The Impact of CEO Turnover on Equity Volatility

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Abstract

A change in executive leadership is a significant event in the life of a firm. Our paper investigates a potentially significant consequence of a CEO turnover: a change in equity volatility. We develop several hypotheses about how CEO changes might affect stock price volatility, and test these hypotheses using a sample of 872 CEO changes over the 1979-1995 period. We find that volatility increases following a CEO turnover, even for the most frequent type, when a CEO leaves voluntarily and is replaced by someone from inside the firm. Our results indicate that forced turnovers, which are expected to result in large strategy changes, increase volatility more than voluntary turnovers. Outside successions, which are expected to result in a successor CEO with less certain skill in managing the firm's operations, increase volatility more than inside turnovers. We also document a greater stock-price response to earnings announcements around CEO turnover, consistent with more informative signals of value driving the increased volatility. Controls for firm-specific characteristics indicate that the volatility changes cannot be entirely attributed to factors such as changes in firm operations, firm size, and both volatility change and performance prior to the turnover.

I. Introduction

A change in executive leadership is a significant event in the life of a firm. A chief executive officer's ability, preferences, and ultimate decisions may affect the firm through the projects the firm selects, its financial policy, or the corporate culture. To the extent that these characteristics and the resulting decisions differ across individuals, CEO changes can alter the course of the firm and its performance.

Many studies have analyzed the short-run impact of CEO changes on shareholder wealth, and the longer-term effects on firm operations. In general, a CEO turnover is followed by positive excess returns and restructuring of firm operations. Furtado and Karan (1990) cite 10 studies that estimate the announcement effect of CEO changes. They find that abnormal returns around the announcement are typically 25-50 basis points for all changes, and increase to 1% to 3% for certain subsamples. Denis and Denis (1995) find changes in operating performance, the level of corporate control activity, and asset restructuring around turnover, especially forced departures. Weisbach (1995) shows evidence that new CEOs often reverse the investment decisions of their predecessors, a tendency that is independent of the cause of the predecessor's departure. Huson, Malatesta, and Parrino (1999) document an increase in accounting performance subsequent to CEO turnover, especially for turnovers associated with outside succession.

Our paper investigates another potentially significant consequence of a CEO turnover: a change in equity-return volatility. We analyze changes in stock-market volatility for turnovers in general, and by departure type and source of the successor, for a sample of 872 CEO changes over the 1979-1995 period. We find a significant and long-lived volatility increase associated with forced turnover. Volatility increases are greater for forced than voluntary turnover, and volatility increases are greater for outside than for insider succession.

We also analyze the stock-price response to information announcements around CEO turnover using earnings response coefficients. We find that stock-price sensitivity to the unexpected component of quarterly earnings announcements increases following a turnover. This result is consistent with our volatility findings, where part of the increased volatility may be

due to signals of firm value that are more informative following turnover.

It is possible that the observed link between turnover and volatility might be due to other firm-specific characteristics such as firm size or historical stock-price performance. For example, the poor performance that typically precedes the forced departure of a CEO is likely to cause the firm to be smaller and more levered (all else equal) around forced departures, characteristics which are associated with increased volatility (e.g., see Black 1976; Christie 1982; and Hawawini and Keim 1995).[1] As we show below, we also find an increase in volatility during the period prior to the announcement. So, another alternative hypothesis is that we are observing firms with increasing volatility that happened to experience CEO turnovers and that we are mistakenly attributing the effect to the turnover event.

To test whether these firm-specific characteristics are driving our results, we construct two matching samples of firms of similar size, one based on historical stock-return performance as of the announcement date, and one based on the pre-event change in volatility. We compare the volatility changes of the turnover and matching-sample firms and find that CEO turnover type is informative, even when the effects of size, historical performance, and pre-event changes are taken into account. We also analyze changes in company operating characteristics and find that these changes do not fully explain the volatility differences that we observe across turnover types. We conclude that different turnover types, controlling for other factors, have different effects on future volatility.

The volatility consequences of a turnover are important because a change in stock price volatility may have a meaningful impact on the firm, its management, and its stakeholders. A change in volatility may affect a firm's optimal capital structure, cost of capital, optimal allocation of control rights, and may result in a wealth transfer between stockholders and bondholders. Higher stock-price volatility may magnify agency problems, complicate implementation of pay-for-performance policies, and decrease the ability of the board to

[1] Many papers find a connection between poor performance and CEO turnover. For examples, see Coughlan and Schmidt (1985) , Weisbach (1988), and Parrino (1997).

determine a manager's ability using observed performance. Increased volatility may also limit a stock's attractiveness as a means of compensation or as a currency for acquisitions. For example, a recent popular press article cites high stock-market volatility as a rationale for Bertelsmann rebuffing a merger attempt by AOL (Ewing 2000). Another article describes an internet company's (E-Loan's) inability to use its volatile shares to make acquisitions (Hof and Saveri 1999). These effects imply that the expected volatility impact may be an important factor for the board in planning a CEO succession strategy.

While economic significance is a matter of opinion, we believe the effects we estimate to be economically meaningful. For example, depending on the controls used, we find a volatility increase for forced departures of approximately 16% to 25% for the year following the event. This corresponds to six to 10 percentage points for an average forced-departure firm. One informal way to gauge significance would be to estimate the change in the value of an at-the-money call option as a result of this volatility increase. A one-year at the money call option on our average forced-departure firm's equity would increase in value by around 14% using the conservative end of our predicted effects.[2]

At one end of the spectrum, an orderly succession from a retiring CEO to the firm's long-time president or chief operating officer — e.g., the "passing the baton" model of Vancil (1987) — might be expected to add little uncertainty about the future prospects of the firm. In such a case, it seems likely that the market would expect the incoming CEO to continue to lead the firm in its current direction. Furthermore, there would likely be less uncertainty about the new CEO's ability to manage the particular firm, *ceteris paribus*, because the new CEO was previously an officer of the firm.

At the other end of the spectrum, the replacement of a fired CEO with an outsider might add a significant amount of uncertainty about the future direction of the firm. This type of turnover might signal the board's desire for a drastic change in the firm's strategy. The expected change in

[2] Specifically, this estimate relies on the Black-Scholes (1973) model, with no dividends, stock and strike prices of $50, a risk-free rate of eight percent, a beginning volatility of 40% (roughly our sample average for firms with forced departures) and change in volatility of 7 percentage points (using the coefficient estimates of Table 5).

strategy, enacted by a leader without significant experience within the firm, could lead to a larger increase in the uncertainty over the future success of the firm. It is also possible that this type of turnover might result in a decrease or unchanged level of volatility. For example, a replacement CEO with better skill in project selection might implement projects with higher expected returns and lower risk than the projects of the outgoing CEO. Thus, different types of CEO departure (firing versus retirement) and succession (inside successor versus outside successor) may add differing degrees of uncertainty about firm prospects. This is consistent with our results; forced departures and outside successions are associated with greater volatility increases.

We develop three hypotheses of CEO succession which lead to different predictions of turnover's impact on volatility: the *strategy hypothesis*, the *ability hypothesis*, and the *scapegoat hypothesis*. These are designed to differentiate between the possible ways that the circumstances surrounding the departure of the incumbent CEO, as well as the source of his or her successor, affect the degree to which uncertainty (and volatility) increase following turnover.

The next section discusses the economic impact of an increase in volatility. Section III develops our hypotheses about volatility and CEO turnover. Section IV discusses the data, and Section V presents our empirical results. Section VI concludes.

II. Economic impact of a volatility increase

The volatility impact of a CEO turnover is important for several reasons. For example, equity volatility has different costs for different stakeholders in the firm. Volatility increases may exacerbate conflicts between stockholders and bondholders, and may hinder resolution of stockholder-management problems. Furthermore, increased volatility may be a cost to the firm due to increased costs of raising capital and less attractive medium for acquisitions or compensation. To the extent that these effects imply a marginal cost of increased volatility (or possibly a marginal benefit), the expected volatility impact should also be a factor for the board in planning a CEO succession strategy.

In general, increases in stock-price volatility are associated with a wealth transfer from

bondholders to stockholders. The Merton (1974) model provides strong predictions about linkages between equity volatility and the value of debt and equity claims. In this model, an increase in equity volatility is associated with an increase in asset volatility. Higher asset volatility raises the probability that firm assets will not meet liabilities, resulting in default. Thus, an increase in equity volatility decreases the value of the claims of bondholders. Higher equity volatility might also lead to a lower credit rating and a higher cost of future debt issuance.

In Merton's model, equity is a call option on firm assets with an exercise price equal to the face value of outstanding debt. An increase in volatility results in greater upside potential and no change in downside risk for equity claims, which increases their value. Equity volatility increases are also beneficial to holders of equity options.[3]

Increased volatility might also imply an increase in the required return to the firm's equity. Kalay and Loewenstein (1985) and Bhagat, Brickley, and Loewenstein (1987) argue that "information risk" — undiversifiable risk associated with event-specific information announcements — may be priced by the market. When this type of risk increases, expected returns will increase. Using equity return standard deviation as a proxy for information risk, these papers provide empirical evidence that expected returns increase after dividend announcements and during tender offer periods.

Stakeholders might favor different types of turnover to take advantage of different volatility impacts. Previous theoretical work has typically made an assumption as to the effect of managerial replacement on volatility, without the benefit of empirical evidence. Which direction the change is assumed to take can have important implications for the results of these models. Dewatripont and Tirole (1994) analyze the relations between the financial structure of a firm, the return streams of the firm's securities, and the incentives to intervene in management. Their Assumption 1 (p. 1031) is that the riskiness in firm value is reduced following turnover. This assumption has important implications in their model. For example, it implies that when debtholders are in control, they will be "excessively tough" in replacing management following

[3] In the Black-Scholes (1973) model, increases in volatility increase the option price.

poor performance.

In contrast, Berkovitch and Israel (1996) and Grinstein (2000) assume that volatility increases following managerial replacement. They show that when residual claimholders have control rights, they are more likely to make changes that result in volatility increases. In Berkovitch and Israel (1996), when manager ability is unknown ex-ante, then for the firm to commit to an optimal dismissal policy that involves firing above-average managers, it must give control rights to the residual claimants. However, if the optimal policy is to dismiss only below-average managers, then the firm must give control rights to the fixed claimants. Crucial to these results is the assumption that replacing the manager increases the uncertainty of future cash flows. If replacing the manager leads to less volatility, then the optimal allocation of control rights could be reversed. In related work, Grinstein (2000) addresses the optimality of selling the firm's assets or replacing the manager in the event of poor performance. Thus, the volatility change subsequent to a CEO turnover has implications concerning the optimal capital structure and the allocation of control rights.

