices affect corporate decisions? Recent evidence based on exogenous stock mispricing events suggests that stock prices affect firms' financing and investment decisions – either because managers act on the effect of mispricing on the firm's cost of capital (Kahn et al. 2012, Hau and Lai 2013, Lou and Wang 2018) or because they mistakenly suppose that the mispricing shock reflects fundamental information (Dessaint et al. 2018). Likewise, shareholders and directors of the board also follow their firm's stock price and may condition their decisions on that price. Yet despite the relevance of firms' management for productivity (Bloom et al. 2013), little is known about the possible effects of stock mispricing on one of the most important decision that directors and shareholders must make: whether to retain or instead to replace the firm's chief executive officer (CEO).

In this paper, I study whether and why non-fundamental movements in stock prices may affect the likelihood of CEO replacement. Standard economic theory suggests that managers should be sanctioned only for those changes in firm performance that are under their control (see e.g. Holmström 1979). To the extent that CEOs cannot prevent stock price deviations from fundamental value, directors should not punish CEOs for a temporary undervaluation of the firm. However, if directors wrongly interpret noise in stock prices as a signal about the CEO's performance or if they accommodate misinformed shareholders in order to improve their own prospects in the labor market for directors, then they may decide to replace a CEO after a non-fundamental shock. Note that, given how difficult it is for independent directors to access firm-specific information and given their reputation's importance to their respective careers, we should expect independent directors to be especially sensitive to mispricing.

To examine this issue, I exploit the forced sale of stocks by mutual funds as a source of temporary mispricing (cf. Coval and Stafford 2007, Edmans et al. 2012, Lou 2012) and relate

such sales to involuntary CEO turnover events in a sample of 1,738 large public firms tracked over a period of 14 years.

I first find that exogenous and non-fundamental downward movements in stock prices significantly increase the probability of involuntary CEO replacement at affected firms. In particular, after controlling for fundamental performance, I find that – following an uninformative shock – a 10% decline in the firm's market value results in a 5%–11% increase in the likelihood of involuntary CEO turnover. This finding is consistent across various robustness tests and alternative econometric specifications. More specifically, the result does not change when I include firm fixed effects, use accounting rather than market performance to control for fundamental performance, estimate a logit rather than a linear probability model, or restrict the sample of firms to those that experience at least one severe mispricing event.

Next, I examine the role played by board independence. Although previous research has documented the importance of director independence in the sensitivity of CEO turnover to firm performance (e.g., Guo and Masulis 2015), we know nothing about independent directors' ability to discern mispricing from fundamental shocks or about the reaction of such directors to mispricing shocks. I establish that independent boards drive the sensitivity of CEO turnover to mispricing. At firms for which more than two thirds (i.e., the mean proportion) of directors are independent, a 10% decline in market value that is due to mispricing increases by 9%–15% the probability of CEO replacement. On average, boards on which fewer than two thirds of directors are independent do not respond significantly to mispricing.

Because this result could be driven by an omitted variable that is correlated with board independence, I conduct two additional tests to confirm the effect of board independence. First, I assess whether firm characteristics that might be correlated with board independence across firms are also associated with a greater sensitivity of CEO turnover to mispricing. I find that – unlike

board independence – characteristics such as board size, shareholder rights, firm size, leverage, and research and development (R&D) expenditures are not associated with this sensitivity. Furthermore, controlling for the interactions between each of these variables and stock mispricing has little effect on the regression coefficient for board independence. As a second test, I exploit the changes in listing rules after passage of the Sarbanes–Oxley Act (SOX) as an exogenous regulatory shock to board independence. Implemented from 2001, the new rules required any firm with an insider-dominated board to increase its fraction of independent directors to at least 50%. In comparison with firms whose boards were already independent, the regulation increased the sensitivity of CEO turnover to mispricing at affected firms.

Informed by existing theories, I assess two plausible reasons why independent boards may react to mispricing. Even as directors monitor the CEO, they are themselves disciplined by the firm's shareholders and by the wider labor market for directors (Fama 1980, Fos et al. 2018). As Guo and Masulis (2015) point out, independent directors by definition have strong incentives to develop their reputations, in the corporate directorship market, as skilled monitors. So if independent directors expect mispricing to affect that market's evaluation of their performance – since overall the market seems unaware of mispricing – then they might respond to uninformative price movements irrespective of their own mispricing awareness (Fisman et al. 2014).[1]

An alternative account is that independent directors may receive little private information about the firms they monitor (Adams and Ferreira 2007, Harris and Raviv 2008, Duchin et al. 2010) and therefore rely mainly on stock prices when assessing the CEO's performance. The average board tends to not fully filter out common industry shocks from firm performance when

[1] One example of this lack of awareness by the market is that the negative stock price pressure due to redemptions by mutual funds is not "traded away" until several months after the mispricing event (see the evidence presented in Figure 1 as well as in Edmans et al. 2012, Dessaint et al. 2018, and Lou and Wang 2018.)

deciding on a CEO's fate (Jenter and Kanaan 2015) and reward CEOs for changes in macroeconomic conditions that are, in fact, beyond their control (Bertrand and Mullainathan 2001). If an independent board infers performance from stock prices but fails to filter out mispricing, then it will misattribute an undervalued stock to underperformance and may consequently sanction the CEO.

To test the relative viability of these two explanations, I first examine how the sensitivity of CEO turnover to mispricing relates to the characteristics of independent directors. In accord to the idea that independent directors react to mispricing mainly because of reputational concerns, I find that independent boards on which independent directors care relatively more about the labor market (i.e., boards whose independent directors are younger, closer to re-election, and have shorter tenure) are more sensitive to mispricing than are other independent boards. Moreover, I show that independent directors involved in a turnover event that follows a upper-quintile mispricing shock occupy 5% more board seats after that event than do directors who are not associated with a CEO turnover event. In contrast, I find no significant association between (proxies for) firm opacity or independent director information and the sensitivity of independent boards to mispricing.

Second, I examine whether independent directors actually are misled by uninformative shocks. If independent directors realize that the stock is somewhat undervalued, then they should personally trade – like insiders do – against that anomaly and purchase the firm's stock after mutual fund forced sales events (Kahn et al. 2012, Dessaint et al. 2018). Indeed, I find that independent directors do trade against mispricing and increase their purchases of stock when its price is depressed by such forced sales.

Together, these results cast doubt on the notion that uninformed independent directors misattribute non-fundamental movements in stock prices to information about performance.

Instead, the evidence is consistent with the predictions of theoretical models in which informed, un-entrenched agents take actions based on noise as a way of catering to the uninformed investors who monitor them (Brandenburger and Polak 1996, Fisman et al. 2014). Exploiting exogeneous mispricing shocks, as I do in this paper, yields results that constitute novel empirical evidence for the mechanism underlying those theoretical models.

