Have the benefits of CEO purchases been understated?

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Abstract: Between 1992 and 2015, CEOs earned modest abnormal returns on their open-market purchases of their firm's shares, and their average one-year abnormal returns following purchases do not exceed those following sales. Since CEOs are typically assumed to possess private information about their firm, this raises the question of why CEOs voluntarily assume—often substantial—additional idiosyncratic risk to make purchases without expecting to earn more than, at best, a modest profit. Consistent with our conjecture that some CEOs do so to forestall termination, we find that CEOs who purchase shares are less likely to be terminated following poor performance, and that this relation is more pronounced when the board is less likely to have alternative sources of information about the CEO. Collectively, our results provide evidence that CEOs can and do receive benefits from diversification-decreasing—and, in many cases, outright unprofitable—trades by prolonging their tenure.

1. Introduction

Most CEOs hold large amounts of their firm's stock that is both vested and unencumbered by ownership guidelines and, therefore, is presumably salable (Armstrong, Core, and Guay 2018). Moreover, Armstrong, Core, and Guay (2018) report that the average CEO sells little equity and instead holds about 95% of the equity received through grants and appreciation during their tenure. The question of why CEOs hold so much seemingly unconstrained equity has been the subject of considerable debate (e.g., Abowd and Kaplan 1999; Bebchuk and Fried 2003; Malmendier and Tate 2005; Fos and Jiang 2015). Adding to this puzzle, more than 70% of CEOs in Execucomp actually *purchase* additional shares at some point during their tenure.[1] Because CEOs are undiversified and have significant exposure to their firm's idiosyncratic risk, one might expect them to purchase additional shares only when the expected benefit—typically assumed to be directly profiting from the trade—outweighs the cost of foregone diversification. Jenter (2005) tests this prediction, but concludes that there is "absolutely no evidence that managers use information not already contained in size and book-to-market."

Based on these seemingly anomalous empirical regularities, we examine why some CEOs *purchase additional shares* when they already hold more equity than is formally required (e.g., by ownership guidelines) and, presumably, expect to earn abnormal returns that, at best, only modestly exceed those from alternative, more diversified investments. Indeed, we find that the CEOs in our sample expose themselves to significantly more idiosyncratic volatility by purchasing additional shares of their firm's stock rather than a diversified portfolio that would

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[1] Although some shares acquired through open-market purchases could be meant to satisfy equity ownership guidelines and are therefore constrained (i.e., unsalable), Quinn (2018) finds that CEOs typically reach their required ownership levels by reducing their sales of new stock grants, rather than by making open market purchases. Moreover, he finds that 77% of CEOs have stockholdings that exceed their stock ownership guidelines at the time the guidelines are adopted. Our empirical analysis examines CEOs who are either above their ownership guideline or are at firms without ownership guidelines.

not only add no additional idiosyncratic risk, but would also likely reduce the idiosyncratic risk of their overall portfolio.[2] Similar to Jenter (2005), we find that the mean and median dollar-weighted abnormal returns in the one, two, three, and five years following CEOs' purchases fail to exceed the abnormal returns following CEO sales, and this is before considering trading costs. The modest abnormal returns following CEO purchases suggests that not only do CEOs fail to significantly profit from their purchases, but they also assume more idiosyncratic risk from their purchases.

To the best of our knowledge there is little empirical evidence that speaks to CEOs' incentives to make open market purchases for reasons other than directly profiting from the trade.[3] Most prior empirical studies find that CEOs are contrarian traders and focus on the direct profitability of their trades. We argue that an additional—and potentially overlooked—motive for CEOs' open market purchases is to prolong their tenure. We conjecture that, in certain instances, the present value of a CEO's expected future benefit from prolonged employment outweighs the foregone benefit of diversification and may even outweigh the cost of purchasing shares expecting to incur negative abnormal returns.

There are at least four non-mutually exclusive ways in which CEOs' purchases might prolong their tenure. First, CEOs could purchase shares to signal their favorable private information. The cost of a purchase is decreasing in the favorability of a CEO's private information (i.e., their expectation of earning positive abnormal returns), and thus boards may interpret a purchase as a credible signal. Second, boards could screen CEOs by implicitly

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[2] The standard deviation of returns is approximately 3.5 times greater for their firms' raw returns than the returns of a diversified portfolio with no idiosyncratic risk, and the difference is statistically significant at the one-percent level.

[3] A notable exception is Fos and Jiang (2015) who examine whether CEOs exercise options prematurely (i.e., earlier than they otherwise would), delay sales of shares, and purchase additional shares as ways to increase their voting rights during proxy fights. However, these instances of managers acquiring additional shares to increase their "formal" control (i.e., voting) rights are relatively rare.

requiring them to purchase shares (rather than explicitly via mandatory ownership guidelines).[4] Third, purchases provide CEOs with a commitment mechanism, because purchases "relax" the limited liability constraint in the sense that by putting more of the CEO's wealth at risk (i.e., tied to the firm's stock price), the CEO's potential losses become greater than what they would have been had the CEO only held the stock and options that were granted.[5] Fourth, instances may arise in which CEOs can credibly share favorable private information through non-pubic channels with their board (e.g., board meetings), but frictions (e.g., proprietary costs) prevent direct disclosure of such information to external stakeholders. In such instances, purchases may provide board members (e.g., those who are loyal to the CEO) with justification for not terminating a poorly performing CEO.

We begin by examining the characteristics of CEOs who make net purchases and the attributes of their firms. CEOs who are net purchasers tend to be shorter-tenured and employed by smaller firms with relatively poor recent stock price and operating performance. CEOs who are net purchasers also have a relatively high unconditional likelihood of performance-related turnover and tend to be employed by firms with less transparent information environments (measured by idiosyncratic risk, Fernandes and Ferreira (2008)) compared to their counterparts who are not net purchasers. The finding that CEOs of firms with poor stock performance are more likely to make net purchases is consistent with both signaling and contrarian trading motives. Insofar as boards have less information about newer CEOs, these univariate differences are consistent with these CEOs using share purchases to signal to the board. These univariate differences are also consistent with CEOs at firms with less transparent information

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[4] Implicit contracts can sometimes be preferable to explicit contracts (or sometimes they may be the only feasible type of contract).

[5] In this case, a CEO's willingness to purchase additional shares, potentially at the request of the board, could still signal the CEO's private information (e.g., information about the firm or the CEO's "type," such as risk-tolerance of time horizon) to the board. Investors would also likely interpret a purchase as a costly signal.

environments being more likely to use purchases to signal to the board. Moreover, since the (opportunity) cost of purchasing additional shares is increasing in the firm's idiosyncratic volatility because of the foregone benefit of diversification, purchases by CEOs of firms with less transparent information environments should make these purchases even more informative.

Next, we examine the relation between CEOs' net purchases and performance-related turnover. Evidence of contrarian trading does not necessarily imply that CEOs' purchases will have a positive relation with prolonged tenure. However, our signaling model does predict such a relation. Consistent with our conjecture that CEOs use purchases to signal their private information, we find that after controlling for other characteristics associated with net purchases and performance-related turnover, CEOs' net purchases are associated with a 1.6 percentage point lower likelihood of performance-related turnover in the subsequent year. Compared to the unconditional sample mean of performance-related turnover of 5.4 percent, this estimate is economically significant and corresponds to a 30% reduction in the unconditional mean.

The foregoing evidence suggests that boards consider CEOs' net purchases when formulating their termination decisions. Our next analysis moves from a general examination to testing several predictions regarding instances in which we expect boards to put relatively more weight on CEO purchases in their termination decisions. First, Pan, Wang, and Weisbach (2015) provide evidence that boards learn about the value of a CEO's match with the firm over time, and we expect purchases to be more informative about—and therefore receive more weight in the board's evaluation of—newer CEOs. Consistent with this prediction, we find that the negative relation between net purchases and performance-related turnover is more pronounced for newer CEOs. Second, boards should be less likely to interpret a CEO's purchases as evidence of favorable private information when the CEO's previous purchases earned negative abnormal

returns. Consistent with boards interpreting CEOs' trades conditional on the ultimate profitability of their *previous purchases*, we find that the negative relation between net purchases and performance-related turnover is attributable to CEOs who have not previously made a net purchase that subsequently earned negative abnormal returns.

These two analyses provide evidence that the extent to which boards consider CEOs' net purchases in their termination decisions depends on the amount and quality of boards' information about their CEO. Our next analysis examines whether the relation between CEO purchases and performance-related turnover depends on the firm's information environment more generally. We find that the negative relation between CEOs' net purchases and performance-related turnover is concentrated in firms with relatively high idiosyncratic volatility, which is symptomatic of a less transparent information environment (e.g., French and Roll 1986; Roll 1988; Fernandes and Ferreira 2008; Armstrong, Balakrishnan, and Cohen 2012).

Next, we examine whether the negative relation between CEO purchases and performance-related turnover varies with *ex post* abnormal returns to the purchases. We find that both CEOs whose purchases earn positive abnormal returns and CEOs whose purchase exhibit small losses have a lower likelihood of performance-related turnover. The former result is consistent with high-type CEOs purchasing shares to prolong their tenure.[6] The latter result is consistent with some low-type CEOs pooling with high-type CEOs to forestall performance-related turnover. In these circumstances, the board might interpret—albeit erroneously in some cases—purchases with small negative abnormal returns as a signal that the CEO had favorable private information at the time of the purchase, but experience "bad luck" *ex post*. The latter

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[6] We refer to CEOs who have favorable private information about firm performance (and therefore expect the firm's stock to earn positive future abnormal returns) as "high-type" CEOs and CEOs who do not as "low-type" CEOs. The private information may relate the CEO's ability, match with the firm, or any other information not yet incorporated in the firm's stock price. Thus, although some purchases by high-type CEO may underperform some purchases by low-type CEOs, purchases by high-type CEOs will have higher future abnormal stock returns *on average*.

result is also consistent with CEOs purchasing shares as a commitment mechanism. Such purchases may provide board members (e.g., those who are loyal to the CEO) with justification for not terminating a poorly performing CEO, but only when the realized abnormal returns are not especially negative. Consistent with CEO purchases serving as a commitment mechanism, we find that the negative relation between CEO net purchases and performance-related turnover is primarily attributable to CEOs who have not already committed to the firm through their unrestricted ownership of their firm's stock.

Collectively, these findings support our conjecture that the relation between CEOs' net purchases and performance-related turnover depends on a board's access to alternative sources of information. In other words, when a board has fewer or lower quality sources of information about a CEO's potential private information, the CEO's actions—including his or her stock purchases—will be perceived as relatively more informative and, in turn, receive more weight in the board's turnover decision.

Our study contributes to several different literatures. First, we contribute to the insider trading literature by providing a rational (i.e., non-behavioral) explanation for why the abnormal returns to CEO purchases appear modest (i.e., 2%-3%) and why CEOs' abnormal returns following purchases fail to exceed those following sales. The insider trading literature tends to emphasize CEOs' potential to earn abnormal returns as the primary motive for their purchases (e.g., Jenter 2005; Piotroski and Roulstone 2005; Rogers 2008). We argue that (implicit) contracting considerations are also an important motive for CEOs' open-market purchases. Our evidence suggests that the average CEO's expected compensation from prolonged tenure is $42,000 following a purchase. Adding the value of this additional compensation to the direct abnormal returns from their purchases results in a sizable increase in the mean abnormal return

from 2.5% to 35%. This finding suggests that prior studies may have understated CEO's *total* benefits from purchasing additional shares. Our results suggest that in addition to, or rather than—in the case of earning positive and negative abnormal returns, respectively—*directly* benefiting from their purchases, some CEOs *indirectly* benefit from their purchases by prolonging their tenure. Second, we extend prior research that finds that CEOs tend to be contrarian traders by providing one explanation for this behavior: namely that CEOs benefit from purchasing shares when their firm is performing poorly by forestalling their termination.

Another contribution of our study is to forge a link between the insider trading and the incentive-compensation literatures. It is somewhat surprising that these literatures are largely independent and distinct from each other despite their close economic connection. Roulstone (2003) finds a positive relation between insider trading restrictions and CEOs' annual compensation, which he interprets as evidence that insider trading profits and monetary compensation are substitutes (Alchian and Woodward 1987). We extend Roulstone (2003) and find that CEOs' foregone diversification (from purchasing their firm's stock rather than a diversified portfolio) has a positive relation with their monetary compensation (from a longer tenure), suggesting that, in certain instances, diversification and monetary compensation are also substitutes. Further, Armstrong, Core, and Guay (2018) find that most CEOs hold much more equity than is formally (or explicitly) required by either ownership guidelines or vesting provisions and consider a number of potential explanations for CEOs' large unconstrained equity holdings. Our finding that some CEOs purchase additional shares—which typically increases their unconstrained equity holdings—to prolong their tenure provides an additional explanation for CEOs' unconstrained equity holdings.

Finally, we contribute to the literature on CEO turnover. Brickley (1983) explains how extant empirical models—which largely focus on estimating the weights assigned to various performance measures—explain only a modest fraction of the variation in CEO turnover. Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011) find that high- and low-optimism CEOs have a higher rate of performance-related turnover than their moderately optimistic counterparts. We consider the role of CEO signaling, commitment, and the potential possession of private information in influencing boards' termination decisions. Our evidence suggests that CEO purchases can, in some cases, prolong their tenure.

2. Background

2.1. Managerial trading

Jenter (2005) provides evidence that managers' trades reflect contrarian views of firm value, but finds that insider purchases do not predict abnormal long-run stock performance after controlling for size and market-to-book.[7] Likewise, Rozeff and Zaman (1988) document that after controlling for transaction costs, size, and earnings-to-price, the abnormal returns to a portfolio that mimics CEO transactions are zero or negative.

The findings in prior literature are consistent with our observation in Table 1 that CEO purchases tend to earn modest abnormal returns. In particular, Panel A shows that the dollar-weighted abnormal returns to CEO purchases in our sample are approximately three percent in the year following the trade, and non-positive thereafter, and these amounts are exclusive of any

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[7] A CEO who requires personal liquidity or who desires increased diversification may sell shares knowing—or expecting—that the shares will appreciate in value after the sale. In contrast, it is less clear why a CEO would make an unprofitable purchase. We focus on CEO purchases to examine a setting that is not likely to be confounded by CEO trades that are motivated by diversification or liquidity.

trading frictions.[8] We find that approximately 33% of CEO purchases earn negative first-year abnormal returns (i.e., using a six-factor model) before transaction costs, but this percentage is not necessarily high. There are many reasons why CEOs could lose money on trades, many of which could surprise even the most prescient CEO. Instead, to the extent that CEOs generally buy shares because they have favorable private information and sell shares for liquidity and diversification, the average dollar-weighted abnormal returns to CEO purchases should significantly exceed the average dollar-weighted abnormal returns following CEO sales. Consistent with prior research that finds that insider trades are most profitable during the first year (e.g., Lakonishok and Lee 2001), Table 1 shows that CEOs' stock purchases earn *negative* second-year abnormal returns. Insofar as managers possess superior private information (e.g., Jaffe 1974; Finnerty 1976), one potential explanation for the modest performance of CEOs' stock purchases is that CEOs are "over-optimistic" in the sense that they have upwardly-biased beliefs (or expectations) about their firm's future stock price performance (Malmendier and Tate 2005).

