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Essays in empirical corporate finance: covenant violations, market timing and product market competition

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ESSAYS IN EMPIRICAL CORPORATE FINANCE: COVENANT VIOLATIONS, MARKET TIMING AND PRODUCT MARKET COMPETITION

by

Burcu Esmer

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Business Administration
in the Graduate College of
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Thesis Supervisor: Professor Matthew T. Billett

ABSTRACT

This thesis comprises of three chapters. The first essay is sole-authored and is titled 'Creditor Control Rights and Managerial Risk Shifting.' The second essay is titled 'Creditor Control Rights and Product Market Competition' and is joint work with Professor Matthew T. Billett and MiaoMiao Yu. The third essay is sole-authored and is titled 'Merger Waves, Pseudo Market Timing, and Post-Merger Performance.'

Chapter one examines agency conflicts around violations of bank loan covenants. Recent evidence shows that corporate policies change significantly following financial covenant violations. These changes are attributed to increased creditor influence over borrowing firms in ways that benefit both shareholders and debtholders. In this essay, I investigate whether shareholders engage in activities counter to creditors' interests following violations. I find that the expected negative relation between volatility and investment reverses for firms once they violate a covenant, consistent with risk-shifting behavior. This behavior is more pronounced in firms with high CEO portfolio sensitivity to stock return volatility and firms with high CEO equity ownership. Moreover, I document a significant increase in firm risk in the year following the violation. Overall, these findings suggest that even in the presence of increased creditor control risk shifting still occurs. The prior conclusions that shareholder-debtholder incentives are congruent at violations do not appear to be the case.

Chapter two documents that debt covenants have a profound impact on firms' product market behavior. By examining financial covenant violations from 1996 to 2007, we show that once firms violate a covenant, they experience a substantial decrease in their market share. We also show that firms exhibit poor long-term abnormal returns following covenant violations. In contrast, their rivals grow market share and exhibit significantly positive abnormal returns after their peer firm violates a covenant. Overall,

these findings suggest that creditor influence over firms have dramatic effects on product market outcomes and rival firm behavior.

Chapter three questions whether managers time the market when they make merger decisions. Merger and acquisition waves seem to correspond with market tides, cresting with bull markets. A contentious debate exists over whether this trend indicates managerial market timing ability. Pseudo market timing, introduced by Schultz (2003, Journal of Finance 58, 483–517), provides an alternative hypothesis to explain abnormal performance following events even when managers cannot time the market. I find that acquiring firms which use stocks as the method of payment exhibit negative long-run abnormal returns in event-time, but not in calendar time. Simulations reveal that even when ex ante expected abnormal returns are zero (i.e. managers have no market timing ability), median ex post performance for acquirers is significantly negative when event-time is used. These findings support pseudo market timing as an explanation for acquiring firm underperformance in the context of stock mergers.

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Graduate College
The University of Iowa
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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

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To my parents

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CHAPTER 1
CREDITOR CONTROL RIGHTS AND MANAGERIAL RISK SHIFTING

1.1. Introduction

Recent empirical corporate finance literature documents a significant change in borrowing firms' investment, financial and payout policies following the violation of financial covenants in private debt agreements. As argued by Chava and Roberts (2008) and Roberts and Sufi (2009), once financial covenants are violated (other than through payment defaults), creditors obtain the right to accelerate any outstanding principal and withhold further credit. Although creditors almost always waive the violation, the threat associated with these rights enables creditors to exert significant influence over the firm. For instance, Nini, Smith, and Sufi (2009b) show that violations are followed by decreased investment spending, reduced net debt issuance, lower leverage, and lower shareholder payouts.[1] These findings are attributed to increased creditor influence on the borrowing firm in ways that would benefit both debtholders and shareholders.

Nini, Smith, and Sufi (2009b) conclude that the shift in control rights to creditors "has a positive knock-on effect that benefits shareholders even as the creditors move to protect their own claims" (page 28). The literature has not investigated, however, actions taken by managers (who are acting on behalf of shareholders) that may be counter to

[1] Chava and Roberts (2008) and Nini, Smith, and Sufi (2009a) show a reduction in investment spending following violations. Roberts and Sufi (2009) study changes in financial policy following violations and show a reduction in net debt issuance and leverage ratio. Nini, Smith, and Sufi (2009b) document a decrease in shareholder payouts. In addition, Nini et al. (2009b) show an increase in CEO turnover, hiring of turnaround management and corporate restructuring following violations. Nini et al. (2009b) and Demiroglu and James (2010) show that stock price performance and operating performance improve following violations.

creditor interests. This paper fills this gap by examining the risk-shifting behavior of managers around covenant violations.

Jensen and Meckling (1976) introduce risk shifting as a source of shareholder-debtholder conflicts and argue that shareholders may extract wealth from debtholders by switching from safer to riskier investments. A large body of work examines various features of debt contracts (including covenants, maturity, and optionality) to see whether they alleviate shareholder-debtholder conflicts (Johnson (2003), Bradley and Roberts (2004), Billett, King, and Mauer (2007)). While these features appear to relate to firm characteristics (e.g. growth opportunities and leverage), little is known about their direct influence on firm behavior on an ongoing basis.[2]

Covenant violations present a unique opportunity to examine agency conflicts between shareholders and debtholders for three reasons. First, violations may signal deterioration in firm condition.[3] If so, these firms are more likely to engage in risk-shifting behavior (Fang and Zhang (2004), Larsen (2006)). Second, covenant violations often follow long and arduous renegotiations, suggesting that reconciliation is difficult and conflicts between creditors and shareholders are not easily resolved. Third, given creditors increased influence over borrowing firms following violations, shareholders may counter creditors' actions by, for example, investing in risky projects.

To empirically examine whether shareholder decisions following covenant violations are driven by agency conflicts, I study the relation between uncertainty and firm investment. Covenant violations are associated with increased uncertainty.

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[2] The static models used in the literature assume the relation between these features and firm characteristics to be fixed over time. An alternative approach is to use a dynamic model and look at changes in firm behavior once the debt is in place.

[3] Beneish and Press (1993, 1995) and Wilkins (1997) argue that technical violations are associated with an increased likelihood of financial distress. Dichev and Skinner (2002), however, point out that technical violations are not always associated with financial distress.

According to the real-options literature, absent agency conflicts, increased uncertainty raises managers' incentives to delay investment. The delay allows them to obtain more information on projects and avoid potentially large losses by discontinuing unprofitable projects.[4,5] It has been widely shown that the relation between investment and uncertainty is negative in healthy firms (see, for instance, McDonald and Siegel (1986)).[6] However, in firms where shareholder-debtholder agency conflicts are severe, this relationship is less negative or even positive (see Mauer and Sarkar (2005) and Eisdorfer (2008)). When managers have incentives to engage in risk-shifting activities, increased uncertainty provides an opportunity for managers to increase equity value through investment in risky projects. In this case, high uncertainty encourages acceleration of investment beyond the first-best level, weakening the negative relation between investment and risk. Eisdorfer (2008) models and empirically documents the existence of the risk-shifting problem in firms with high risk of default by showing a positive relation between uncertainty and investment. Consistent with the existence of agency conflicts, I show that the negative relation between investment and uncertainty reverses for firms following a covenant violation.[7,8]

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4 This is consistent with the argument that managers are likely to undertake new projects that are below optimal risk. See Low (2009), Amihud and Lev (1981), Smith and Stulz (1985), Williams (1987).

5 Instead of timing the investment, managers may forego the investment altogether. For instance, Minton and Schrand (1999) argue that firms experiencing shortfalls forgo investment.

6 See also Pindyck (1988), Pindyck and Solimano (1993), Dixit and Pindyck (1994), Episcopos (1995), Caballero and Pindyck (1996), Ghosal and Loungani (1996), Leahy and Whited (1996), Trigeorgis (1996), Bulan (2003), Stein and Stone (2010).

7 An alternative explanation for the positive correlation between uncertainty and investment is that firms may accelerate investment when there is uncertainty about firms' future financing abilities. For instance, Boyle and Guthrie (2003) argue that the threat of future funding shortfalls reduces the value of firms' timing options and leads to sub-optimal early investment. Even controlling for firms' financial health (proxied by Whited and Wu (2006) index) leaves an economically and statistically significant positive relation between volatility and investment in my analysis.

8 Prior literature on covenant violations raises concerns about a potential sample selection problem. Following Nini et al. (2009b), I use a "quasi-discontinuity" approach similar to the one in

To explore whether risk-shifting behavior changes around violations, I study the volatility-investment relation for one-time only violators before and after the violation. I find that the relation between volatility and investment reverses around covenant violations. Higher uncertainty is associated with lower investment before violations, consistent with managers following the first-best option and delaying the investment. In the year of the violation; however, uncertainty is positively associated with investment, consistent with risk shifting.

I further study whether agency conflicts indeed explain the change in the investment-risk relation around covenant violations by investigating CEO incentives. If risk-shifting is driving this result, I expect the effect to be more pronounced in firms with CEO incentives to take on risk. Previous work suggests equity-based executive compensation induces managers to take more risk, thus better aligning manager and shareholder interests.[9] Large managerial stock ownership and high CEO wealth sensitivity to stock return volatility (vega) provides executives with incentives to implement policy choices that increase risk (Brockman, Martion, and Unlu (2009)).[10] Higher CEO wealth sensitivity to stock prices (delta), in contrast, gives a risk-averse

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Roberts and Sufi (2009) in all tests. This way I hope to compare the investment-risk relation of firms which violate a covenant relative to firms which do not violate a covenant in the same quarter with a similar pre-violation pattern. In each regression, I include linear and higher order control variables (squared and cubic terms) on which financial covenants are written. I also control for changes in these control variables before and after a violation. This way, I hope to identify the effect of violations separately from the expected changes in outcomes driven by the performance of violators. Further, I use a first-difference specification to control for the expected time-series path of outcomes following negative firm performance. I also use a matching firm procedure to control for the size and book-to-market effects. The results are robust to this alternative methodology.

[9] Agrawal and Mandelker (1987) and Datta, Iskandar-Datta, and Raman (2001) provide such evidence for industrial firms, Rajgopal and Shevlin (2001) for oil and gas producers, and Saunders, Strock, and Travlos (1990) for banks.

[10] See also Smith and Stulz (1985), Guay (1999), Cohen, Hall, and Viceira (2000), Coles, Daniel, and Naveen (2006).

manager an incentive to avoid risk (Chava and Purnanandam (2010)).[11] Consistent with the literature, I find that managers with higher stock ownership and managers whose wealth is more sensitive to changes in stock volatility (higher vega) engage in more risk-shifting activities, whereas high delta is associated with less risk-shifting.