My findings also contribute to several other strands of the literature on corporate governance and on the real effects of the stock market. First, the extent to which stock prices affect firms' investment decisions has long been subject to debate (Barro 1990, Morck et al. 1990, Blanchard et al. 1993). Several measures of stock mispricing are related to firm investment either through equity issues (Baker and Wurgler 2002) or through catering to market sentiment (Polk and Sapienza 2009). More recent research shows that plausibly exogenous mispricing shocks induced by mutual fund forced sales affect capital issues (Kahn et al. 2012) as well as takeover decisions (Edmans et al. 2012) and investment levels (Hau and Lai 2013, Dessaint et al. 2018, Lou and Wang 2018). I contribute to this literature by showing that these shocks also affect leadership choices – an important determinant of firm value and productivity.

Second, the results reported in this paper augment the literature on independent directors. Although independent directors are widely presumed to be beneficial and effective monitors of CEO behavior (Weisbach 1988, Guo and Masulis 2015), several studies offer a more nuanced view by highlighting the costs of independent boards. For example, independent directors may have greater difficulty accessing strategic information about the firm (Duchin et al. 2010) and/or be less effective at advising executives (Adams and Ferreira 2007). My results show that labor

market pressure may also result in independent directors acting on non-fundamental stock price movements so as to burnish their reputations as tough monitors.[2]

Also closely related to this paper is the study by Cai et al. (2015); these authors argue, in the context of determining CEO bonuses, that boards adjust the weight they place on accounting versus market performance depending on how mispriced is the firm's market value. Their results, as do mine, suggest that boards tend to be aware of stock mispricing. I show that such awareness need not, in itself, imply that mispricing is irrelevant to their decisions. As already mentioned, independent directors may react to mispricing also out of reputational concerns.

Finally, my results contribute to the literature on CEO turnover and its sensitivity to firm performance (for a summary, see Brickley 2003). Whereas Jenter and Kanaan (2015) argue that boards tend to discipline CEOs following industry shocks, I show that boards may also impose discipline in response to firm-specific shocks that are largely beyond the CEO's control.

2. Data

Data on CEO turnover come from Jenter and Lewellen (2014), Peters and Wagner (2014), and Jenter and Kanaan (2015). Algorithms that describe turnovers as "forced" or "voluntary" based on press releases are notoriously imprecise (Jenter and Lewellen 2014), and the majority of CEO turnovers are difficult to classify (Eisfeldt and Kuhnen 2013). Replacements of a CEO that are triggered by non-fundamental movements in stock prices may also be less likely to be reported in

[2] Two related papers study the interactions between stock price informativeness and board monitoring. Ferreira et al. (2011) examine the relationship between such informativeness and board structure; they find that, on average, firms with more informative stock prices have less independent boards. Along the same lines, Gorton et al. (2017) show that – when the board's monitoring intensity and informed traders' knowledge are both endogenized – there is a negative relationship between stock price informativeness and board monitoring. I extend these results by documenting the effect of well-defined yet uninformative mispricing shocks on CEO turnover and by assessing how and why the effect varies with the board's independence.

press releases as clear-cut dismissals. For these reasons, I consider all turnovers except for those of CEOs beyond the retirement age of 65 (Jenter and Lewellen 2014). I require that CEOs be in the sample for at least two years.

Data on stock returns and firm characteristics are from the Center for Research in Security Prices (CRSP) and Compustat; insider trading data are extracted from Thomson Reuters. Data on board characteristics and directors' independence are from ISS/RiskMetrics. I exclude firms in the finance and utility sectors (SIC codes 6000–6700 and 4000–4900). The final sample includes 1,738 unique firms and spans the period from 1996 (the first year for which ISS/RiskMetrics data are available) and 2010 – the last year with CEO turnover data.

To isolate non-fundamental movements in stock prices, I follow Edmans et al. (2012) and exploit forced sales by mutual funds. Stock sales by diversified mutual funds in response to investor outflows generate large demand shocks on stocks in those funds' portfolios. As a result, these stocks experience substantial declines in price (Coval and Stafford 2007). Since only diversified mutual funds are considered in the construction of the measure, the investor outflows are unlikely to reflect investors' private information about a given firm. Nevertheless, fund managers have some discretion regarding which stocks to sell following outflows. A concern in my setting is that managers act on private information and choose to sell stocks that would have performed badly even in the absence of fund outflows. I address that concern by following Edmans et al. also in measuring only hypothetical sales that depend on the fund's holdings *before* a large investor outflow occurs. So by construction, this measure avoids any correlation between the mutual fund's actual sales and the manager's private information. The measure includes only those funds that experience extreme outflows – that is, amounting to at least 5% of total assets. In line with previous studies, I exclude all mutual funds specializing in a single sector to avoid the possibility that outflows are driven by negative views of one particular sector because industry

views may be correlated with CEO turnover (Jenter and Kanaan 2015). Finally, as suggested by Berger (2017), I implement robustness tests that address the remaining concern of sample selection bias in the firms affected by mispricing shocks.

Construction of the forced sales measure proceeds as follows. I first calculate quarterly mutual fund flows from the CRSP mutual fund database. Then, for each stock in each quarter, I use Thomson Reuters–CDA Spectrum data to compute the total holdings of funds that experienced at least 5% of outflows in that quarter. These holdings are next summed and divided by the trading volume of the focal stock in that quarter, where the sum includes only diversified funds that experienced outflows in excess of 5%. Finally, I sum the quarterly measures over the four quarters of the firm's fiscal year.[3]

[[INSERT Figure 1 about Here]]

Figure 1 plots the sample quarterly cumulative average abnormal return (CAAR) around forced sales events for a mispricing measures falling below the 5th percentile. This graph closely resembles the pattern described by Edmans et al. (2012) and Dessaint et al. (2018). In particular, it exhibits no significant abnormal decline in returns before the event yet shows an abrupt drop in returns immediately after the event. Cumulative returns reach −10% but subsequently recover after about eight quarters. That price recovery, too, is consistent with these forced sales generating uninformative shocks. In other words, the price drop would be permanent if it were related to bad fundamentals.

[[INSERT Figure 2 about Here]]

Figure 2 presents the sample average of the mispricing measure and frequency of CEO turnover by year and industry. On average, 7.8% of CEOs are replaced before age 65. Mutual

[3] See Edmans et al. (2012) or Dessaint et al. (2018) for further details on construction of the mispricing measure.

fund forced sale events occur throughout the sample period and are not distinctly clustered, although a significant increase in the measure is observed for 1999. Forced sales affect stocks across a wide variety of industries. Table 1 presents all the summary statistics.

[[INSERT Table 1 about Here]]

3. Methodology

To assess how sensitive CEO turnover is to non-fundamental shocks to the stock price, I implement a two-stage procedure similar to that employed by Jenter and Kanaan (2015) and Dessaint et al. (2018).