Increased stock-price volatility could also impact a firm's ability to use its stock in acquisitions, issue debt or equity, and use stock-market performance as a metric for managerial performance. Volatility changes also affect distortions arising from incentive problems – caused, for example, by executives or employees holding undiversified portfolios. If the firm's management and shareholder preferences over volatility differ, changes in volatility could exacerbate agency problems. If managerial ability is unknown but related to firm performance, increased stock-price volatility would also reduce the board's (or stockholders') ability to revise their beliefs about managerial talent or ability. A model that captures both of these effects is Gibbons and Murphy (1992). In their model, managerial ability is unobservable, managers are risk averse, and shareholders are risk neutral. In this setting, increased noise or volatility in the profitability signal would lead to less precise revisions of beliefs about managerial ability. It would also change the optimal managerial contract due to the risk aversion of the manager; a manager would demand a higher expected wage, *ceteris paribus,* if his or her wealth were based

on a noisier signal. Similarly, Campbell and Kracaw (1987) argue for the benefit of hedging by showing how a decrease in volatility leads to increased managerial effort in equilibrium.

To the extent that a turnover results in a (marginally) costly increase in volatility, the optimal dismissal strategy of the board will be affected. In this case, a turnover should only occur when the prospective gains from turnover (e.g., better management skill) outweigh the costs (including those from volatility). High volatility costs might lead the board to choose a lower performance threshold below which the manager would be the dismissed (e.g., Hartzell 1998).

III. CEO turnover and firm performance

The CEO may have a major influence on investment decisions, financing decisions, and operating policies of the firm. A change in the CEO can represent a structural break in the operations of the firm. If the CEO's decisions have a major effect on firm performance, we would expect to potentially observe changes in the characteristics of the return series following a turnover, including changes in the volatility. There are two ways a new CEO can significantly affect firm performance. The first is through changes in the strategy of the firm (investment, operations, and financial), and the second is through ability to implement the new strategy. A third possibility is that a change in CEO does not significantly affect firm performance. This may occur when alternative CEOs have similar abilities and implement analogous strategies. In this section, we discuss three theories of CEO replacement and explore their implications for equity volatility changes around CEO turnover.

A. Board decisions and the strategy hypothesis

The CEO makes decisions regarding the strategic direction of the firm. In the event of a turnover, the board of directors has discretion over the selection of the new CEO. The board is likely to choose a CEO they expect will implement a successful business strategy. When the current business strategy is performing well, it is reasonable to expect that the board will select a successor CEO who will in turn be unlikely to significantly alter the firm's strategy. When the current business strategy is performing poorly, the board is likely to choose a successor CEO

with new plans for the firm. This model of CEO selection focuses on the desire of the board to maintain or change the strategy of the firm.

Regardless of the cause of CEO turnover (retirement or termination), the board can use the opportunity to replace the CEO as a means of controlling the future direction of the firm. If the board wishes to keep the current strategy, they are likely to choose an inside successor. An inside successor is likely to have been "groomed" by the company, and may be expected to continue to operate the company in a manner similar to that of the departing CEO. Thus, under the strategy hypothesis, we would not expect to see an increase in volatility following the appointment of an insider as CEO.

Alternatively, the board may choose to replace the CEO with someone from outside the firm. This occurs when there are no acceptable candidates within the firm, or when the board decides the firm needs to move in another direction. For example, Helmich and Brown (1972) find that organizational change increases following outside succession. As the firm changes its underlying business strategy, uncertainty about the future plans of the firm may increase, leading to increased stock-price volatility. In contrast to inside succession, we would expect outside succession to be associated with a volatility increase due to the uncertainty over the new strategy of the firm.

The board of directors also makes decisions regarding the firing of the CEO, although a CEO may voluntarily leave the firm at any time. The retirement of the CEO is an example of a voluntary turnover, i.e., one not initiated by the board. Since this is not a decision of the board, we would not expect the voluntary departure of the CEO to be correlated with the board's desire to move the firm in a new direction. Thus, we would not expect voluntary departures to be associated with an increase in volatility due to the board desire to change the firm's strategy.

A forced turnover occurs when the board is dissatisfied with the existing CEO. If the board wishes to move the firm in a new direction and feels the current CEO cannot perform the task, the board dismisses the CEO. We should only observe forced turnover when the board is dissatisfied with the results of the existing CEO. Hence, forced turnover signals that the existing

firm policies are inadequate, and that substantial changes are required. We expect a firm to change strategy and policies following a forced turnover, leading to a period of higher stock-price volatility.

We refer to this line of reasoning as the *strategy hypothesis*. The strategy hypothesis posits that volatility increases after a turnover are the result of uncertainty about the nature of the strategy that will be implemented by the new CEO. The magnitude of the increase in volatility should depend on how significantly the new strategy is expected to differ from the old strategy. This volatility increase will diminish as the market learns about details of the plans, and their likelihood of success or failure. This hypothesis implies that voluntary departures followed by an inside replacement will not result in a volatility change, while forced departures (especially when followed by outside replacements) will result in a significant volatility increase.

B. Learning models and the ability hypothesis

An alternative (though not mutually exclusive) model of CEO selection is based on unknown CEO ability. When the CEO departs, the board of directors chooses the best replacement CEO based on expected ability. In these models, the board of directors and investors learn about the CEO's ability over time after the CEO is hired. For example, MacDonald (1982) shows that learning may lead to changes in tasks, while Murphy (1986) and Gibbons and Murphy (1992) use learning models to address compensation issues.

Based on this model of CEO selection, a CEO turnover is expected to lead to increased uncertainty about future firm performance and increased stock-price volatility as the market learns about the ability of the new CEO. The magnitude of the volatility increase should depend on the level of uncertainty about the skills of the new CEO. If the CEO is from inside the firm, the market and board are likely to have a more precise initial evaluation of the CEO's ability to run the firm. If the CEO is from outside the firm — especially if he or she is from outside the industry — the market and board are likely to have a less precise estimate about initial ability,

and the early signals of performance should be especially informative. Hence, we expect to observe higher volatility after a turnover with outside successions relative to inside successions.[4]

In a learning-model setting, the dismissal of an existing CEO occurs when the expected ability of the current manager based on past performance drops below the expected ability of a replacement CEO. If there is a cost to change the CEO, the expected improvement of the new CEO must outweigh the replacement cost for a dismissal to be optimal.[5] The change in volatility due to learning the new CEO's ability will be based solely on the precision of beliefs about the new CEO compared to the precision of beliefs about the departing CEO. The *type* of departure by the old CEO (voluntary or forced) should have no effect on the volatility change.[6]

We refer to this line of reasoning as the *ability hypothesis*. The ability hypothesis predicts that volatility increases after a turnover are due to investor uncertainty about the skill of the new CEO in managing the existing operations of the firm. Based on this prediction, we expect stock-price volatility to increase following a turnover as the market learns the ability of the new CEO. We expect this increase in volatility to be larger for outside successions, due to the limited information about an outsider's ability to run the company relative to an insider. We would not expect the type of departure (forced or voluntary) to affect the stock-price volatility under the ability hypothesis.

C. Agency models and the scapegoat hypothesis

The *scapegoat hypothesis* is based on the agency models of Holmstrom (1979), Shavell (1979), and Mirrlees (1976).[7] These models imply that a credible dismissal threat is necessary to ensure optimal exertion of effort by the incumbent CEO. In these models, all CEOs have equal ability, and differences in firm performance are due to the level of effort exerted and chance.

[4] It is worth noting that it is very rare that a CEO leaves one firm to be CEO of another firm. Thus, outside replacements typically have track records based on their performance as a non-CEO executive, not as CEO of another firm.

[5] The exact firing rule would also depend on the model's assumptions about contract renegotiation.

[6] We are assuming that the CEO has no advantage over the board in choosing a high-ability successor. In other words, a CEO leaving voluntarily who helps pick a successor from outside the firm does so with no more precision than a board picking an outside successor following a forced departure.

[7] Huson, Malatesta, and Parrino (1999) develop the implications of this hypothesis (or lack thereof) on accounting performance. We extend the analysis to discuss the implications on stock price volatility.

In equilibrium, the board of directors commits to a policy of manager dismissal after poor firm performance. This policy induces all managers to exert the optimal level of effort. Dismissal occurs when there is poor performance due to chance, and a replacement manager (with equal ability) is selected. Since firing occurs due to random factors that result in poor firm performance, rather than the ability or effort of the CEO, the CEO appears to be a "scapegoat."

The *scapegoat hypothesis* implies that volatility is unaffected by a CEO turnover. All managers have the same ability and exert the same effort, so the characteristics of the firm (including firm volatility) do not change after a turnover. The type of succession and type of departure convey no information about the future volatility of the firm. Of course, this is an extreme version of this hypothesis. An alternative hypothesis, which is difficult to distinguish empirically, is that the uncertainty over the new CEO's ability is very small. For example, screening mechanisms for selecting CEOs may be so developed that there is little difference in uncertainty between the incumbent and new CEOs.

The volatility effects implied by the strategy hypothesis, ability hypothesis, and scapegoat hypothesis are summarized below:

	Type of Departure		**Type of Succession**	
	Voluntary	*Forced*	*Inside*	*Outside*
Strategy Hypothesis	No change	Increase	No change	Increase
Ability Hypothesis	No change	No change	Increase	Larger increase
Scapegoat Hypothesis	No change	No change	No change	No change

IV. Data and descriptive statistics

Changes in top executives are identified using the *Forbes* executive compensation surveys over the 1979-1995 period. In order to qualify for the sample, both the departing and incoming CEO must have appeared in the survey. For each change, the announcement date is obtained from the *Wall Street Journal*.

Of particular interest is the nature of the change in management. We classify each turnover as either forced or voluntary, and each succession as inside or outside. Forced departures are those for which (1) the announcement says that the departing CEO was forced out or fired, or (2) the departing CEO is under the age of 60 and does not leave for health reasons or to go to another firm. All other departures are voluntary. Outside successions are those for which the incoming CEO has been with the firm for less than one year, and all other successions are classified as inside.[8]

Each turnover is matched with stock-price data from the Center for Research in Security Prices (CRSP), and where available, accounting data from Compustat. We collect returns for each firm for two years before and four years after the announcement date. We also collect each firm's total assets, net sales, and operating income for two fiscal years before and after the fiscal year of the event. These accounting data are converted into 1983 dollars. Our proxy for the market return is the CRSP value-weighted index.