Finally, I examine firm risk around violations. If risk shifting is occurring then we would expect firm risk to increase.[12] Using a "quasi-discontinuity" design to isolate the effect of the violation on firm risk, I show a significant 5% increase in risk over the industry median in the year following violations. Moreover, the increase is persistent, lasting over two years after the violation. The main measure is asset volatility calculated using Moody's KMV method (e.g. Vassalou and Xing (2004)). I also use alternative proxies for risk including total equity risk, systematic and unsystematic risk (calculated from the market model), asset beta, and volatility of earnings to alleviate concerns that the results are sensitive to the measure of risk. The increase in risk following violations using these alternative measures varies from 8% to 15% and is statistically significant.

The main contribution of this study is to the growing body of literature on the effect of covenant violations on financial, capital structure, and payout policies of firms (Beneish and Press (1993, 1995), Chen and Wei (1993), Dichev and Skinner (2002), Chava and Roberts (2008), Nini et al. (2009a, 2009b)). These studies argue that creditors exert influence over borrowing firms following violations to protect their own interests. Nini et al. (2009a, 2009b) conclude that shareholders and debtholders may have common interests and restrictions put by creditors can also benefit shareholders. My paper questions this argument and show that even in the presence of increased creditor

[11] See also Knopf, Nam, and Thornton (2002), Brockman, Martin and Unlu (2009).

[12] There are obviously other explanations why firm risk increases so this evidence is seen as consistent but not entirely conclusive of risk shifting.

monitoring, risk-shifting occurs.[13] This suggests that the conclusion that shareholder-debtholder incentives are congruent does not appear to be the case.

This study also contributes to the applied financial contracting literature that focuses on the implications of covenants for agency conflicts (Smith and Warner (1979), Malitz (1986), Hart (1995), Tirole (2006), Billett et al., (2007)). The presence of covenants in financial contracts is motivated and rationalized by their ability to mitigate the conflicts between shareholders and debtholders. In this paper, I show that financial covenant violations may help alleviate worse problems absent covenants; however, they do not fully prevent the problem.

Another important contribution of this paper is to the theoretical and empirical literature on risk shifting. Although a large number of studies theoretically analyze the implications of the risk-shifting problem, the evidence on the existence of the problem is mixed. Andrade and Kaplan (1998), De Jong and Van Dijk (2001), and Graham and Harvey (2001) examine risk-shifting and find little or no evidence. Fang and Zhong (2004) and Larsen (2006) study asset risk and find evidence of risk shifting among industrial firms. Eisdorfer (2008) recently provided evidence of risk shifting in financially distressed firms by studying investment-risk relationship. Eisdorfer (2008) relates firm characteristics (financial health) to agency conflicts. My paper, however, investigates changes in investment behavior and firm risk around covenant violations. The evidence of risk shifting in firms which violate covenants is especially interesting since these firms are not necessarily financially distressed.

This paper is related to Hjortsho and Wei (2009) who investigate public debt contracts and managerial risk shifting. They find that firms with more detailed covenants have lower risk. They argue that this finding is evidence that firms with an effective debt

[13] Another argument is that observed changes in firm behavior following violations are not driven by creditor actions (see Demiroglu and James, (2010)).

governance mechanism engage in less risk shifting. I do not limit my analysis to changes in risk, but rather investigate investment-relation to examine risk shifting. Moreover, I study private credit agreements rather than public bonds for several reasons. First, private debtholders have superior monitoring ability since they govern the terms of sole-lender and syndicated bank loans to companies. Second, these agreements include more detailed, comprehensive, and tighter covenants. These covenants are more binding for borrowers which are typically small, growing firms (Malitz (1986)), which are more likely to engage in risk-shifting activities (Fang and Zhong (2004), Larsen (2006)). Lastly, violations of private debt covenants are more common. Nearly 40 percent of firms are in violation at some point during 1996 through 2007.

1.2. Related literature

1.2.1. Background on financial covenants

Financial covenants consist of restrictions that do not allow certain balance sheet items or ratios to fall below or exceed an agreed upon limit. These covenants can include restrictions on a firm's leverage, interest coverage, total fixed charges (including, for example, interest, rent, and capital expenditures), and net worth. Once covenants are violated, creditors receive the right to accelerate the outstanding principal and to terminate any unused revolving debt (Aghion and Bolton (1992), Dewatripont and Tirole (1994)). Although creditors often waive violations, they protect their financial claims through bargaining that occurs around the waiver. The actions creditors can take includes but not limited to: tightening constraints on existing credit agreements (by increasing interest rates, reporting requirements and collateral requirements), and extracting amendment fees (Gopalakrishnan and Parkash (2005)).

A number of recent studies investigate violations of financial covenants in private debt agreements and their effect on firm policies. Chava and Roberts (2008) and Nini et

al. (2009a) show a sharp decrease in investment following violations. Roberts and Sufi (2009) find that firms violating covenants significantly decrease their net debt issuing activity, which decreases their leverage ratios. Nini et al. (2009b) confirm these results and also show that violations are followed by a decrease in shareholder payouts, an increase in CEO turnover, an increase in the incidence of corporate restructurings, and an increase in the likelihood of hiring turnaround specialists. These studies attribute the changes in firm behavior following violations to increased creditor control over the borrowing firm.

1.2.2. Covenants and agency conflicts

A number of studies in the optimal contracting literature examine security design models where covenants define the circumstances under which creditors are permitted to intervene in management (e.g. Aghion and Bolton (1992), Dewatripont and Tirole (1994)). In such instances, the transfer of decision rights can be seen as a corporate governance mechanism to prevent "bad" managers from making value-reducing decisions following poor performance (due to, for instance, low effort and risk-shifting), but well before bankruptcy. These theories view potential agency conflicts arising between managers and external investors (shareholders and debtholders), not between manager-shareholders and debtholders. Consistent with this view, Nini et al. (2009a, 2009b) conclude that creditor intervention following violations benefit shareholders, by constraining managerial value-reducing overinvestment.

In this paper, I focus on agency conflicts between shareholders and debtholders, and study whether shareholders engage in actions that are counter to debtholders' interests following financial covenant violations. Covenant violations present a unique opportunity to examine shareholder-debtholder agency conflicts for several reasons. First, the existence of covenants is motivated and rationalized by their ability to mitigate

conflicts such as dividend payment, claim dilution, risk shifting, and underinvestment (Smith and Warner, 1979).[14] Consistent with theoretical predictions, Malitz (1986) shows that firms with high shareholder-debtholder conflicts are more likely to include covenants in debt contracts. Billett, King, and Mauer (2007) find a positive relation between covenant protection in public debt contracts and growth opportunities using a simultaneous-equation model. Similarly, Bradley and Roberts (2004), and Demiroglu and James (2008) study private debt agreements and find positive relation between growth opportunities and covenant protection.

Second, violations may signal deterioration in a borrowing firm's condition. Beneish and Press (1993, 1995) and Wilkins (1997) argue that financial covenant violations are associated with an increased likelihood of financial distress.[15] Third, given creditors increased influence over borrowing firms following violations, shareholders may counter creditors' actions by, for example, investing in risky projects. Lastly, covenant violations often follow long and arduous renegotiations, suggesting that conflicts between creditors and shareholders are not easily resolved.

1.2.3. Evidence on risk shifting

One of the important sources of conflicts between shareholders and debtholders is the risk-shifting problem (Jensen and Meckling (1976) and Myers (1977)). When firms are indebted, investments or transactions that increase cash flow volatility also increase the value to shareholders of their call option on the firm's assets, causing devaluation of debt. Although a large number of studies theoretically analyze the implications of risk-

[14] See also Myers (1977), Smith (1993), Hart (1995), Tirole (2006).

[15] Dichev and Skinner (2002), however, report that financial covenant violations are not always associated with financial distress.

shifting, there is little evidence on the existence of the problem. Andrade and Kaplan (1998) study investment activities of 31 financially distressed firms and find no evidence of risk-shifting. De Jong and Van Dijk (2001), and Graham and Harvey (2001) examine the risk-shifting incentives using surveys and find little or no evidence. Esty (1997) finds that risk shifting was significant in the savings and loan industry during the 1980s. More recently, Laeven and Levine (2009) provide evidence of risk shifting in banks. Fang and Zhong (2004), and Larsen (2006) document evidence of risk shifting among industrial firms by showing that financially distressed firms are more likely to have high asset volatility.

Large sample evidence of risk-shifting is recently provided by Eisdorfer (2008) using a real options framework. Under the real options logic, a firm's investment decision involves a tradeoff between delaying investment to obtain more information about a project's value, and realizing early cash flows by investing in the project immediately. The value of delaying the investment increases with the degree of uncertainty about a project's cash flows. Therefore, absent agency conflicts, investment is expected to decrease when uncertainty increases (e.g. McDonald and Siegel (1986)). The empirical evidence generally supports the negative relation between investment and volatility (see Panousi and Papanikolaou (2009), Baum, Caglayan and Talavera (2008), Bulan (2005), Leahy and Whited (1996), Dixit and Pindyck (1994)).

In firms where shareholder-debtholder conflicts are severe; however, this relationship becomes less negative or even positive. When managers have incentives to engage in risk-shifting activities, increased uncertainty decreases the value of waiting and provide an opportunity for managers to increase equity value by investing in risky projects. In this case, increased uncertainty encourages acceleration of investment beyond the first-best level (see Mauer and Sarkar (2005)). Eisdorfer (2008) models and shows that in financially distressed firms, high uncertainty has a positive effect on investment, consistent with the risk-shifting argument.

1.3. Data, variable definitions, and methodology

Covenant violations data is obtained from Amir Sufi's website.[16] The sample construction below follows Nini et al. (2009a) using the period 1996 through 2007. To be included in the sample, I require firms to be U.S. (fic="USA") public firms and to have data available on the Compustat and Center for Research in Security Prices (CRSP) databases. I exclude financial firms (SIC 6000–6999) and utilities (SIC 4900-4999) because these firms are often subject to heavy federal regulations. I exclude firms with missing information on total assets, sales, common shares outstanding, closing share price, and the calendar quarter of the filing. Finally, I require firms to be publicly traded with ordinary common shares (CRSP share code 10 or 11: thus I exclude ADRs, REITs, units, certificates, and trusts). Imposing these restrictions leaves a sample of 9,915 firms and 233,398 firm-quarter observations. I follow Nini et al. (2009a) and focus my analysis on new financial covenant violations, which are defined as financial covenant violations for firms that have not violated a covenant in the previous four quarters.

1.3.1. Variable definitions

This section describes the construction of each measure including firm risk, investment and managerial risk taking incentives. For variable definitions of control variables, please see Appendix A.

Total Investment. Following Coles, Daniel, and Naveen (2006) and Biddle, Hilary and Verdi (2009), I define *Total Investment* in a given fiscal end-year as the sum

[16] This data is available at http://faculty.chicagobooth.edu/amir.sufi/data.htm. Nini, Smith, and Sufi extract information from every 10-Q and 10-K filing on SEC Edgar website. Using a text-searching algorithm, they determine whether a firm is in violation of a covenant. Then they match this information to COMPUSTAT file. For more information on the data, please see Appendix of "Creditor Control Rights, Corporate Governance and Firm Value" by Nini, Smith and Sufi (2009).

of capital expenditures, research and development (R&D) expenditures, and acquisitions minus sales of plant, property and equipment (PPE), scaled by lagged total assets. An advantage of this approach is that it considers several types of investments such as capital expenditures and acquisitions as well as asset sales. It also considers R&D expenditure which has become an important investment item in the recent years.