The baseline, first-stage regression decomposes observed firm market values (Tobin's Q) into a *non-fundamental* component, which is based on shocks to mutual fund outflows (mutual fund hypothetical sales, the *MFHS* variable) and a *fundamental* residual component (v)

$$Q_{it} = \delta_t + \eta_s + \psi(MFHS_{it}) + v_{it}\,, \tag{1}$$

where i indexes firms, t indexes years, and δ_t and η_s represent year and industry (2-digit Standard Industrial Classification, SIC2) fixed effects, respectively. The stock mispricing measure described previously is denoted by the *MFHS* variable. In the second stage, I build on this decomposition to estimate the sensitivity of CEO turnover to such non-fundamental movements in share price. For this purpose, I use the following linear probability model:

$$P(CEO\_turnover_{it+1}) = \delta_t + \eta_s + \beta(MFHS_{it}) + \gamma v_{it} + \Phi X_{it} + \varepsilon_{it}\,; \tag{2}$$

here v_{it} is the fundamental residual of equation (1), X is a vector of control variables that includes firm size (log of assets), CEO tenure, and a dummy variable for whether or not the CEO is also chairman of the board (COB), and ε is an error term. Standard errors are clustered at the firm level. The coefficient of interest is β, which measures the sensitivity of CEO turnover to non-fundamental movements in stock prices. Since *MFHS* is a negative number (greater mispricing

implies a *MFHS* that is more negative), it follows that a negative coefficient β indicates that non-fundamental declines in Q increase the likelihood of CEO turnover.

These baseline regressions are directly comparable to the standard CEO turnover regressions estimated in the literature. In some tests I further tighten the specifications – equations (1) and (2) both – by including industry-year fixed effects (which control for any industry-specific, time-varying factor) and/or firm fixed effects (which control for time-invariant firm characteristics). The results are unchanged when I control for fundamental performance via an accounting measure (i.e., return on assets), instead of via the residuals *v*, and when I estimate a logit model rather than a linear probability model.[4] To address the concern that outflow-driven mispricing may affect only certain types of firms, I follow Berger (2017) and re-run my regressions on the sample of firms affected at least once by "extreme" mispricing event (defined as *MFHS* falling below various thresholds); the results are unaffected by these variations.

[[INSERT Table 2 about Here]]

Table 2 confirms that the mutual fund hypothetical sales measure is a strong predictor of declines in firms' market value. An increase of one standard deviation in that price pressure measure (σ_{MFHS} = 4.1), is associated with a 7%–16% reduction in market value, where the exact percentage by which that value falls depends on which fixed effects are included in the specification.

[4] In untabulated results, I find that these findings are robust also to estimating the model with a standard two-stage least-squares procedure, where the stock mispricing measure is used to instrument the firm's market performance.

4. Results

4.1. Baseline Result

I start by estimating the sensitivity of CEO turnover to stock mispricing via the two-stage approach described in Section 3. Recall that the first stage decomposes variation in firm market value into a non-fundamental predictable component caused by mutual fund forced sales (*MFHS*) and a fundamental residual component ($v = Q - \beta(MFHS)$). The second stage regresses an indicator for CEO turnover on these two components. If CEO turnover is sensitive to non-fundamental movements in stock prices, then the coefficient for *MFHS* will be negative and statistically significant.

[[INSERT Table 3 about Here]]

Table 3 presents the main result of this paper: when regressing CEO turnover on the fundamental and non-fundamental components of firm market value, both terms are strongly associated with CEO turnover. Column [1] uses the baseline specification introduced in Section 3. The coefficient for *MFHS* is negative and statistically significant (−0.0016, with a *t*-statistic of 2.63). In column [2], I add industry-year fixed effects to account for time-varying industry shocks; these additional terms do not affect the coefficient (−0.0016, $t = 2.54$). In column [3], I tighten the specification by incorporating firm fixed effects. The coefficient, which is now estimated within firms, increases slightly in magnitude and remains statistically significant (−0.0019, $t = 2.59$). These results exhibit no qualitative changes when the regression incorporates both industry-year and firm fixed effects (−0.0020, $t = 2.55$; see column [4]).

The effect of mispricing on CEO turnover is economically meaningful. In the firm fixed effects specification (column [3]), an increase of one standard deviation in the non-fundamental shock increases the probability of CEO turnover by 0.78 percentage points (= 0.19% × 4.10); this

amounts to nearly a 7.8% increase over the unconditional probability of CEO turnover. Given that a one–standard deviation increase in the non-fundamental movement is associated with a 9.23% (= 4.82% × 4.10/2.14) decline in the mean market value (see Table 2), the coefficient for *MFHS* implies that a 10% drop in market value for non-fundamental reasons increases the CEO turnover likelihood by almost 0.85 percentage points (= 0.78% × 10%/9.23%), or a 10.82% increase in the unconditional probability of CEO turnover. In comparison, a one–standard deviation decline in market value due to fundamental reasons increases CEO turnover by 1.08 percentage points (= 1.25% × 0.865) – a 13.83% increase in the probability of CEO turnover. On average, then, non-fundamental movements in stock prices do affect boards' assessment of CEOs. The sensitivity of CEO turnover to these non-fundamental movements is smaller than its sensitivity to fundamental movements, which suggests that the average board filters out at least some of the noise contained in stock prices.

[[INSERT Table 4 about Here]]

Table 4 presents robustness tests on the sensitivity of CEO turnover to mispricing. In columns [1] and [2], I control for firm fundamental performance by using return on assets (*RoA*) instead of *v*. The coefficient for *MFHS* is statistically significant regardless of whether the specification includes industry fixed effects (column [1]) or firm fixed effects (column [2]). Columns [3]–[5] of the table address the concern that CEO turnover sensitivity to price pressure may be driven by selection bias. Following Berger (2017), I re-estimate the regression on the sample of firms that are affected at least once by an extreme mispricing event. A mispricing event is defined as "extreme" if the price pressure measure falls within the 20th percentile (column [3]), the 10th percentile (column [4]), or the 5th percentile (column [5]). I find that, despite the reduction in sample size, there is not much effect on the magnitude of the coefficient for *MFHS* ; that coefficient also remains statistically significant at conventional levels. Finally, I show in

columns [6] and [7] of Table 4 that using a logit model instead of a linear probability model does not materially affect my findings.

4.2. Board Independence

The board of directors hires and dismisses CEOs. Which directors react most to non-fundamental movements in stock prices? I conjecture that directors' independence plays a key role in their sensitivity to mispricing. First of all, it is difficult for independent boards to access inside information about the firm (Adams and Ferreira 2007, Harris and Raviv 2008, Duchin et al. 2010). Because they therefore lack sufficient strategic information, independent boards may rely more (than do other boards) on public signals – such as the stock price – when assessing CEO performance. On average, independent directors do not seem to filter out common industry and macroeconomic factors from performance evaluation (Bertrand and Mullainathan 2001, Jenter and Kanaan 2015). To the extent that independent directors do not filter out noise from the stock price, they may also react to non-fundamental movements.