[INSERT TABLE 1 ABOUT HERE]

Table 1 shows the distribution of turnovers by type and year for our sample of 872 events. As the table shows, forced departures are fairly uncommon using our proxy, at about 17% of both the full sample and Compustat subsample. This frequency is similar to that found previously; Mehran and Yermack (1996) find 15% of turnovers in their sample are forced, and Denis and Denis (1995) find 13.6%. Outside successions are slightly more common, at approximately 21% of the events. The events are well dispersed over time, with no year having more than 10% of the total sample.[9] Panel B presents the distribution of turnovers across the four pairs of departure- and succession-types. Voluntary departure followed by insider succession is the most common event, comprising almost 72% of the sample. The other three

[8] Subject to slightly different arbitrary cutoffs, these proxies for turnover types are similar to those used earlier in the literature. For examples of forced/voluntary turnover classification, see Weisbach (1988), Denis and Denis (1995), Mehran and Yermack (1996), Parrino (1997), Denis, Denis, and Sarin (1997), and Hartzell (1998). Borokhovich, Parrino, and Trapani (1996) use an identical definition of inside/outside succession.

[9] The 1995 *Forbes* survey yields a small number of announcements in 1995, hence the small number of events for that period.

pairs – voluntary departure/outside succession, forced departure/inside succession, and forced departure/outside succession – are almost equally common, at 11%, 8%, and 10% of the sample, respectively.

[INSERT TABLE 2 ABOUT HERE]

Table 2 details the summary statistics for the sample. This table previews the findings of the formal tests in the next section. Pre-event (annualized) daily volatility for the two years prior to a turnover averages 30.9% with a median of 27.7%. These increase to 34.9% and 28.1%, respectively, for the two years following a turnover.

Average volatility is higher prior to a forced turnover and increases by a larger amount after a forced turnover. For the forced-turnover subsample, pre-event mean (median) volatility is 39.6% (35.2%), followed by 53.8% (36.3%) after the event. To a lesser degree, outside successions are also associated with higher volatility than the overall sample, with pre-event mean (median) of 39.5% (34.6%) and post-event mean (median) of 48.3% (34%). Table 2 also shows that inside successions are associated with larger firms, based on net sales, operating income, or total assets as a proxy for firm size. In addition, voluntary turnovers are associated with larger firm size, using net sales or operating income as a proxy for size. Voluntary turnovers are associated with smaller firm size using total assets as a size proxy. Furthermore, forced turnovers are associated with slower asset growth following turnover.

Figure 1 graphically depicts changes in volatility for the entire sample, and by turnover type. In constructing the figure, returns are separated into 24 event months before and 48 event months after the announcement date, where each event month consists of 21 trading days. We calculate volatility as the standard deviation of daily returns for each event month. In order to control for the overall level of stock-market volatility, we then scale this firm-specific volatility by the standard deviation of the market return over the same period. For each event month, these ratios are averaged across events.

[INSERT FIGURE 1 ABOUT HERE]

The figure is consistent with the summary statistics in Table 2. Volatility is higher for the full sample following turnover. Volatility is also higher for the outside-succession and forced-departure subsamples. Forced departures experience the biggest increase on average, and the announcement is preceded by an increase in volatility over the year prior to the event. Interestingly, the increase in volatility after turnover appears to persist over several years subsequent to the event. While Table 2 and Figure 1 are consistent with volatility increasing around turnover – especially for forced departures and outside successions – this evidence is descriptive rather than rigorous. The next section follows up with formal tests of the volatility impact of different types of CEO turnover.

V. Empirical tests

A. Testing the strategy hypothesis, ability hypothesis, and scapegoat hypothesis

The scapegoat hypothesis predicts that CEO turnover will not affect volatility regardless of type of departure and type of succession. In contrast, the strategy and ability hypotheses predict that volatility will increase following a turnover, and that the magnitude of the volatility increase will depend on the turnover type. The strategy hypothesis implies that forced departures and outside successions will be followed by increases in volatility. The learning hypothesis implies that outside successions will lead to increased volatility, but that the type of departure does not matter. The strategy and ability hypotheses are not mutually exclusive, and the evidence may support both hypotheses.

We empirically test these hypotheses using several techniques that are described in detail in the following sections. Section B summarizes previous studies that analyze the impact of corporate events on firm volatility. Section C proposes and implements volatility regression tests to measure the relationship between turnover type and volatility. In Section D, we further explore evidence for changes in the operating characteristics of the firm that would be associated with the strategy hypothesis. Section E presents an analysis of the return sensitivity to earnings news before and after a turnover, suggesting a possible mechanism by which volatility would

increase after a turnover event. Section F presents evidence on competing hypotheses in an effort to ensure that the volatility effects of different turnover types cannot be attributed to firm-specific factors.

B. Volatility event studies

A number of papers have considered the impact of corporate events on firm volatility. For example, Dodd and Ruback (1977) and Bhagat, Brickley, and Loewenstein (1987) investigate the volatility effect of cash tender offers. Mandelker (1974) and Vijh (1994) report volatility changes due to mergers and spinoffs. Ohlson and Penman (1985) and Dubofsky (1991) analyze the volatility impact of stock splits. Dann, Masulis, and Mayers (1991), Hertzel and Jain (1991), and Bartov (1991) estimate volatility changes around stock repurchases. Kalay and Loewenstein (1985) and Jayaraman and Shastri (1993) consider the volatility effect of dividend announcements and increases. Finally, Cornell (1978) discusses the effect of earnings announcements on volatility, and Brown, Harlow, and Tinic (1988) analyze the effect of major corporate announcements on volatility.

Several papers compare option implied volatilities before and after the event to measure the volatility impact. Mayhew (1995) reviews the literature related to these "implied volatility event studies"; a subsequent related paper is Donders and Vorst (1996). However, the majority of papers perform a volatility event study based on a comparison of the variability of equity price changes before and after the event to determine the volatility impact of the event. For example, Bhagat, Brickley, and Loewenstein (1987) compare pre-event and post-event standard deviations using a t-test, Wilcoxon test, and Fisher sign test. Ohlson and Penman (1985) compare the proportion of post-event squared returns that exceed pre-event squared returns using Cochran's z-statistic. Dubofsky (1991) uses a regression of log-ratios of pre-event and post-event variance on explanatory variables.

C. Volatility regression tests

In this section, we analyze volatility changes around turnover events using regression tests similar to those of Dubofsky (1991). We construct the log-ratio of post-event to pre-event

standard deviations (the "volatility ratio") as the dependent variable. We construct independent variables using indicators for the departure type (equal to one for forced, zero for voluntary) and for succession type (equal to one for outside, zero for inside). The regression coefficients of the indicator variables measure the average volatility change due to the particular turnover or succession type. White (1980) robust standard errors are used to obtain the correct significance levels and robust t-statistics for parameter estimates in the presence of heteroscedasticity.

In order to mitigate announcement effects, and to test for persistence in volatility changes, we use the volatility two years prior to the event as the base level and then compare this to the yearly volatility for each of the four years after the turnover. This also allows us to determine if there is a significant volatility increase prior to the turnover as suggested by Figure 1.[10] In order to control for changes in market volatility over the same period, we calculate for each event the volatility ratio for the CRSP value-weighted index over the identical sample window.

Columns two through six of Table 3 report the volatility regression results for the volatility changes in the four years following the turnover relative to the base-period volatility. When firm returns are positively correlated with market returns, we expect to find a significant positive correlation between firm and market volatility. Our control for market volatility is highly significant in each regression, with a p-value of less than 1%, which is consistent with our prior.

[INSERT TABLE 3 ABOUT HERE]

More importantly, the intercept in all five regressions is statistically significant at the 5% level implying that stock-price volatility increases after all turnovers, regardless of succession or departure type. This evidence is inconsistent with the scapegoat hypothesis, which predicts no volatility change following a turnover, and is consistent with the ability hypothesis, which predicts an increase in volatility due to increased uncertainty about the CEOs effectiveness. Based on the intercept coefficient in column two, a routine turnover (voluntary departure

[10] Similar regressions were run for all tests using the year prior to the turnover as the base level volatility (i.e., the denominator in our ratios), and the main findings of this paper are not affected by the choice of base level volatility period. Specifically, volatility is significantly higher following turnover, and the change in volatility is significantly larger for forced departures.

followed by an inside succession) is associated with a volatility increase of 4% in the first year after the turnover. The intercept is also significant in columns three through five, indicating that the volatility increase persists for at least four years. In addition, outside successions and forced departures result in even larger volatility increases over one year and three years following turnover, respectively.

The coefficients on the turnover-type indicator variables (the forced dummy) provide evidence that supports the strategy hypothesis. The regression results show that volatility is 24%, 22%, and 17% higher on average for forced turnovers compared to voluntary turnovers in the three years after the turnover. This volatility increase due to forced turnover is approximately seven times the increase for non-forced turnover. This result is not predicted by the ability hypothesis, which asserts that there should be no difference in volatility based on manner of departure. This result is also inconsistent with the scapegoat hypothesis, under which we would expect no change in volatility.

The lack of a volatility effect due to a forced turnover in the fourth year indicates that (on average) the forced departure and resulting changes in CEO firm strategy do not have a permanent effect on the riskiness of the firm's returns to shareholders. The temporary nature of the volatility change is consistent with a market that is initially uncertain about the characteristics of the firm's new direction, and likelihood of success of the new strategy to be implemented by the new CEO. As the nature of the strategy is revealed through its implementation and the success of the strategy is revealed through new results (e.g., reported sales or earnings), the added uncertainty dissipates.

The coefficient on the succession-type indicator variable (the outside dummy) supports both hypotheses. The regression results show that an outside succession (relative to an inside succession) leads to an average 9% increase in volatility in the year following the turnover. The succession type variable is not significant in years two or three (and is actually negative and significant in year four), indicating that the volatility increase lasts about one year. This evidence is consistent with the implications of the ability hypothesis: there is a temporary

increase in volatility associated with an outside succession — above that of an inside succession — due to greater uncertainty about the skill of an outsider versus an insider in running the firm. This result is also consistent with the strategy hypothesis, which posits that the board chooses outside replacements when they want the firm to change strategy. This uncertainty, however, is notably less than that associated with forced departures, and of a much shorter duration. The finding of a volatility increase associated with an outside succession is inconsistent with the scapegoat hypothesis.

These results suggest that the source of the successor CEO has comparatively less economic significance than the circumstances of the incumbent's departure. In the year after a turnover, forced departures increase volatility by approximately two-and-a-half times the increase attributed to outside successions. Furthermore, the change due to forced departure lasts about three times as long as the change due to outside succession.

Alternative specifications (not reported here) lead to similar conclusions. Specifically, interactions of the forced and outside dummy variables are insignificant, indicating no multiplicative effect between departure type and source of successor. Also, when we add to the base regressions a dummy variable equal to one for successor CEOs from outside the firm's industry, the coefficient on this outside-industry variable is insignificant and the base outside-succession dummy variable retains its significant coefficient for the first year following turnover. Thus, the fact that the replacement CEO is from outside the industry does not appear to add uncertainty beyond the fact that he or she comes from outside the firm.