Asset Volatility. I follow Fang and Zhong (2004), Larsen (2006), and Hjortshøj and Wei (2009) and use asset volatility to investigate risk shifting. To estimate asset volatility, I use Moody's KMV method (Crosbie and Bohn (2003)). In this model, equity is viewed as a call option on the value of the firm's assets (Merton (1974). The market value of equity is the number of shares outstanding multiplied by closing price at the end of the firm's fiscal year. The face value of the firm's debt (strike price) is set equal to the current liabilities plus half the long-term debt, *T* equals one year, and *r* is the one-year Treasury bill rate from Ken French's website.[17,18]

I follow Hillegeist, Keating, Cram, and Lundstedt (2004) and estimate the asset value and asset volatility by simultaneously solving the call option equation and the optimal hedge equation. The starting values are determined by setting value of assets equal to the book value of liabilities plus the market value of equity and asset volatility equal to weighted value of equity volatility. Appendix B further explains the method.

Following Hjortshoj and Wei (2009), I calculate a risk adjustment ratio (RAR) to examine the change in risk following violations. RAR is the ratio between next year's asset volatility and this year's asset volatility ($\sigma_A^{t+1} / \sigma_A^{t}$). Hence, when RAR in a given

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[17] Fang and Zhong (2004), Vassalou and Xing (2004), and Hjortshøj and Wei (2009).

[18] As a robustness check, I follow Barclay and Smith (1995) who document that the median maturity of long-term debt is around five years, and assuming short-term debt follows a uniform distribution (i.e. median maturity is six months), the firm's average debt maturity is estimated by: T=(0.5*Short-Term Debt + 5*Long-Term Debt)/Total Debt. This estimation gives an average maturity is six years, which is consistent with previous literature. The results are robust to this maturity choice.

year is above (below) one, the firm subsequently increases (decreases) its business risk. In a given year, market conditions and business cycles may affect asset volatility. In order to filter out industry-wide factors, I use an industry-adjusted risk adjustment ratio ($IRAR_t$). IRAR is calculated by subtracting the industry median in the same year from each firm's RAR, where the industry definition is based on the two-digit SIC code. When IRAR is above (below) 0, the firm subsequently increases (decreases) its business risk relative to the industry peers.

Total risk, systematic risk, unsystematic risk. Total equity risk is a widely used equity risk indicator in finance research (see Goyal and Santa-Clara (2003)). I use the standard deviation of daily stock returns for the 252 trading days before the covenant violation to estimate total firm risk. I decompose total equity risk into systematic risk and unsystematic risk since managers can affect both the level of total risk and its components. Moreover, shareholders are especially interested in systematic risk since it cannot be eliminated through diversification. Parties that have business relations with violating firm are likely to be interested in unsystematic risk, given that violations may affect the borrowing firm's ability to satisfy existing contracts. I regress the same daily returns data for each firm against the CRSP equal-weighted market index and use the standard deviation of the errors in this regression as a measure of firms' unsystematic risk. Systematic risk is measured by the standard deviation of the firm beta times the daily market returns.

Asset Beta. Following Fargher, Wilkins, and Holder-Webb (2001), I use unlevered asset beta to measure change in business risk. I first calculate equity beta with a one-factor market model using daily returns for the 252 trading days before the violation, then I calculate asset betas by "unlevering" equity betas to remove the effects of leverage using market leverage. Equity beta reflects the combined effects of business and financial risk that the company faces with. Asset beta, however, is not confounded by financial risk.

Earnings Volatility. To ensure that the change in risk following violations is not determined by the change in stock prices, I use an accounting measure, earnings volatility, following Laeven and Levine (2009). I calculate earnings volatility as the standard deviation of a firm's return on asset (ROA) over 12 quarterly observations.

CEO Incentives. I use CEO portfolio vega and delta values to measure managers' incentives to change firm risk (Coles, Daniel, and Naveen (2006)). Vega is the dollar change in CEO option holdings for a one percent change in the annualized standard deviation of stock returns. Delta is the dollar gain in the manager's personal portfolio as the stock price goes up by one percent. I calculate vega and delta values using the Black-Scholes option valuation model outlined in Core and Guay (2002). Appendix C further describes the method. I also use percentage stock ownership of managers as an alternative measure of managerial incentives. The percentage of equity owned by the CEO is calculated using Execucomp database.

1.3.2. Summary statistics

Table I shows the fraction of firms that violate a covenant in any given year from 1996 to 2007. Between ten and 17 percent of firms violate a covenant in a given year. Five to nine percent of firms experience a new violation in a given year. Not surprisingly, both violations and new violations follow a cyclical pattern and peak during the 2001 recession.[19]

[19] In untabulated results, I find that around 38 percent of firm in my sample violate a financial covenant at some point during the sample period. This shows that violations are common among public firms. Most firms violate debt covenants only once (more than 50 percent). Less than 18 percent of firms violate covenants twice. The distribution of violations is similar across industries, but violations are most common in wholesale trade.

Table II displays the summary statistics for new violator firms and non-violator firms.[20] Although the numbers vary between violators and non-violators, the median violator is not on the verge of payment default or bankruptcy and it is not experiencing a sharp liquidity shortage. Net worth scaled by assets for the median violator is 0.40, and 0.50 for the median non-violator. Similarly, the current ratio (1.49) for new violators is lower than for non-violators (1.96). The median violator has reasonably high market to book ratio (1.18) compared to the median non-violator (1.44). Not surprisingly, violator firms have higher leverage ratios and interest expense scaled by lagged assets compared to non-violators. The quarterly operating cash flow for the median violator is 0.01 which is close to the median non-violator number of 0.03. The median violator has an S&P issuer credit rating of BB and a Z-score of 1.95, consistent with notion that firms experiencing a technical default are not on the verge of bankruptcy. Panel B presents summary statistics for important organizational characteristics of violator and non-violator firms. Consistent with Denis and Mihov (2003), the median violator is smaller, has fewer tangible assets, and has lower credit quality.

Panel C displays summary statistics for firm risk variables. The median annualized total equity risk (total unsystematic risk) is 72% (70%) for violators and 55% (52%) for non-violators.[21] The median annualized systematic risk is 15% for violators and 14% for non-violators. The equity beta and asset beta for non-violators are higher. The equity (asset) beta is 1.08 (0.80) for non-violators and 1.01 (0.54) for violators. The asset volatility calculated using Merton's model is 39% for both violators and non-violators. On average, violators increase their asset risk by three percent from the

[20] A new covenant violation is a financial covenant violation by a firm that has not violated a covenant for the previous four quarters. A firm is included in the non-violation sample if it has not announced a new violation at that quarter.

[21] These estimates are higher compared to other studies. The difference arises from the time period used in this study. Equity volatility is particularly high in late 1990s and early 2000s.

previous year. Even adjusting for the industry, I show that the median violator increases its firm risk by four percent after the covenant violation. The sample median RAR for non-violators indicates that non-violators are reducing asset risk more than half of the time.

Panel D shows summary statistics for managerial risk taking incentives: Vega. For a one percentage point increase in the company's equity risk, there is a $22,279 increase in CEO compensation for the median firm. This number is nearly three times larger for the median non-violator firm.

1.3.3. Estimation methods

Following Nini et al. (2009b), I use the first difference regression for continuous dependent variables:

$$y_{i,t+4} - y_{i,t} = \boldsymbol{\beta_1}\textbf{*Violation Dummy}_{\mathbf{i,t}} + \Theta_1*\text{Covenant Controls}_{i,t} + \Theta_2*(\text{Covenant Controls}_{i,t+4} - \text{Covenant Controls}_{i,t}) + \Theta_3*(\text{Covenant Controls}_{i,t} - \text{Covenant Controls}_{i,t-4}) + \Theta_4*(\text{Covenant Controls}_{i,t})^2 + \Theta_5*(\text{Covenant Controls}_{i,t})^3 + SIC_i + Year_t + \varepsilon_{i,t} \quad (1)$$

In this equation, *Violation* is an indicator variable that equals 1 for a new financial covenant violation, *SIC* represents one-digit SIC industry indicator variables, and *Year* represents year indicator variables, which is included because firm outcomes may change over time.[22] To avoid overlapping observations, I restrict the sample to firm-quarter observations in the fourth quarter of each year. I use the fourth quarter since financial covenant violation announcements are more common in 10-K filings than in 10-Q filings.

I include the most common ratios used in debt agreements in my analysis. These ratios include: operating cash flow to lagged assets, leverage (debt-to-assets), interest

[22] The results are robust if I use the two-digit SIC industry indicator variables.

expense to lagged assets, net worth to assets, and the current ratio (current assets / current liabilities).

As pointed out by Roberts and Sufi (2009), violations may occur due to deterioration of firm performance and results, therefore, are mechanically driven by the performance of violators. To alleviate sample selection problems, Roberts and Sufi (2009) use a "quasi-discontinuity" approach and exploit the discontinuity created in the violation quarter. I adopt this approach and add variables on which covenants are written as linearly, squared, and cubed controls. The causal inferences from regression discontinuity approach are argued to be more credible than the typical natural experiment strategies such as difference-in-differences or instrumental variables methods (Lee and Lemieux (2009)).

Another potential issue is the difficulty in identifying the effect of violations separately from expected changes in outcomes related to differences in the underlying fundamentals of violators and non-violators. In order to address this issue, I follow Nini et al. (2009) and use both the level and first-differences of the control variables before and after violations. This way, I hope to control for the differences of time-invariant and firm-level effects between non-violators and violators, and I compare risk-shifting activities of violators relative to non-violators with a similar pre-violation pattern.

1.4. Empirical results

1.4.1. The relation between risk and investment

I start my analysis by examining borrowing firms' investment policy following violations. Table III shows the effect of covenant violations on firm investment. The first column of Table III shows a 2.1 percentage points decrease in total investment (sum

of capital expenditures, acquisitions, and R&D expenditures minus asset sales) following a covenant violation.[23] This result is consistent with the findings of previous papers. In order to compare these results with previous research, I also investigate the impact of creditors on the sub-components of investment. Consistent with Nini, Smith, and Sufi (2009b), Column 2 and Column 3 of Table III presents evidence that capital and acquisition expenditure declines after covenant violations. Capital (cash acquisition) expenditure decreases by 0.9 (1.1) percentage points.[24] Column 4 displays an insignificant effect of creditors on R&D expenditure. The change in R&D spending is insignificant, meaning that creditors have no effect on R&D spending. This is interesting since one would expect creditors to cut R&D spending first due to the risky nature of these investments. The last column shows that there is no significant change in PPE sales following violations.