Second, independent directors are disciplined by the labor market (Fama 1980). Independent directors are more likely to keep their seats and to acquire new directorships after they replace a CEO (Fos et al. 2018), and independent directors may count on the labor market offering them additional board seats. Hence these directors may act on non-fundamental declines in the stock price so that they appear to be tough monitors – that is, even if they realize that such price movements do not reflect CEO quality. For this dynamic to play out, it may be sufficient for these directors to believe that the market will rely on public signals to assess their monitoring effectiveness but will not filter out mispricing in making that assessment (Fisman et al. 2014).

[[INSERT Table 5 about Here]]

Table 5 evaluates the role of director independence in the association between CEO turnover and mispricing. I measure board independence with a dummy variable that is set to 1 if independent directors represent more than two thirds – that is, the mean of the continuous variable – of the board in the year during which the CEO is appointed (and is set to 0 otherwise).[5] Board independence is measured at the time of CEO hiring in order to mitigate concerns of endogenous board structure changes, which could be related to firm performance, during the CEO's term.

In columns [1] and [2] of the table, I split the sample in terms of board independence and then estimate the baseline regression separately for each subsample. Non-fundamental movements in stock prices are significantly associated with CEO turnover only in the independent board subsample, for which the coefficient is 3 times higher than that for the less independent subsample (−0.0028 vs. −0.0009).

Column [3] of Table 5 reports the full-sample estimation results based on my interacting fundamental and non-fundamental movements with board independence. The interaction term on non-fundamental movements is negative and statistically significant, which confirms that independent boards are more sensitive to mispricing when it comes to CEO replacement. Adding industry-year and firm fixed effects (in columns [4] and [5], respectively) barely change the coefficient.[6] Finally, in column [6] I augment the fixed-effects model by adding the interaction of *MFHS* with year fixed effects to control for possible time-series changes – in the relationship

[5] The results are robust to using instead a continuous measure of board independence (i.e., the fraction of directors that are independent). Yet as noted by Balsmeier et al. (2017), it may be that the influence of independent directors on board oversight does not increase linearly with the number or fraction of independent members; there may rather be a "jump" when independent directors reach a clear majority.

[6] The coefficient for the interaction between board independence and fundamental movements is negative but not statistically significant. It becomes significant if board independence is measured with a (more endogenous) continuous measure that is contemporaneous with CEO turnover.

between mutual fund forced sales and CEO turnover – that may be correlated with trends in board independence. The inclusion of this interaction does not change the regression results.

A potential concern with the findings presented in Table 5 is that board independence might be correlated with other firm characteristics that drive the association between board independence and the sensitivity of CEO turnover to mispricing. I address this concern in two ways.

[[INSERT Table 6 about Here]]

First, I study the determinants of board independence and assess whether predictors of that independence are associated also with the turnover–mispricing sensitivity. I use the first year in which each CEO takes office and regress both dichotomous and continuous measures of board independence on several firm characteristics: board size, shareholder rights – as proxied by the G-index of Gompers et al. (2003), firm size, leverage, and R&D expenditures as a fraction of assets. The regression results presented in Table 6 show that board independence is most highly correlated with firm size and the G-index. Next, I re-estimate the baseline regressions but now interact *MFHS* with those firm characteristics; see Table 7. I do not find any significant association between the CEO turnover–mispricing sensitivity and these characteristics. Although the sensitivity of CEO turnover to non-fundamental movements changes as a function of board independence (column [1]), it is not associated with board size, G-index, firm size, leverage, or R&D (columns [2]–[6]). In addition, including all the interactions between these characteristics and mispricing does not alter the effect of board independence (column [7]).

[[INSERT Table 7 about Here]]

Second, I exploit the change in listing rules that followed implementation of the Sarbanes–Oxley Act as a further test of how independent directors affect the turnover–mispricing sensitivity. One of the key listing rule provisions was to impose a majority of independent

directors on the boards of listed firms. Although some firms (the "control" firms) were already in compliance with that requirement when the regulation was enacted, other firms (the "treated" firms) were forced to increase the number of their independent directors. I follow Duchin et al. (2010), Guo and Masulis (2015), and Balsmeier et al. (2017) and adopt a difference-in-differences framework for comparing the sensitivity of CEO turnover to mispricing at the control and the treated firms both before and after the implementation of the listing rule changes. Thus I estimate the following model:

$$\begin{aligned} P(CEO\_turnover_{it+1}) = {} & \delta_t + \eta_s + \beta_0(MFHS_{it} \times Treat_i \times After_{it}) + \beta_1(v_{it} \times Treat_i \times After_{it}) \\ & + \beta_2(MFHS_{it} \times Treat_i) + \beta_3(v_{it} \times Treat_i) + \beta_4(MFHS_{it} \times After_{it}) \\ & + \beta_5(v_{it} \times After_{it}) + \beta_6(MFHS_{it}) + \beta_7 v_{it} + \beta_8(Treat_i \times After_{it}) + \Phi X_{it} + \varepsilon_{it}; \end{aligned} \quad (3)$$

here the indicator *Treat* is set to 1 if fewer than half of a firm's directors were independent in year 2000 (and to 0 otherwise), and *After* is set to 1 only for (a) years after 2000 for control firms and (b) the year of compliance (and subsequent years) for treated firms.[7] The coefficient of interest is β_0, which measures the change in post-compliance sensitivity of CEO turnover to non-fundamental shocks (*MFHS*) at treated firms as compared to the corresponding change at control firms.

[[INSERT Table 8 about Here]]

Table 8 reports the results of this experiment. Column [1] shows that the shock is relevant: treated firms significantly increased their fraction of independent directors in response to the regulation. The table's next four columns assess the regulation's effect on the sensitivity of CEO turnover to stock mispricing. Column [2] displays the basic regression results when industry fixed effects are included. Columns [3] and [4] add (respectively) industry-year fixed effects and

[7] Firms were given until 2005 to comply with the regulation. For additional details see Duchin et al. (2010), Guo and Masulis (2015), or Balsmeier et al. (2017).

firm fixed effects. Column [5] addresses the imbalance of treated and control firms with regard to such observable characteristics as size (treated firms tend to be smaller) by re-estimating the firm fixed effect regression after matching treated and control firms.[8] Across these four columns, the coefficient of interest is consistently negative and statistically significant. In comparison with control firms, treated firms exhibit increased sensitivity of CEO turnover to mispricing after the regulation went into effect. These results reinforce the idea that independent boards are especially responsive to non-fundamental movements in stock prices. I shall next investigate two channels through which this result might operate.

4.3. Channels

4.3.1. Independent Directors and Firm Opacity

A widespread concern with independent boards is that executives may be reluctant to provide independent directors with timely information about the firm. As a result, independent directors may end up with inferior information relative to other directors who have business or personal ties to the firm or its executives. For example, Ravina and Sapienza (2010) find that independent directors tend to possess inferior information when serving on the boards of firms with more entrenched executives. Given inferior information, independent directors may feel impelled to rely on public signals (e.g., stock prices) to monitor executives. Since directors have been shown to reward CEOs for "lucky" changes in firm performance (for example, Bertrand and Mullainathan (2001) find that CEOs are rewarded macroeconomic movements in oil prices and

[8] The matching is performed as follows. For each 1-digit industry, I estimate the probability (i.e., the propensity score) that a firm is treated as a function of its size (log of assets), leverage, and return on assets – all measured for the first year that the firm appears in the sample. I then perform a "radius" match (with a standard 0.005 caliper) based on that propensity score.

exchange rates), independent directors may also (mistakenly) attribute to CEO performance the stock mispricing that is triggered by mutual funds' forced sales.