D. The strategy hypothesis and the operating characteristics of the firm

To further analyze the strategy hypothesis, it is useful to examine evidence of significant changes in firm operating characteristics after a forced turnover and outside succession, which would be expected if the firm implemented a major strategy change. For example, Denis and Denis (1995) find evidence of large changes in operating characteristics and firm size around forced turnover. We also would expect to find little change in operating characteristics for voluntary turnovers and inside succession. Of course, it is possible that new CEOs make similar

changes following voluntary departures compared to forced departures. For example, Weisbach (1995) finds that new CEOs are equally likely to reverse the investment decisions of their predecessors following a forced departure as a voluntary one.

To proxy for changes in firm strategy and operating practices, we calculate five accounting-based variables for the set of events for which Compustat data is available. First, we calculate the percentage change in total assets (net of inflation) from the fiscal year prior to the turnover (t-1) to two fiscal years after the year of the turnover (t+2).[11] By using the prior year as our base year, we start with firm numbers prior to any large write-offs commonly associated with a turnover (e.g., Murphy and Zimmerman 1993). We also calculate the percent change in net sales over the same interval, and the change in operating income, scaled by total assets at time t-1. To proxy for firm restructuring, we calculate the absolute value of the sum of extraordinary items for the year of and year following turnover, scaled by total assets at time t-1. We expect large assets sales to also be associated with changes in structure and strategy; we proxy for this by dividing the total cash from asset sales in years t and t+1 by total assets at time t-1.

Table 4 presents means of these variables by type of departure and succession. As Panel A shows, our sample seems to mirror the results found by Denis and Denis (1995). Forced turnovers are associated with significant decreases in total assets and net sales relative to all turnovers, but are not associated with changes in operating income. Forced departures are also associated with greater extraordinary items and cash from asset sales relative to voluntary departures. Outside successions are associated with significantly lower changes in assets compared to inside successions, but none of the other operating characteristics are significantly different across succession types. This is a univariate analysis, however. As Table 1 shows, many inside successions are also voluntary and Panel A does not separate the effects of departure relative to those of succession.

[INSERT TABLE 4 ABOUT HERE]

[11] The accounting data is collected for fiscal years, so it does not match the timing of our volatility calculations. The fiscal year of the turnover is considered year 0. Year –1 is the fiscal year prior to the fiscal year containing the turnover. This overlaps with, but is not the same as, year –2 of the volatility calculations.

In order to separate these effects, Panel B of Table 4 further subdivides the sample into departure-type/succession-type pairs. These results show that there are significant differences in our proxies for operating changes for forced turnover compared to voluntary, independent of the source of the successor (although the differences are largest for inside succession). Inside and outside successions have little differences in operating measures in either subsample, with the exception of lower asset growth for outside successions following voluntary departures compared to inside successions.

While these results are related to those of Weisbach (1995) and Huson, Malatesta, and Parrino (1999), they are not directly comparable. Weisbach tracks investment and divestiture decisions around CEO turnover, while we only proxy for these decisions using Compustat data. That said, we do find differences in firm size and restructuring activity across types of departure, where he did not. Huson et al. look for changes in operating performance following inside and outside succession, and find that outside succession is associated with a greater improvement in operating return on assets. Our results are over a shorter window, and we track the change in operating income scaled by beginning firm size rather than the change in scaled operating income. We are more interested in finding changes in strategy that might be associated with changes in the level of income than changes in the quality of firm performance.

The results of this section document a relation between departure type and changes in operating characteristics of the firm. Consistent with the strategy hypothesis, forced departures are associated with larger changes in firm operations than voluntary departures. Outside successions are associated with lower growth in assets, but not with any of the other proxies for changes in operations. These results are consistent with the volatility changes in the previous section being due at least in part to changes in firm strategy.

E. News and volatility: An earnings response analysis

The previous sections have documented significant increases in stock-price volatility following CEO turnover. In an efficient market, the volatility we observe should be associated with new information being incorporated into prices. Turnover could increase volatility in two

ways: the volume of relevant firm-specific news could increase following turnover, or there could be an increase in the importance of each news item. For example, consider a firm-specific news release of performance data (e.g., an earnings announcement). For a given deviation from expected value, such a release should be more informative for a new CEO compared to his or her predecessor. Whether the release provides information about the new CEO's ability or the viability of his or her strategy, the market is likely to have less precise prior beliefs about the new CEO (i.e., ability or strategy) and therefore should place greater weight on the announcement or signal. Thus, for a given announcement, one would expect to see a greater stock-price reaction for a new CEO compared to the incumbent prior to departure.

Systematically measuring the stock-price response to all firm-specific information is impossible, so we concentrate on quarterly earnings announcements, which are frequent firm-level announcements with measurable ex ante expectations. This approach allows us to test for differences in the magnitude of response to new information before and after CEO turnover. Given the evidence on increased volatility following turnover, our hypothesis is that we should observe greater stock-price response to information in general and earnings announcements in particular following CEO turnover.

We use the standard earnings-response-coefficient methodology to analyze the importance of unexpected earnings news on returns. There is an extensive literature on earnings response, but the most applicable study to our hypothesis is Chambers, Freeman, and Koch (1999).[12] They find a positive, cross-sectional relationship between volatility (or total risk) and earnings response coefficients. Our results complement theirs by analyzing the change in the informativeness of earnings around an event associated with higher volatility, CEO turnover.

To implement our test, we calculate quarterly cumulative abnormal returns as the sum of abnormal daily firm returns relative to the CRSP beta-matched portfolios, where quarters begin three days after the previous quarter's earnings announcement and end two days after the current

[12] Please see their paper for a more extensive discussion of the earnings response literature and methodology.

announcement.[13] Unexpected earnings are the difference between actual earnings and the median analyst's forecast, normalized by the closing stock price two days after the previous quarter's earnings announcement. Actual earnings, earnings estimates, and announcement dates are from the Institutional Brokers Estimate System (I/B/E/S). To test for changes in earnings response around turnover, we then run the following regression:

$$CAR_{it} = \gamma_0 + UE_{it}\, \Sigma^{4}_{y=-2}\, \delta_y Year_y + \gamma_1 UE_{it}*|UE_{it}|. \quad (1)$$

In this regression, CAR_{it} is the cumulative abnormal return for firm *i* during quarter *t*, UE_{it} is the unexpected earnings for firm *i* over quarter *t* (actual earnings less the median forecast), and $Year_y$ equals one if quarter *t* is in (event) year *y* relative to the turnover. We include an interaction term, $UE_{it}*|UE_{it}|$, as a control for nonlinearity in earnings response (Freeman and Tse 1992; Das and Lev 1994).

Consistent with our above volatility tests, we include data from two years (eight quarters) before the turnover until four years (16 quarters) after the turnover, and exclude the quarter that includes the turnover announcement. The δ_y coefficients represent the earnings response coefficients (ERCs) for years –2 through +4. Our hypothesis of an increased stock-price response around turnover predicts an increase in δ_y for the years following CEO turnover.

Our estimated regression is as follows

$$\begin{aligned} CAR_{it} = -0.011 + UE_{it} (&0.162\ Year_{t-2} + 0.251\ Year_{t-1} + 0.232\ Year_{t+1} + 0.200\ Year_{t+2} \\ &+ 0.200\ Year_{t+3} + 0.128\ Year_{t+4} - 0.033\ UE_{it}*|UE_{it}| \end{aligned} \quad (2)$$

All of the coefficients are significant at the 1% level.[14] More importantly, the ERCs increase around turnover, from 0.16 two years prior to the event to from 0.25 to 0.20 over the *t*-1 to *t*+3 period. Using an F-test, the coefficients for years *t*-1 to *t*+3 are significantly different from the coefficient for year *t*-2, at significance levels of 1% for *t*-1, and 10% for the remaining three years. Similarly, the joint hypothesis that the coefficients for years *t*-1 through *t*+3 equal that of year *t*-2 can be rejected at the 1% level.

[13] Daily abnormal returns using CRSP standard-deviation-matched portfolios produce very similar results.
[14] The regression has an R^2 of 0.02 with 9,075 observations.

These results are consistent with our hypothesis; announcements are more informative (i.e., have a more positive relation with returns) around CEO turnover. This is also consistent with our finding of higher volatility during these periods, and the findings of Chambers, Freeman, and Koch (1999). Unlike our volatility results, earnings response is highest for the year prior to turnover (although the coefficient for year *t*-1 is not significantly greater than the coefficient for year *t*+1). Consistent with our volatility results, the increased response lasts for three years after the turnover.

F. Tests of competing hypotheses

Given the strong linkage that we find between turnover type and volatility, we are interested in investigating whether this result may be attributed to firm-specific characteristics such as firm size, historical performance, or operating characteristics. For example, a forced turnover is associated with poor performance prior to the turnover event. Thus, the volatility increase following a forced turnover might be due to poor performance, rather than the turnover itself.[15] Another alternative hypothesis is suggested by Figure 1, which shows an increase in volatility prior to the event. It is possible that our sample consists of firms experiencing increases in uncertainty and volatility that also had changes in their CEOs. In other words, we might be mistakenly attributing the observed volatility pattern to an endogenous turnover event.

To test our results against these alternatives, we construct two matching samples. By doing so, we control for firm-specific factors including pre-event stock-price performance, pre-event changes in volatility, and firm size. Our first matched sample consists of firms with similar size and return history prior to the turnover event. In the spirit of Barber and Lyon (1996), for each turnover event, we select the firm within the same NYSE size decile with the closest two-year compounded return as of the announcement date. If the matching firm is in our sample, we select the next-best match. Our second matched sample consists of firms with similar size and pre-event changes in volatility. For this sample, for each turnover event, we select the firm

[15] The volatility increase and the turnover could be jointly caused by other unobservable factors. We construct two matching samples using three variables (historical stock price performance and volatility change, and firm size) to proxy for factors that the existing literature and sample characteristics indicates might be the strongest.

within the same NYSE size decile with the closest change in volatility from two years prior to the event to the year prior to the event. Specifically, we match on the natural logarithm of the ratio of the sample standard deviation for year –1 in event time to the sample standard deviation for year –2 (where years consist of 250 trading days). This is our dependent variable in column one of Table 3. We then use these two matching samples as controls to determine whether pre-event size, performance, and volatility changes explain the post-event volatility increases documented above. This is also related to the approach of Bollen (1998), in which a matched sample is constructed using non-event firms matched by industry group.

[INSERT FIGURE 2 ABOUT HERE]

Figure 2 graphs the monthly volatility of the turnover firms and the performance-based matched-sample firms, in event time, before and after the turnover event. As in Figure 1, returns are separated into 24 event months before and 48 event months after the announcement date and we calculate volatility as the standard deviation of daily returns for each event month. As we are most interested in the changes in volatility, we construct the ratio of each month's average volatility to the average volatility of 24 months prior to the event. Thus, a number of 2 for a given month implies that the average volatility is twice as high as the base month two years prior to the event. For each event month, these ratios are calculated for all turnover firms and all matched-sample firms, respectively.