According to the real-options literature, the option to delay investment becomes more valuable when uncertainty about a project's cash flows and/or future funding shortfall is high. Managers can avoid potentially large losses by foregoing investment when the outcome is unfavorable. This manager/shareholder response to increased uncertainty is also consistent with creditors' actions. Chava and Roberts (2009) argue that some lenders "advise management to reduce investment expenditures" or put explicit investment restriction on new credit agreements following violations. When there is a risk-shifting problem; however, increased uncertainty may provide an opportunity for managers to invest in risky projects and increase equity value. In order to examine whether shareholder decisions are driven by first-best response (delaying investment) or

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[23] Relative to an average annual investment rate of approximately 13.36% in nonviolation states, this estimate corresponds to a relative decrease in total investment of almost 15%.

[24] Relative to an average annual capital (cash acquisition) expenditure rate of approximately 5.25% (3.49%) in nonviolation states, this estimate corresponds to a relative decrease in capital (cash acquisition) expenditure of almost 18% (32%).

agency conflicts (increase investment), I investigate the relation between investment and uncertainty.

I add the variables *Change in Risk* and an interaction variable *New Viol * Change in Risk* to regression (1). Column 1 of Table IV shows how changes in risk affect firm investment. The coefficient of *Change in Risk* is -0.01 and significant at 1 percent level. It indicates that the relation between risk and investment is negative, consistent with prior literature (see, for example, Episcopos, 1995). Once firms violate a covenant, however, volatility-investment relation is different. The marginal effect of change in risk becomes significantly positive (0.03) at one percent level.[25] This result is consistent with Eisdorfer (2008), who argues and shows that the effect of volatility on investment is less negative (or even positive) for firms with risk-shifting problems.[26] Columns 2 through 5 present the results for different measures of investment. The change in risk is positively related to change in capital expenditure and acquisition spending, similar to the results when total investment is used. The relation between volatility and R&D expenditure is positive (although insignificant) following covenant violations.

To gauge the economic significance of these results, I calculate within-firm standard deviations and the effect of a one standard deviation change in *Change in Risk* on investment (unreported analysis). I next compare it to the effect of other right-hand side variables on investment. A one standard deviation increase in *Change in Risk* leads to a 5.57% increase in the firm's investment. The marginal impact of change in risk on investment is greater than the impact of size (-2.87%) and comparable to the effects of

[25] I also calculate the sum of the coefficients *New Viol * Change in Risk* and *Change in Risk,* which.is positive and significant at 12 percent level.

[26] It is also consistent with Mauer and Sarkar (2005) who argue that in firms with agency conflicts, high uncertainty encourages managers to invest in risky projects.

market-to-book (5.69%) and operating cash flow (-4.09%). This finding suggests that risk-shifting incentive has an economically meaningful effect on investment.

One concern is that the positive relation between investment and risk is driven by firms that decrease investment following violations. If decreased investment is associated with a decrease in risk (which suggests that creditors are able to reduce the firm risk with their actions), one would also observe a positive investment-volatility relationship. To investigate this possibility, I study the investment-risk relation for firms that have an increase (decrease) in risk following violations. I use a dummy variable, *Increase in Risk*, for firms with increased risk over the median firm in their industry (IRAR>0). The first column of Table V confirms that for firms which are not in violation of a covenant, increased risk is negatively associated with investment (-0.01, statistically significant). Moreover, decreased risk is associated with increased investment (the intercept is 0.034, statistically significant). Once firms violate covenants, an increase in risk is positively associated with investment (the coefficient on the interaction variable *Increase in Risk * New Viol* is 0.028, statistically significant). Decrease in risk, however, is associated with increased investment (the sum of the intercept and the coefficient on *New Financial Violation* is positive, although not significant at a reasonable confidence level). Moreover, the sum of coefficients on *Increase in Risk* and *Increase in Risk * New Viol* is positive and significant at six percent level. This result shows that the negative relationship between investment and risk is reversed for firms once they violate a covenant. Moreover, the positive relation between investment and risk is not driven by firms that decrease investment following violations.

The second column in Table V separates the effect of initial versus subsequent violations on risk shifting. Models by Aghion and Bolton (1992) and Dewatripont and Tirole (1994) suggest that creditors have stronger influence over the borrowing firm after creditors initially obtain acceleration and termination rights. Consistent with these models, Roberts and Sufi (2009) show that significant changes in borrowing firms'

financial policies occur after the initial violation as opposed to after subsequent violations. If creditors exert more influence over the firm after initial violations, these firms are less likely to engage in risk shifting. As a result, it is important to take into account how initial and subsequent violations affect risk-shifting behavior. The second column of Table V presents the results. *First Time* violation is defined to be a violation for a firm that violates a covenant for the first time. If the violation is not the first time the firm violates a financial covenant, it is considered a *Repeat* violation.[27] The estimates show that risk shifting is stronger for first-time violators (the coefficient on the interaction variable *Increase in Risk * New viol * First Time* is 0.026 and significant at two percent level). This finding provides evidence of risk shifting even in the presence of increased creditor control.[28]

The previous results provide evidence of risk shifting following violations. I next examine the risk-shifting behavior before the violation. This analysis is important for two reasons. First, although the quasi-discontinuity approach used in analyses mitigates the sample selection concerns, the evidence of risk shifting following violations may still be due to the different characteristics of violating firms and firms which have not violated a covenant. Second, Dewatripont and Tirole (1994) argue that control rights shift to

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[27] There are 1,071 first-time violators in the regression. Out of 1,071 firms, 129 of them violates a covenant second time and 8 of them violate a covenant third time. I re-do the analysis with these 129 firms that violate a covenant more than once. Risk shifting is stronger in their first time than their second and third time.

[28] An alternative explanation is that if subsequent violations signal that firms are near insolvency, the fiduciary duties of the directors are owed to creditors as well as shareholders. In this case, we would expect to see less risk shifting after subsequent violations. The results are mixed. Unlike the first-time violations, repeat violations have a much smaller effect on risk shifting, however, the estimate is not statistically significant at a reasonable confidence level. To further investigate whether the weak evidence on risk shifting is due to firms' financial health, I examine the financial situation of firms when they violate a covenant once and more than once. The untabulated results show that although repeat violations are related to lower *Z*-scores (*Z*-score is 1.94 for median repeat violator versus 2.04 for median first time violators), repeat violators are not on the brink of becoming insolvent. These findings reassure that risk shifting occurs even when creditors have stronger control over borrowing firms.

creditors following "bad" managerial behavior such as risk shifting. To address these concerns, I examine the risk-investment relation for one-time only violators before and after the violation. The first column of Table VI presents the relation between the change in risk and the change in total investment using all years before the violation.[29] The coefficient is significantly negative (-0.02). Even when I focus on the year before the violation, the relation between risk and investment is negative (-0.04, statistically significant). The third column shows the results for the firms after the violation. The coefficient becomes positive. These results indicate that the negative relation between risk and investment before the violation attenuates following the violation. This result reassures that the results are not driven by the differences in the two samples. Beyond ensuring the robustness of my inferences, these results indicate that violations are not the result of managerial risk shifting, at least for first-time violators.

Next, I explore an alternative explanation for the positive investment-uncertainty relationship. In their theoretical paper, Boyle and Guthrie (2003) argue that the threat of future funding shortfalls reduces the value of a firm's timing options and leads to sub-optimal early investment. This argument also predicts a positive relation between investment and uncertainty. Since the risk of funding shortfall is more relevant for financially constrained firms, I investigate the risk-shifting incentives of these firms. I use the Whited and Wu (2006) index to measure financial constraints. A firm is financially constrained if it is in the upper third of the distribution following Chava and Roberts (2008). Table VII displays the results. Consistent with Boyle and Guthrie's (2003) predictions, the coefficient of *Change in Risk * NewViol * Financially Constrained* is 0.03 and statistically significant. However, the coefficient of *Change in*

[29] Suppose that the violation occurred at the end of 2000. The first column shows the investment-risk relation for all years before 2000 (i.e. 1997, 1998, 1999, and 2000). The second column shows the investment-risk relation in the year 2000. The last column shows the investment-risk relation in the year 2001.

Risk NewViol* remains positive and statistically significant. This result shows that firms increase their investment not only due to concerns about future financing capabilities, but also due to risk-shifting incentives.

In sum, this section provides evidence for risk-shifting behavior in firms which violate financial covenants. The next section explores further whether agency conflicts explain the change in investment-risk relation around covenant violations by looking at managerial incentives.

1.4.2. Risk taking and managerial incentives

The previous section shows heightened agency conflicts between shareholders and debtholders around violations. In this section, I examine the managerial incentives behind firms' risk-taking activities. I use three proxies that measure the extent of manager-shareholder interest alignment: 1) the sensitivity of CEO wealth to stock volatility (vega), 2) the sensitivity of CEO wealth to stock price (delta), and 3) managerial stock ownership.

A large literature has argued that equity-based compensation is awarded to managers to overcome managerial risk aversion and encourage risk-taking behavior (e.g., Smith and Stulz (1985), Guay (1999)).[30] Empirical evidence shows that there is a positive association between vega and managerial risk taking (e.g. Hanlon, Rajgopal, and Shevlin (2004), Knopf, Nam, and Thornton (2002), Coles, Daniel and Naveen (2006), Brockman, Martion, and Unlu (2009)). This is because high stock return volatility increases the value of the executive stock options (Haugen and Senbet (1981), Smith and Stulz (1985)). High delta, however, is associated with greater managerial risk aversion

[30] Another set of studies uses a utility-based framework and document that managerial risk-taking incentives are highly sensitive to certain compensation characteristics such as the option's moneyness and CEO's outside wealth (e.g. Brisley (2006)).

(Knopf, Nam, and Thornton (2002), Chava and Purnanandam (2010)). This is due to the assumption that under-diversified and risk-averse managers prefer lower cash flow variance (e.g. Amihud and Lev (1981)). Equity ownership of managers is also shown to align manager-shareholder interests and mitigate managerial risk avoidance (e.g. Mehran (1995), Eisdorfer (2008)).

As the theory predicts, I find that the economic magnitude of the risk taking is higher for firms with high managerial risk-taking incentives. Table VIII presents the results for the regressions. I add the variables *Increase in Risk* (equals one if firm risk increase in the following year) and an interaction variable *New Viol * Increase in Risk* to the regression (4) to capture the possible risk-shifting behavior following violations. In order to show the effect of managerial incentives on risk-shifting behavior, I am primarily interested in the three-way interaction term, which captures the effect of managerial incentives on risk-shifting behavior. The two-way interaction variables are also included in the tests (not reported in the tables to save space).