Under this hypothesis, the sensitivity of CEO turnover to mispricing should be greatest in firms with a high fraction of independent directors and in which it is difficult to acquire firm-specific information. To examine this possibility, I implement a "triple difference" test that compares the sensitivity of CEO turnover to stock mispricing in firms with independent boards and different levels of opacity. I use three different proxies for the cost of acquiring information about the firm. First, I use the opacity index of Duchin et al. (2010). This index is the average of (i) 100 minus the centile of the number of analysts covering the firm, (ii) the centile of the standard deviation of analysts' forecasts, and (iii) the centile of analysts' average forecast errors. A higher opacity index indicates that it is harder to acquire information about the firm. Second, following Ravina and Sapienza (2010), I proxy the information that independent directors have about the firm by the abnormal returns on their insider trades (IT) at the 60-day horizon.[9] Third, because Ravina and Sapienza's results show that independent directors are better informed in firms where managers are less entrenched, I also use the G-index of shareholder rights as a proxy for the quality of independent directors' information.

[[INSERT Table 9 about Here]]

Table 9 reports the results of these tests. The triple interaction terms involving non-fundamental shocks, board independence, and firm opacity are all statistically insignificant. Hence it seems that independent directors' access to firm information does not play a major role in the sensitivity of CEO turnover to mispricing.

[9] In this calculation, for each year and firm I average the abnormal returns across all of the firm's independent directors. The results are similar if instead a horizon of 30, 90, or 180 days is used.

4.3.2. Independent Directors and Career Concerns

I now turn to a different channel that could explain the sensitivity of CEO turnover to mispricing at firms with independent boards.

Fos et al. (2018) find that (i) CEO turnover sensitivity to firm accounting performance increases as directors approach re-election and (ii) the labor market tends to reward directors – with seats on additional boards – who replace a firm's CEO. Independent directors are naturally concerned about the labor market for director seats (Guo and Masulis 2015), and this generalization holds even more so with regard to directors who are younger, have less tenure, and are closer to the end of their current term.

To assess the role of such career concerns, I create an index that measures the importance of the labor market for independent directors. For each firm-year observation, I calculate the average age, tenure, and years until the next election with regard to all independent directors sitting on the board; I then use these measures to construct an index using the methodology of Duchin et al. (2010). I calculate 100 minus the centile in which each average measure lies, average the three measures, and scale the resulting number so that it lies between 0 and 1. Finally, a *labor market–sensitive* independent board is defined as one for which this reputation index is above the median value.

[[INSERT Table 10 about Here]]

Table 10 presents results of the regression that incorporates the triple interaction term among mispricing, board independence, and career concerns. The negative and significant coefficients indicate that, for firms with independent boards, those on which independent directors care the most about the labor market exhibit rates of CEO turnover that are more sensitive to mispricing. The coefficient is robust to the inclusion of industry-year and firm fixed effects.

Next, I assess whether independent directors associated with CEO turnovers do, in fact, experience better labor market outcomes relative to other directors. Following Fos et al. (2018), I match directors by (i) age buckets and number of seats in the year before the turnover event and (ii) buckets for the average RoA and average size of the firms for which they are independent directors. I then compare the mean number of independent seats in the three years before and after a turnover event across event-associated directors and matched directors.

[[INSERT Table 11 about Here]]

Table 11 reports the results. In line with Fos et al. (2018), column [1] shows that directors associated with CEO turnover events experience better post-event labor market outcomes than do other directors. On average, these "event directors" have 0.06 more independent seats than matched directors in the years following a CEO turnover;[10] this difference amounts to a 5.1% increase over the mean number (= 1.19) of independent seats. In column [2], I include only those event directors for whom the CEO turnover follows a price pressure measure in the lowest quintile of the overall price pressure distribution. In this case I observe similar results: directors who replace a CEO after significant stock price pressure benefit from relative labor market outcomes that are better to much the same extent as the case of any director involved in a CEO turnover (viz., a 5% increase in the number of seats). In column [3] of the table, I compare only the event directors from column [2] to the directors who also experience mispricing in the lowest quintile (but do not replace the CEO). For a given mispricing event, directors who respond by replacing the CEO experience a 3.7% relative increase in seats during the years that follow. Overall, these tests indicate that directors associated with a CEO turnover occurring after a mispricing event tend to be rewarded in the labor market for independent seats.

[10] Here 0.06 represents the average difference in the number of seats across years t, $t + 1$, $t + 2$, and $t + 3$. I observe (as do Fos et al.) that, on average, the absolute number of seats of matched directors declines over time.

4.4. Are Independent Directors Aware of Mispricing?

The evidence presented so far is consistent with independent directors reacting to mispricing in order to improve their labor market outcomes. In a final test, I examine directors' trades of the firm's stock after mispricing episodes to assess whether directors misattribute mispricing to information about the CEO or whether they possibly replace the CEO to cater to misinformed shareholders. Kahn et al. (2012) and Dessaint et al. (2018) find that corporate officers have some awareness of the undervaluation triggered by mutual funds' forced sales, as evidenced by those officers trading the firm's stock against that undervaluation on their own account. In Table 12, I compare the trading pattern of independent directors (shown in Panel B) to that of the firm's main officers (Panel A).[11] I assess the probability that independent directors and officers are net purchasers of the stock (column [1]), their amount of net purchase (column [2]), and the (log of the) number of shares they purchase (column [3]) in a quarter that follows stock price pressure. I find that, like corporate officers, independent directors in this sample of firms trade against the mispricing. Stock mispricing increases not only the likelihood that independent directors and officers purchase that stock in the following quarter but also the number of shares that they buy.

[[INSERT Table 12 about Here]]

In Panel C of Table 12, I augment the sample and consider the trading of all independent directors at firms in the full CRSP universe. The coefficients derived in this regression are also positive and statistically significant. In Panel D, I restrict the sample to the years during which the firm is headed by an ultimately fired CEO and again find similar results. I therefore conclude that independent directors do trade against non-fundamental movements driven by mutual funds' forced sales. Together, the evidence from Sections 4.3 and this Section 4.4 is consistent with the

[11] Those officers are the CEO, the Chief Financial Officer, the Chief Operating Officer, the Chief Investment Officer, and the Chief Technology Officer.

predictions of theoretical models whereby un-entrenched informed directors act on faulty performance signals, thus catering to misinformed monitors and improving personal outcomes (Fisman et al. 2014). In short, discipline from the labor market can lead independent directors to make CEO turnover decisions that are more sensitive to noise in CEO performance.