We offer a rational (i.e., non-behavioral) explanation for the observed pattern of systematically low profits to CEO purchases. If CEOs possess superior private information about the distribution of future stock price and make purchases that generate future abnormal returns like those seen in Table 1, it implies that at least some—and perhaps even many—CEOs purchase shares without expecting significant *direct* profits from their trades. Moreover, by

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[8] The average bid-ask spread for the sample purchases is 1.3%. When we follow Seyhun (1986) and deduct the bid-ask spread from gross returns, the long-term (i.e., five-year) risk-adjusted returns to CEOs' dollar-weighted purchases become negative.

purchasing additional shares, these already undiversified and presumably risk-averse CEOs deliberately *increase* their exposure to their firm's idiosyncratic risk.[9]

To illustrate this idea, suppose that a firm's stock price is normally distributed with mean μ and variance σ^2, or $N \sim (\mu, \sigma^2)$. This is the stock price's "objective" distribution based solely on *public* information. Now suppose that the CEO has *private* information that the mean will be higher by π. Further suppose that unlike diversified investors, the CEO is exposed to idiosyncratic volatility (u^2) in the stock price. The CEO's "subjective" distribution based on *private* information, coupled with exposure to idiosyncratic risk is $N \sim (\mu+\pi, \sigma^2+u^2)$. Now, if we observe a large sample of CEO trades and observe a histogram that looks like an objective distribution of stock price based solely on public information, or $N \sim (\mu, \sigma^2)$, then we could infer that CEOs *deliberately forego* trading on their private information π. In other words, even ignoring the cost of foregone diversification (i.e., u^2), this simple example shows that not trading based on π is the CEO's (opportunity) cost of the trade. Accordingly, we can infer that the CEO's expected benefit from the trade must be at least as large as π. Because a CEO's private information is inherently unobservable—and therefore difficult to measure—we examine prolonged tenure as a potential benefit that accrues to a CEO rather than attempt to measure their private information.

2.2. Signaling and empirical predictions

Signaling is one of the most frequently cited motives for CEOs' unconstrained equity holdings (e.g., Leland and Pyle 1977), which includes shares acquired from their open-market purchases. Despite well-known theoretical foundations, there is surprisingly little empirical

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[9] It is well known that it might be in the interest of risk-averse and undiversified executives to pursue projects with *negative* expected net present value (NPV) that reduce their risk exposure. Examples include diversifying acquisitions, hedging, and the purchase of insurance, some of which can constitute an agency conflict with shareholders.

evidence about the signaling value of CEOs' open-market purchases, including the conditions under which it occurs, whether it is successful, and the relevant costs and benefits to CEOs. We conjecture that one motive for CEOs to make open-market purchases that entail an opportunity cost (e.g., investing in a diversified portfolio) is to obtain benefits from continued employment, such as expected future compensation or incumbency rents. In Figure 1, we provide a simple model that presents conditions under which high-type CEOs (i.e., CEOs who have favorable private information about future returns) can use purchases to distinguish themselves from some CEOs without such favorable private information.

The foregoing argument suggests that a CEO's decision to purchase shares is a costly, but imperfect, signal to the board about the CEO's private information, as well as a bonding mechanism that further ties the CEO's wealth to the firm's stock price performance. Therefore, we argue that boards are likely to consider and incorporate these signals in their termination decisions, especially when the perceived costs of CEO turnover are high.[10] However, because the signal may be only partially revealing, it may allow some CEOs who would otherwise face termination to temporarily pool with CEOs who would not by mimicking their purchasing behavior.[11] This intuition leads to our first set of predictions:

P1a: CEO net purchases are more common when the unconditional likelihood of performance-related turnover is high.

P1b: CEO net purchases are associated with a lower likelihood of performance-based turnover.

Our second hypothesis is predicated on a CEO's purchase informing the board's termination decision. We expect that the information contained in CEOs' purchases will be most

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[10] Taylor (2010) estimates that, on average, these costs are at least $200 million.

[11] If a CEO's expected future compensation from continued employment exceeds the expected cost of purchasing additional shares (including the opportunity cost of foregone diversification), then the CEO should purchase additional shares. In other words, the difference between the expected costs of the purchase and the expected benefit from a prolonged tenure and the accompanying compensation means that the *total* expected benefit to the CEO may be substantially larger than the observed abnormal stock returns on the trade.

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informative to boards when they lack alternative sources of information about the CEO. Pan, Wang, and Weisbach (2015) document that return volatility decreases during CEOs' tenure, consistent with boards learning about CEO type through time. Also consistent with boards learning about CEO type through time, Dikolli, Mayew, and Nanda (2014) find that boards' monitoring intensity tends to decline over CEOs' tenure. Thus, we expect that the negative relation between CEO purchases and performance-related turnover will be more pronounced earlier in a CEO's tenure. This leads to our second set of predictions:

P2a: CEOs are more likely to purchase shares early in their tenure.

P2b: The negative relation between CEO purchases and the incidence of performance-based turnover is stronger earlier in a CEO's tenure.

Our third prediction is based on the idea that CEOs who lack sufficiently favorable private information are only able to temporarily prolong their tenure with net purchases. We expect that the board updates its beliefs (in a downward manner) about CEO type when a CEO's net purchases subsequently earn low abnormal returns. Therefore, we expect:

P3: Boards are more likely to extend a CEO's tenure following a net purchase when the CEO has not previously made net purchases that subsequently earned low *ex post* abnormal returns.

Predictions **P2** and **P3** pertain to information that boards have learned about CEOs during their tenure, and our next prediction pertains to boards' information more generally. Specifically, we expect that CEOs' purchases will be more informative—and therefore receive more weight in boards' termination decisions—at firms with less transparent information environments and when the signal is more costly. By definition, less information is available about firms with less transparent information environments and, accordingly, CEOs' information advantage is likely to be greater at these firms:

P4a: CEOs are more likely to make a net purchase at firms that operate in a less transparent information environment.

P4b: Boards are more likely to extend a CEO's tenure following a net purchase when the firm operates in a less transparent information environment.

Our last predictions relate to whether the relation between CEOs' net purchases and performance-related turnover varies with the subsequent abnormal returns earned by their purchases. To the extent that boards ignore CEO net purchases that fail to earn positive abnormal returns, we expect the negative relation between CEOs' net purchases and performance-related turnover to be concentrated among CEOs whose purchases earn *ex post* positive abnormal returns. In contrast, insofar as some CEOs pool with higher type CEOs, some net purchases that earn negative abnormal returns will be associated with a reduced likelihood of performance-related turnover:

P5a: CEOs with positive abnormal returns to their purchases experience a lower likelihood of performance-related turnover.

P5b: CEOs with small negative abnormal returns to their purchases experience a lower likelihood of performance-related turnover.

3. Sample

Our sample period begins in 1992, when Execucomp data becomes available, and ends in 2016. We use the CEO annual flag in Execucomp to identify each firm's CEO, and we require sufficient information to calculate the CEO's age and start date. We also remove observations associated with CEOs who die while in office. Financial statement data are from Compustat, stock return data are from CRSP, and CEOs' insider trading data are from Form 4 filings available through Thomson Reuters.[12]

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[12] Cohen, Malloy, and Pomorski (2012) discuss methods for identifying "routine" managerial purchases. It is not clear whether CEOs would use a routine or a more irregular purchasing strategy to signal to the board. On one hand, a pattern of regular purchases could signal to the board that the CEO has confidence in the firm's long-term

To test our hypotheses, we examine CEOs' open market purchases and sales (i.e., transaction code equals "P" or "S"). Compared to other types of insider trades, open-market purchases are a more costly signal of CEOs' private information. Unlike a foregone sale, an insider purchase entails a risk-averse and already undiversified executive tying even more of his wealth to the firm's stock price. To remove trades with invalid or insufficient data, we delete trades that are subsequently amended to prevent double counting, as well as trades that have cleanse indicator codes of "A" and "S" (Dai, Parwada, and Zhang 2015; Rogers, Skinner, and Zechman 2016). Although prior studies find that many CEOs are frequent sellers of their unrestricted equity (e.g., Ofek and Yermack 2000; Jin and Kothari 2008), we find that over 70 percent of CEOs in Execucomp also buy additional shares at some point during their tenure.[13] This estimate likely represents a lower bound for the proportion of CEOs in Execucomp who buy shares during their tenure, because data limitations prevent us from collecting share purchases made by Execucomp CEOs before 1992. Further, some CEOs whose tenure begins towards the end of our sample period are likely to make purchases after our sample ends. Indeed, an examination of Execucomp CEOs for fiscal year 2004, which is approximately the middle of our sample period, reveals that 80 percent of CEOs make an open market purchase at some point during their tenure.

Table 2 provides descriptive statistics for our sample. In Panel A, we note that CEO net purchasing (i.e., open-market purchases exceed open-market sales during the year) is a relatively common occurrence of 8.8 percent. The mean (median) CEO in our sample is 55 (55) years old

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prospects. On the other hand, less routine purchases could send a signal that the CEO is especially optimistic about future firm performance in the current period. Because it is possible that both routine and non-routine purchases have the potential to signal, we include all purchases in our analysis. Additional analysis reveals that the majority of purchases are classified as non-routine purchases according to Cohen, Malloy, and Pomorski's (2012) algorithm.

[13] Less than two percent of the CEOs in our sample use derivatives to hedge their exposure to downside risk. Whether purchases by these CEOs represent a signal is ambiguous, and our results are robust to removing observations associated with a CEO who, in the current year or a prior year, hedged with a collar, equity swap, forward sale, put option, or exchange fund.

with tenure of 7.3 (5.0) years. The interquartile range for profitability is 0.012 to 0.080, and the mean market capitalization of the firms in our sample is $2.0 billion.

Next, we split our sample according to whether the CEO was a net purchaser during the fiscal year. In Panel B, we provide descriptive statistics for firm-years with and without a net-purchasing CEO. We find that CEOs tend to be net purchasers in years with low stock raw returns (*Annual Return* = 0.008 vs. 0.166) and poor financial performance (*ROA* = −0.003 vs. 0.040). Consistent with **P1a**, Figure 2 shows that the CEOs are more likely to be net purchasers at firms with greater predicted likelihoods of performance-related turnover. The positive relation between net purchases and the predicted likelihood of performance-related turnover in *t+1* is consistent with the positive relation between net purchases and *realized* performance-related turnover in *t+1*.[14]

Consistent with **P2a**, net-purchasing CEOs tend to be earlier in their tenure (5.5 vs. 7.5 years), and consistent with **P4a**, tend to operate firms with lower-quality information environments, as measured by higher idiosyncratic volatility (0.027 vs. 0.021). Given the differences between CEOs who are and who are not net purchasers, we control for these firm and CEO characteristics in our subsequent tests.

Some CEOs pooling across a range of private information about future performance (**P5b**) is consistent with the modest *average* positive abnormal returns in the short-window following insider purchases (Lakonishok and Lee 2001; Brochet 2010). The histogram in Figure 3 presents three-day buy-and-hold abnormal returns for the CEO purchases in our sample (i.e., *t* to *t+2*), and the mean abnormal return is approximately one percent.[15] In contrast, the positive

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[14] Figure 4 provides a summary of the predictions for three potential explanations for CEO purchase behavior.
[15] Our results are qualitatively similar when we examine the three-day period surrounding the purchase (i.e., *t*−1 to *t*+1), rather than only following the purchase (i.e., *t* to *t*+2), to account for possibility that the news of a pending purchase is impounded in price. Our results are also similar when we examine abnormal returns to relatively large

abnormal returns are inconsistent with the notion that investors interpret CEO purchases as a manifestation of their over-optimistic—and therefore biased—beliefs about their firm's future performance (Campbell et al. 2011).

4. Research Design

We begin by creating a performance-related turnover indicator, *Performance-related Turnover*, for our construct of interest, which is distinct from "forced" CEO turnover (e.g., Parrino 1997; Parrino, Sias, and Starks 2003). Jenter and Lewellen (2014) note that some forced CEO turnovers occur because of poor performance, while other forced CEO turnovers occur for reasons such as personal scandals and legal violations. Although we argue that CEOs' purchases provide boards with information about CEOs' type (or private information), it is less clear whether CEOs' purchases will help them forestall termination for matters unrelated to firm performance.

Boards and CEOs rarely explicitly identify turnover as being due to poor performance. Instead, CEOs often announce that they are leaving the company for reasons that are unrelated to job performance, such as "family reasons." Jenter and Lewellen (2014) make a similar observation and show that "forced turnover" proxies frequently fail to identify turnovers that result from CEO performance (e.g., CEOs may voluntarily resign to preempt impending termination). The authors then note that turnover is often "performance induced." Boards remove CEOs for both poor absolute and poor relative performance (Eisfeldt and Kuhnen 2013), and we classify CEO turnover as performance-related if, in the year of or the year before the turnover,

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CEO purchases, defined as those of above-median dollar size. An alternative explanation for the modest abnormal returns is that the announcement returns are typically "contaminated" by concurrent firm news events. However, McConnell, Servaes, and Lins (2008) examine the announcement returns to insider share purchases and find that only 9.7 percent of purchase announcements are contaminated by other firm news announcements during the t to $t+5$ announcement window.

the firm's stock price performance is either (i) in the bottom quartile of its industry that year, or (ii) in the bottom quartile of the full sample.[16]

We examine performance-related turnover in *t*+1, and Table 1 shows that our sample has an annual unconditional *Performance-related Turnover* rate of 5.4 percent. Guay, Taylor, and Xiao (2016) use a similar classification for performance-related turnover in years *t*+1 and *t*+2. Our documented rate of 5.4% in *t*+1 is consistent with the 10% rate of combined one- and two-year ahead performance-related turnover that Guay, Taylor, and Xiao (2016) report. An important benefit of the approach in Guay, Taylor, and Xiao (2016) is that it avoids conditioning the sample on future economic performance, which can induce bias in the resulting estimates and lead to erroneous inferences. We estimate the following specification using a linear probability model:

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\begin{aligned}
\Pr(Performance-related\ Turnover_{i,t+1}) = {} & \beta_1 CEO\ Net\ Purchase_{i,t} + \beta_2 CEO\ Net\ Sale_{i,t} + \\
& \beta_3 CEO\ Tenure_{i,t} + \beta_4 CEO\ Age_{i,t} + \beta_5 Ln(CEO\ Salary)_{i,t} + \beta_6 Ln(CEO\ Bonus)_{i,t} + \\
& \beta_7 Ln(CEO\ LTIP)_{i,t} + \beta_8 Ln(CEO\ Restricted\ Equity\ Wealth)_{i,t} + \\
& \beta_9 Ln(CEO\ Unrestricted\ Equity\ Wealth)_{i,t} + \beta_{10} CEO\ Over\ Optimism\ Investment_{i,t} + \\
& \beta_{11} CEO\ Under\ Optimism\ Investment_{i,t} + \beta_{12} Idio\ Vol_{i,t} + \beta_{13} BTM_{i,t} + \beta_{14} Size_{i,t} + \\
& \beta_{15} ROA_{i,t} + \beta_{16} Loss_{i,t} + \beta_{17} Annual\ Return_{i,t} + \beta_{18} Under\ Perform\ Industry_{i,t} + \\
& \beta_{19} Absolute\ Poor\ Performance_{i,t} + \beta_{20} Litigation\ Risk_{i,t} + \beta_{21} Dividends_{i,t} + \\
& \beta_{22} Share\ Repurchases_{i,t} + \beta_{23} Goodwill\ Impairments_{i,t} + \beta_{24} Restructurings_{i,t} + \\
& \beta_{25} Writedowns_{i,t} + \beta_{26} Capex_{i,t} + \Sigma\ FIRM\ FE_i + \Sigma\ YEAR\ FE_t + \varepsilon_{i,t} \qquad (1)
\end{aligned}
$$

We use two alternative measures of CEO net purchases and net sales. Our first measure, *Net Purchase Ind.* (*Net Sale Ind.*), is an indicator that equals one if the dollar value of the CEO's open-market purchases exceeds (is less than) the dollar value of the CEO's open-market sales during the year. We focus on CEO *net* purchases because we expect that purchases that are completely offset by sales are less costly—and therefore less informative—signals. When the

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CEO is a net purchaser for the year, our second measure, *Ln(Net Purchase)*, equals the natural logarithm of the difference between the dollar value of the CEO's open-market purchases and sales. This is a less coarse measure that captures variation in the magnitude of the net purchase.[17] When the CEO makes no open-market trades or is a net seller, *Net Purchase Ind.* and *Ln(Net Purchase)* equal zero. Similarly, when the CEO is a net seller for the year, *Ln(Net Sale)* equals the natural logarithm of the difference between the dollar value of the CEO's open-market sales and purchases. When the CEO makes no open market trades or is a net purchaser, *Net Sale Ind.* and *Ln(Net Sale)* equal zero. Appendix A provides detailed variable definitions of the main variables in our analyses.