The first column shows the effect of executive stock options on risk-shifting behavior. A firm is considered a high vega (delta) firm if the manager's vega (delta) is higher than the sample median. For firms whose managers' wealth is more sensitive to stock volatility, there is a more positive effect of increased risk on investment (coefficient is 0.03 and significant at five percent level). In contrast, high delta mitigates risk-shifting behavior (coefficient is -0.02 and significant at 10 percent level). The weak significance of this result may be due to mixed incentives provided by delta since delta measures both the incentive alignment effect and the risk-aversion effect (see Low (2009) for further discussion).

The second column shows the effect of managerial stock ownership on risk-shifting behavior. A firm is considered to be a high managerial ownership firm if the percentage of equity owned by the CEO is higher than the sample median. For firms

with high CEO equity ownership, the effect of increased risk has a more positive effect on investment (coefficient is 0.02 and significant at 5 percent level).

1.4.3. The change in risk following violations

In this section, I examine the changes in firm risk following violations since shareholders with risk-shifting incentives and creditors have conflicting interests. Increased risk hurts debtholders and benefits shareholders by increasing the value of the put option imbedded in risky debt. Table IX shows the effect of covenant violations on firm risk using different measures. In each regression, I control for market-to-book, book leverage, size (log total assets), asset tangibility (PPE/lagged total assets), and operating income scaled by lagged assets as these variables may affect firms' risk. In all models, I take the natural logarithm of the dependent variable to control for outliers. Columns 1-6 show the change in risk using different firm risk measures. All models except the one which uses systematic risk documents a significant increase in firm risk after covenant violations.

The first column reports the change in firm risk using industry adjusted risk adjustment ratio (IRAR). The coefficient of *New Financial Covenant Violation* is strongly negative and significant. Covenant violations are associated with a 5% increase in firm risk relative to the firm's industry median. Coefficient estimates on control variables are generally consistent with recent studies. For instance, high growth firms are more likely to have risky investments left in their investment opportunity set (Jensen and Meckling (1976)). Firms with larger cash holdings are mature firms which are less likely to take risky projects. The increase in risk goes up to 8% using the risk measures from the market model and 15% for the asset beta.[31]

31 In the untabulated results, I add current asset volatility as a control variable. Parrino and Weisbach (2000) argue that firms with higher asset volatility are more likely to have fewer risky projects

The increase in risk should be interpreted with caution. One explanation for the increased risk is that the borrowing firm is moving to a riskier stage due to an economic shock. For instance, firms may face with a higher risk of losing employees, suppliers, clients, partners, and new deals.[32] Figure I shows the pattern in equity volatility and earnings volatility. Although there is a jump in firm risk in the quarter following the violation, the increase in risk persists, lasting over two years following the violation.[33] Another explanation is that shareholder actions drive the increase in risk. Managers, who are facing increased likelihood of losing control rights after violations, may follow riskier strategies. However, one may also argue that creditor actions dampen the increase in risk.

The increase in risk, together with the positive volatility-investment relation for firms violating covenants shows that shareholders are not giving up their control over the firm when creditors increase their influence. Creditors may be engaging in actions to reduce the risk-shifting problem, but they cannot eliminate it.

1.5. Robustness tests

One concern is the impact of measurement error in the volatility estimates. To address this concern, I estimate Table IV using analyst forecasts dispersion. The dispersion of analyst forecasts measures uncertainty in the firms' economic prospects (e.g. Diether, Malloy, and Scherbina (2002)). I use standard deviation of I/B/E/S

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left in their investment opportunity set. I also add systematic volatility (volatility index, VIX) to further control for the trends in change in volatility. The results remain robust.

[32] For instance, Falato and Liang (2009) show that employment risk increases after a covenant violation.

[33] Moreover, the results are robust when I calculate the next year's volatility excluding the first quarter after the violation, suggesting that the results are not driven by announcement effect.

earnings per share forecasts for the next fiscal year end, scaled by the absolute value of the mean estimate (Chava, Kumar, and Warga (2009)). Table X presents the results, which are qualitatively similar. This finding reassures that the results are robust to the volatility measure choice and suggests that measurement error likely leads to conservative estimates of investment response to the increase in volatility. [34]

Next, instead of using firm-specific ex-post volatility, I follow Eisdorfer (2008) and study the relationship between annual expected market volatility and capital expenditure. I calculate annual expected market volatility using a generalized autoregressive conditional heteroskedasticity (GARCH) model, and employ a linear regression of capital expenditure on an interaction variable between expected volatility and a violation dummy. To manage the length of my study, I refer the reader to Eisdorfer (2008) for additional details. The untabulated results support the previous findings. The coefficient on volatility is -0.14 (p-value 0.08) for non-violators and the coefficient on the interaction variable is 0.09 (p-value 0.12). [35] One advantage of using firm-specific volatility, rather than expected market volatility is that the former captures uncertainty firms face arising from covenant violations. Firms which violate covenants may be more interested in the firm specific uncertainty. Moreover, I use industry adjusted risk adjustment ratio which takes into account industry-wide uncertainty.

Another concern is that the increase in risk following violations is due to the persistence in volatility (see Campbell and Taksler (2003)). Since volatility increases

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[34] The focus of this paper is not the effect of uncertainty on investment, but rather is the association between these two variables. Managers with risk shifting incentives may increase investment as a response to increased uncertainty. Investment decisions may also drive the degree of uncertainty. For example, if managers undertake risky investments, implied volatility may increase to reflect the uncertainty regarding future returns. These are both consistent with the risk-shifting argument. I investigate the effect of uncertainty on investment by using analyst forecast dispersion and expected market volatility. These tests reveal that uncertainty has a positive impact on investment for firms which violate a covenant.

[35] The table is available upon request.

before and at the time of the violation, the increase in risk following violations may not be surprising. To control for the autocorrelation in volatility, I add to each model in Table IX the current volatility, lags and polynomials of volatility using the relevant risk measure. The results are qualitatively similar to those presented in Table IX and, as such, not tabulated. Thus, persistence in risk does not appear to be responsible for the increased risk following violations.

Lastly, I re-estimate Table IV using a matching firm procedure. Specifically, for each violator firm, I choose a matching non-violator firm in the same year with the same 2-digit SIC, in same size decile and closest book-to-market. Table XI presents the estimation results for violators and corresponding matched firms. For non-violators, the association between change in risk and change in investment is significantly negative. The coefficient is -0.02 with a t-statistics of -2.5. This relation becomes positive for violator firms (the coefficient on the interaction variable is 0.02, statistically significant). The results are similar when I use change in capital expenditure as the dependent variable.

1.6. Conclusion

Recent studies suggest constraints on firms' behavior imposed by creditors following violations of financial covenants can benefit shareholders by curbing by managerial value-reducing overinvestment. The literature has not investigated, however, managers (who are acting on behalf of shareholders) engage in activities counter to creditor interests. This study fills in this gap by examining risk shifting behavior around violations.

A healthy firm will delay or forego the investment when uncertainty is high. Managers with risk-shifting incentives, however, increase investment when uncertainty is high. I show that there is negative association between volatility and investment before

the violation. Once firms violate covenants; however, the negative relation between risk and investment reverses, consistent with risk shifting. This effect is more pronounced in firms where managers have incentives to take more risk. I find that risk shifting is more pronounced in firms with high CEO wealth sensitivity to stock volatility (vega) and with high managerial equity ownership. In contrast, managers whose wealth is more sensitive to stock prices are more risk averse. I also show that firm risk increases following violations and that the increase is persistent, lasting over two years following the violation.

While prior studies document that creditors increase control following covenant violations, I show that risk shifting occurs even in the presence of increased creditor control. This finding counters prior conclusions that shareholders and debtholders have common interests at violations. Creditor actions may help alleviate agency problems; however they do not fully prevent the problem.

A fruitful area for future empirical research would be to document the full set of actions shareholders can take to protect their control over the firm when covenants are violated. It would also be interesting to examine whether different features of covenants (e.g. covenant tightness, structure of debt, maturity of debt) alleviate shareholder-debtholder conflicts at violations.

Table 1.1 Financial covenant violations (1996-2007)

	Covenant Violation		New Covenant Violation	
Year	Violation Incidence	Percentage of Sample	Violation Incidence	Percentage of Sample
1996	6,240	10.50%	0	0.00%
1997	6,550	11.74%	315	5.00%
1998	6,409	14.60%	480	7.59%
1999	6,366	15.60%	483	8.01%
2000	6,267	16.26%	502	5.64%
2001	5,676	11.64%	511	5.70%
2002	5,121	12.18%	399	6.65%
2003	4,784	16.07%	318	5.70%
2004	4,613	12.18%	263	5.64%
2005	4,554	11.64%	257	5.78%
2006	4,445	11.27%	257	4.99%
2007	4,325	10.68%	216	7.59%
Total	65,350	14.02%	4,001	6.12%

Note: This table presents the percentage of firms that report a financial covenant violation during the fiscal year from 1996 to 2007. A new covenant violation is a financial covenant violation by a firm that has not violated a covenant for the previous four quarters. The sample includes 9,915 firms.

Table 1.2 Summary statistics

Panel A. Covenant Control Variables

	New Violators						Non-Violators					
	N	10th	25th	50th	75th	90th	N	10th	25th	50th	75th	90th
Market-to-Book	3,810	0.77	0.92	1.18	1.64	2.52	180,443	0.84	1.05	1.44	2.29	3.88
Leverage Ratio	3,897	0.03	0.15	0.30	0.47	0.64	187,014	0.00	0.02	0.19	0.37	0.55
Current Ratio	3,898	0.63	1.01	1.49	2.30	3.45	188,041	0.79	1.23	1.96	3.27	5.84
Net Worth scaled by assets	4,001	0.06	0.24	0.40	0.57	0.72	193,031	0.14	0.31	0.50	0.71	0.84
Interest expense / lag(assets)	3,391	0.00	0.00	0.01	0.01	0.02	158,547	0.00	0.00	0.00	0.01	0.01
Operating income / lag(assets)	3,637	-0.07	-0.02	0.01	0.03	0.04	177,834	-0.06	0.00	0.03	0.04	0.07

Panel B. Other Firm Characteristics

	New Violators						Non-Violators					
	N	10th	25th	50th	75th	90th	N	10th	25th	50th	75th	90th
Size (Log_atq)	4,001	2.74	3.58	4.75	6.04	7.25	193,044	2.66	3.68	5.10	6.65	8.03
PPE/assets	3,996	0.05	0.10	0.21	0.41	0.65	192,525	0.03	0.08	0.19	0.39	0.65
Total Debt	3,897	1.16	5.55	24.91	139.70	568	187,014	0.00	1.11	16.78	198.05	916.86
Free Cash Flow/Assets	3,522	-0.09	-0.02	0.00	0.02	0.03	173,729	-0.08	-0.01	0.02	0.03	0.05
Market Value Equity/Assets	4,001	0.12	0.27	0.55	1.06	1.92	194,408	0.22	0.47	0.94	1.82	3.41
Sales/Assets	4,001	0.08	0.16	0.27	0.40	0.58	193,044	0.55	0.13	0.24	0.38	0.62

Table 1.2 Continued

Panel B. Other Firm Characteristics (cont.)