5. Conclusion

This paper investigates whether stock mispricing affects the probability of CEO turnover. Using a sample of US firms between 1996 and 2010, I find that non-fundamental downward movements in stock prices significantly increase the probability of CEO turnover. This association is stronger for firms with a large fraction of independent directors, and that finding is supported by a quasi-natural experiment based on the change in listing requirements that followed passage of the Sarbanes–Oxley Act.

Further tests suggest that independent directors are aware of such mispricing but do not act on it for strictly informational reasons. Instead, the evidence is consistent with models under which independent directors act on faulty signals as a way of catering to the misinformed investors who monitor them – that is, in order to improve their own personal outcomes. In this sense, my results highlight an agency conflict between independent directors and the shareholders whom they represent. Whether this particular channel is responsible for other real effects, and whether it influences the broader labor market for CEOs, remain intriguing avenues for further research.

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Table 1
Descriptive Statistics

This table presents summary statistics of the main variables used in the analysis. For each variable, the statistics are computed across pooled observations for the entire sample period (1996–2010). COB = chairman of the board; IT = insider trades.

	Mean	Median	S.D.	Min.	Max.
Tobin's Q	2.137	1.665	1.492	0.725	10.180
Mutual fund hypothetical sales	–3.489	–2.275	4.100	–27.501	–0.004
CEO turnover	0.078	0.000	0.268	0.000	1.000
CEO age (years)	51	51	8	25	90
Dual CEO–COB	0.605	1.000	0.489	0.000	1.000
Assets (millions of dollars)	4,843	1,165	15,982	10	479,921
Leverage	0.207	0.194	0.174	0.000	0.817
R&D ÷ Assets	0.035	0.006	0.057	0.000	0.349
Independent directors	0.676	0.714	0.176	0.000	1.000
Independent directors ≥ 67% of board	0.498	0.000	0.500	0.000	1.000
Independent directors' career concern index	0.530	0.530	0.204	0.000	0.990
Firm opacity index	0.502	0.503	0.253	0.007	0.997
60-day Indep. directors return on IT	0.066	0.040	0.165	–0.337	0.627

Table 2
First Stage: Firm Market Value Decomposition

This table presents results from the first-stage regressions, which decompose Tobin's Q for firms into a fundamental component (v) and a non-fundamental component (*MFHS*). Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level. *** indicates statistical significance at the 1% level.

	Tobin's Q			
	[1]	[2]	[3]	[4]
MFHS	0.0845***	0.0775***	0.0482***	0.0358***
	(0.0048)	(0.0048)	(0.0033)	(0.0030)
Year FE	Yes	No	Yes	No
Industry FE	Yes	No	No	No
Firm FE	No	No	Yes	Yes
Industry FE × Year FE	No	Yes	No	Yes
Controls	Yes	Yes	Yes	Yes
Observations	15,493	15,461	15,481	15,449
R^2	0.0211	0.0544	0.1473	0.1814

Table 3
Mispricing and CEO Turnover

This table presents results from the second-stage regressions. Non-fundamental movements in market values are measured by *MFHS* (mutual fund hypothetical sales). Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. *Fundamental* market value movements are measured as residuals of the first-stage regression (*v*). The standard deviation (S.D.) of *Fundamental* is 1.35 for the specification in column [1], 1.31 in column [2], 0.86 in column [3], and 0.81 in column [4]. FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level. ** and *** indicate statistical significance at (respectively) the 5% and 1% level.

	CEO_turnover			
	[1]	[2]	[3]	[4]
MFHS	–0.0016***	–0.0016**	–0.0019***	–0.0020**
	(0.0006)	(0.0006)	(0.0007)	(0.0008)
Fundamental	–0.0072***	–0.0072***	–0.0125***	–0.0132***
	(0.0015)	(0.0016)	(0.0027)	(0.0030)
Year FE	Yes	No	Yes	No
Industry FE	Yes	No	No	No
Firm FE	No	No	Yes	Yes
Industry FE × Year FE	No	Yes	No	Yes
Controls	Yes	Yes	Yes	Yes
Observations	15,449	15,449	15,449	15,449
R^2	0.0220	0.0553	0.1449	0.1787
Note: Economic magnitudes are the increases in *CEO turnover* implied by a one–standard deviation shock to *MFHS* or *Fundamental*.				
Absolute increase in CEO turnover				
One-S.D. shock to *MFHS*	0.66%	0.66%	0.78%	0.82%
One S.D. shock to *Fundamental*	0.97%	0.94%	1.08%	1.07%
Increase in CEO turnover relative to the unconditional probability of turnover (7.81%)				
One-S.D. shock to *MFHS*	8.45%	8.45%	9.99%	10.50%
One-S.D. shock to *Fundamental*	12.42%	12.04%	13.83%	13.70%

Table 4
Mispricing and CEO Turnover: Robustness

This table presents results of several robustness tests on the sensitivity of CEO turnover to stock mispricing. Non-fundamental movements in market values are measured by *MFHS* (mutual fund hypothetical sales), and *RoA* is the firm's return on assets. Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. *Fundamental* market value movements are measured as residuals of the first-stage regression (v) in columns [3]–[7]. Columns [1] and [2] use *RoA*, rather than those residuals, to control for fundamental performance. Columns [3]–[5] reproduce the baseline regressions but on the sample of firms affected by at least one extreme mispricing event, defined as an event for which *MFHS* falls below the 20th percentile (column [3]), the 10th percentile (column [4]), or the 5th percentile (column [5]). Columns [6] and [7] reproduce the baseline regressions using a logit model rather than a linear probability model. FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level – except in column [7], where they are bootstrapped with 50 repetitions. The last row of columns [6] and [7] reports the *pseudo-*R^2. *, **, and *** indicate statistical significance at (respectively) the 10%, 5%, and 1% level.

	CEO_turnover						
	RoA		Selection bias			Logit	
	Industry FE [1]	Firm FE [2]	p20 [3]	p10 [4]	p5 [5]	Industry FE [6]	Firm FE [7]
MFHS	–0.0016***	–0.0015**	–0.0016**	–0.0017**	–0.0018*	–0.0210***	–0.0361***
	(0.0006)	(0.0007)	(0.0008)	(0.0008)	(0.0010)	(0.0075)	(0.0105)
Fundamental			–0.2624***	–0.2588***	–0.2970***	–0.1187***	–0.2145***
			(0.0539)	(0.0635)	(0.0862)	(0.0261)	(0.0442)
RoA	–0.1850***	–0.2448***					
	(0.0231)	(0.0376)					
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,449	15,449	10,396	7,016	3,854	15,374	9,528
R^2	0.0251	0.1465	0.1316	0.1268	0.1309	0.0491	0.2332

Table 5
Board Independence and Mispricing

This table presents the results from regressions that assess the role of independent directors. Non-fundamental movements in market values are measured by *MFHS* (mutual fund hypothetical sales), and *Fundamental* market value movements are measured as residuals of the first-stage regression (*v*). Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. The dummy variable *Indep.* is set to 1 when independent directors account for more than two thirds of the board (measured in the first year the CEO takes office). FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level. ** and *** indicate statistical significance at (respectively) the 5% and 1% level.