As the figure shows, turnover firms have bigger increases than similarly-performing firms prior to the event. This gap persists for roughly two years following the event. The increase in volatility of the forced-turnover firms after the event relative to the performance-matched firms is especially strong. Overall, it is clear that the performance-matched firms have volatility increases, but these increases are smaller than for turnover-sample firms. We take this as evidence that more than returns and firm size our driving our results.

[INSERT FIGURE 3 ABOUT HERE]

Figure 3 shows identically-constructed graphs, but where the match is based on pre-event volatility changes (hereafter, the volatility-matched sample). As the graphs show, the match

procedure does a good job of selecting firms with similar run-ups in volatility prior to the event date, until a couple of months prior to the event. Then, the turnover firms increase at a greater rate than the matching firms, and this gap lasts until about two years after the event. As in Figure 1, the evidence is particularly strong for forced-turnover firms.

To more rigorously analyze this question, we directly test whether the sample of turnover firms experiences increased volatility, controlling for the changes of both groups of matching-sample firms. We conduct the same tests as those of Table 3, but we include the corresponding volatility ratios for both matching samples as explanatory variables. The percentage change in volatility for each matching firm is calculated in an identical way, the same event windows (i.e., trading days) are used, and the market-volatility control variable is still included. If our matching characteristics explain our previous results, then these regressions should show insignificant coefficients for the intercept, and turnover and succession indicator variables. For example, if pre-event volatility changes were completely driving our results, one would expect to find a coefficient of one on the volatility-matched volatility ratio, with coefficients of zero for the other variables. As Table 5 shows, this is basically the case for the volatility ratio for the year prior to the event (the basis for our match), but not after the turnover.

[INSERT TABLE 5 ABOUT HERE]

Columns two through four of Table 5 show that volatility is significantly higher for three years following turnover, even when controlling for pre-event volatility changes and performance. This is evidenced by significant intercept terms in each of these columns. Further, forced departures have a significant marginal effect, ranging from a 17% increase in the year after departure to 10.7% in the third year after the event. Thus, our observed results are more than just unobservable firm activities leading to both a persistent (pre-event) run-up in volatility and CEO turnover. These controls do absorb the outside-succession effect of Table 3. So, while we find that volatility increases overall, and by even more following forced departures, outside successions have no marginally significant impact controlling for the matching characteristics. Interestingly, the volatility-matched firms appear to act as more of a control than do the

performance-matched firms. The performance-matched firms' coefficient is only significant at the 5% level for the year following the event, while the volatility-matched firms' coefficients are significant at the 1% level every year.

One methodological concern is the use of estimated volatility ratios on the right-hand side of our regressions in Table 5. As estimates of the true (unobserved) volatility changes, they may be subject to an errors-in-variables problem. As a robustness test for this possibility, we compute empirical standard errors for each regression in Table 5 using a 1,000-iteration bootstrap procedure. These results are nearly identical to those presented above (and as such are not presented).[16] In fact, the only change in significance level due to the use of bootstrapped errors is for the performance-matched volatility ratio in column four, which is no longer significant at the 10% level.

The results of Table 4 on the relation between operating variables (proxying for strategy changes) and volatility raise the question of whether the volatility change after a turnover is due to turnover type or if it can be explained entirely by changes in the operating variables. Table 6 extends the regression analysis of Table 3 by measuring volatility changes while controlling for changes in company fundamentals before and after turnover events for subset of firms for which we have data from Compustat.[17] Using a set of variables from Table 4, we add the percentage changes in assets and sales, and the change in scaled operating income to the regressions of Table 3.

[INSERT TABLE 6 ABOUT HERE]

We present the augmented volatility regression results for three years following the turnover. After controlling for the changes in operating characteristics, we find that the source of the successor (inside or outside) no longer affects volatility. However, forced departures still cause a significant increase in volatility of 16% in year one and 9% in year two. Furthermore, the

[16] The presented standard errors are the robust standard errors calculated according to White (1980).
[17] Due to incomplete Compustat coverage, the sample size in the Table 7 regressions is reduced from 872 to 703 events. Including the other two restructuring proxies (extraordinary items and cash from asset sales) reduces our sample again by roughly half, so we exclude those two variables from Table 7.

regression intercept is positive and significant in the three regressions. This indicates that a turnover event is associated with average increase in volatility of 4%, 5%, and 3% for the following three years, after controlling for changes in operating characteristics of the firm. Thus, changes in firm size or other operating characteristics do not eliminate the importance of turnover (especially forced departures) on volatility.[18]

Columns four through six report the association between changes in operating characteristics and volatility. For example, column four shows that decreases in total assets (shrinkage of the firm) is associated with increased volatility in the two years following the turnover. Columns five and six indicate that changes in operating income and net sales have a weaker association with changes in volatility.

Overall these tests of competing hypotheses indicate that while there is some evidence that firm size and pre-event performance are related to volatility changes following turnover, these variables only explain a small fraction of the observed total increase in volatility. In addition, their ability to explain this fraction is limited to non-forced turnovers. Forced turnovers are associated with an increase in stock-market volatility, controlling for changes in operating characteristics, market volatility, firm size, pre-event changes in volatility, and pre-event performance.

VI. Conclusion

A change in firm leadership signals the possibility of a change in firm strategy. The uncertain nature and prospects of a new strategy may lead to increased uncertainty about the firm's future cash flows. In addition, a change in leadership results in uncertainty about the ability of the new CEO. As the market evaluates the characteristics of the new CEO's strategy and ability, market expectations about firm value may be revised more frequently or dramatically than in the past. These factors suggest that the stock-price volatility may increase following a

[18] Many of the dropped observations due to unavailable Compustat data are associated with high changes in volatility. Thus, the drop in magnitudes and significance of forced turnover and outside succession from Tables 4 to 7 are attributable to both the inclusion of operating variables and the excluded observations.

CEO turnover. Such a volatility change might affect many stakeholders of the firm, due to changes in the likelihood of distress, the degree of information asymmetry, or the impact of agency problems.

One can segment CEO turnovers by the reason for the departure of the incumbent, and the source of the successor. We explore the different possible volatility effects of departure and succession type through what we term the strategy hypothesis, the ability hypothesis, and the scapegoat hypothesis. The strategy hypothesis holds that forced turnovers and outside succession will lead to greater volatility increases, while the ability hypothesis holds that turnovers with outside succession will lead to greater volatility increases than inside successions but predicts no differences in volatility change due to the type of departure. Alternatively, the scapegoat hypothesis predicts that CEO turnover will not change volatility.

We test these hypotheses using a sample of 872 turnovers in large firms from 1979 through 1995. In our most basic specification, we find an increase in annualized stock return volatility around turnover of roughly 3% for the four years subsequent to the turnover. In the three years following a forced departure, there is an additional volatility increase of approximately 20%. The source of the new CEO is also important; in the first year following an outside succession volatility increases by roughly an additional 9%. We believe that these results are economically significant, and are consistent with both the strategy and ability hypotheses but broadly inconsistent with the scapegoat hypothesis. The fact that forced turnover leads to higher volatility is consistent with the strategy hypothesis but would not be expected under the two alternative hypotheses. The results on outside versus inside succession are consistent with both the strategy and ability hypotheses and inconsistent with the scapegoat hypothesis.

An alternative explanation for these results is that changes in firm size, operating performance, or market volatility, as well as pre-event firm size, performance, and volatility changes are the factors that drive increases in volatility. For example, the increase in volatility and CEO turnover may be jointly caused by poor performance or perhaps an unobserved factor. We directly control for firm size, operating performance, and market volatility in our tests, and

through the use of matching samples we control for pre-event firm size, volatility change and performance. Given these controls, the overall effect for outside successions is insignificant, but forced turnovers are still associated with significant increases in volatility, as are turnovers in general. Our matching sample results indicate that firm size, pre-event performance, and pre-event volatility run-ups explain only a fraction of the forced-turnover volatility change. Further, alternative explanations cannot explain the persistence of the volatility increase after a forced turnover.

Our tests provide new evidence on the importance of CEOs. While previous studies have shown small shareholder-wealth changes around the announcement of a turnover, followed by changes in operations, we document a significant change in the volatility of the stock-price process around a change in firm leadership. The volatility changes that follow a CEO turnover may have a significant impact on the firm, and the board may plan a succession strategy taking these effects into account.

References

Barber, B.M., and J.D. Lyon, 1996. Detecting abnormal operating performance: The empirical power and specification of test statistics. *Journal of Financial Economics* 41, 359-399.

Bartov, E., 1991. Open-market stock repurchases as signals of earnings and risk changes. *Journal of Accounting and Economics* 14, 275-294.

Berkovitch E., and R. Israel, 1996. The design of internal control and capital structure. *Review of Financial Studies* 9, 209-240.

Bhagat, S., Brickley, J., Loewenstein, U., 1987. The pricing effect of interfirm cash tender offers. *Journal of Finance* 42, 965-986.

Black, F., 1976. *Studies in Stock Price Volatility Changes*, Proceedings of the 1976 Business Meeting of the Business and Economic Statistics Section, American Statistical Association, 177 - 181.

Black, F. and M. Scholes, 1973, The Pricing of Options and Corporate Liabilities, *Journal of Political Economy* 81, 637-654.

Bollen, N., 1998. A note on the impact of options on stock return volatility. *Journal of Banking and Finance* 22, 1181-1191.

Borokhovich, K.A., R. Parrino, and T. Trapani, 1996. Outside directors and CEO selection. *Journal of Financial and Quantitative Analysis* 31, 337-355.

Brown, K., Harlow, W., and S. Tinic, 1988. Risk aversion, uncertain information, and market efficiency. *Journal of Financial Economics* 22, 355-386.

Campbell, T.S., and W.A. Kracaw, 1987. Optimal managerial incentive contracts and the value of corporate insurance. *Journal of Financial and Quantitative Analysis* 22, 315-328.

Chambers, D.J., R.N. Freeman, and A.S. Koch, 1999. The role of risk in price-earnings relations. Unpublished Manuscript.

Christie, A.A., 1982. The Stochastic Behavior of Common Stock Variances: Value, Leverage and Interest Rate Effects. *Journal of Financial Economics* 10, 407-432.

Cornell, B., 1978. Using the options pricing model to measure the uncertainty producing effect of major announcements. *Financial Management* 7, 54-59.

Coughlan, A.T., and R.M. Schmidt, 1985. Executive compensation, management turnover and firm performance. *Journal of Accounting and Economics* 7, 43-66.

Dann, L., Masulis, R., and D. Mayers, 1991. Repurchase tender offers and earnings information. *Journal of Accounting and Economics* 14, 217-252.