	New Violators						Non-Violators					
	N	10th	25th	50th	75th	90th	N	10th	25th	50th	75th	90th
Market Value	3,810	19.61	45.53	138.42	481.3	1661.6	180,443	21.36	59.44	239.48	1,104.6	4,483.2
RD/assets	1,862	0.00	0.00	0.01	0.04	0.07	95,473	0.00	0.00	0.02	0.04	0.08
RD/sales	1,858	0.00	0.00	0.06	0.16	0.32	93,178	0.00	0.01	0.08	0.21	0.78
Zscore	3,490	-1.27	0.77	1.95	3.15	5.01	168,774	-0.74	1.31	2.94	5.33	10.31
Credit Rating	740	BBB	BB	BB-	B	B-	44,480	A	BB+	BB+	BB-	B

Panel C. Firm Risk Variables

	New Violators						Non-Violators					
	N	10th	25th	50th	75th	90th	N	10th	25th	50th	75th	90th
Total Equity Risk	1,600	0.37	0.51	0.72	0.99	1.34	43,172	0.27	0.37	0.55	0.83	1.17
Unsystematic Risk	1,600	0.35	0.49	0.70	0.96	1.31	43,172	0.25	0.34	0.52	0.79	1.14
Systematic Risk	1,600	0.05	0.08	0.15	0.23	0.34	43,172	0.05	0.09	0.14	0.21	0.31
Equity Beta	1,600	0.17	0.53	1.01	1.59	2.19	43,172	0.25	0.60	1.08	1.64	2.26
Asset Beta	1,577	0.06	0.21	0.54	1.07	1.70	42,626	0.13	0.38	0.80	1.39	2.03
Asset Volatility	1,537	0.16	0.26	0.39	0.61	0.91	41,018	0.17	0.25	0.39	0.62	0.91
RAR	1,207	0.61	0.79	1.03	1.34	1.79	33,748	0.63	0.77	0.95	1.18	1.47
IRAR	1,207	-0.32	-0.16	0.04	0.36	0.79	33,748	-0.31	-0.16	0.00	0.20	0.47

Panel D. Managerial Incentives

	New Violators						Non-Violators					
	N	10th	25th	50th	75th	90th	N	10th	25th	50th	75th	90th
Vega	307	25.237	3,442.68	22,279	99,164	422,857	14,735	1,497.2	13,150	56,483	214,849	914,506
Delta	181	2,029	6,485	15,099	35,273	79,541	9,387	3,840	9,535	25,908	72359	180,423

Table 1.2 Continued

Note: This table presents summary statistics of variables for the sample from 1996 to 2007. A new violator is a firm that has not violated a covenant for the previous four quarters. Panel A and Panel B display the descriptive statistics for covenant control variables and other firm characteristics for violators and non-violators. Panel C presents summary statistics for key variables that are used to measure firm risk. Panel D presents the summary statistics for managerial incentives. The risk adjustment ratio (RAR) is the ratio between the current and next year's asset risk. The industry adjusted risk adjustment ratio (IRAR) is the difference between the firm's RAR and median RAR of the firms in the same 2-digit SIC code in the same year. Vega is the dollar change in CEO stock holdings for a 1% change in stock return volatility. Delta is the dollar change in CEO stock holdings for a 1% change in stock price. See Appendix A for variable definitions.

Table 1.3 The effect of financial covenant violations on firms' investment

	Total Investment	Capital Expenditure	Acquisition Expenditure	R&D Expenditure	Sale of PPE
New Financial Covenant Violation	-0.021***	-0.009***	-0.011***	-0.002	0.000
	0.005	0.002	0.004	0.002	0.001
Market-to-Book ratio	0.003	0.000	0.002***	0.001	0.000
	0.002	0.000	0.000	0.002	0.001
Current Ratio	0.004***	0.001***	0.001***	0.001***	0.000
	0.001	0.000	0.000	0.000	0.000
Net worth/assets	0.011	-0.007***	-0.007**	0.020**	-0.006*
	0.013	0.003	0.003	0.008	0.008
Interest expense/lagged assets	-0.643*	0.099	-0.344***	-0.405*	-0.086
	0.339	0.144	0.133	0.218	0.102
Leverage Ratio	-0.066***	-0.013***	-0.032***	0.005	0.007
	0.017	0.005	0.007	0.013	0.010
Operating cash flow/lagged assets	-0.199***	0.009	0.002	-0.207***	-0.015*
	0.054	0.012	0.009	0.043	0.008
Additional Control Variables	Yes	Yes	Yes	Yes	Yes
N	22,817	23,949	24,329	25,549	25,549
R^2	0.075	0.047	0.044	0.053	0.012

Note: This table presents first difference estimates of the marginal effect of covenant violation on firm investment from the quarter of the violation to one year after the violation. Covenant control variables include operating cash flow scaled by lagged assets, the leverage ratio, interest expense scaled by lagged assets, net worth scaled by assets, the current ratio, and the market-to-book ratio. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant control variables and higher order covenant control variables. First difference covenant control variables are differences from the quarter of the violation to one year after the violation. Lagged first difference covenant control variables are differences from one year ago to the present quarter of each of these variables. Higher order covenant control variables are covenant control variables raised to the second and third power. The sample is limited to firms-quarter observations in the fourth quarter of each year. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. See Appendix A for variable definitions.

Table 1.4 The relation between change in investment and change in risk

	Change in Total Investment	Change in Capital Expenditure	Change in Cash Acquisition	Change in R&D Expenditure	Sale of Plant, Property and Equipment
New Financial Covenant Violation	-0.019***	-0.012***	-0.005	-0.001	0.000
	0.005	0.002	0.005	0.002	0.001
Change in Risk	-0.011***	-0.003**	-0.010***	0.003	0.002**
	0.004	0.001	0.002	0.002	0.001
Change in Risk* New Viol	0.031***	0.007*	0.019**	0.004	-0.001
	0.013	0.004	0.010	0.004	0.003
Market-to-Book	0.004	0.000	0.002***	0.001	0.001
	0.003	0.000	0.000	0.002	0.000
Leverage Ratio	-0.115***	0.014	-0.108***	0.005	0.027*
	0.028	0.009	0.022	0.018	0.016
Operating cash flow/lagged assets	-0.082*	0.014	0.025**	-0.126***	-0.014*
	0.044	0.009	0.013	0.036	0.007
Size	-0.002***	0.001*	-0.004***	0.001	0.000
	0.001	0.000	0.001	0.000	0.000
Additional Control Variables	Yes	Yes	Yes	Yes	Yes
N	20,732	21,704	20,862	21,885	21,885
R^2	0.126	0.063	0.154	0. 085	0.012

Table 1.4 Continued

Note: This table presents the relation between risk and investment following covenant violation in the year following the violation. *Change in Risk* is equal to the natural logarithm of 1+IRAR. In each specification, change in investment is equal to the difference of investment measure scaled by lagged assets from the quarter of the violation to one year after the violation. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant control variables and higher order covenant control variables. Additional control variables are described in Table III. The sample is limited to firms-quarter observations in the fourth quarter of each year. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 1.5 The relation between change in investment and increase in risk

	Change in Total Investment	Change in Total Investment
Intercept	0.034 **	0.032 **
	0.015	0.014
New Financial Covenant Violation	-0.029 ***	
	0.007	
Increase in Risk	-0.010 ***	
	0.002	
Increase in Risk* New Viol	0.028 ***	
	0.010	
Increase in Risk* New Viol * First Time		0.026 **
		0.011
Increase in Risk* New Viol * Repeat		0.016
		0.021
First Time		-0.031 ***
		0.008
Repeat		-0.023 *
		0.013
Market-to-Book	0.004	0.004
	0.003	0.003
Leverage Ratio	-0.120 ***	-0.114 ***
	0.029	0.028
Operating cash flow/lagged assets	-0.087 *	-0.081 *
	0.044	0.044
Size	-0.002 **	-0.002 ***
	0.001	0.001
Additional Control Variables	Yes	Yes
N	20,735	20,735
R^2	0.128	0.126

Note: This table presents the relation between increase in risk and investment in the year following covenant violations. Increase in Risk is 1 if next year's risk is higher than current year's risk, adjusted by 2-digit SIC industry median, and 0 otherwise. Change in Total Investment is equal to the difference of total investment scaled by lagged assets from the quarter of the violation to one year after the violation. First Time equals one if it is the first time a firm violates a covenant. Repeat equals one if it is not the first time the firm violates a covenant. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant control variables, and higher order covenant control variables. Additional control variables are described in Table III. The sample is limited to firms-quarter observations in the fourth quarter of each year. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 1.6 The risk-shifting activities before and after the violation

	Before the violation	One year before the violation	After the violation
	Change in Total Investment	Change in Total Investment	Change in Total Investment
Change in Risk	-0.018**	-0.037*	0.013*
	0.007	0.021	0.060
Market-to-Book	0.006	0.003	0.030
	0.005	0.006	0.027
Leverage Ratio	-0.190***	-0.090**	-0.039
	0.060	0.041	0.107
Operating cash flow/lagged assets	0.240***	0.050	-0.279**
	0.059	0.165	0.129
Size	-0.002	-0.019***	-0.003
	0.001	0.006	0.003
Additional Control Variables	Yes	Yes	Yes
N	2,197	1,001	1,389
R^2	0.057	0.051	0.147

Note: This table presents the risk-shifting activities of firms which violate a covenant once during the sample period. Change in Risk is equal to the natural logarithm of 1+IRAR. Change in Total Investment is equal to the difference of total investment scaled by lagged assets from the quarter of the violation to one year after the violation. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant control variables and higher order covenant control variables. Additional control variables are described in Table II. The sample is limited to firms-quarter observations in the fourth quarter of each year. The first column includes all years before the violation. The second column shows the investment-risk relation in year before the violation. The third column shows the investment-risk relation in the year following the violation. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 1.7 The relation between change in investment and change in risk for financially constrained firms

	Change in Total Investment
New Financial Covenant Violation	-0.017***
	0.005
Change in Risk	-0.013***
	0.003
Change in Risk* New Viol	0.025**
	0.012
Change in Risk * New Viol * Financially Constrained	0.034*
	0.020
Financially Constrained	-0.003
	0.004
Change in Risk * Financially Constrained	-0.002
	0.008
Financially Constrained * New Viol	0.002
	0.008
Market-to-Book	0.002
	0.001
Leverage Ratio	-0.102***
	0.015
Operating cash flow/lagged assets	-0.017
	0.020
Size	-0.003***
	0.001
Additional Control Variables	Yes
N	20,463
R^2	0.152