	CEO_turnover					
			Full sample			
	Indep. < 0.67 [1]	*Indep.* ≥ 0.67 [2]	[3]	[4]	[5]	[6]
MFHS	–0.0009	–0.0028***	–0.0005	–0.0005	–0.0007	–0.0002
	(0.0008)	(0.0009)	(0.0008)	(0.0008)	(0.0010)	(0.0012)
MFHS × *Indep.*			–0.0025**	–0.0024**	–0.0028**	–0.0028**
			(0.0012)	(0.0012)	(0.0014)	(0.0014)
Fundamental	–0.0067***	–0.0096***	–0.0059***	–0.0061***	–0.0115***	–0.0115***
	(0.0022)	(0.0021)	(0.0022)	(0.0023)	(0.0040)	(0.0040)
Fundamental × *Indep.*			–0.0027	–0.0025	–0.0021	–0.0020
			(0.0030)	(0.0031)	(0.0055)	(0.0055)
Indep.			–0.0066	–0.0066	–0.0821***	–0.0818***
			(0.0056)	(0.0056)	(0.0133)	(0.0133)
Year FE	Yes	Yes	Yes	No	Yes	Yes
Industry FE	Yes	Yes	Yes	No	No	No
Firm FE	No	No	No	No	Yes	Yes
Industry FE × Year FE	No	No	No	Yes	No	No
MFHS × Year FE	No	No	No	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,757	7,692	15,449	15,449	15,449	15,449
R^2	0.0254	0.0359	0.0224	0.0557	0.1479	0.1483

Table 6
Determinants of Board Independence

This table presents the results of cross-sectional regressions designed to assess the determinants of board independence. For each firm's executive, I use the first year in which that executive becomes the firm's CEO. In column [1], the dependent variable is a dummy set to 1 when independent directors account for more than two thirds of the board; in column [2], the dependent variable is the continuous measure of the fraction of board directors that are independent. Robust standard errors are given in parentheses. * and *** indicate statistical significance at (respectively) the 10% and 1% level.

	Fraction of independent directors ≥ 0.67 [1]	Fraction of independent directors [2]
Board size	–0.0035	–0.0006
	(0.0055)	(0.0022)
G-index	0.0927***	0.0446***
	(0.0252)	(0.0090)
ln(Assets)	0.0310***	0.0140***
	(0.0104)	(0.0038)
Leverage	0.0129	0.0052
	(0.0747)	(0.0283)
R&D ÷ Assets	0.3482	0.1378*
	(0.2348)	(0.0826)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	2,202	2,202
R^2	0.1344	0.1919

Table 7
Placebo Test: Other Interactions

This table presents results from regressions that assess the possible confounding effect of several firm characteristics. Non-fundamental movements in market values are measured by *MFHS* (mutual fund hypothetical sales). Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. The dummy variable *Indep*. is set to 1 when independent directors account for more than two thirds of the board. The regressions also include *MFHS*, *Fundamental*, the "*Interaction"* variable, and *Fundamental* × *Interaction*, where *Fundamental* is measured by the residuals of the first stage regression (*v*). FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level. ** indicates statistical significance at the 5% level.

	CEO_turnover						
Interaction variable:	*Indep.* [1]	Board size [2]	G-index [3]	ln(Assets) [4]	Leverage [5]	R&D [6]	All [7]
MFHS × *Indep.*	–0.0025**						–0.0027**
	(0.0012)						(0.0013)
MFHS × Board size		–0.0003					–0.0003
		(0.0002)					(0.0003)
MFHS × G-index			–0.0002				–0.0001
			(0.0002)				(0.0003)
MFHS × ln(Assets)				–0.0004			–0.0004
				(0.0005)			(0.0006)
MFHS × Leverage					0.0040		0.0040
					(0.0031)		(0.0035)
MFHS × R&D						0.0070	0.0062
						(0.0150)	(0.0160)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,449	15,449	13,061	15,449	15,449	15,449	13,061
R^2	0.0224	0.0225	0.0211	0.0218	0.0225	0.0228	0.0231

Table 8

Change in Listing Rules and CEO Turnover Sensitivity to Mispricing

This table presents regression results for equation (3); thus it assesses the impact of the change in listing rules following SOX, which mandated that the majority of a firm's board members be independent directors. Non-fundamental movements in market values are measured by *MFHS* (mutual fund hypothetical sales), and *Fundamental* market value movements are measured as residuals of the first-stage regression (v). The indicator variable *Treat* is set to 1 for firms that had, in year 2000, a board that comprised directors of which fewer than half were independent (and is set to 0 otherwise); *After* is a dummy set to 1 for years after 2000 (in the case of control firms) and starting in the first year of compliance (in the case of treated firms); otherwise, it is set to 0. Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. In column [5], I estimate the regression on the matched sample described in note 8 (Section 4.2). The regressions include all of equation (3)'s terms, though only *Treat* × *After*, *MFHS* × *Treat* × *After, and Fundamental* × *Treat* × *After* are reported for brevity. FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level. *, **, and *** indicate statistical significance at (respectively) the 10%, 5%, and 1% level.

	Indep.	*CEO_turnover*			
	[1]	[2]	[3]	[4]	[5]
Treat × *After*	0.2012***	–0.0191	–0.0238	–0.0176	–0.0271
	(0.0107)	(0.0162)	(0.0169)	(0.0195)	(0.0217)
MFHS × *Treat* × *After*		–0.0087**	–0.0095**	–0.0099**	–0.0099*
		(0.0037)	(0.0038)	(0.0047)	(0.0051)
Fundamental × *Treat* × *After*		–0.0101	–0.0126	–0.0101	–0.0136
		(0.0115)	(0.0120)	(0.0193)	(0.0229)
Year FE	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	No
Firm FE	Yes	No	No	Yes	Yes
Industry FE × Year FE	No	No	Yes	No	No
Controls	Yes	Yes	Yes	Yes	Yes
Matched sample	No	No	No	No	Yes
Observations	12,229	12,229	12,205	12,229	9,191
R^2	0.7676	0.0232	0.0646	0.1256	0.1261

Table 9
Independent Directors and Firm Opacity

This table presents results from regressions designed to assess the effect of independent directors' information about the firm (*Info.*) on independent directors' sensitivity to stock mispricing. Non-fundamental movements in market values are measured by *MFHS* (mutual fund hypothetical sales), and *Fundamental* market value movements are measured as residuals of the first-stage regression (*v*). Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. Regressions also include the following (unreported) additional terms: *Indep.*, *Info.*, *Indep.* × *Info.*, *MFHS* × *Indep.*, *MFHS* × *Info.*, *Fundamental* × *Indep.*, and *Fundamental* × *Info.* CAR = cumulative abnormal returns; FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level.