Das, S., and B. Lev, 1994. Nonlinearity in the returns-earnings relation: Tests of alternative specifications and explanations. *Contemporary Accounting Research* Fall, 353-379.

Denis, D.J., and D.K. Denis, 1995. Performance changes following top management dismissals. *Journal of Finance* 50, 1029-1057.

Denis, D.J., D.K. Denis, and A. Sarin, 1997. Ownership structure and top executive turnover. *Journal of Financial Economics* 45, 193-221.

Dewatripont, M., and J. Tirole, 1994. A theory of debt and equity: Diversity of securities and manager-shareholder congruence. *Quarterly Journal of Economics*, 1027-1054.

Dodd, P., and R. Ruback, 1977. Tender offers and stockholder returns. *Journal of Financial Economics* 5, 351-373.

Donders, M.W.M., and T.C.F. Vorst, 1996. The impact of firm specific news on implied volatilities. *Journal of Banking And Finance* 20, 1447-1461.

Dubofsky, D., 1991. Volatility increases subsequent to NYSE and AMEX stock splits. *Journal of Finance* 46, 421-431.

Ewing, J., 2000. Can Bertelsmann Take Wing? *Business Week* February 7.

Freeman, R.N., and S.Y. Tse, 1992. A nonlinear model of security price response to unexpected earnings. *Journal of Accounting Research* 30(2), 185-209.

Furtado, E.P.H., and V. Karan, 1990. Causes, consequences, and shareholder wealth effects of management turnover: A review of the empirical evidence. *Financial Management* 19, 60-75.

Gibbons, R., and K.J. Murphy, 1992. Optimal incentive contracts in the presence of career concerns: Theory and evidence. *Journal of Political Economy* 100, 468-505.

Grinstein, Y., 2000. The design of leveraged buyout transactions: Theory and tests. Unpublished manuscript.

Hartzell, J.C., 1998. The impact of the likelihood of turnover on executive compensation. Unpublished Manuscript.

Hawawini, G., and D.B. Keim, 1995. On the predictability of common stock returns, in: R.A. Jarrow, V. Maksimovic, and W.T. Ziemba, eds., Handbook of Operations Research and Management Science (Elsevier, New York) 497-544.

Hertzel, M., and P. Jain, 1991. Earnings and risk changes around stock repurchase tender offers. *Journal of Accounting and Economics* 14, 253-275.

Helmich, D.L. and W.B. Brown, 1972. Successor type and organizational change in the corporate enterprise. *Administrative Science Quarterly* 17, 371-381.

Hof, R.D., and G. Saveri, 1999. Inside an internet IPO, *Business Week* September 6.

Holmstrom, B., 1979. Moral hazard and observability. *The Bell Journal of Economics* 10, 79-91.

Huson, M.R., P.H. Malatesta, and R. Parrino, 1999. Managerial succession and firm performance. Unpublished manuscript.

Jayaraman, N., and K. Shastri, 1993. The effects of the announcements of dividend increases on stock volatility: The evidence from the options market. *Journal of Business Accounting and Finance* 20, 673-685.

Kalay, A., and U. Loewenstein, 1985. Predictable events and excess returns: The case of dividend announcements. *Journal of Financial Economics* 14, 423-449.

MacDonald, G.M., 1982. A market equilibrium theory of job assignment and sequential accumulation of information. *American Economic Review* 72, 1038-1055.

Mandelker, G., 1974. Risk and return: The case of merging firms. *Journal of Financial Economics* 14, 237-250.

Mayhew, S., 1995. Implied volatility. *Financial Analysts Journal* July-August, 8-20.

Mehran, H., and D. Yermack, 1996. Stock-based compensation and top management turnover. Unpublished manuscript.

Merton, R., 1974. On the pricing of corporate debt: The risk structure of interest rates. *Journal of Finance* 29, 449-470.

Mirrlees, J.A., 1976. The optimal structure of incentives and authority within an organization. *The Bell Journal of Economics* 7, 105-131.

Murphy, K.J., 1986. Incentives, learning, and compensation: A theoretical and empirical investigation of managerial labor contracts. *Rand Journal of Economics* 17, 59-76.

Murphy, K.J., and J.L. Zimmerman, 1993. Financial performance surrounding CEO turnover. *Journal of Accounting and Economics* 16, 273-315.

Ohlson, J.A., and S.H. Penman, 1985. Volatility increases subsequent to stock splits: An empirical aberration. *Journal of Financial Economics* 14, 251-266.

Parrino, R., 1997. CEO turnover and outside succession: A cross-sectional analysis. *Journal of Financial Economics* 46, 165-197.

Shavell, S., 1979. Risk sharing and incentives in the principal and agent relationship. *The Bell Journal of Economics* 10, 55-73.

Vancil, R.F., 1987. Passing the baton: Managing the process of CEO succession. Harvard Business School Press, Cambridge, Mass.

Vijh, A., 1994. The spinoff and merger ex-date effects. *Journal of Finance* 49, 581-609.

Warner, J., R.L. Watts, and K.H. Wruck, 1988. Stock prices and top management changes. *Journal of Financial Economics* 20, 461-492.

Weisbach, M.S., 1988. Outside directors and CEO turnover. *Journal of Financial Economics* 20, 431-460.

Weisbach, M.S., 1995. CEO turnover and the firm's investment decisions. *Journal of Financial Economics* 37, 159-188.

White, H., 1980. A heteroskedasticity-consistent covariance matrix and a direct test for heteroskedasticity. *Econometrica* 48, 817-838.

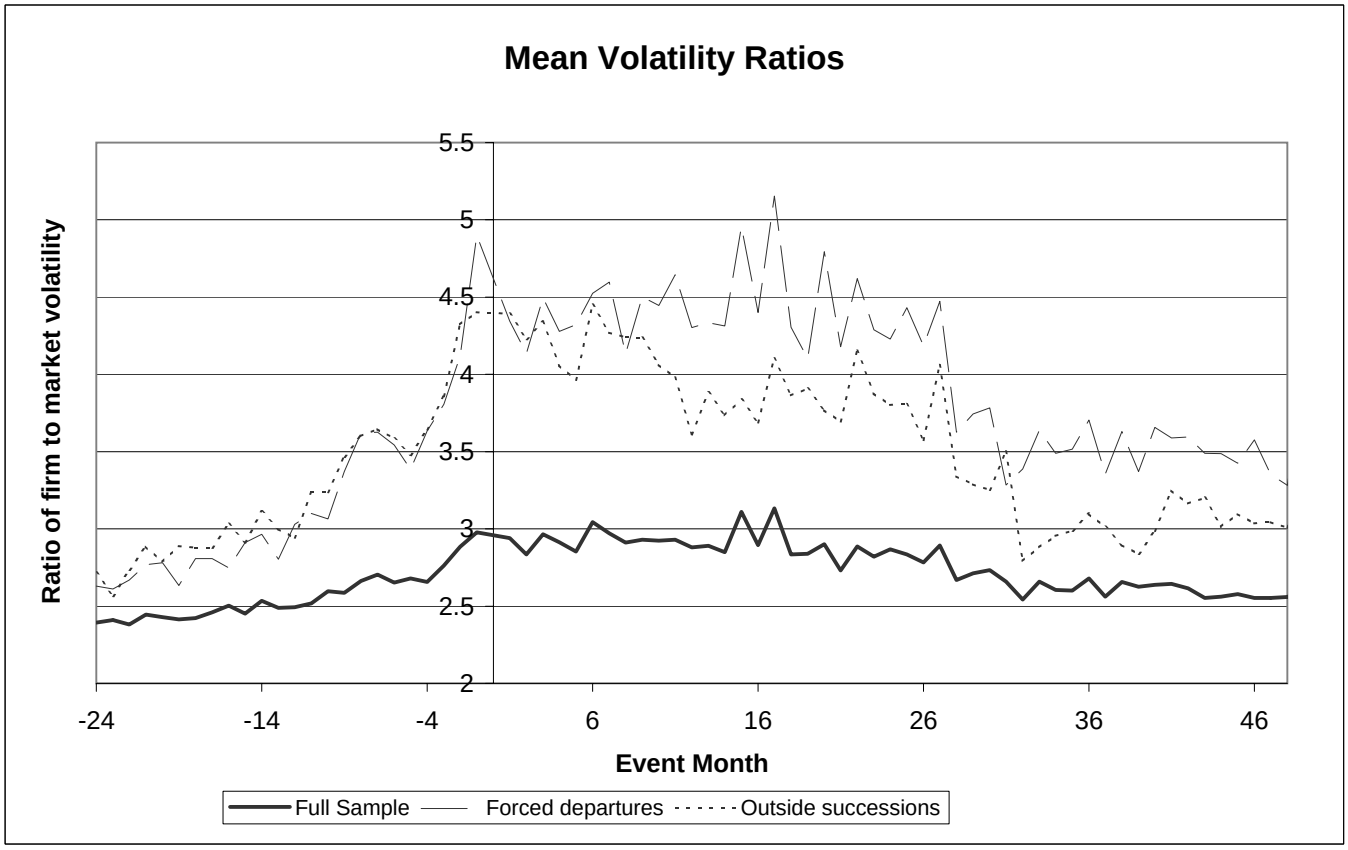

Fig. 1: Mean ratios of firm volatility to market volatility around CEO turnover. Volatility is calculated as the sample daily standard deviation of returns. Means are calculated by averaging across events by month. Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement. The CRSP value-weighted index is the market proxy.