Note: This table presents the relation between risk and investment following covenant violations for financially constrained firms at the year following the violation. *Change in Risk* is equal to the natural logarithm of 1+IRAR. *Change in Total Investment* is equal to the difference of total investment scaled by lagged assets from the quarter of the violation to one year after the violation. A firm is financially constraint if the Whited and Wu (2006) index is in the upper third of the distribution. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant control variables and higher order covenant control variables. Additional

Table 1.7 Continued

control variables are described in Table III. The sample is limited to firms-quarter observations in the fourth quarter of each year. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 1.8 The effect of managerial risk incentives on risk-taking behavior

	CEO Wealth Sensitivity	CEO Equity Ownership
New Financial Covenant Violation	-0.035	-0.026***
	0.031	0.007
Increase in Risk	0.002	-0.007***
	0.006	0.002
Increase in Risk* NewViol	0.082*	0.013*
	0.047	0.008
Increase in Risk * NewViol * High Managerial Ownership Dummy		0.020**
		0.003
High Managerial Ownership Dummy		0.005
		0.003
Increase in Risk * NewViol * High Vega Dummy	0.028**	
	0.014	
Increase in Risk * NewViol * High Delta Dummy	-0.022*	
	0.013	
High Vega Dummy	-0.008	
	0.005	
High Delta Dummy	0.005	
	0.006	
Market-to-Book	-0.003	0.000
	0.003	0.002
Leverage Ratio	-0.054	-0.103***
	0.040	0.018
Operating cash flow/lagged assets	0.145	-0.052
	0.108	0.039
Size	-0.002	-0.002
	0.001	0.001
Additional Control Variables	Yes	Yes
N	4,513	8,274
R^2	0.228	0.156

Note: This table presents the relation between risk and investment in the year following covenant violations for firms with high managerial risk taking incentives. *Increase in Risk* is 1 if next year's risk is higher than current year's risk, adjusted by 2-digit SIC industry median, and 0 otherwise A firm is a *High Vega* (*High Delta*) firm if vega (delta) is higher than the sample mean. A firm is considered to be a *High Managerial Ownership* firm if the percentage of equity owned by the CEO is higher than the sample median. The dependent variable is the change in investment. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant control variables, higher order covenant control variables, two-way interaction variables. Additional control variables are described in Table III. The sample is limited to firms-quarter observations in the fourth quarter of each year. The two-way interaction variables are also included in the tests but not reported. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 1.9 Financial covenant violations and firm risk

	Change in Asset Volatility	Change in Earnings Volatility	Change in Total Risk	Change in Systematic Risk	Change in Unsystematic Risk	Change in Asset Beta
New Financial Covenant Violation	0.046***	0.088***	0.079***	0.008	0.082***	0.154***
	0.015	0.014	0.012	0.041	0.013	0.044
Market-to-Book	0.016**	-0.021***	-0.004*	0.022***	-0.006***	-0.063***
	0.003	0.003	0.002	0.004	0.002	0.008
Leverage Ratio	-0.106*	0.196***	-0.045	0.039	-0.051	0.065
	0.055	0.046	0.037	0.080	0.033	0.100
Operating cash flow/lagged assets	-0.153**	-1.034***	-0.247***	0.242**	-0.282***	-0.238*
	0.066	0.002	0.045	0.108	0.045	0.130
Size	-0.004***	0.014***	0.006***	-0.001	0.005***	-0.010***
	0.001	0.002	0.001	0.003	0.001	0.003
Asset Tangibility	-0.035*	0.015	0.029***	0.023	0.026***	0.032
	0.013	0.017	0.011	0.021	0.008	0.029
Additional Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
N	20,102	22,817	21,096	21,096	21,096	19,690
R^2	0.064	0.075	0.158	0.156	0.156	0.061

Note: This table presents the estimates of the marginal effect of covenant violation on firm risk from the quarter of the violation to one year after the violation. All the dependent variables except *Change in Asset Volatility* are the natural logarithm of the ratio of next year's firm risk to current year's firm risk. *Change in Asset Volatility* is the natural logarithm of 1+IRAR. Asset Volatility is derived from Moody's KMV method. *Earnings Volatility* is the standard deviation of a firm's return on assets (ROA) over 12 quarterly observations. *Total Risk* is annualized standard deviation of daily returns over the fiscal year. *Systematic Risk* is the standard deviation of the product of the firm beta times the market daily returns. *Unsystematic Risk* is annualized standard deviation of the residuals from the market model. *Asset Beta* is the calculated by unlevering the equity beta which is derived from the market model. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant

Table 1.9 Continued

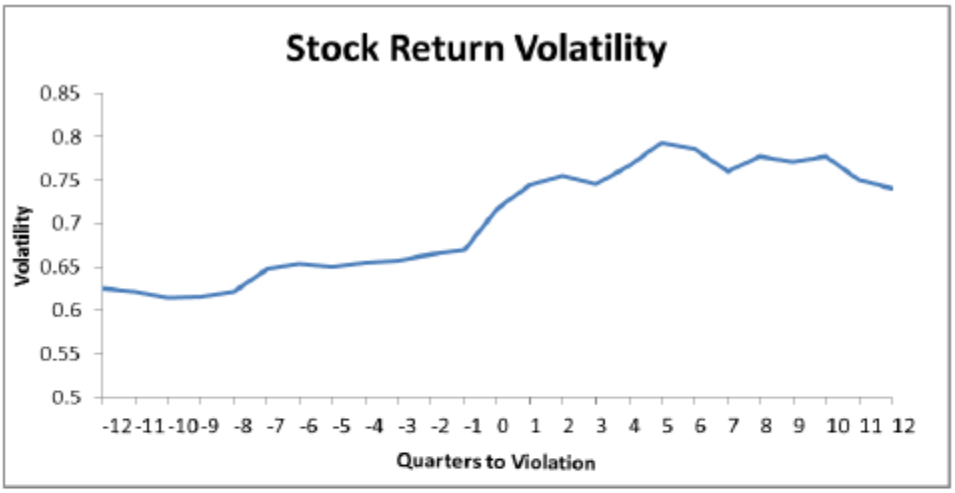
fourth quarter of each year. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 1.10 The relation between change in investment and change in risk using analysts' forecasts dispersion

	Change in Total Investment	Change in Capital Expenditure
New Financial Covenant Violation	-0.014	-0.024**
	0.009	0.005
Expected Volatility	-0.005***	-0.002***
	0.001	0.000
Expected Volatility * NewViol	0.006**	0.003**
	0.003	0.001
Market-to-Book	0.020***	0.002
	0.005	0.001
Leverage Ratio	-0.082***	-0.014
	0.030	0.013
Operating cash flow/lagged assets	-0.148**	-0.012
	0.069	0.018
Size	-0.002**	0.002***
	0.000	0.001
Additional Control Variables	Yes	Yes
N	9946	10,381
R^2	0.168	0.140

Note: This table presents the relation between risk and investment following covenant violation. *Expected Volatility* is the standard deviation of I/B/E/S earnings per share forecasts for the next fiscal year end, scaled by the absolute value of the mean estimate. *Change in Total Investment* (*Capital Expenditure*) is the change in total investment (capital expenditure) in the following year. All specifications include industry, year fixed effects, lagged first difference covenant control variables, first difference covenant control variables and higher order covenant control variables. Additional control variables are described in Table III. The sample is limited to firms-quarter observations in the fourth quarter of each year. Standard errors are clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Figure 1.1 Stock return and earnings volatility



Note: The top panel of this figure presents annualized mean of stock return volatility and earnings volatility around a new financial covenant violation. Stock return volatility is the annualized standard deviation of stock prices calculated using 180-day window, normalized by market volatility over the same period. The bottom panel plots the mean earnings volatility normalized by 2 digit SIC industry median over the same period. Earnings volatility is the standard deviation of return on assets (ROA) scaled by lagged assets using 3-year window.

CHAPTER 2
CREDITOR CONTROL RIGHTS AND PRODUCT MARKET COMPETITION

2.1. Introduction

The Modigliani-Miller theorem (1958) argues that, if capital markets are well-functioning and in the absence of taxes, firms' financing and investment decisions are independent. Since the publication of Modigliani-Miller, numerous papers have investigated the validity of this independency and have established that financing and investment decisions are related (Stein (2005)). More recently, theoretical and empirical literature has examined how asymmetric information and capital market imperfections could forge a link between a firm's capital structure choices and product market behavior (Titman (1984), Brander and Lewis (1986), Maksimovic (1998), Philips (1995), Chevalier (1995a, 1995b), Zingales (1998), Campello (2003)). While previous research has investigated how the level of debt influences product market outcomes and rival behaviors, it has been less clear whether various features of debt contracts have similar effects. The goal of this study is to examine whether debt covenants lead to distortions affecting firms' product market behaviors.

In an ideal setting, restrictive covenants not only protect debtholders but also provide enough flexibility for the managers to pursue first-best outcomes. However, as pointed out by a CPA firm Clayton & McKervey, P.C, "loan covenants can backfire if they are too inflexible or restrictive by slowing a borrower's growth and development. Borrowers may end up managing the loan covenants, rather than their business".[1] In this case, covenants can lead to unintended consequences in the product market. We

[1] http://www.claytonmckervey.com/news/articles/loan-covenants.htm

examine this channel by looking at financial covenant violations. Once financial covenants are violated (other than through payment defaults), creditors obtain the right to accelerate any outstanding principal and withhold further credit. Although creditors almost always waive the violation, the threat associated with these rights enables creditors to exert significant influence over the firm. A number of recent studies document that such financial covenant violations lead to increased creditor control over borrowing firms that significantly changes firms' financial, investment, and payout policies.[2]

While these studies show the impact of a specific mechanism (transfer of control rights) on firms' investments via misalignment of incentives, how increased creditor control over firms following covenant violations affect their product market outcomes and rivals behavior has been overlooked in the literature. This study intends to fill this gap. As noted by Jensen (1989), firms may benefit from creditor control as creditors restrict aggressive output strategies and prohibit managers from taking "empire-building" projects. On the other hand, covenant violations may reduce firms' financial flexibility to pursue investments that they would otherwise pursue and to respond to changes in market conditions. If increased creditor control makes firms low-cost competitors, we should see improvements in the competitive position of firms that violate covenants. If covenant violations weaken firms' competitiveness, however, these firms will be subject to rival actions and lose market share to their competitors.

We examine sales growth around violations and document that firms that violate a financial covenant lose their market share to their rivals. We show a substantial decrease in firms' sales growth following covenant violations compared to their rivals both in

[2] Beneish and Press (1993, 1995), Chen and Wei (1993), Sweeney (1994), Dichev and Skinner (2002), Chava and Roberts (2008), Roberts and Sufi (2009), Nini et al. (2009a, 2009b).

univariate and multivariate analyses. In addition to reporting changes in sales growth for firms which are in violation of financial covenants and sales growth changes net of corresponding changes for industry peers, we report sales growth changes net of changes for firms with similar pre-event sales growth performance. When we look at relative sales growth of violators, the industry adjusted sales growth is -5.74 percent in the year following the violation, and -11.52 percent in two years after the violation (both significant at one percent level). The performance-adjusted analysis shows a similar pattern. Relative to the control firms with similar pre-event sales growth performance, violators' sales growth is -4.99 percent (significant at one percent level) in the year following the violation.