	CEO_turnover		
	Opacity index [1]	60-day CAR [2]	G-index [3]
MFHS × *Indep.* × *Info.*	–0.0007	0.0001	0.0035
	(0.0026)	(0.0028)	(0.0027)
Fundamental × *Indep.* × *Info.*	–0.0009	–0.0071	0.0050
	(0.0062)	(0.0082)	(0.0077)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Observations	15,108	12,072	13,061
R^2	0.0232	0.0213	0.0218

Table 10
Independent Directors and Career Concerns

This table presents results from regressions that assess how independent directors' career concerns affect their sensitivity to stock mispricing. Non-fundamental movements in market values are measured by *MFHS* (mutual fund hypothetical sales), and *Fundamental* market value movements are measured as residuals of the first-stage regression (*v*). Controls are firm size (log of assets), CEO tenure, and a dummy variable indicating whether or not the CEO is also chairman of the board. Regressions also include the following (unreported) additional terms: *Indep.*, *Career.*, *Indep.* × *Career, MFHS* × *Indep.*, *MFHS* × *Career*, *Fundamental* × *Indep.*, and *Fundamental* × *Career*. FE = fixed effects. Standard errors are clustered at the firm level. ** indicates statistical significance at the 5% level.

	CEO_turnover			
	[1]	[2]	[3]	[4]
MFHS × *Indep.* × *Career*	–0.0059**	–0.0056**	–0.0059**	–0.0058**
	(0.0024)	(0.0024)	(0.0027)	(0.0027)
Fundamental × *Indep.* × *Career*	0.0066	0.0068	–0.0149	–0.0132
	(0.0066)	(0.0069)	(0.0128)	(0.0136)
Year FE	Yes	Yes	Yes	No
Industry FE	Yes	No	No	No
Firm FE	No	No	Yes	Yes
Industry FE × Year FE	No	Yes	No	Yes
Controls	No	Yes	No	Yes
Observations	14,448	14,439	14,433	14,424
R^2	0.0249	0.0622	0.1540	0.1916

Table 11

Independent Directors, CEO Turnover, and Labor Market for Director Seats

This table describes the evolution of the difference in the average number of independent seats across (a) independent directors involved in a CEO turnover at time *t* and (b) matched independent directors. Directors are matched by (i) age buckets and number of seats in the year before the turnover event and (ii) buckets for the average return on assets and average size of the firms for which they are a director. Bucket sizes are determined by a "coarsened" exact matching algorithm. In column [1], the sample includes all independent directors. In column [2], the "event directors" are those involved in a CEO turnover event following the occurrence of lower-quintile price pressure (MFHS (p20)); this column excludes all other directors involved in a CEO turnover event. In column [3], both event and control directors belong to firms that experience lower-quintile price pressure (all other directors are excluded). Standard errors (in parentheses) are clustered at the director level. *, **, and *** indicate statistical significance at (respectively) the 10%, 5%, and 1% level.

	Number of independent seats		
Year from CEO turnover event	[1]	[2]	[3]
$t-3$	0.0034	–0.0181	–0.0001
	(0.0142)	(0.0243)	(0.0271)
$t-2$	0.0002	–0.0264	–0.0295
	(0.0116)	(0.0236)	(0.0250)
$t-1$	–0.0000	0.0000	0.0000
	(0.0095)	(0.0195)	(0.0196)
t	0.0863***	0.0752***	0.0455**
	(0.0089)	(0.0190)	(0.0196)
$t+1$	0.0610***	0.0554***	0.0468**
	(0.0103)	(0.0211)	(0.0213)
$t+2$	0.0478***	0.0491**	0.0318
	(0.0116)	(0.0230)	(0.0242)
$t+3$	0.0467***	0.0562**	0.0493*
	(0.0124)	(0.0243)	(0.0264)
Matched sample	Yes	Yes	Yes
Event sample	All	MFHS (p20)	MFHS (p20)
Control sample	All	All	MFHS (p20)
N	46,038	25,411	9,268
N event directors	8,462	1,982	1,823

Table 12

Officers' and Directors' Insider Trading following Mispricing

This table presents results from regressions related to insider trades (purchases) by officers and independent directors in response to stock mispricing driven by mutual fund outflows. FE = fixed effects. Standard errors (in parentheses) are clustered at the firm level. *, **, and *** indicate statistical significance at (respectively) the 10%, 5%, and 1% level.

	P(Net purchase > 0) [1]	Net purchase [2]	ln(Shares purchased) [3]	*N*
	Panel A: *Four main officers*			
MFHS (previous quarter)	0.035***	12.246***	0.309***	
	(0.008)	(3.155)	(0.073)	12,324
	Panel B: *Independent directors*			
MFHS (previous quarter)	0.047***	7.621**	0.483***	
	(0.008)	(3.148)	(0.069)	16,745
	Panel C: *Independent directors, CRSP universe*			
MFHS (previous quarter)	0.036***	11.121***	0.291***	
	(0.004)	(1.578)	(0.034)	56,581
	Panel D: *Independent directors during tenure of fired CEOs*			
MFHS (previous quarter)	0.037***	9.547*	0.338***	
	(0.011)	(4.932)	(0.099)	6,566
Firm FE	Yes	Yes	Yes	
Time FE	Yes	Yes	Yes	

Figure 1
Stock Returns around Extreme Mutual Fund Forced Sales

This figure presents cumulative abnormal returns around extreme Mutual Fund Forced Sales (i.e., *MFHS* in the 5th percentile). Market-adjusted returns (i.e., returns *minus* the equally weighted market portfolio) are regressed on time-event dummies relative to an extreme forced sale event, where the regression incorporates firm and quarter fixed effects that control for constant firm characteristics and aggregate shocks. The graph plots the cumulative coefficients.

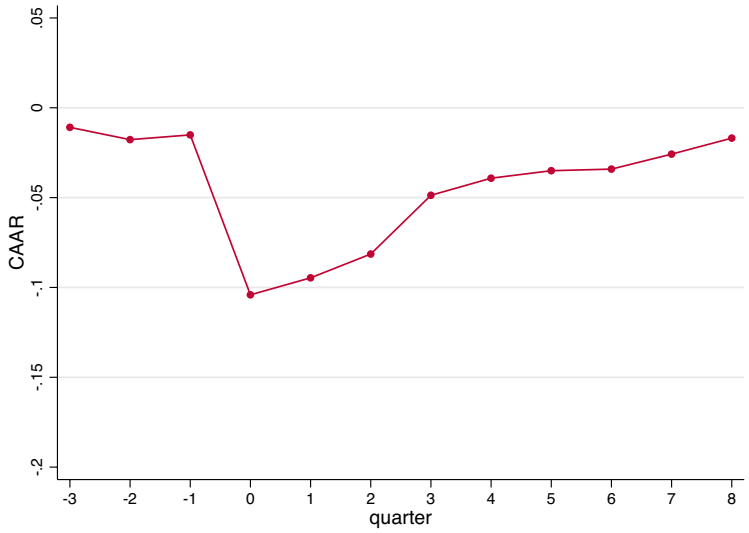

Figure 2

Sample Average of CEO Turnover and Mutual Fund Forced Sales across Time and by Industry