We include a set of control variables that are common in the literature that examines CEO turnover. Specifically, we include the following attributes of the CEO and the CEO's incentive-compensation contract: tenure as CEO (*CEO Tenure*), age (*CEO Age*), annual salary (*Ln(CEO Salary)*), bonus (*Ln(CEO Bonus)*), long-term incentive pay (*Ln(CEO LTIP)*), and the values of the CEO's restricted and unrestricted holdings of the firm's equity (*Ln(CEO Restricted Equity Wealth)* and *Ln(CEO Unrestricted Equity Wealth)*, respectively). We argue that boards interpret a CEO net purchase as a costly signal about the CEO's presumably favorable private information. An alternative possibility, however, is that boards interpret CEO purchases as a sign of over-optimism. Prior research suggests that CEO over-optimism is associated with distortions in corporate investment (Malmendier and Tate 2005), and Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011) develop a model in which CEOs with either high or low optimism make suboptimal investments, while moderately-optimistic CEOs' investments maximize shareholder value. The authors then provide empirical evidence that high- and low-

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[17] Trivial net purchases are unlikely to represent costly signals to the board or meaningful commitment devices. Therefore, we also confirm that our results are robust to dropping trivial net purchases from our sample (i.e., net purchases of under $10,000).

optimism CEOs are more likely to be terminated involuntarily than are moderately-optimistic CEOs. We control for this non-monotonic relation between CEO optimism and turnover using their investment-based measures of CEO optimism (*CEO Over Optimism Investment* and *CEO Under Optimism Investment*).[18]

We also control for the firm's information environment using idiosyncratic volatility (*Idio Vol*), the firm's growth options using the book-to-market ratio (*BTM*), and firm size (*Size*). Bushman, Dai, and Wang (2010) provide theoretical and empirical evidence that CEO turnover is increasing in firms' idiosyncratic volatility, and we expect a positive relation between performance-related turnover and idiosyncratic volatility. We also include several measures of firm performance that are associated with the likelihood of performance-related turnover, including (i) return on assets (*ROA*), (ii) an indicator for whether the firm reports an accounting loss during the year (*Loss*), (iii) the firm's recent raw stock price performance (*Annual Return*), and (iv) an indicator for whether the firm's current stock price performance was in the lowest quartile of its industry (*Under Perform Industry*) or the lowest quartile of all firms with available CRSP data during our sample period (*Absolute Poor Performance*).[19] We also control for the firm's litigation risk using the measure that Kim and Skinner (2012) describe in Model (2) of their Table 7 (*Litigation Risk*).

Stock purchases are just one signal that CEOs have available to convey their private information about future firm performance to their board. Prior literature also argues that CEOs

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[18] Our inferences are unaffected when we use either of Campbell, Gallmeyer, Johnson, Rutherford, and Stanley's (2011) trading-based measures of over- and under-optimism (i.e., the measures that include or exclude transactions that relate to stock options). See Appendix B for a more complete discussion of how our results relate to those of Campbell et al. (2011) and how our findings extend the literature by refining their inferences.

[19] We rely on two alternative approaches to examine the relation between CEO net purchases and performance-related turnover. In our main tests, we examine the relation between CEO net purchases and performance-related turnover, controlling for *Under Perform Industry* and *Absolute Poor Performance*. In Section 6, we exclude these control variables and instead examine the relation between CEO net purchases and performance-related turnover *within* the subsample of firms that experience either *Under Perform Industry* or *Absolute Poor Performance*.

may use dividends to signal information about future firm performance (e.g., Brickley 1983). We measure dividends as the ex-date dividends during the fiscal year scaled by average total assets (*Dividends*). Similar to dividends, the literature also argues that corporate share repurchases are another mechanism that managers can use to convey their private beliefs to investors and other stakeholders (e.g., Louis and White 2007). We measure share repurchases as repurchases of common and preferred stock during year *t* scaled by average total assets (*Share Repurchases*). CEOs may feel compelled to purchase shares to signal their confidence around recent goodwill impairments (*Goodwill Impairments*), restructurings (*Restructurings*), asset writedowns (*Writedowns*), and capital expenditures (*Capex*), and we control for each of these major corporate decisions. We winsorize all continuous variables at the 1st and 99th percentiles.[20]

Next, we conduct a series of tests to examine whether the signaling value of CEOs' open-market purchases is greater when the board is less certain about the CEO's private information. In our first test, we examine whether CEOs' ability to prolong their tenure depends on the CEO's tenure. To test this conjecture, we modify Eq. (1) by interacting our measures of CEO net purchase activity with CEO tenure, and we expect a positive coefficient on the interaction.

In our second test, we examine whether CEOs' ability to prolong their tenure depends on whether they have previously made a net purchase that subsequently earned negative abnormal returns. In this test, we modify Eq. (1) by replacing the net purchase indicator with an indicator for whether the CEO made a net purchase that subsequently earned negative abnormal returns in a prior year, where we measure abnormal returns using a six-factor model that includes the five factors of Fama and French (2017) and the momentum factor of Carhart (1997). For CEOs who made a net purchase that subsequently earned negative abnormal returns in a prior year, we set

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[20] Our inferences are unchanged when we use unwinsorized values.

an indicator, *Net Purchase & Prior Neg. Ab. Ret. NP Ind.*, equal to one for all of the CEO's future net purchases at that firm, and zero otherwise. For CEOs without a history of net purchases that subsequently earned negative abnormal returns, we set *Net Purchase & No Prior Neg. Ab. Ret. NP Ind.* equal to one, and zero otherwise.

Third, we examine whether CEOs' ability to signal with net purchases is decreasing in the quality of their firm's information environment measured using idiosyncratic volatility. In less transparent information environments, we expect boards to have a higher marginal value of additional information. Additionally, when a firm has high idiosyncratic volatility the (opportunity) cost of a purchase to a CEO is also higher, as these CEOs expose themselves to even greater undiversifiable risk than do CEOs of firms with low idiosyncratic volatility. For both reasons, we expect a stronger negative relation between net purchases and performance-related turnover at firms with higher idiosyncratic volatility.

Fourth, we examine whether CEOs' ability to signal with net purchases depends on the *ex post* abnormal returns earned by their purchases. CEOs whose purchases earn positive abnormal returns are, on average, more likely to have had favorable private information prior to their purchase that they convey to the board than are CEOs whose purchases subsequently earn negative abnormal returns. Further, boards can use *ex post* abnormal returns from CEO purchases to make inferences about the CEO's type. We expect that CEOs with favorable private information at the time of the purchase will, on average, earn both direct abnormal returns on their purchase and indirect benefits from prolonging their employment. Conversely, CEOs without favorable private information will, on average, earn negative abnormal returns on the trade and no benefit of prolonged tenure. This intuition suggests that abnormal returns to CEO purchases and CEOs' extended employment are complements. Insofar as some CEOs pool with

higher-type CEOs, we expect purchases that earn small negative, but not large negative, abnormal returns are associated with a reduced likelihood of performance-related turnover.

5. Results

5.1. Main results

Table 3 presents results from estimating a linear probability model of the relation between CEO net purchases and the incidence of performance-related turnover. Unlike a logistic model, the linear probability model can accommodate a large number of fixed effects without encountering the so-called incidental parameters problem (Neyman and Scott 1948; Lancaster 2000).[21] Thus, the linear probability model accommodates firm fixed effects that allow us to control for any time-invariant correlated omitted variables. A firm fixed effects specification is well-suited to our research question, because signaling relates to a CEO's private information about his firm, and it is primarily a *time-series* phenomenon. Therefore, a firm fixed effects specification abstracts away from cross-sectional variation and isolates within-firm variation. The linear probability model also provides more readily interpretable interactive effects (Ai and Norton 2003). For ease of interpretation and because results are consistent across our two measures of open-market purchases, we focus our discussion on the estimates based on *Net Purchase Ind*.

Consistent with prior literature, we find that CEOs who are identified as having either high or low optimism are more likely to experience performance-related turnover (Campbell, Gallmeyer, Johnson, Rutherford, and Stanley 2011). We also find that CEOs are more likely to experience performance-related turnover if their firm reports an accounting loss or has higher

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[21] Predicted values (probabilities) from a linear probability model are not constrained to lie between zero and one. To address this well-known issue, we also estimate a logistic model (Section 6) and find similar results.

idiosyncratic volatility. In contrast, CEOs with greater ownership of their firm and CEOs who receive larger bonuses are less likely to experience performance-related turnover.

Turning to our variable of interest, we find that CEOs who make net purchases are 1.6 percent less likely to experience performance-related turnover during the subsequent year, consistent with **P1b**.[22] This effect is economically meaningful, because 5.4 percent of the CEOs in our sample experience performance-related turnover during the subsequent year. Next, we re-examine the *total* benefits to CEOs' purchases, which consists of both the *direct* abnormal returns from the purchase and the *indirect* benefit from forestalling performance-related turnover. To do so, we need to estimate the cost to CEOs of performance-related turnover.

Ideally, to estimate the cost, one would examine the compensation of CEOs who experience performance-related turnover before and after the turnover. However, the majority of CEOs in the Exeucomp database do not reappear in Execucomp following turnover, either because they accept positions not covered by Execucomp or they leave the labor force altogether. These factors complicate our ability to accurately estimate the cost of performance-related turnover. Nevertheless, to proceed with our estimation, we assume that such CEOs who later gain employment as a named executive officer at an Execucomp firm tend to have better labor market outcomes than do CEOs who do not reappear in Execucomp. Insofar as this assumption is accurate, our estimate should represent a lower bound on the cost of performance-related turnover.

We identify 73 CEOs with Execucomp compensation data both before and after their performance-related turnover and available ending and starting employment dates, respectively. The 73 CEOs were between positions for a median of 460 days (1.26 years), and the median

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[22] Our inferences are unchanged when we exclude *Under Perform Industry* and *Absolute Poor Performance.*

change in their total annual compensation was a reduction of $407 thousand. We therefore assume that the cost of performance-related turnover equals 1.26 years of lost compensation.[23] We multiply 1.6 percent by 1.26 years of the average total annual compensation of CEOs who are net purchasers (i.e., $2.081 million), and we estimate the value of prolonged CEO tenure from a net purchase is approximately $42,000.[24]

5.2. Cross-sectional results

Next we conduct several tests to determine whether the observed heterogeneity in the relation between CEOs' net purchases and turnover is consistent with our predictions. In Table 4, we present evidence on whether CEOs' ability to use net purchases to signal varies with their tenure. We do so by interacting our two measures of net purchases (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*) with *CEO Tenure.* A positive coefficient on the interaction term would be consistent with boards having less information about shorter-tenured CEOs. Consistent with this conjecture (**P2b**), we find a positive and statistically significant relation between *Net Purchase Ind. * CEO Tenure* and *Performance-related Turnover.*[25]

Our results in Table 4 suggest that a CEO's ability to signal their private information through net purchases is enhanced when there is less information about the CEO. In Table 5, we examine whether a CEO's ability to signal private information through net purchases is diminished when the board has reason to believe the CEO is either over-optimistic or attempting to pool with higher type CEOs (i.e., those who truly possess and are trading on favorable private

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[23] Here we also assume that 1.26 years after their performance-related turnover, CEOs find employment with compensation equal to that of their prior position. Because performance-related turnover is a publicly observable signal, we expect that it would affect a CEO's outside opportunities, and we thus expect that our estimate represents a lower bound of the indirect benefits of a CEO net purchase.

[24] By documenting that CEO net purchases are associated with greater pay through prolonged tenure, we also contribute to the literature that catalogs the determinants of CEO pay (e.g., Cadman, Klasa, and Matsunaga 2010).

[25] In supplemental analysis, we allow for the possibility of a non-linear relation with tenure. Specifically, we create an indicator, *CEO Early Tenure*, that equals one when *CEO Tenure* is between zero and five years (inclusive), and zero otherwise. When we replace *CEO Tenure* and *Net Purchase Ind. * CEO Tenure* with *CEO Early Tenure* and *Net Purchase Ind. * CEO Early Tenure*, we find similar results.

information). Consistent with net purchases being ineffective at extending the tenure of CEOs who have previously made a net purchase that subsequently earned negative abnormal returns, the coefficient on *Net Purchase & Prior Neg. Ab. Ret. NP Ind.* is not significantly distinguishable from zero in Column 1.[26] In contrast, the coefficient on *Net Purchase & No Prior Neg. Ab. Ret. NP Ind.* is negative and significant in Column 1 (coeff. = −0.020, *t*-stat = −3.35), which is consistent with CEOs' net purchases prolonging their tenure only when there is no prior evidence of net purchases that ultimately proved to be unprofitable (**P3**). In Column 2, we include an indicator that equals one when the CEO made a large net purchase in a prior year, but not in the current year. Consistent with Campbell et al. (2011), we find that CEOs with a prior (i.e., not current) large purchase are more likely to experience performance-related turnover.[27] Collectively, the results in Table 5 suggest that CEOs' ability to prolong their tenure with net purchases hinges on whether they appear to have previously—and misleadingly—used net purchases to pool with high-type CEOs.

The results in Tables 4 and 5 are consistent with boards learning about CEOs over the course of CEOs' tenure and from the realized profitability of CEOs' prior net purchases. Next, we examine whether CEOs have greater ability to signal private information through net purchases when their firm's information environment is less transparent in general. Following prior research, we use idiosyncratic volatility to measure firms' information environment (e.g., French and Roll 1986; Roll 1988; Fernandes and Ferreira 2008; Armstrong, Balakrishnan, and

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[26] We find similar evidence when we examine raw returns, rather than abnormal returns.
[27] Campbell et al. (2011) use large CEO purchases to create a measure of CEO over-optimism. Specifically, Campbell et al. (2011) first identify CEOs who make a large net purchase, which is a net purchase of his or her firm's stock that is both (i) at least 10% of his or her stock ownership, and (ii) in the top quartile of net purchases by dollar amount. Once a CEO is classified as over-optimistic, the CEO retains that classification for the remainder of his or her tenure, unless the CEO subsequently makes a large net sale. We find that large purchases by CEOs are associated with a lower likelihood of performance-related turnover in the year following the purchase, but a higher likelihood of performance-related turnover in subsequent years. These results are consistent with CEOs using costly large purchases to prolong their tenure, but only until more information becomes available.

Cohen 2012). French and Roll (1986) and Roll (1988) find that market movements fail to explain a significant portion of firms' stock return volatility, and they argue that idiosyncratic volatility measures the speed at which private information is incorporated in stock prices.

In Table 6, we find modest evidence that the negative relation between CEO net purchases and performance-related turnover is stronger at firms with less transparent information environments. Specifically, when we examine firms with low idiosyncratic volatility (i.e., those with idiosyncratic volatility below the sample median), we find no significant relation between *Net Purchase Ind.* and *Performance-related Turnover*. In contrast, when we examine firms with high idiosyncratic volatility (i.e., those with idiosyncratic volatility above the sample median), we find a significant relation between *Net Purchase Ind.* and *Performance-related Turnover* (**P4b**).[28] Collectively, the results in Tables 4, 5, and 6 provide evidence that the relation between CEO net purchases and the incidence of performance-related turnover depends on the availability of other sources of information.