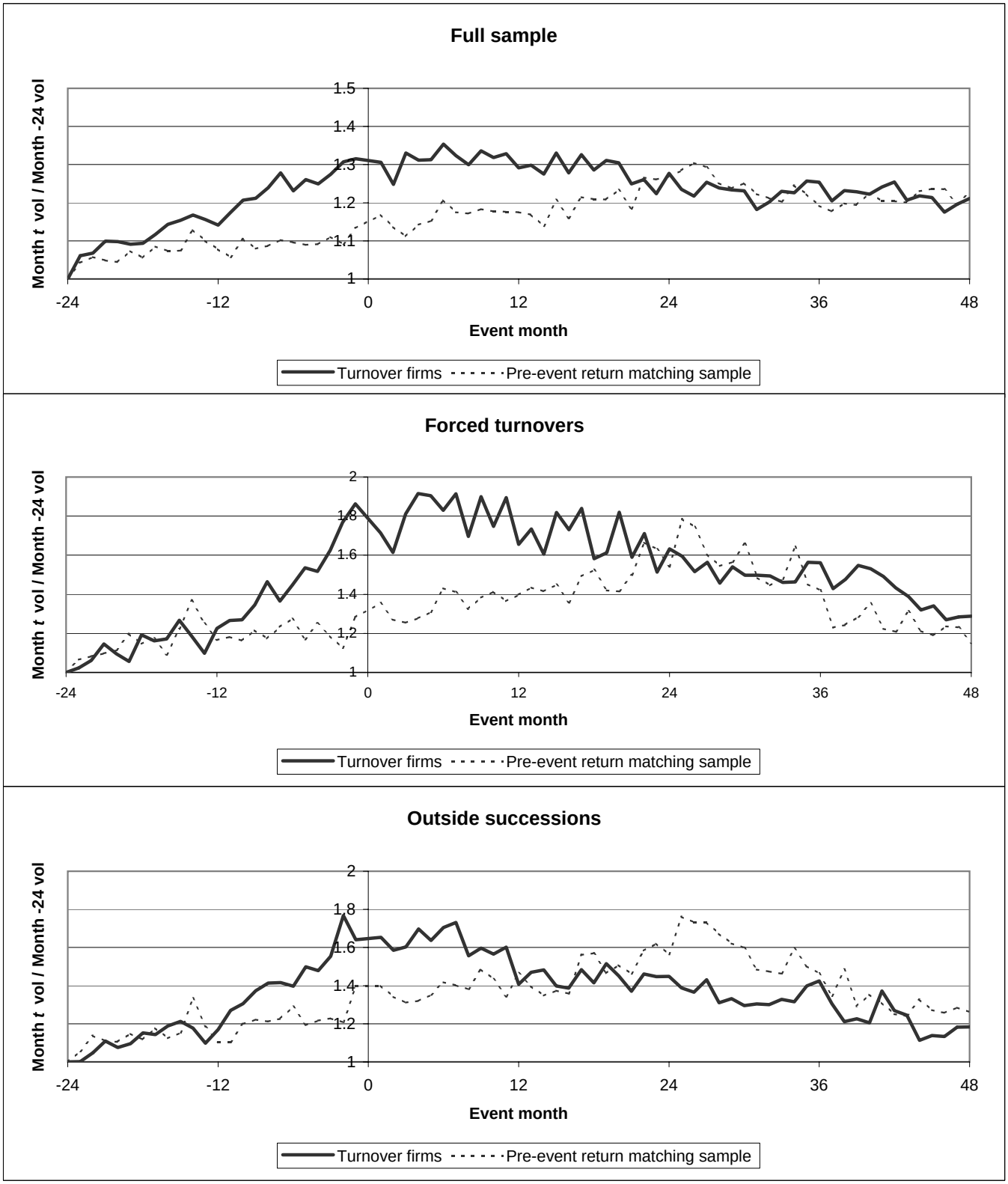

Fig. 2: Ratio of mean month t volatility to month -24 volatility around CEO turnover for turnover and matching-sample firms, with match based on pre-event returns. For each turnover-sample firm, a matching firm is selected from the same size decile, with the closest 2-year return as of the announcement date. Volatility is calculated as the sample daily standard deviation of returns. Means are calculated by averaging across events by month. The ratio of each month's volatility to event month -24 volatility is then computed. Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement. The CRSP value-weighted index is the market proxy.

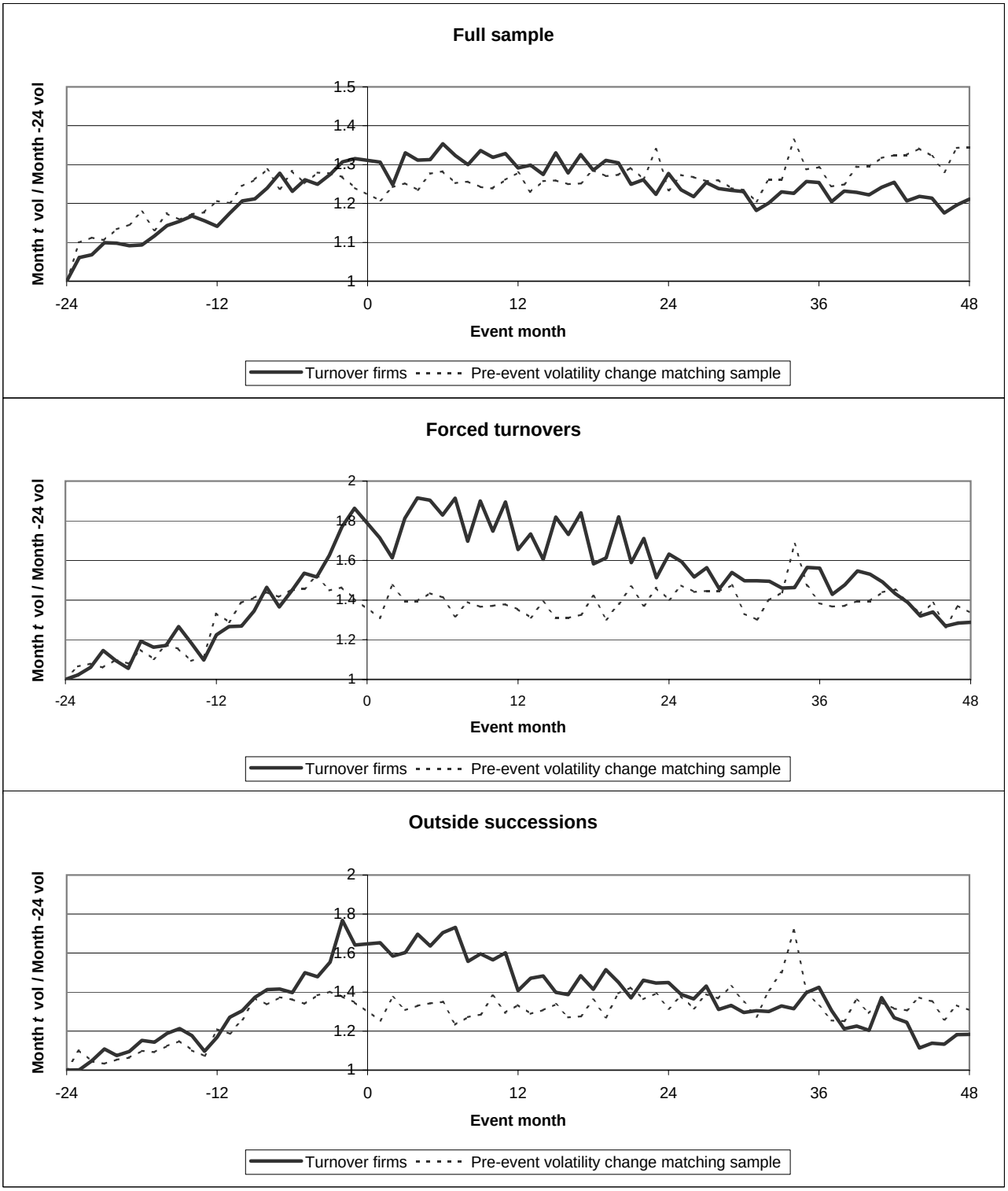

Fig. 3: Ratio of mean month t volatility to month -24 volatility around CEO turnover for turnover and matching-sample firms, with match based on pre-event change in volatility. For each turnover-sample firm, a matching firm is selected from the same size decile, with the closest change in volatility as of the announcement date. The change in volatility for matching purposes is calculated as the natural logarithm of the ratio of volatility for event year *t*-1 to that of *t*-2. Volatility is calculated as the sample daily standard deviation of returns. Means are calculated by averaging across events by month. The ratio of each month's volatility to event month -24 volatility is then computed. Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement. The CRSP value-weighted index is the market proxy.

Table 1
Distribution of Turnovers by Type

This table presents summary statistics for the sample of CEO turnovers. Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement.

Panel A: Turnovers by Year

Year	Total Turnovers	Forced	Outside Successions
1979	50	5	9
1980	54	8	8
1981	49	8	4
1982	43	4	2
1983	58	2	4
1984	51	12	9
1985	57	11	15
1986	50	4	5
1987	64	12	13
1988	78	15	20
1989	52	10	15
1990	55	17	18
1991	49	14	15
1992	37	10	10
1993	59	12	19
1994	53	6	10
1995	13	2	4
Total	872	152	180

Panel B: Turnovers by Departure/Succession Pair

	Number of Observations	Percent of Total
Forced Departure / Outside Succession	85	9.7%
Forced Departure / Inside Succession	67	7.7%
Voluntary Departure / Outside Succession	95	10.9%
Voluntary Departure / Inside Succession	625	71.7%

Table 2
Summary Statistics

This table presents summary statistics for the sample of CEO turnovers. Each statistic is shown for the entire sample, forced turnovers only, and outside successions only. Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement. Standard deviations are annualized by multiplying the daily volatility by the square root of 250, and are presented for two event years before and after the turnover, where an event year is defined as 250 trading days. Accounting variables are presented for the fiscal year prior to the turnover (*t*-1) and for two fiscal years after the year of the turnover (*t*+2). Accounting variables are available for 703 of the 872 events.

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
Pre-Turnover Standard Deviation of Firm Returns (Annualized) [t-500 days, t-1 day]					
Full Sample	30.9%	27.7%	13.8%	7.4%	156.4%
Forced Turnover	39.6%	35.2%	17.3%	13.1%	117.0%
Outside Succession	39.5%	34.6%	20.4%	7.4%	156.4%
Post-Turnover Standard Deviation of Firm Returns (Annualized) [t+1 day, t+500 days]					
Full Sample	34.9%	28.1%	30.9%	9.7%	431.4%
Forced Turnover	53.8%	36.3%	45.8%	15.1%	307.3%
Outside Succession	48.3%	34.0%	43.9%	10.2%	342.8%
Total Assets Year *t*-1 ($MM)					
Full Sample	9,210.50	2,995.52	20,568.00	135.17	184,325.50
Forced Turnover	9,458.90	3,523.43	20,337.00	135.17	184,325.50
Outside Succession	8,312.87	3,800.93	14,969.80	178.94	124,315.00
Total Assets Year *t+2* ($MM)					
Full Sample	11,401.26	3,587.89	26,193.00	4.45	243,283.00
Forced Turnover	9,671.73	4,024.89	22,628.00	4.45	198,598.70
Outside Succession	8,864.57	4,238.46	19,313.47	4.45	180,978.00
Operating Income Before Depreciation Year *t*-1 ($MM)					
Full Sample	852.82	282.62	1,970.00	(840.00)	20,443.90
Forced Turnover	704.03	155.79	1,993.00	(459.42)	12,627.00
Outside Succession	616.79	175.75	1,612.84	(459.42)	12,627.00
Operating Income Before Depreciation Year *t+2* ($MM)					
Full Sample	1,058.20	341.47	2,367.00	(1,478.00)	27,824.00
Forced Turnover	961.11	195.45	2,929.00	(41.00)	21,564.60
Outside Succession	814.08	241.15	2,022.04	(41.00)	13,874.00
Net Sales Year *t*-1 ($MM)					
Full Sample	5,658.89	2,252.58	12,277.00	98.39	124,993.90
Forced Turnover	5,305.44	2,082.00	14,037.00	114.30	122,081.40
Outside Succession	3,634.97	1,784.74	6,841.69	98.39	64,523.00
Net Sales Year *t+2* ($MM)					
Full Sample	6,747.34	2,541.54	14,223.00	0.07	152,172.00
Forced Turnover	6,182.56	2,174.03	17,732.00	1.07	152,172.00
Outside Succession	4,213.32	1,978.41	8,618.28	0.07	71,940.00

Table 3
Changes in Firm Volatility Around Turnover by Turnover Type
Dependent variable: Ln(*Event-Year Volatility* /*Year t-2 Volatility*)

This table presents regressions of changes in firm volatility on the type of turnover and the change in market volatility over the same period. The dependent variable is the natural logarithm of the ratio of event-year volatility to base-year volatility, where the base year is defined as from 500 to 250 trading days prior to the turnover announcement. Volatility is defined as the standard deviation of daily returns, and the CRSP value-weighted index is the market proxy. Column one examines the event-year prior to the turnover (250 trading days prior to announcement), while columns two through five examine one through four event years after announcement, respectively. Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement. Robust t-statistics are in parentheses, and one, two, and three asterisks indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. Standard errors are calculated using the White (1980) hetereoscedasticity-consistent covariance matrix.