Next, we examine whether the relation between CEO purchases and performance-related turnover varies with the abnormal returns that are subsequently realized from the CEO purchases, where abnormal returns are measured using a six-factor model that includes the five factors of Fama and French (2017) and the momentum factor of Carhart (1997). In column 1 of Table 7, we find that CEO purchases that subsequently earn positive abnormal returns are associated with a lower likelihood of performance-related turnover. However, we find no evidence of a relation between CEO purchases that earn negative abnormal returns and the likelihood of performance-related turnover. These results suggest that CEOs who *directly* profit from their purchases also *indirectly* profit by prolonging their tenure.

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[28] A test of equality of coefficients rejects the null hypothesis that the coefficient on *Net Purchase Ind.* in the low idiosyncratic volatility sample equals the coefficient on *Net Purchase Ind.* in the low idiosyncratic volatility sample at the ten percent level (one-tailed test).

In column 2, we partition the sample of CEOs who make net purchases according to the abnormal returns they subsequently earn on their purchases. For CEOs who purchase their firm's shares on multiple dates throughout the year, we weight each purchase by its dollar value. Interestingly, we find that purchases that earn small negative abnormal returns are also associated with a lower likelihood of performance-related turnover. In contrast, we find no evidence that CEO purchases that earn moderate or large negative abnormal returns exhibit a relation with future performance-related turnover.[29] This finding suggests that some CEOs' negative abnormal returns from their purchases are at least partially offset by prolonged tenure (**P5b**).

6. Supplemental Analysis

6.1. Other turnover

We perform several additional analyses to corroborate our earlier findings and inferences. One potential concern with our main analysis is that CEOs may only purchase shares when they expect to remain employed by the firm. Under this alternative explanation, we would expect a negative relation between CEO net purchases and turnover for reasons other than poor performance (e.g., retirement). To investigate this alternative explanation, we examine the relation between CEO net purchases and *non-performance-related turnover*, which we define as any turnover not classified as related to performance. Table 8 presents results that are inconsistent with this alternative explanation. In particular, the coefficient estimates on both *Net*

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[29] The negative relation between CEO purchases that earn small losses and performance-related turnover has at least three possible interpretations. First, to the extent that there is information asymmetry between CEOs and boards, CEO purchases could "fool" directors into believing that the CEO has favorable private information about future firm performance and, in turn, prolong his or her tenure. Second, boards could be equally informed as—or perhaps even better informed than—the CEO and CEO purchases provide boards with a way to justify a delay in terminating the CEO. Under this explanation, CEO purchases provide "cover" to directors, who are concerned about protecting their personal reputational capital. Third, CEOs with mildly unfavorable private information may be able to forestall turnover by credibly signaling to the board that although they lack favorable private information, they do not have extremely unfavorable private information.

Purchase Ind. and *Ln(Net Purchase)* are positive and statistically significant. A related possibility is that CEOs rarely buy shares before performance-related turnover. This possibility, however, is inconsistent with descriptive statistics in Table 2 and Figure 2, where we report univariate evidence that CEOs are significantly more likely to buy shares before performance-related turnover.

6.2. Bad control problem

We address the concern that our empirical approach has what Angrist and Pischke (2008, p. 64) refer to as a "bad control problem," whereby the inclusion of certain control variables inappropriately conditions the coefficient on the variable of interest. Although we believe it is appropriate to control for observable differences in CEO optimism, absolute poor performance, and under-performing industry peers between firms with and without a net purchase by the CEO, an argument can be made that these variables constitute "bad controls." For example, given the findings in Campbell et al. (2011) that over- and under-optimism leads to a higher likelihood of forced turnover, an interpretation of our results is that, controlling for some amount of over- and under-optimism, more CEO purchasing is associated with prolonged tenure. Thus, to examine whether our results are an artefact of a bad control problem, we exclude *CEO Over Optimism Investment*, *CEO Under Optimism Investment*, *Under Perform Industry*, and *Absolute Poor Performance* from Eq. (1). In Table 9, we continue to find negative coefficients on the measures of CEO net purchases in Columns 1 and 2, which suggests that our results are not an artefact of a bad control problem.

6.3. Identification of performance-related turnover

Next, we assess the sensitivity of our inferences to the classification of turnovers as either performance-related or non-performance-related and to our use of a linear probability model. As

an alternative that does not rely on our ability to accurately distinguish between performance-related and non-performance-related turnover, we examine all CEO turnovers within a set of firms with either poor relative or poor absolute performance. Table 10 presents the results of examining the relation between CEO turnover and CEO net purchases when the sample is restricted to this set of poorly performing firms. The results in Panel A are consistent with those reported in Table 3 and show that CEOs who make net purchases are less likely to experience performance-related turnover during the following year.

Similar to our primary research design, Panel A of Table 10 reports estimates from a linear probability model. Next, we examine whether these results are sensitive to estimating a logistic model. Although a linear probability model allows for the inclusion of firm fixed effects, this quickly becomes infeasible in a logistic model due to the large number of incidental parameters. Panel B therefore presents results using a logistic model without firm fixed effects. Consistent with our primary results and with those reported in Panel A of Table 10, we continue to find a significant negative coefficient on both *Net Purchase Ind.* and *Ln(Net Purchase)*. This finding assuages concerns that our primary results are an artefact of estimating a linear probability model that allows for predicted probabilities outside the unit interval.

6.4. Stock ownership guidelines

An additional concern is that CEOs' net purchases may be made to satisfy stock ownership guidelines. To address this concern, we hand-collect data about the stock ownership guidelines of firms that were in the S&P 1500 as of January 1, 1995, and we gather stock ownership guideline data from Institutional Shareholder Services (ISS).[30] Next, we remove all CEO-year observations that occur after the adoption of a stock ownership guideline at their firm,

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[30] ISS data on CEOs' stock ownership guidelines is scarce for fiscal years before 2006.

unless ISS data indicate that the CEO's holdings met the ownership requirements. In Table 11, we continue to find a significant negative coefficient on the large net purchase indicator, regardless of whether we control for CEO optimism using trade-based or investment-based measures.

6.5. Purchases as a bonding mechanism

The CEOs in our sample exhibit considerable variation in their unrestricted holdings of their firm's stock: the interquartile range spans from $811,593 to $17,676,652. To the extent that CEOs' net purchases serve as a commitment or bonding mechanism, we expect CEOs who have relatively low unrestricted stockholdings to derive a greater marginal benefit from this commitment. In Table 12, we partition firms according to whether their CEO holds unrestricted equity above or below the sample median. Our findings in Table 12 show that the relation between CEO net purchases and performance-related turnover only occurs at firms with CEOs who have below-median unrestricted holdings. This evidence is consistent with CEOs purchasing additional shares to "relax" the limited liability constraint in the sense that by putting more of their wealth at risk (i.e., tied to the firm's stock price), the CEO's potential losses become greater than what they would have been had the CEO only held the stock and options that were granted.

7. Conclusion

The insider trading and incentive-compensation literatures are largely independent and distinct from each other, despite their close conceptual relation. Any insider trade—whether a purchase, sale, or option exercise—has an immediate and direct effect on the executives' (equity) incentives. Likewise, because of regulatory requirements, executives' open market purchases are publicly-observable actions that are potentially informative to boards, investors, and other

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stakeholders. Therefore, one would expect boards to use these signals as inputs in their contracting decisions. Several authors have noted the relation between these two literatures. For example, Roulstone (2003) argues that annual flow compensation and trading profitably based on inside information are substitutes, and consistent with this argument, presents evidence that CEOs who are relatively low paid also have relatively permissive (or lax) insider trading policies that allow them to directly profit from their trades.

We build on prior research and examine whether CEOs engage in seemingly poorly-timed share purchases as a way to forestall termination. In doing so, we extend prior research that provides limited evidence that managers outperform the market after controlling for risk associated with firm size and book-to-market (Jenter 2005). In contrast to Jenter (2005), who looks directly at the trades themselves to assess their profitability, we also look for indirect evidence of whether CEOs benefit from the trades. We provide new evidence that CEOs can, in some instances, indirectly benefit from purchasing stock through prolonged employment and that this can have a sizable effect on the overall profitability of their trades.

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Appendix A: Variable definitions

Variable	Definition (source(s) in parentheses)
Absolute Poor Performance$_t$	Indicator equal to one when a firm's raw returns are in the bottom quartile of CRSP, zero otherwise (CRSP)
Annual Return$_t$	Twelve-month raw buy and hold stock raw returns (CRSP)
BTM$_t$	Total stockholders' equity divided by market value of equity, both calculated as of the fiscal year end (CRSP; Compustat)
Capex$_t$	Capital expenditures divided by average total assets (Compustat)
CEO Age$_t$	CEO's age (Execucomp)
CEO Duality$_t$	Indicator equal to one if the CEO is also the chair of the board, zero otherwise (BoardEx)
CEO Over Optimism Investment$_t$	CEO over optimism indicator, calculated as Campbell, Gallmeyer, Johnson, Rutherford, and Stanley's (2011) three-digit SIC investment measure of optimism. This indicator takes a value of one when a firm is in the top quintile of capital expenditures to lagged property, plant, and equipment for its three-digit SIC industry group (calculated by year). Once this variable takes a value of one, it retains that value until either the CEO's tenure ends or the firm is in the bottom quintile of capital expenditures to lagged property, plant, and equipment, in which case the indicator reverts to zero (Thomson Reuters; Execucomp).
CEO Over Optimism Trading$_t$	CEO over optimism indicator, calculated as Campbell, Gallmeyer, Johnson, Rutherford, and Stanley's (2011) net stock purchases measure of optimism, which includes open market transactions that relate to stock options. The indicator equals one when the CEO has a *Large Net Purchase,* and the indicator retains the value of one until either the CEO's tenure ends or the CEO makes a *Large Net Sale*, in which case the indicator reverts to zero (Thomson Reuters; Execucomp).
CEO Tenure$_t$	Number of continuous years the CEO has been in office at the current firm (Execucomp)
CEO Under Optimism Investment$_t$	CEO under optimism indicator, calculated as Campbell, Gallmeyer, Johnson, Rutherford, and Stanley's (2011) three-digit SIC investment measure of optimism. This indicator takes a value of one when a firm is in the bottom quintile of capital expenditures to lagged property, and equipment for its three-digit SIC industry group (calculated by year). Once this variable takes a value of one, it retains that value until either the CEO's tenure ends or the firm is in the top quintile of capital expenditures to lagged property, plant, and equipment, in which case the indicator reverts to zero (Thomson Reuters; Execucomp).
CEO Under Optimism Trading$_t$	CEO under optimism indicator, calculated as Campbell, Gallmeyer, Johnson, Rutherford, and Stanley's (2011) net stock purchases measure of optimism, which includes open market transactions that relate to stock options. The indicator equals one when the CEO has a *Large Net Sale, and* the indicator retains the value of one until either the CEO's tenure ends or the CEO makes a *Large Net Purchase*, in which case the indicator reverts to zero (Thomson Reuters; Execucomp).
Dividends$_t$	Ex-date fiscal year dividends divided by average total assets (Compustat)
Goodwill Impairments$_t$	After-tax impairments of goodwill divided by average total assets (Compustat)
Idio Vol$_t$	The standard deviation of the residual from a regression of daily stock returns on the Fama French (1993) factors and the momentum factor (Carhart 1997), where a minimum of 100 non-missing daily returns are required (CRSP)

Large Net Purchase$_t$	Indicator equal to one when a CEO makes a net purchase of stock in his or her firm that is both (1) equal to at least 10% of his or her stock ownership and (2) the dollar amount of the net purchase is in the top quartile of net purchases, zero otherwise
Large Net Sale$_t$	Indicator equal to one when a CEO makes a net sale of stock in his or her firm that is both (1) equal to at least 10% of his or her stock ownership and (2) the dollar amount of the net sale is in the top quartile of net purchases, zero otherwise
Litigation Risk$_t$	Probability of litigation, measured using the fitted values that Kim and Skinner (2012) report in Model (2) of Table 7 (Compustat; CRSP)
Ln(CEO Bonus)$_t$	Natural log of CEO bonus (Execucomp)
Ln(CEO LTIP)$_t$	Natural log of CEO long-term incentive plan (Execucomp)
Ln(CEO Restricted Equity Wealth)$_t$	Natural log of CEO's restricted stock holdings (Execucomp)
Ln(CEO Salary)$_t$	Natural log of CEO salary (Execucomp)
Ln(CEO Unrestricted Equity Wealth)$_t$	Natural log of the value of the CEO's aggregate shares, excluding stock options and restricted stock holdings (Execucomp)
Ln(Net Purchase)$_t$	Natural log of CEO net purchases (in dollars) of company stock when net purchases is greater than zero; zero otherwise (Thomson Reuters)
Ln(Net Sale)$_t$	Natural log of absolute value of CEO net purchases (in dollars) of company stock when net purchases is less than zero; zero otherwise (Thomson Reuters)
Loss$_t$	Indicator equal to one if the firm reports negative income before extraordinary items, zero otherwise (Compustat)
Net Purchase & No Prior Neg. Ab. Ret. NP Ind.$_t$	Indicator equal to one if the CEO has not made a net purchase that earned negative abnormal returns at the current firm in a prior year, zero otherwise. Abnormal returns are from a model that includes the five factors of Fama and French (2017) and a momentum factor (Thomson Reuters; CRSP)
Net Purchase & Prior Neg. Ab. Ret. NP Ind.$_t$	Indicator equal to one if the CEO made a net purchase that earned negative abnormal returns at the current firm in any prior year, zero otherwise. Abnormal returns are from a model that includes the five factors of Fama and French (2017) and a momentum factor (Thomson Reuters; CRSP)
Net Purchase Ind.$_t$	Indicator equal to one if the CEO makes a net purchase of company stock in year t, zero otherwise (Thomson Reuters)
Net Sale Ind.$_t$	Indicator equal to one if the CEO makes a net sales of company stock in year t, zero otherwise (Thomson Reuters)
Other Turnover$_{t+1}$	*Turnover* minus *Performance-related Turnover* (Execucomp; CRSP)
Performance-related Turnover$_{t+1}$	Indicator equal to one if the CEO listed on ExecuComp in year t+1 is not listed as the CEO on ExecuComp in year t and when the firm's stock price performance in year t or t+1 was either (1) in the lowest quartile of its Fama French (1997) 48 industry that year (i.e., t or t+1) or (2) in the lowest quarter of the entire sample; zero otherwise (Execucomp; CRSP)
Restructurings$_t$	After-tax restructuring costs divided by average total assets (Compustat)
ROA$_t$	Return on assets, measured as income before extraordinary items divided by average total assets (Compustat)
Share Repurchases$_t$	Purchases of common and preferred stock from the statement of cash flows divided by average total assets (Compustat)
Size$_t$	Natural log of total assets (Compustat)
Turnover$_{t+1}$	Indicator equal to one if the CEO listed on ExecuComp in year *t+1* is not listed as the CEO on ExecuComp in year *t*; zero otherwise (Execucomp)
Under Perform Industry$_t$	Indicator equal to one when a firm's raw returns are in the bottom quartile of its Fama French (1997) 48 industry that year (CRSP)

Writedowns$_t$	After-tax writedowns divided by average total assets, where writedowns include impairments and write-offs of assets other than goodwill (Compustat)

Appendix B: Over-optimism measures of Campbell et al. (2011)

Our empirical results provide evidence that CEO net purchases are associated with a lower likelihood of performance-related turnover. This finding is seemingly at odds with Campbell et al.'s (2011) finding that "over-optimistic" CEOs who are identified on the basis of two measures of net purchases have a *higher* likelihood of forced turnover. To measure CEO over optimism, Campbell et al. (2011) first identify CEOs who make a large net purchase, which is a net purchase of his or her firm's stock that is both (i) at least 10% of his or her stock ownership and (ii) in the top quartile of net purchases by dollar amount. Once a CEO is classified as over-optimistic, the CEO retains that classification for the remainder of his or her tenure, unless the CEO subsequently makes a large net sale. Campbell et al. (2011) find that this highly persistent measure of CEO over-optimism is positively associated with forced CEO turnover. We reconsider Campbell et al.'s (2011) net-purchase-based proxies by first examining whether they exhibit a positive association with performance-related turnover during our sample period. We then proceed to reconcile our findings with those of Campbell et al. (2011).

We begin by replicating the results of Campbell et al. (2011) in our sample period. One reason that the trading-based results of Campbell et al. (2011) may not hold in our sample is because CEO sales have increased over time, which reduces the proportion of CEOs who are classified as over-optimistic. For example, Table 1 shows that 14.2% of CEOs are over-optimistic according to their net purchase activity during our sample period, whereas Campbell et al. (2011) classify 30.7% of CEOs as over-optimistic during their sample period. We also find that a greater proportion of CEOs are classified as under-optimistic than over-optimistic in our sample. The larger proportion of CEOs who are classified as over-optimistic is consistent with prior research that finds that CEOs tend to be net sellers (e.g., Ofek and Yermack 2000; Jin and Kothari 2008).

Despite the lower proportion of CEOs who are classified as over-optimistic, the inferences from Campbell et al. (2011) hold in our sample period (untabulated). Specifically, consistent with the argument in Campbell et al. (2011) that boards prefer CEOs with moderate optimism, we find a positive association between performance-related turnover and both *CEO Over Optimism Trading* and *CEO Under Optimism Trading*.[31] Next, we find that our results are robust to the inclusion of the net-purchase-based measures of optimism of Campbell et al. (2011). Both of our measures of net purchases, *Net Purchase Ind.* in Model (1) and *Ln(Net Purchase)* in Model (2), remain negative after including the trading-based measures of CEO optimism.

Next, we reconcile the results of Campbell et al. (2011) with our findings. Campbell et al. (2011) classify their measures of optimism as semi-permanent, which means that large purchases are not associated with higher turnover per se, but rather that CEOs who either make or have made a large purchase are more likely to face performance-related turnover. This is because once a CEO is classified as either over- or under-optimistic by virtue of either making a large net purchase or a large net sale, the CEO retains that classification through the end of his or her tenure, unless the CEO subsequently exhibits the opposite type of optimism.

To reconcile both our predictions and our findings with those in Campbell et al. (2011), we separately identify the years in which CEOs make large net purchases and large net sales, both as defined by Campbell et al. (2011). We find that CEO-years with large net purchases are associated with a *reduced* likelihood of performance-related turnover in the following year. This finding is consistent with our results in Table 5, which show that CEOs with a history of making net purchases that earn negative abnormal returns are unable to extend their tenure by making subsequent net purchases.

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[31] Campbell et al. (2011) note that Thomson Reuters provides data on whether specific stock purchases or sales relate to stock options. Rather than choosing to either include or exclude such transactions, the authors calculate two measures of optimism – one that includes and one that excludes such transactions. We report results using the low- and high-optimism CEO indicators that include transactions relating to stock options, but our inferences are unchanged when we use the measures that exclude such transactions.

Figure 1: Reduced Form Model
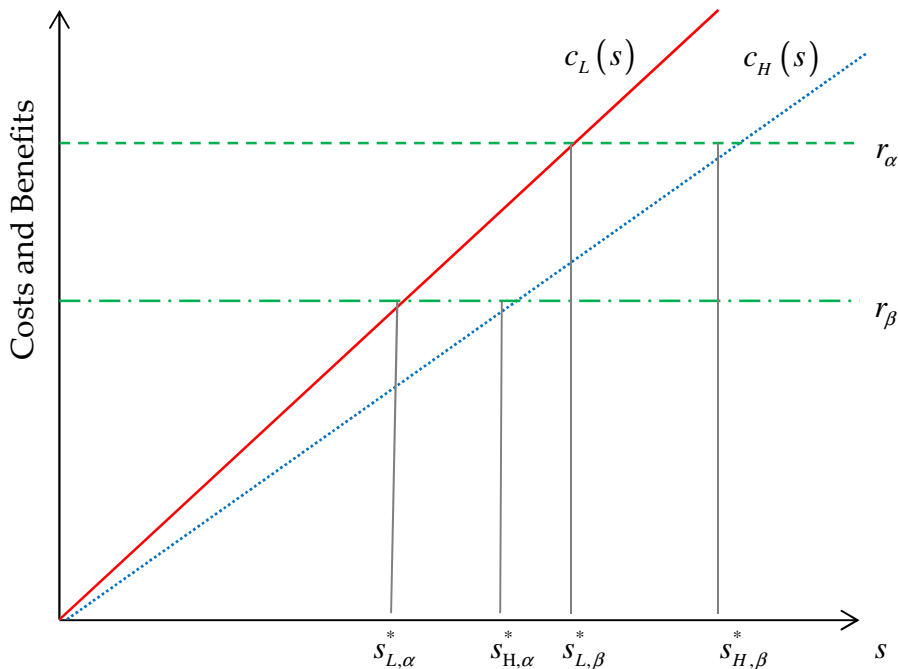
This figure presents a graphical illustration of a reduced-form model (see below) to demonstrate how equilibria can emerge where some low-type CEOs use insider purchases to pool with high-type CEOs to help motivate our empirical predictions.

As in Hermalin and Weisbach (1998), we assume that the function of the board is to determine the CEO's type and decide whether to retain or dismiss the CEO. A CEO can vary along two dimensions: type and incumbency value (e.g., Fudenberg and Tirole 1995). On the dimension of CEO type, the CEO can be one of two types, H with probability p, or L with probability 1-p. On the dimension of incumbency value, the CEO earns private incumbency rents, r_j, from continued employment, where $j \in \{\alpha, \beta\}$. With probability q these rents are r_α, and with probability 1-q the CEO's incumbency rents are r_β. We assume that $r_\alpha > r_\beta > 0$.

The board receives utility of V_i if it retains the CEO, where $i \in \{H, L\}$. We assume that the board prefers a high-type CEO to a low-type CEO, or $E[V_H] > E[V_L]$. If the board chooses to terminate the CEO, it hires a new CEO who is high or low type with the above-stated probabilities. Hiring a new CEO also involves a switching cost, $\kappa > 0$. Therefore, the board's expected utility from terminating the CEO is $E[V_i] - \kappa$. The CEO knows his or her type and incumbency benefits, but the board does not. Prior to the board's termination decision, the CEO can send a signal, s, to the board by purchasing shares in the firm. Therefore, the board will maximize its utility by retaining the CEO when $E[V_i | s] > E[V_i] - \kappa$.

The CEO bears a cost to send the signal, $c_i(s)$, where $c_i' > 0$, $c_i'' \geq 0$, and $c_H(s) < c_L(s)$. We can think of these costs as deriving from both the expected profitability of the trade *and* the extra idiosyncratic risk borne by the CEO. A CEO is willing to send a signal $s > 0$ only if there exists an $s_{i,j}^*$ such that $r_j > c_i\left(s_{i,j}^*\right)$ *and* $E\left[V_i \middle| s_{i,j}^*\right] > E[V_i] - \kappa$. That is, the CEO will send a signal as long as the expected benefits of the signal exceed the expected costs. We emphasize that our theory neither assumes nor requires that high-type CEOs *always* outperform low-type CEOs. Instead, our theory only requires that high-type CEOs outperform low-type CEOs *on average*. Because costs are increasing in the signal, the optimal signal for a given CEO is the smallest value of *s* that meets the above criteria.

Figure 1 shows the necessary conditions for a pooling equilibrium to emerge whereby the board will be unable to distinguish perfectly between CEOs who are high- or low-type. Specifically, if $s_{H,\alpha}^* \geq s_{L,\alpha}^* \geq s_{H,\beta}^* \geq s_{L,\beta}^*$ then some pooling will exist along the type dimension. Low-type CEOs will be able to pool successfully with high-type CEOs if the opportunity cost to the board of incorrectly terminating a high-type CEO is greater than the opportunity cost of incorrectly retaining a low-type CEO.

Figure 2: Net purchases by quintile of predicted likelihood of performance-related turnover
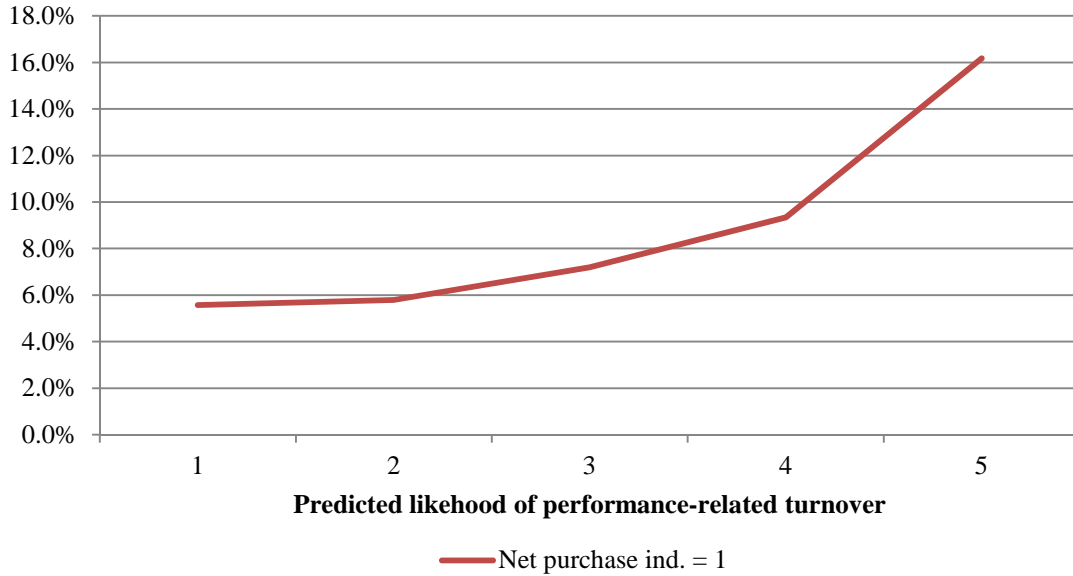
The figure shows the proportion of CEOs who are net purchases for each quintile of the predicted likelihood of performance-related turnover in $t+1$. We calculate predicted values using a modified version of Eq. (1) that includes the independent variables for β_3 to β_{26} (i.e., we exclude CEO Net Purchase, CEO Net Sale, and fixed effects). Quintile 1 (5) contains those observations with the lowest (highest) predicted likelihood of performance-related turnover in $t+1$.

The positive relation between net purchases and the predicted likelihood of performance-related turnover in $t+1$ is consistent with the positive relation between net purchases and *realized* performance-related turnover in $t+1$:

	Net Purchases Ind.$_{i,t}$ = 0	*Net Purchases Ind.$_{i,t}$ = 1*	*Total*
Performance-related Turnover$_{i,t+1}$ = 0	86.5%	8.1%	94.6%
Performance-related Turnover$_{i,t+1}$ = 1	4.7%	0.7%	5.4%
Total	91.2%	8.8%	100.0%

That is, conditional on the absence of performance-related turnover in $t+1$, 8.6% of CEOs are net purchasers, and conditional on performance-related turnover in $t+1$, 12.4% of CEOs are net purchasers.

Pr(*Net Purchase Ind.$_{i,t}$ = 1 | Performance-related Turnover$_{i,t+1}$ = 0*):	8.6%
Pr(*Net Purchase Ind.$_{i,t}$ = 1 | Performance-related Turnover$_{i,t+1}$ = 1*):	12.4%

Figure 3: Market Response to CEO Purchases
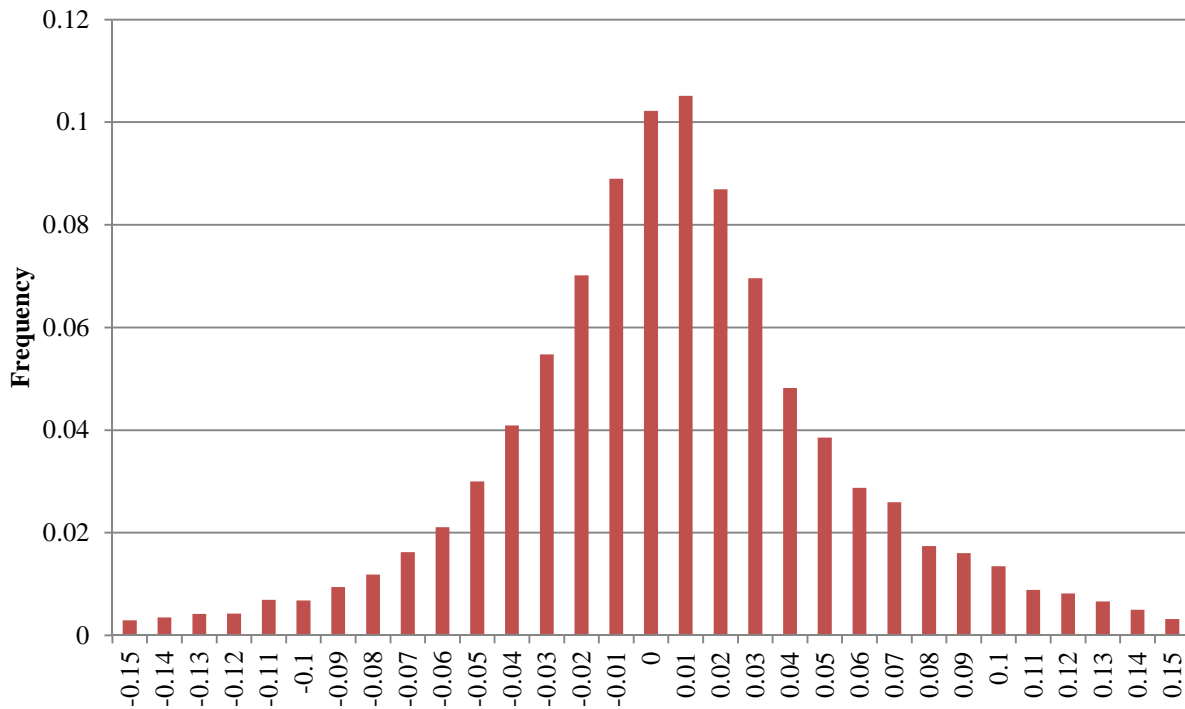
This figure presents a histogram of the buy-and-hold abnormal returns for the two trading days following open market CEO purchases (i.e., *t* to *t*+2, inclusive). The y-axis of the histogram plots the proportion of all CEO purchases fall into the corresponding bin. Market responses are measured using abnormal returns from a six-factor model that includes the five factors of Fama and French (2017) and a momentum factor (Carhart 1997), where factors are estimated over calendar days *t*-190 to *t*-10. Bins have widths of one percent (e.g., the zero-percent bin contains observations with abnormal returns between −0.005 and 0.005). Returns data are from CRSP, and CEO purchases are from Thomson Reuters.