Volatility event period Base period	year *t* -1 year *t* -2	year *t*+ 1 year *t* -2	year *t+2* year *t* -2	year *t+3* year *t* -2	year *t+4* year *t* -2
	(1)	(2)	(3)	(4)	(5)
Intercept	0.0191 **	0.0396 ***	0.0409 ***	0.0311 **	0.0335 **
	(2.11)	(3.39)	(2.84)	(2.19)	(2.37)
Dummy=1 for Forced Turnovers	0.1591 ***	0.2424 ***	0.2168 ***	0.1668 ***	0.0938
	(4.95)	(5.03)	(3.64)	(3.03)	(1.50)
Dummy=1 for Outside Succession	0.0679 **	0.0910 **	0.0108	-0.0098	-0.0902 *
	(2.15)	(2.24)	(0.23)	(-0.21)	(-1.80)
Ln(Ratio of Post- to Pre-Event Market Volatility)	0.5065 ***	0.5110 ***	0.4296 ***	0.3467 ***	0.3954 ***
	(22.11)	(17.72)	(12.01)	(10.42)	(13.70)
Adjusted R^2	0.380	0.320	0.162	0.141	0.175
Number of Observations	860	860	850	812	773

Table 4
Tests of Differences in Operations by Turnover and Succession Type

This table presents an analysis of the changes in firm operations around CEO turnover as it relates to the type of turnover and the source of the successor CEO. We present averages of changes in various operating variables around turnover for firms with forced departures (outside successions) versus firms with voluntary departures (inside successions). Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement. The table presents differences in the following variables across volatility-change subsamples: the percentage changes in total assets, operating income before depreciation, and net sales from the fiscal year prior to the turnover (t-1) to the fiscal year two years after the turnover (t+2), the absolute value of the sum of extraordinary items and the sum of cash flows from assets sales in years t and t+1, both scaled by total assets in year t-1. Robust t-statistics are in parentheses, and one, two, and three asterisks indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. Accounting variables are available for 703 of the 872 events. Panel A details differences across forced and voluntary departures, and outside and inside successions. Panel B details the differences across each possible pair of these two classifications. Columns five and six of Panel B present t-statistics for means tests for departure type, holding succession type constant, and for succession type, holding departure type constant.

Panel A: By Turnover and Succession Type

	Departure Type			**Succession Type**		
	Forced Departures (1)	Voluntary Departures (2)	t-statistic for difference (3)	Outside Succession (4)	Inside Succession (5)	t-statistic for difference (6)
%Δ(*Total Assets* $_{t-1,t+2}$)	-5.21%	13.30%	-4.65 ***	-0.67%	14.12%	-3.73 ***
%Δ(*Operating Income* $_{t-1,t+2}$)	1.50%	1.63%	-0.19	1.45%	1.57%	-0.16
%Δ(*Net Sales* $_{t-1,t+2}$)	-4.69%	9.97%	-3.65 ***	2.86%	10.18%	-1.42
|*Extraordinary Items* $_{t,t+1}$| / *Total Assets* $_{t-1}$	2.62%	1.00%	1.75 *	1.61%	1.17%	1.29
Sales of PP&E $_{t,t+1}$ / *Total Assets* $_{t-1}$	2.83%	1.52%	2.03 **	1.75%	1.66%	0.23

Panel B: By Turnover/Succession subsample

					t-statistics	
					Inside vs. Outside	Forced vs. Voluntary
Departure type Succession type	Forced Inside (1)	Voluntary Inside (2)	Forced Outside (3)	Voluntary Outside (4)	Forced [Vol.] (1) vs. (3) [(2) vs. (4)] (5)	Outside [Inside] (3) vs. (4) [(1) vs. (2)] (6)
%Δ(*Total Assets* $_{t-1,t+2}$)	-6.93%	14.72%	-3.70%	2.54%	-0.46 [2.43**]	-0.89 [-4.37***]
%Δ(*Operating Income* $_{t-1,t+2}$)	1.21%	1.66%	1.76%	1.39%	-0.46 [0.28]	0.29 [-0.52]
%Δ(*Net Sales* $_{t-1,t+2}$)	-3.24%	9.84%	-6.02%	10.96%	0.39 [-0.14]	-1.78* [-2.72***]
|*Extraordinary Items* $_{t,t+1}$| / *Total Assets* $_{t-1}$	3.13%	0.98%	2.18%	1.11%	0.48 [-0.39]	1.81* [1.13]
Sales of PP&E $_{t,t+1}$ / *Total Assets* $_{t-1}$	3.53%	1.48%	1.90%	1.84%	1.40 [-0.76]	0.07 [2.12**]

Table 5
Changes in Matching-Firm Volatility Around Event by Sample-Firm Turnover Type
Dependent variable: Ln(*Post-event Volatility*/*Pre-event Volatility*)

This table presents regressions of changes in firm volatility for the *matching-sample* firms on the type of turnover for the corresponding *sample* firm, and the change in market volatility over the same period. For each turnover-sample firm, a matching firm is selected from the same size decile, with the closest return from two years before the announcement until announcement date. The dependent variable is the natural logarithm of the ratio of post-event-date volatility to pre-event-date volatility. Volatility is defined as the standard deviation of daily returns, and the CRSP value-weighted index is the market proxy. Column one uses the 250 trading days prior to the turnover (event year t-1), while columns two through five analyze event years t+1 through t+4, respectively. Forced turnovers are defined as those turnovers for which the WSJ announcement indicates the CEO was forced out or fired, or for which the CEO was under the age of 60 and did not leave for health reasons or to go to another firm. An outside succession is defined as a change in CEO where the new CEO has been with the firm for less than one year at the date of the announcement. Robust t-statistics are in parentheses using White (1980) robust standard errors. t-Statistics are in parentheses, and one, two, and three asterisks indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

Volatility event period	year t-1	year t+1	year t+2	year t+3	year t+4
Base period	year t-2	year t-2	year t-2	year t-2	year t-2
	(1)	(2)	(3)	(4)	(5)
Intercept	0.0008	0.0237 **	0.0357 **	0.0286 *	0.0240
	(0.36)	(2.20)	(2.35)	(1.75)	(1.59)
Dummy=1 for Corresponding Forced Turnovers	0.0073	0.1706 ***	0.1411 **	0.1065 **	0.0213
	(0.53)	(3.90)	(2.31)	(1.99)	(0.31)
Dummy=1 for Corresponding Outside Succession	0.0000	0.0487	-0.0003	-0.0408	-0.0926
	(0.00)	(1.31)	(-0.01)	(-0.82)	(-1.46)
Ln(Ratio of Post- to Pre-Event Market Volatility)	0.0070	0.1959 ***	0.2905 ***	0.2173 ***	0.3048 ***
	(0.65)	(5.89)	(6.61)	(4.81)	(7.48)
Ln(Ratio of Post- to Pre-Event Matching Firm Volatility), Matched on Δ(Pre-event Volatility)	0.9897 ***	0.5298 ***	0.3329 ***	0.2218 ***	0.2236 ***
	(44.47)	(10.12)	(6.18)	(5.33)	(5.00)
Ln(Ratio of Post- to Pre-Event Matching Firm Volatility), Matched on Pre-event Return	-0.0154	0.1322 **	0.0359	0.0813 *	0.0461
	(-1.64)	(2.51)	(0.79)	(1.71)	(1.08)
Adjusted R^2	0.950	0.485	0.250	0.175	0.227
Number of Observations	818	803	731	628	548

Table 6
Tests for Changes in Volatility Controlling for Operating Variables

This table augments the regressions shown in columns (2) through (4) of Table 3 with operating variables. The dependent variable is the natural logarithm of the ratio of post-turnover volatility to pre-turnover volatility. Volatility is defined as the standard deviation of daily returns, and the CRSP value-weighted index is the market proxy. The additional control variables are the percentage changes in total assets, operating income before depreciation, and net sales from the fiscal year prior to the turnover (t-1) to the fiscal year two years after the turnover (t+2). Other variables are as defined in Table 3. Robust t-statistics are in parentheses using White (1980) robust standard errors. One, two, and three asterisks indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. Accounting variables are available for 703 of the 872 events.

Dependent Variable	Intercept	Forced Turnover Dummy	Outside Succes-sion Dummy	%Δ(*Total Assets* $_{t-1,t+2}$)	%Δ(*Operating Income* $_{t-1,t+2}$)	%Δ(*Net Sales* $_{t-1,t+2}$)	*Market Volatility Ratio*
Ln(*Year t+1 Volatility* /	0.0425 ***	0.1565 ***	0.0588	-0.0923 *	0.3806 *	-0.1037 *	0.5147 ***
Year t-2 Volatility)	(3.01)	(3.30)	(1.38)	(-1.96)	(1.86)	(-1.89)	(16.30)
Ln(*Year t+2 Volatility* /	0.0461 ***	0.0868 *	0.0312	-0.1114 **	0.3282	-0.0773	0.4669 ***
Year t-2 Volatility)	(3.08)	(1.74)	(0.68)	(-2.27)	(1.49)	(-1.52)	(14.03)
Ln(*Year t+3 Volatility* /	0.0329 **	0.0658	-0.0257	-0.0240	-0.2936 *	0.0164	0.3943 ***
Year t-2 Volatility)	(2.41)	(1.60)	(-0.63)	(-0.54)	(-1.85)	(0.42)	(13.63)