Figure 4: Differential predictions

	Contrarian trader	CEO over-optimism	Strategic trade
Event returns	No or low abnormal returns	No or negative abnormal returns	No or low abnormal returns
Purchase during poor performance / when likelihood of performance-related turnover is high	More likely	Ambiguous	More likely
Long-run returns	No or low abnormal returns	No or negative abnormal returns	No or low abnormal returns
Purchase earlier in CEO tenure	Ambiguous	Ambiguous	More likely
Purchase at firms with weak information environments	Ambiguous	Ambiguous	More likely
Association with performance-related turnover, conditioned on other determinants of turnover	Ambiguous	Ambiguous	Less likely
Performance-related turnover following purchases with positive abnormal returns, conditioned on other determinants of turnover	Ambiguous	Ambiguous	Less likely
Performance-related turnover following purchases with small negative abnormal returns, conditioned on other determinants of turnover	Ambiguous	More likely	Less likely

Table 1: Returns to CEO trades

This table presents the buy-and-hold abnormal returns (BHAR) following CEO transactions. In Panel A, we provide the median and average abnormal returns for the 6, 12, 24, 36, and 60 months following the CEO purchases, where CEO purchases are weighted by dollar size of the purchase (i.e., a CEO purchase of $10 of stock receives twice the weight of a CEO purchase of $5). In Panel B, we provide the median and average abnormal returns following CEO purchases for months 0 through 6 (0:6), months 6 through 12 (6:12), months 12 through 24 (12:24), months 24 through 36 (24:36), and months 36 through 60 (36:60), where we again weight CEO purchases by dollar amount. Panels C and D provide dollar-weighted abnormal returns following CEO sales. In each panel, we provide abnormal returns to four standard models of abnormal returns. The six factor model controls for factor exposure to the market (*Beta*), Small Minus Big (*SMB*), High Minus Low (*HML*), Up Minus Down (*UMD*), Robust Minus Weak (*RMW*), and Conservative Minus Aggressive (*CMA*). FF 2017 controls for factor exposure to *Beta*, *SMB*, *HML*, *RMW*, and *CMA* (Fama and French 2017). The Carhart (1997) model controls for factor exposure to *Beta*, *SMB*, *HML*, and *UMD*. FF 1993 controls for factor exposure to *Beta*, *SMB*, and *HML* (Fama and French 1993).

Panel A: Cumulative dollar-weighted abnormal returns to CEO purchases

	Median BHAR by month					Mean BHAR by month				
Model	6	12	24	36	60	6	12	24	36	60
Six factor	2.8%	2.6%	2.2%	1.9%	1.9%	4.5%	2.5%	2.1%	1.5%	1.2%
FF 2017	3.2%	2.8%	2.3%	1.9%	1.9%	5.2%	3.1%	2.1%	1.5%	1.0%
Carhart 1997	2.9%	2.6%	2.3%	2.1%	2.0%	4.1%	2.6%	2.2%	1.7%	1.3%
FF 1993	3.2%	2.7%	2.3%	2.0%	2.0%	5.1%	2.9%	2.3%	1.7%	1.1%

Panel B: Dollar-weighted abnormal returns to CEO purchases by period

	Median BHAR by month					Mean BHAR by month				
Model	0:6	6:12	12:24	24:36	36:60	0:6	6:12	12:24	24:36	36:60
Six factor	2.8%	-0.2%	-0.4%	-0.3%	0.0%	4.5%	-2.0%	-0.5%	-0.5%	-0.3%
FF 2017	3.2%	-0.4%	-0.5%	-0.4%	-0.1%	5.2%	-2.1%	-1.0%	-0.7%	-0.4%
Carhart 1997	2.9%	-0.3%	-0.3%	-0.2%	0.0%	4.1%	-1.5%	-0.4%	-0.5%	-0.4%
FF 1993	3.2%	-0.5%	-0.3%	-0.3%	-0.1%	5.1%	-2.1%	-0.7%	-0.6%	-0.6%

Panel C: Cumulative dollar-weighted abnormal returns following CEO sales

	Median BHAR by month					Mean BHAR by month				
Model	6	12	24	36	60	6	12	24	36	60
Six factor	0.3%	1.2%	1.3%	1.3%	1.2%	3.3%	3.8%	3.5%	3.2%	2.7%
FF 2017	0.3%	1.2%	1.3%	1.3%	1.2%	3.3%	3.7%	3.4%	3.2%	2.7%
Carhart 1997	0.3%	1.0%	1.1%	1.2%	1.1%	2.6%	3.2%	2.7%	2.5%	2.1%
FF 1993	0.2%	1.0%	1.1%	1.1%	1.1%	2.7%	3.1%	2.5%	2.3%	1.9%

Panel D: Dollar-weighted abnormal returns to CEO sales by period

	Median BHAR by month					Mean BHAR by month				
Model	0:6	6:12	12:24	24:36	36:60	0:6	6:12	12:24	24:36	36:60
Six factor	0.3%	0.9%	0.1%	0.0%	-0.1%	3.3%	0.5%	-0.3%	-0.2%	-0.5%
FF 2017	0.3%	0.9%	0.1%	0.0%	-0.1%	3.3%	0.4%	-0.3%	-0.2%	-0.6%
Carhart 1997	0.3%	0.8%	0.0%	0.1%	0.0%	2.6%	0.5%	-0.5%	-0.2%	-0.4%
FF 1993	0.2%	0.8%	0.1%	0.1%	-0.1%	2.7%	0.4%	-0.6%	-0.2%	-0.4%

Table 2: Sample statistics
Panel A: Descriptive statistics

VARIABLES	mean	sd	p25	p50	p75
Absolute Poor Performance	0.204	0.403	0.000	0.000	0.000
Annual Return	0.152	0.472	-0.126	0.100	0.343
BTM	0.558	0.420	0.284	0.470	0.720
Capex	0.051	0.055	0.015	0.036	0.068
CEO Age	55.400	7.172	51.000	55.000	60.000
CEO Duality	0.531	0.499	0.000	1.000	1.000
CEO Over Optimism Investment	0.297	0.457	0.000	0.000	1.000
CEO Tenure	7.319	7.093	2.000	5.000	10.000
CEO Under Optimism Investment	0.246	0.431	0.000	0.000	0.000
Dividends	0.012	0.019	0.000	0.004	0.018
Goodwill Impairments	0.002	0.011	0.000	0.000	0.000
Idio Vol	0.022	0.012	0.013	0.019	0.027
Litigation Risk	0.098	0.114	0.034	0.059	0.112
Ln(CEO Bonus)	3.160	3.171	0.000	3.714	6.217
Ln(CEO LTIP)	0.498	1.722	0.000	0.000	0.000
Ln(CEO Restricted Equity Wealth)	3.882	3.911	0.000	4.489	7.695
Ln(CEO Salary)	6.410	0.591	6.111	6.477	6.804
Ln(CEO Unrestricted Equity Wealth)	7.709	3.364	6.699	8.392	9.780
Ln(Net Purchase)	1.037	3.378	0.000	0.000	0.000
Ln(Net Sale)	4.412	6.871	0.000	0.000	13.250
Loss	0.159	0.366	0.000	0.000	0.000
Net Purchase Ind.	0.088	0.284	0.000	0.000	0.000
Net Sale Ind.	0.296	0.457	0.000	0.000	1.000
Performance-related turnover	0.054	0.225	0.000	0.000	0.000
Restructurings	0.002	0.005	0.000	0.000	0.000
ROA	0.037	0.095	0.012	0.042	0.080
Share Repurchases	0.025	0.049	0.000	0.001	0.026
Size	7.622	1.743	6.341	7.492	8.757
Under Perform Industry	0.164	0.370	0.000	0.000	0.000
Writedowns	0.001	0.004	0.000	0.000	0.000

This panel provides descriptive statistics for the main variables used in our analyses. The descriptive statistics for all variables except for *CEO Duality* come from 33,762 observations drawn from the intersection of the Execucomp, Compustat, CRSP, and Thompson Reuters universes between 1992 and 2016. The descriptive statistics for *CEO Duality* come from a sample of 21,987 observations with available data from BoardEx. Appendix A contains variable definitions.

Table 2: Sample statistics

	Panel B: Difference in means			
VARIABLES	*Net Purchase Ind. = 0*	*Net Purchase Ind. = 1*	Difference	p-value
Absolute Poor Performance	0.187	0.377	-0.190	0.000
Annual Return	0.166	0.008	0.158	0.000
BTM	0.540	0.741	-0.201	0.000
CAPEX	0.052	0.046	0.006	0.000
CEO Age	55.477	54.609	0.868	0.000
CEO Duality	0.540	0.447	0.093	0.000
CEO Over Optimism Investment	0.301	0.263	0.038	0.000
CEO Tenure	7.499	5.457	2.042	0.000
CEO Under Optimism Investment	0.243	0.272	-0.028	0.001
Dividends	0.013	0.010	0.003	0.000
Goodwill Impairments	0.002	0.005	-0.003	0.000
Idio Vol	0.021	0.027	-0.006	0.000
Litigation Risk	0.094	0.131	-0.037	0.000
Ln(CEO Bonus)	3.209	2.660	0.549	0.000
Ln(CEO LTIP)	0.518	0.289	0.229	0.000
Ln(CEO Restricted Equity Wealth)	3.905	3.640	0.266	0.000
Ln(CEO Salary)	6.418	6.328	0.090	0.000
Ln(CEO Unrestricted Equity Wealth)	7.780	6.982	0.798	0.000
Ln(Net Purchase)	0.000	11.768	-11.768	0.000
Ln(Net Sale)	4.839	0.000	4.839	0.000
Loss	0.145	0.307	-0.162	0.000
Net Purchase Ind.	0.000	1.000	-1.000	0.000
Net Sale Ind.	0.325	0.000	0.325	0.000
Performance-related turnover	0.052	0.076	-0.024	0.000
Restructurings	0.001	0.002	-0.001	0.000
ROA	0.040	-0.003	0.043	0.000
Share Repurchases	0.025	0.017	0.008	0.000
Size	7.656	7.271	0.385	0.000
Under Perform Industry	0.153	0.274	-0.121	0.000
Writedowns	0.001	0.001	-0.001	0.000

This table provides a difference-in-means test between firm-years in which the CEO was a net purchaser of stock (i.e., *Net Purchase Ind. = 1)* and firm-years in which the CEO was not a net purchaser of stock (i.e., *Net Purchase Ind. = 0)*. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0.* Variable definitions appear in Appendix A.

Table 3: CEO Purchases and Performance-related Turnover

DV = *Performance-related Turnover$_{i,t+1}$*

	(1) Coeff.	(1) *t*-stat	(2) Coeff.	(2) *t*-stat
Net Purchases Ind.$_{i,t}$	-0.016***	(-2.84)		
Net Sales Ind.$_{i,t}$	0.004	(1.22)		
Ln(Net Purchases)$_{i,t}$			-0.001***	(-2.76)
Ln(Net Sales)$_{i,t}$			0.000	(1.29)
CEO Tenure$_{i,t}$	0.003***	(8.49)	0.003***	(8.47)
CEO Age$_{i,t}$	0.005***	(12.45)	0.005***	(12.45)
Ln(CEO Salary)$_{i,t}$	-0.016***	(-2.85)	-0.016***	(-2.86)
Ln(CEO Bonus)$_{i,t}$	-0.004***	(-6.16)	-0.004***	(-6.16)
Ln(CEO LTIP)$_{i,t}$	0.000	(0.18)	0.000	(0.18)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.006***	(-11.29)	-0.006***	(-11.29)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.006***	(-8.78)	-0.006***	(-8.77)
CEO Over Optimism Investment$_{i,t}$	0.016***	(3.63)	0.016***	(3.62)
CEO Under Optimism Investment$_{i,t}$	0.020***	(4.19)	0.020***	(4.19)
Idio Vol$_{i,t}$	1.084***	(3.38)	1.081***	(3.37)
BTM$_{i,t}$	-0.010	(-1.58)	-0.010	(-1.58)
Size$_{i,t}$	0.016***	(4.29)	0.016***	(4.29)
ROA$_{i,t}$	-0.057*	(-1.70)	-0.057*	(-1.70)
Loss$_{i,t}$	0.013*	(1.96)	0.013*	(1.96)
Annual Return$_{i,t}$	-0.001	(-0.30)	-0.001	(-0.32)
Under Perform Industry$_{i,t}$	0.053***	(9.07)	0.053***	(9.07)
Absolute Poor Performance$_{i,t}$	0.065***	(10.92)	0.065***	(10.92)
Litigation Risk$_{i,t}$	-0.015	(-0.59)	-0.015	(-0.58)
Dividends$_{i,t}$	0.271**	(2.12)	0.270**	(2.12)
Share Repurchases$_{i,t}$	0.025	(0.74)	0.025	(0.74)
Goodwill Impairments$_{i,t}$	0.443**	(2.12)	0.444**	(2.13)
Restructurings$_{i,t}$	0.654	(1.48)	0.657	(1.49)
Writedowns$_{i,t}$	1.669***	(2.96)	1.664***	(2.95)
Capex$_{i,t}$	0.045	(0.92)	0.045	(0.92)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	33,566		33,566	
R-squared	0.190		0.190	
Within R-squared	0.079		0.079	

This table reports the results of linear probability models in which *Performance-related Turnover$_{t+1}$* is regressed on one of two variables that measure CEO net purchase activity (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*), as well as control variables. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0.* When net purchases are greater than 0, *Ln(Net Purchase)* equals the natural log of net purchases, and *Ln(Net Purchase)* equals zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4: CEO Purchases and Tenure

DV = *Performance-related Turnover*$_{i,t+1}$

	(1) Coeff.	(1) *t*-stat	(2) Coeff.	(2) *t*-stat
Net Purchase Ind.$_{i,t}$	-0.027***	(-3.79)		
Net Purchase Ind.$_{i,t}$ * CEO Tenure$_{i,t}$	0.002**	(2.31)		
Net Sale Ind.$_{i,t}$	0.004	(1.27)		
Ln(Net Purchase)$_{i,t}$			-0.002***	(-3.69)
Ln(Net Purchase)$_{i,t}$ * CEO Tenure$_{i,t}$			0.000**	(2.24)
Ln(Net Sale)$_{i,t}$			0.000	(1.34)
CEO Tenure$_{i,t}$	0.003***	(8.12)	0.003***	(8.10)
CEO Age$_{i,t}$	0.005***	(12.43)	0.005***	(12.43)
Ln(CEO Salary)$_{i,t}$	-0.016***	(-2.85)	-0.016***	(-2.86)
Ln(CEO Bonus)$_{i,t}$	-0.004***	(-6.12)	-0.004***	(-6.12)
Ln(CEO LTIP)$_{i,t}$	0.000	(0.19)	0.000	(0.18)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.006***	(-11.31)	-0.006***	(-11.30)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.006***	(-8.78)	-0.006***	(-8.77)
CEO Over Optimism Investment$_{i,t}$	0.016***	(3.57)	0.016***	(3.57)
CEO Under Optimism Investment$_{i,t}$	0.020***	(4.17)	0.020***	(4.17)
Idio Vol$_{i,t}$	1.090***	(3.40)	1.088***	(3.39)
BTM$_{i,t}$	-0.011	(-1.63)	-0.011	(-1.62)
Size$_{i,t}$	0.016***	(4.32)	0.016***	(4.31)
ROA$_{i,t}$	-0.057*	(-1.70)	-0.057*	(-1.70)
Loss$_{i,t}$	0.013*	(1.95)	0.013*	(1.95)
Annual Return$_{i,t}$	-0.001	(-0.29)	-0.001	(-0.31)
Under Perform Industry$_{i,t}$	0.053***	(9.08)	0.053***	(9.08)
Absolute Poor Performance$_{i,t}$	0.065***	(10.91)	0.065***	(10.91)
Litigation Risk$_{i,t}$	-0.015	(-0.60)	-0.015	(-0.59)
Dividends$_{i,t}$	0.269**	(2.10)	0.268**	(2.10)
Share Repurchases$_{i,t}$	0.025	(0.74)	0.025	(0.74)
Goodwill Impairments$_{i,t}$	0.439**	(2.10)	0.440**	(2.11)
Restructurings$_{i,t}$	0.657	(1.49)	0.661	(1.50)
Writedowns$_{i,t}$	1.689***	(3.00)	1.684***	(2.99)
Capex$_{i,t}$	0.046	(0.93)	0.046	(0.93)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	33,566		33,566	
R-squared	0.190		0.190	
Within R-squared	0.079		0.079	

This table reports the results of linear probability models in which *Performance-related Turnover*$_{t+1}$ is regressed on one of two variables that measure CEO net purchase activity (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*), an interaction of the net purchase measures with CEO tenure, and control variables. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0*. When net purchases are greater than 0, *Ln(Net Purchase)* equals the natural log of net purchases, and *Ln(Net Purchase)* equals zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Evidence of Prior Pooling

	DV = *Performance-related Turnover*$_{i,t+1}$			
	(1)		(2)	
	Coeff.	*t*-stat	Coeff.	*t*-stat
β_1 *Net Purchase & No Prior Neg. Ab. Ret. NP Ind.*$_{i,t}$	-0.020***	(-3.35)	-0.016***	(-2.67)
β_2 *Net Purchase & Prior Neg. Ab. Ret. NP Ind.*$_{i,t}$	-0.002	(-0.15)		
Prior Period Large Purchase Ind.$_{i,t}$			0.016**	(2.53)
Net Sale Ind.$_{i,t}$	0.004	(1.21)	0.005	(1.46)
CEO Tenure$_{i,t}$	0.003***	(8.46)	0.003***	(8.44)
CEO Age$_{i,t}$	0.005***	(12.42)	0.005***	(12.09)
Ln(CEO Salary)$_{i,t}$	-0.016***	(-2.86)	-0.016***	(-2.86)
Ln(CEO Bonus)$_{i,t}$	-0.004***	(-6.15)	-0.004***	(-6.00)
Ln(CEO LTIP)$_{i,t}$	-0.016***	(-2.86)	0.000	(0.26)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.004***	(-6.15)	-0.006***	(-11.48)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	0.000	(0.17)	-0.006***	(-8.83)
CEO Over Optimism Investment$_{i,t}$	-0.006***	(-11.30)	0.015***	(3.32)
CEO Under Optimism Investment$_{i,t}$	-0.006***	(-8.80)	0.018***	(3.89)
Idio Vol$_{i,t}$	0.016***	(3.58)	1.076***	(3.37)
BTM$_{i,t}$	0.020***	(4.17)	-0.010	(-1.58)
Size$_{i,t}$	1.094***	(3.41)	0.017***	(4.64)
ROA$_{i,t}$	-0.011	(-1.62)	-0.057*	(-1.69)
Loss$_{i,t}$	0.016***	(4.35)	0.013*	(1.91)
Annual Return$_{i,t}$	-0.057*	(-1.69)	-0.001	(-0.35)
Under Perform Industry$_{i,t}$	0.013*	(1.95)	0.053***	(9.09)
Absolute Poor Performance$_{i,t}$	-0.001	(-0.31)	0.065***	(10.90)
Litigation Risk$_{i,t}$	0.052***	(9.04)	-0.013	(-0.52)
Dividends$_{i,t}$	0.065***	(10.92)	0.288**	(2.28)
Share Repurchases$_{i,t}$	-0.015	(-0.61)	0.026	(0.80)
Goodwill Impairments$_{i,t}$	0.273**	(2.14)	0.466**	(2.24)
Restructurings$_{i,t}$	0.025	(0.76)	0.659	(1.50)
Writedowns$_{i,t}$	0.443**	(2.12)	1.622***	(2.89)
Capex$_{i,t}$	0.661	(1.50)	0.042	(0.86)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	33,566		33,587	
R-squared	0.190		0.187	
Within R-squared	0.079		0.079	

This table reports the results of linear probability models in which *Performance-related Turnover*$_{t+1}$ is regressed on two net purchase indicator variables and control variables. *Net Purchase & No Prior Neg. Ab. Ret. NP Ind.*$_{i,t}$ is an indicator variable equal to one if the CEO has not made a net purchase that earned negative abnormal returns at the current firm in a prior year, zero otherwise, and *Net Purchase & Prior Neg. Ab. Ret. NP Ind.*$_{i,t}$ is an indicator variable equal to one if the CEO made a net purchase that earned negative abnormal returns at the current firm in any prior year, zero otherwise. Abnormal returns are from a model that includes the five factors of Fama and French (2017) and momentum (Carhart (1997). *Recent Large Purchase Ind.*$_{i,t}$ is an indicator variable equal to one if a CEO has made in any prior period a net purchase of stock in his or her firm that is both (1) equal to at least 10% of his or her stock ownership and (2) the dollar amount of the net purchase is in the top quartile of net purchases, zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Firm Information Environment

DV = *Performance-related Turnover*$_{i,t+1}$

	Low Idio Vol (1)		High Idio Vol (2)	
	Coeff.	*t*-stat	Coeff.	*t*-stat
β_1 *Net Purchase Ind.*$_{i,t}$	-0.002	(-0.23)	-0.021**	(-2.44)
Net Sale Ind.$_{i,t}$	-0.001	(-0.26)	0.011*	(1.73)
CEO Tenure$_{i,t}$	0.003***	(6.78)	0.005***	(6.58)
CEO Age$_{i,t}$	0.003***	(6.95)	0.006***	(8.89)
Ln(CEO Salary)$_{i,t}$	-0.015**	(-2.10)	-0.022**	(-2.25)
Ln(CEO Bonus)$_{i,t}$	-0.002**	(-1.99)	-0.007***	(-5.47)
Ln(CEO LTIP)$_{i,t}$	-0.001	(-0.83)	0.001	(0.41)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.004***	(-5.76)	-0.011***	(-9.25)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.003***	(-3.93)	-0.009***	(-7.53)
CEO Over Optimism Investment$_{i,t}$	0.016***	(2.85)	0.023***	(2.84)
CEO Under Optimism Investment$_{i,t}$	0.014**	(2.39)	0.030***	(3.34)
Idio Vol$_{i,t}$	0.704	(0.90)	1.094**	(2.49)
BTM$_{i,t}$	0.006	(0.54)	-0.018**	(-2.01)
Size$_{i,t}$	0.017***	(3.22)	0.021***	(3.20)
ROA$_{i,t}$	-0.055	(-0.79)	-0.048	(-1.15)
Loss$_{i,t}$	0.005	(0.42)	0.019**	(2.15)
Annual Return$_{i,t}$	-0.005	(-0.65)	-0.000	(-0.09)
Under Perform Industry$_{i,t}$	0.065***	(7.95)	0.039***	(4.37)
Absolute Poor Performance$_{i,t}$	0.052***	(4.92)	0.072***	(8.73)
Litigation Risk$_{i,t}$	-0.034	(-0.64)	-0.024	(-0.74)
Dividends$_{i,t}$	0.233	(1.50)	0.347	(1.31)
Share Repurchases$_{i,t}$	0.036	(0.89)	0.044	(0.73)
Goodwill Impairments$_{i,t}$	0.390	(0.87)	0.539**	(2.07)
Restructurings$_{i,t}$	1.027	(1.39)	0.394	(0.66)
Writedowns$_{i,t}$	1.439	(1.54)	2.023***	(2.76)
Capex$_{i,t}$	0.102	(1.27)	0.050	(0.68)
Test: Model (1) β_1 > Model (2) β_1	$p = 0.041$**			
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	16,300		15,719	
R-squared	0.197		0.248	
Within R-squared	0.060		0.095	

This table reports the results of linear probability models in which *Performance-related Turnover*$_{t+1}$ is regressed on a variable that measures CEO net purchase activity (i.e., *Net Purchase Ind.*) and control variables. We estimate Model (1) using firm-year observations with idiosyncratic volatility below the sample median. We estimate Model (2) using firm-year observations with idiosyncratic volatility above the sample median. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0*. The test of β_1 between Model (1) and (2) is one-tailed. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7: Ex post profitability of purchases

	(1) Coeff.	(1) t-stat	(2) Coeff.	(2) t-stat
DV = *Performance-related Turnover*$_{i,t+1}$				
Positive Returns to Net Purchase Ind.$_{i,t}$	-0.026***	(-3.95)	-0.026***	(-3.96)
Negative Returns to Net Purchase Ind.$_{i,t}$	0.002	(0.14)		
Small Negative Returns to Net Purchase Ind.$_{i,t}$			-0.026*	(-1.82)
Moderate Negative Returns to Net Purchase Ind.$_{i,t}$			0.000	(0.02)
Large Negative Returns to Net Purchase Ind.$_{i,t}$			0.032	(1.51)
Net Sale Ind.$_{i,t}$	0.004	(1.17)	0.004	(1.14)
CEO Tenure$_{i,t}$	0.003***	(8.52)	0.003***	(8.51)
CEO Age$_{i,t}$	0.005***	(12.12)	0.004***	(12.11)
Ln(CEO Salary)$_{i,t}$	-0.016***	(-2.79)	-0.016***	(-2.79)
Ln(CEO Bonus)$_{i,t}$	-0.004***	(-6.02)	-0.004***	(-6.01)
Ln(CEO LTIP)$_{i,t}$	0.000	(0.29)	0.000	(0.27)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.006***	(-11.44)	-0.006***	(-11.46)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.006***	(-8.78)	-0.006***	(-8.78)
CEO Over Optimism Investment$_{i,t}$	0.015***	(3.43)	0.015***	(3.46)
CEO Under Optimism Investment$_{i,t}$	0.019***	(4.03)	0.019***	(4.04)
Idio Vol$_{i,t}$	1.106***	(3.46)	1.097***	(3.43)
BTM$_{i,t}$	-0.010	(-1.46)	-0.010	(-1.53)
Size$_{i,t}$	0.016***	(4.39)	0.016***	(4.36)
ROA$_{i,t}$	-0.058*	(-1.72)	-0.057*	(-1.71)
Loss$_{i,t}$	0.013*	(1.90)	0.013*	(1.87)
Annual Return$_{i,t}$	-0.001	(-0.18)	-0.001	(-0.16)
Under Perform Industry$_{i,t}$	0.064***	(10.80)	0.064***	(10.80)
Absolute Poor Performance$_{i,t}$	0.052***	(9.04)	0.052***	(9.01)
Litigation Risk$_{i,t}$	-0.013	(-0.51)	-0.012	(-0.49)
Dividends$_{i,t}$	0.270**	(2.13)	0.268**	(2.12)
Share Repurchases$_{i,t}$	0.024	(0.74)	0.025	(0.75)
Goodwill Impairments$_{i,t}$	0.463**	(2.22)	0.461**	(2.21)
Restructurings$_{i,t}$	0.655	(1.49)	0.651	(1.48)
Writedowns$_{i,t}$	1.628***	(2.90)	1.615***	(2.87)
Capex$_{i,t}$	0.038	(0.77)	0.035	(0.71)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	33,587		33,587	
R-squared	0.187		0.187	
Within R-squared	0.079		0.079	

This table reports the results of linear probability models in which *Performance-related Turnover*$_{t+1}$ is regressed on measures of the *ex post* returns to CEO purchases and control variables. *Positive Returns to Net Purchase Ind.* equals one for CEO net purchasers whose purchases earned positive abnormal returns. *Negative Returns to Net Purchase Ind.* equals one for CEO net purchasers whose purchases earned negative abnormal returns. *Small Negative Returns to Net Purchase Ind.*, *Moderate Negative Returns to Net Purchase Ind.*, and *Large Negative Returns to Net Purchase Ind.* are indicators that equal one when a CEO's net purchases earned negative returns in the first, second, and third terciles of negative abnormal return percentages, respectively. Abnormal returns are from a model that includes the five factors of Fama and French (2017) and momentum (Carhart (1997). Variable definitions appear in Appendix A. T-statistics, from standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8: CEO Purchases and Other Turnover

DV = *Other Turnover$_{i,t+1}$*

	(1)		(2)	
	Coeff.	*t*-stat	Coeff.	*t*-stat
Net Purchases Ind.$_{i,t}$	0.019***	(3.91)		
Net Sales Ind.$_{i,t}$	0.009***	(2.72)		
Ln(Net Purchases)$_{i,t}$			0.001***	(3.67)
Ln(Net Sales)$_{i,t}$			0.001***	(2.92)
CEO Tenure$_{i,t}$	0.004***	(10.05)	0.004***	(10.01)
CEO Age$_{i,t}$	0.006***	(18.05)	0.006***	(18.04)
Ln(CEO Salary)$_{i,t}$	-0.020***	(-4.23)	-0.020***	(-4.22)
Ln(CEO Bonus)$_{i,t}$	-0.001**	(-2.31)	-0.001**	(-2.29)
Ln(CEO LTIP)$_{i,t}$	-0.001	(-0.88)	-0.001	(-0.87)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.006***	(-10.52)	-0.006***	(-10.52)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.006***	(-9.27)	-0.006***	(-9.29)
CEO Over Optimism Investment$_{i,t}$	0.010**	(2.48)	0.010**	(2.45)
CEO Under Optimism Investment$_{i,t}$	0.015***	(3.26)	0.015***	(3.25)
Idio Vol$_{i,t}$	0.447*	(1.91)	0.448*	(1.91)
BTM$_{i,t}$	0.014***	(3.45)	0.014***	(3.53)
Size$_{i,t}$	0.001	(0.17)	0.000	(0.09)
ROA$_{i,t}$	-0.036	(-1.61)	-0.037*	(-1.65)
Loss$_{i,t}$	0.001	(0.14)	0.001	(0.14)
Annual Return$_{i,t}$	-0.012***	(-3.47)	-0.012***	(-3.50)
Under Perform Industry$_{i,t}$	-0.043***	(-18.02)	-0.043***	(-18.01)
Absolute Poor Performance$_{i,t}$	-0.051***	(-16.42)	-0.051***	(-16.41)
Litigation Risk$_{i,t}$	-0.040**	(-2.42)	-0.040**	(-2.44)
Dividends$_{i,t}$	0.008	(0.07)	0.007	(0.06)
Share Repurchases$_{i,t}$	0.092***	(2.74)	0.092***	(2.73)
Goodwill Impairments$_{i,t}$	0.284**	(2.16)	0.282**	(2.15)
Restructurings$_{i,t}$	0.727**	(2.35)	0.730**	(2.36)
Writedowns$_{i,t}$	0.308	(0.83)	0.314	(0.85)
Capex$_{i,t}$	0.030	(0.70)	0.029	(0.68)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	33,566		33,566	
R-squared	0.150		0.150	
Within R-squared	0.066		0.066	

This table reports the results of linear probability models in which *Other Turnover$_{t+1}$* (i.e., turnover that is not associated with poor performance) is regressed on one of two variables that measure CEO net purchase activity (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*), as well as control variables. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0.* When net purchases are greater than 0, *Ln(Net Purchase)* equals the natural log of net purchases, and *Ln(Net Purchase)* equals zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9: Bad control problem

	DV = *Performance-related Turnover$_{i,t+1}$*			
	(1)		(2)	
	Coeff.	*t*-stat	Coeff.	*t*-stat
Net Purchases Ind.$_{i,t}$	-0.014**	(-2.34)		
Net Sales Ind.$_{i,t}$	0.004	(1.08)		
Ln(Net Purchases)$_{i,t}$			-0.001**	(-2.24)
Ln(Net Sales)$_{i,t}$			0.000	(1.16)
CEO Tenure$_{i,t}$	0.004***	(9.33)	0.004***	(9.31)
CEO Age$_{i,t}$	0.005***	(12.20)	0.005***	(12.20)
Ln(CEO Salary)$_{i,t}$	-0.014**	(-2.47)	-0.014**	(-2.48)
Ln(CEO Bonus)$_{i,t}$	-0.005***	(-7.22)	-0.005***	(-7.23)
Ln(CEO LTIP)$_{i,t}$	0.000	(0.06)	0.000	(0.06)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.006***	(-11.46)	-0.006***	(-11.46)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.005***	(-8.48)	-0.005***	(-8.48)
CEO Over Optimism Investment$_{i,t}$				
CEO Under Optimism Investment$_{i,t}$				
Idio Vol$_{i,t}$	1.921***	(6.03)	1.918***	(6.02)
BTM$_{i,t}$	0.003	(0.45)	0.003	(0.45)
Size$_{i,t}$	0.016***	(4.19)	0.016***	(4.19)
ROA$_{i,t}$	-0.069**	(-2.03)	-0.069**	(-2.03)
Loss$_{i,t}$	0.015**	(2.24)	0.015**	(2.24)
Annual Return$_{i,t}$	-0.047***	(-12.48)	-0.047***	(-12.49)
Under Perform Industry$_{i,t}$				
Absolute Poor Performance$_{i,t}$				
Litigation Risk$_{i,t}$	-0.017	(-0.65)	-0.016	(-0.65)
Dividends$_{i,t}$	0.311**	(2.40)	0.310**	(2.39)
Share Repurchases$_{i,t}$	0.034	(1.02)	0.035	(1.03)
Goodwill Impairments$_{i,t}$	0.531**	(2.52)	0.531**	(2.52)
Restructurings$_{i,t}$	0.794*	(1.78)	0.797*	(1.78)
Writedowns$_{i,t}$	1.675***	(2.95)	1.671***	(2.94)
Capex$_{i,t}$	0.078*	(1.67)	0.079*	(1.68)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	33,566		33,566	
R-squared	0.189		0.189	
Within R-squared	0.079		0.079	

This table reports the results of linear probability models in which *Performance-related Turnover$_{t+1}$* is regressed on one of two variables that measure CEO net purchase activity (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*), as well as control variables. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0*. When net purchases are greater than 0, *Ln(Net Purchase)* equals the natural log of net purchases, and *Ln(Net Purchase)* equals zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10: CEO Purchases at Poor Performing Firms

Panel A: Linear Probability Model

DV = $Turnover_{i,t+1}$

	(1) Coeff.	(1) t-stat	(2) Coeff.	(2) t-stat
Net Purchases Ind._{i,t}	-0.037**	(-2.46)		
Net Sales Ind._{i,t}	0.015	(1.22)		
Ln(Net Purchases)_{i,t}			-0.003**	(-2.33)
Ln(Net Sales)_{i,t}			0.001	(1.16)
CEO Tenure_{i,t}	0.010***	(7.26)	0.010***	(7.26)
CEO Age_{i,t}	0.009***	(7.34)	0.009***	(7.33)
Ln(CEO Salary)_{i,t}	-0.030*	(-1.81)	-0.030*	(-1.81)
Ln(CEO Bonus)_{i,t}	-0.009***	(-4.46)	-0.009***	(-4.47)
Ln(CEO LTIP)_{i,t}	0.004	(1.04)	0.004	(1.04)
Ln(CEO Restricted Equity Wealth)_{i,t}	-0.018***	(-9.44)	-0.018***	(-9.44)
Ln(CEO Unrestricted Equity Wealth)_{i,t}	-0.016***	(-7.54)	-0.016***	(-7.52)
CEO Over Optimism Investment_{i,t}	0.043***	(2.90)	0.043***	(2.91)
CEO Under Optimism Investment_{i,t}	0.046***	(2.97)	0.046***	(2.96)
Idio Vol_{i,t}	1.625*	(1.93)	1.615*	(1.91)
BTM_{i,t}	-0.002	(-0.16)	-0.002	(-0.17)
Size_{i,t}	0.028**	(2.31)	0.028**	(2.32)
ROA_{i,t}	-0.063	(-0.90)	-0.062	(-0.89)
Loss_{i,t}	0.014	(0.88)	0.014	(0.87)
Annual Return_{i,t}	-0.048	(-1.38)	-0.048	(-1.37)
Litigation Risk_{i,t}	-0.067	(-1.16)	-0.067	(-1.15)
Dividends_{i,t}	0.474	(1.01)	0.474	(1.01)
Share Repurchases_{i,t}	0.092	(0.80)	0.093	(0.80)
Goodwill Impairments_{i,t}	0.545	(1.63)	0.550	(1.64)
Restructurings_{i,t}	1.613	(1.58)	1.618	(1.58)
Writedowns_{i,t}	1.983*	(1.87)	1.979*	(1.86)
Capex_{i,t}	-0.073	(-0.50)	-0.073	(-0.49)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	8,256		8,256	
R-squared	0.339		0.339	
Within R-squared	0.102		0.102	

This panel reports the results of linear probability models in which $Turnover_{t+1}$ is regressed on one of two variables that measure CEO net purchase activity (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*), as well as control variables. The sample includes only firms either in the bottom quartile of its Fama French (1997) 48 industry stock performance or in the bottom quartile of all CRSP firms' stock performance over our sample. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0.* When net purchases are greater than 0, *Ln(Net Purchase)* equals the natural log of net purchases, and *Ln(Net Purchase)* equals zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10: CEO Purchases at Poor Performing Firms

Panel B: Logit

DV = *Turnover*$_{i,t+1}$

	Coeff.	*t*-stat	Coeff.	*t*-stat
Net Purchases Ind.$_{i,t}$	-0.299**	(-2.30)		
Net Sales Ind.$_{i,t}$	0.130	(1.02)		
Ln(Net Purchases)$_{i,t}$			-0.023**	(-2.16)
Ln(Net Sales)$_{i,t}$			0.009	(1.01)
CEO Tenure$_{i,t}$	0.132***	(10.24)	0.132***	(10.24)
CEO Age$_{i,t}$	0.081***	(8.80)	0.081***	(8.80)
Ln(CEO Salary)$_{i,t}$	-0.106	(-1.01)	-0.107	(-1.02)
Ln(CEO Bonus)$_{i,t}$	-0.063***	(-3.38)	-0.063***	(-3.37)
Ln(CEO LTIP)$_{i,t}$	-0.007	(-0.18)	-0.007	(-0.20)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.154***	(-9.26)	-0.154***	(-9.25)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.136***	(-8.32)	-0.136***	(-8.31)
CEO Over Optimism Investment$_{i,t}$	0.325**	(2.30)	0.324**	(2.30)
CEO Under Optimism Investment$_{i,t}$	0.488***	(3.51)	0.486***	(3.49)
Idio Vol$_{i,t}$	16.757**	(2.36)	16.686**	(2.35)
BTM$_{i,t}$	0.111	(1.00)	0.107	(0.97)
Size$_{i,t}$	0.227*	(1.95)	0.228**	(1.96)
ROA$_{i,t}$	-0.734	(-1.31)	-0.742	(-1.33)
Loss$_{i,t}$	0.089	(0.67)	0.087	(0.65)
Annual Return$_{i,t}$	-0.312	(-0.98)	-0.310	(-0.97)
Litigation Risk$_{i,t}$	-0.292	(-0.60)	-0.286	(-0.59)
Dividends$_{i,t}$	4.084	(1.08)	4.133	(1.09)
Share Repurchases$_{i,t}$	0.460	(0.39)	0.464	(0.39)
Goodwill Impairments$_{i,t}$	3.549	(1.38)	3.582	(1.39)
Restructurings$_{i,t}$	11.373	(1.53)	11.355	(1.53)
Writedowns$_{i,t}$	14.465*	(1.77)	14.351*	(1.75)
Capex$_{i,t}$	-0.872	(-0.60)	-0.873	(-0.60)
Firm FE	No		No	
Year FE	Yes		Yes	
Non-Singleton Obs.	8,256		8,256	
Log likelihood	-1083.7		-1084.1	

This panel reports the results of two logistic models in which *Turnover*$_{t+1}$ is regressed on one of two variables that measure CEO net purchase activity (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*), as well as control variables. The sample includes only firms either in the bottom quartile of their Fama French (1997) 48 industry stock performance or in the bottom quartile of all CRSP firms' stock performance over our sample. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0.* When net purchases are greater than 0, *Ln(Net Purchase)* equals the natural log of net purchases, and *Ln(Net Purchase)* equals zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 11: Stock ownership guidelines

	DV = *Performance-related Turnover$_{i,t+1}$*				
	(1)			(2)	
	Coeff.	*t*-stat		Coeff.	*t*-stat
Net Purchases Ind.$_{i,t}$	-0.021**	(-1.97)			
Net Sales Ind.$_{i,t}$	0.005	(0.87)			
Ln(Net Purchases)$_{i,t}$				-0.002*	(-1.90)
Ln(Net Sales)$_{i,t}$				0.000	(0.85)
CEO Tenure$_{i,t}$	0.004***	(6.77)		0.004***	(6.76)
CEO Age$_{i,t}$	0.004***	(6.84)		0.004***	(6.84)
Ln(CEO Salary)$_{i,t}$	-0.006	(-0.73)		-0.006	(-0.75)
Ln(CEO Bonus)$_{i,t}$	-0.005***	(-4.12)		-0.005***	(-4.12)
Ln(CEO LTIP)$_{i,t}$	-0.000	(-0.14)		-0.000	(-0.14)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.004***	(-5.31)		-0.004***	(-5.31)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.006***	(-5.93)		-0.006***	(-5.92)
CEO Over Optimism Investment$_{i,t}$	0.017**	(2.47)		0.017**	(2.47)
CEO Under Optimism Investment$_{i,t}$	0.016**	(2.12)		0.016**	(2.13)
Idio Vol$_{i,t}$	1.912***	(3.50)		1.907***	(3.49)
BTM$_{i,t}$	-0.014	(-1.33)		-0.014	(-1.34)
Size$_{i,t}$	0.015**	(2.53)		0.015**	(2.54)
ROA$_{i,t}$	-0.075	(-1.35)		-0.075	(-1.35)
Loss$_{i,t}$	0.010	(0.89)		0.010	(0.89)
Annual Return$_{i,t}$	-0.005	(-0.73)		-0.005	(-0.73)
Under Perform Industry$_{i,t}$	0.057***	(6.14)		0.057***	(6.14)
Absolute Poor Performance$_{i,t}$	0.064***	(6.68)		0.064***	(6.68)
Litigation Risk$_{i,t}$	-0.021	(-0.47)		-0.020	(-0.46)
Dividends$_{i,t}$	0.335	(1.57)		0.334	(1.57)
Share Repurchases$_{i,t}$	0.092*	(1.72)		0.092*	(1.72)
Goodwill Impairments$_{i,t}$	0.404	(0.99)		0.405	(0.99)
Restructurings$_{i,t}$	0.382	(0.50)		0.387	(0.51)
Writedowns$_{i,t}$	1.882*	(1.87)		1.878*	(1.87)
Capex$_{i,t}$	0.059	(0.76)		0.060	(0.76)
Firm FE	Yes			Yes	
Year FE	Yes			Yes	
Non-Singleton Obs.	14,643			14,643	
R-squared	0.201			0.201	
Within R-squared	0.079			0.079	

This table reports the results of linear probability models in which *Performance-related Turnover$_{t+1}$* is regressed on one of two variables that measure CEO net purchase activity (i.e., *Net Purchase Ind.* and *Ln(Net Purchase)*), as well as control variables. The sample in this table is comprised of observations where the firm has not adopted a stock ownership plan or where the CEO has already met the stock ownership guidelines. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0.* When net purchases are greater than 0, *Ln(Net Purchase)* equals the natural log of net purchases, and *Ln(Net Purchase)* equals zero otherwise. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 12: Unrestricted ownership as a substitute for commitment

DV = *Performance-related Turnover*$_{i,t+1}$

	Low Unrestricted Ownership		High Unrestricted Ownership	
	(1)		(2)	
	Coeff.	*t*-stat	Coeff.	*t*-stat
β_1 Net Purchase Ind.$_{i,t}$	-0.026***	(-3.22)	0.005	(0.56)
Net Sale Ind.$_{i,t}$	0.005	(0.93)	-0.003	(-0.59)
CEO Tenure$_{i,t}$	0.006***	(6.21)	0.003***	(5.06)
CEO Age$_{i,t}$	0.006***	(9.95)	0.004***	(6.38)
Ln(CEO Salary)$_{i,t}$	-0.055***	(-4.13)	-0.005	(-0.72)
Ln(CEO Bonus)$_{i,t}$	-0.006***	(-5.19)	-0.003***	(-2.80)
Ln(CEO LTIP)$_{i,t}$	0.001	(0.67)	-0.000	(-0.25)
Ln(CEO Restricted Equity Wealth)$_{i,t}$	-0.010***	(-9.30)	-0.004***	(-5.55)
Ln(CEO Unrestricted Equity Wealth)$_{i,t}$	-0.008***	(-8.06)	-0.004	(-1.47)
CEO Over Optimism Investment$_{i,t}$	0.026***	(3.38)	0.010	(1.58)
CEO Under Optimism Investment$_{i,t}$	0.026***	(3.37)	0.018***	(2.60)
Idio Vol$_{i,t}$	1.453***	(3.04)	0.735	(1.54)
BTM$_{i,t}$	-0.017*	(-1.72)	0.002	(0.22)
Size$_{i,t}$	0.022***	(3.31)	0.018***	(3.27)
ROA$_{i,t}$	-0.103**	(-2.11)	0.026	(0.55)
Loss$_{i,t}$	0.013	(1.44)	0.022**	(2.07)
Annual Return$_{i,t}$	-0.007	(-1.17)	0.002	(0.30)
Under Perform Industry$_{i,t}$	0.054***	(6.31)	0.044***	(5.33)
Absolute Poor Performance$_{i,t}$	0.073***	(8.25)	0.055***	(6.35)
Litigation Risk$_{i,t}$	-0.054	(-1.42)	-0.016	(-0.44)
Dividends$_{i,t}$	0.226	(0.97)	0.052	(0.31)
Share Repurchases$_{i,t}$	0.138**	(2.36)	0.007	(0.17)
Goodwill Impairments$_{i,t}$	0.549**	(1.99)	0.154	(0.44)
Restructurings$_{i,t}$	-0.153	(-0.27)	2.901***	(3.57)
Writedowns$_{i,t}$	2.116***	(2.69)	0.870	(1.05)
Capex$_{i,t}$	-0.037	(-0.42)	0.062	(0.98)
Test: Model (1) β_1 < Model (2) β_1	$p = 0.003$***			
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Non-Singleton Obs.	15,994		16,016	
R-squared	0.255		0.213	
Within R-squared	0.060		0.095	

This table reports the results of linear probability models in which *Performance-related Turnover*$_{t+1}$ is regressed on a variable that measures CEO net purchase activity (i.e., *Net Purchase Ind.*) and control variables. We estimate Model (1) using firm-year observations with CEO unrestricted equity below the sample median, and Model (2) using firm-year observations with CEO unrestricted equity above the sample median. We define a CEO as a net purchaser of stock in his or her firm when the total dollar value of the open market purchases exceeds the total dollar value of open market sales for the fiscal year. We set firm-years in which the CEO makes no open market trades as *Net Purchase Ind. = 0*. The test of β_1 between Model (1) and (2) is one-tailed. Variable definitions appear in Appendix A. T-statistics, based on standard errors that are clustered by CEO, are presented beside the coefficients with *, **, and *** representing statistical significance at the 10%, 5%, and 1% levels, respectively.