We also conduct a multivariate test to see the impact of violations on firms' sales growth performance. Roberts and Sufi (2009) point out violations may occur due to deterioration of firm performance and results, therefore, are mechanically driven by the performance of violators. In univariate analysis, we see that there is a kink in sales growth behavior in the quarter in which the violation occurs. In order to exploit the discontinuity created in the violation quarter, we use a "quasi-discontinuity" approach as in Roberts and Sufi (2009). In these regressions, we include linear and higher-order controls for performance measures that are commonly used in financial covenants. This way, we hope to control for the differences of time-invariant and firm-level effects in the sample and compare violator firms to firms which did not violate a covenant in the same quarter with similar pre-violation performance.[3] The regression analysis confirms the univariate observations; firms which violate a covenant lose their market share to their competitors.

[3] In this approach, the effect of the violation is identified by the discontinuity that is created in the violation quarter. Under the assumption that there is no natural discontinuity in the outcome absent the violation, the effect of the violation is identified by comparing outcomes for firms just above (violation occurs, creditors obtain control) and just below (violation does not occur, creditors do no obtain control) the covenant threshold.

Next, we explore the changes in profit margins and long-run equity returns around covenant violations. We show that there is an improvement in profit margins for firms that violate a covenant, however, using various approaches we show zero to negative long-run equity abnormal returns. This finding suggests that while shareholders earn relatively poor returns, creditors protect themselves from default losses, consistent with Billett et al. (2006). In contrast, rivals exhibit positive long-run abnormal returns following their peer firm's covenant violation. While it is not clear whether increased creditor over firms leads to product market outcomes that are value maximizing or not, we show that covenant structure of debt agreements have dramatic effects on firms' product market behavior.

This study contributes to the literature on the link between firms' financing decisions and product market behavior. Although several studies show how the level of debt in firms' capital structure affects their product market strategies, it has been less clear how different features of debt contacts influence these decisions.[4] Our paper is the first to empirically document covenants have a profound effect on product market outcomes of the firm. Our paper also adds to the growing body of literature on the effect of financial covenant violations on firm behavior (Beneish and Press (1993, 1995), Chen and Wei (1993), Sweeney (1994), Dichev and Skinner (2002), Chava and Roberts (2008), Roberts and Sufi (2009), Nini et al. (2009a, 2009b), Esmer (2010)). These studies show significant changes in borrowing firms' financial, investment, and payout policies following violations. However, our study is the first to examine the effect of covenant violations on borrowing firms' product market behavior and their rivals' reaction.

Our paper is related to the studies which investigate the effect of bankruptcy or

[4] See Titman (1984), Brander and Lewis (1986), Maksimovic (1998), Chevalier and Scharstein (1996), Rotemberg and Scharfstein (1990) for theoretical work and Chevalier (1995a, 1995b), Phillips (1995), Zingales (1998), Chevalier and Scharfstein (1996), Campello (2003) for empirical evidence.

financial distress on product market competition (Lang and Stulz (1992), Hertzel et al. (2008), Hotchkiss (1995), Eberhart et al. (1999), Zhang (2010)). Relative to these studies, we focus on financial covenant violations that occur well outside of financial distress and rarely lead to default (Gopalakrishnan and Parkash (1995).[5] Moreover, financial covenant violations are very common. From 1996 through 2007, we find that between 10 percent and 20 percent of public firms were in violation of a covenant during any particular quarter and more than 40 percent of the firms were in violation at some point during the period. Thus, the potential impact covenant violations have on product market strategies is not limited to a small fraction of firms facing unique circumstances. By studying financial covenant violations, we are able to document the changes in product market behavior of borrowing firms, when creditors have the opportunity to exert control over corporate behavior in solvent firms on a frequent basis.

2.2. Literature review

A large number of papers examine the link between firms' capital structure and product market behavior. Theoretical papers have mixed predictions about how leverage affects competition. Fudenberg and Tirole (1986), Bolton and Scharfstein (1990), Phillips (1991), Chevalier and Scharstein (1996) argue that competition becomes softer when leverage increases. However, other theoretical papers such as Brander and Lewis (1986), Maksimovic (1998), Rotemberg and Scharfstein (1990) predict that leverage changes managerial and shareholder incentives in a way that makes product-market competition tougher.

5 Firms which violate financial covenants may have performance deterioration leading to the violation. However, the median firm in violation of a financial covenant has comparable liquidity and valuation measures compared to the median firm in the full sample.

The link between financing and product market outcomes has also been investigated empirically. Chevalier (1995a) examines competition in the supermarket industry after one firm undergoes a leveraged buyout (LBO) and shows that LBOs' make firms weaker competitors, as measured by entry and expansion decisions and stock price reaction of rival firms. In her second paper, Chevalier (1995b) finds that LBOs have significant impact on the supermarket prices. She finds that when LBO firm's rivals are less leveraged, LBOs lead to a decrease in prices, consistent with opportunistic predation by less financially constrained rivals. When rival firms are highly leveraged, prices rise following LBOs, consistent with LBOs softening product market competition. Phillips (1995) finds that in three out of four industries he examined, high leverage weakens the competition. Kovenock and Philips (1997) add to Philips (1995) by showing that high leverage makes firms more passive, increasing plant closures and decreasing investment in highly concentrated markets. Zingales (1998) analyze trucking industry and finds that leverage negatively affects the probability that a firm survives increased competition.

Complementing these studies, several papers examine competitive responses to shocks in competitive environments. Chevalier and Scharfstein (1996) and Campello (2003) show that highly leverage firms become weaker competitors during market downturns, consistent with Opler and Titman (1994). Khanna and Tice (2000) study how Wal-mart's expansion affected incumbent firms and show that high leverage is associated with more passive responses. Khanna and Tice (2005) expand their earlier work and show that Wal-mart places its stores closer to less efficient/highly leveraged rival stores, consistent with the idea that leverage weakens competition.

Another body of literature investigates the effect of bankruptcy or financial distress on product market competition. Lang and Stulz (1992) find that, on average, industry rivals suffer negative announcement stock price effects (*contagion effects*) around the time that a competitor files for bankruptcy. However, the stock price effect is positive for rivals in highly concentrated industries with low leverage (*competitive*

effects). Hertzel et al. (2008) also show that rivals have negative announcement reaction if the filing firm is highly levered. Hotchkiss (1995) finds that reorganized firms earn operating profit margin lower than the industry median. Eberhart et al. (1999) assess the long-term stock return performance of 131 firms emerging from Chapter 11. They find large positive excess returns in the 200 days after emergence. They conclude that although firms may not do well in their post-Chapter 11 financial performance, they appear to do better than the market had expected at the time of emergence from Chapter 11. Zhang (2010) shows rivals of firms that emerge from Chapter 11 have negative long-run equity returns and deteriorating financial performance.

The extant literature on capital structure and product market competition has mostly focused on how the level of leverage impacts product market outcomes. However, there are other important features of leverage that may have similar effect on product market outcomes, one of which is covenants on debt agreements. Restrictive covenants define the circumstances under which debtholders are permitted to intervene in management (Aghion and Bolton (1992), Hart (1995)). Building on this view, several papers investigate how firm behavior changes once control rights are transferred to creditors by examining bank loan covenant violations (Beneish and Press (1993, 1995), Chen and Wei (1993), Sweeney (1994), Dichev and Skinner (2002), Chava and Roberts (2008), Roberts and Sufi (2009), Nini et al. (2009a, 2009b), Esmer (2010)). Chava and Roberts (2008) and Nini et al. (2009a) show a sharp decrease in investment following violations. Roberts and Sufi (2009) find that firms violating covenants significantly decrease their net debt issuing activity, which decreases their leverage ratios. Nini et al. (2009b) confirm these results and also show that violations are followed by a decrease in shareholder payouts, an increase in CEO turnover, an increase in the incidence of corporate restructurings, and an increase in the likelihood of hiring turnaround specialists. These studies show creditors exert significant influence over borrowing firms following

violations which leads to changes in borrowing firms' financial, investment, and payout policies.

2.3. Sample construction and summary statistics

Covenant violations data is obtained from Amir Sufi's website.[6] The sample construction below follows Nini et al. (2009a) using the period 1996 through 2007. To be included in the sample, we require firms to be U.S. (fic="USA") public firms, to have data available on the Compustat and Center for Research in Security Prices (CRSP) databases, and have average book assets greater than $10 million in 2000 dollars. We exclude financial firms (SIC 6000–6999) and utilities (SIC 4900-4999) because these firms are often subject to heavy federal regulations. We exclude firms with missing information on total assets, sales, common shares outstanding, closing share price, and the calendar quarter of the filing. Finally, we require firms to be publicly traded with ordinary common shares (CRSP share code 10 or 11: thus I exclude ADRs, REITs, units, certificates, and trusts). Imposing these restrictions leaves a sample of 8,236 firms and 184,189 firm-quarter observations. We follow Nini et al. (2009a) and focus our analysis on new financial covenant violations, which are defined as financial covenant violations for firms that have not violated a covenant in the previous four quarters. The reason to focus on the new covenant violations is that they represent the initial measure of creditor intervention. Therefore, the effect of creditor influence over firms' product market behavior will be more clearly identified. In our sample, we have 3,802 new violations between 1997 and 2007.

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[6] This data is available at http://faculty.chicagobooth.edu/amir.sufi/data.htm. Nini, Smith, and Sufi extract information from every 10-Q and 10-K filing on SEC Edgar website. Using a text-searching algorithm, they determine whether a firm is in violation of a covenant. Then they match this information to COMPUSTAT file. For more information on the data, please see Appendix of "Creditor Control Rights, Corporate Governance and Firm Value" by Nini, Smith and Sufi (2009).

Table 1 presents the distribution of the final sample across the calendar years, fiscal quarters of the covenant violation and industries. The incidence of new violations is cyclical, peaking during the 2001-2002 recession. There is a sharp decline in the incidence of new violations in the latter part of the sample. Not surprisingly, more than 40 percent of new violations are reported in the last fiscal quarter. It is due to the fact that covenant violations are more common in 10-K filings than in 10-Q filings. Table I also shows that the occurrence of new financial covenant violations is similar across industries, although violations are more common in manufacturing.

Table 2 displays percentiles of the distribution of various liquidity and solvency measures for new violator firms. Violators are not experiencing deep liquidity problems. The median current ratio of violators is 1.497, compared to 1.950 in the full sample. The median operating income scaled by average assets is 0.011, which put the median violator are the 30^{th} percentile (untabulated) of the broader distribution. The operating cost scaled by average assets is 0.267 for violator firms, which is very close to the median in the full sample. We observe that violator firms are not extremely leveraged. The net worth ratio is 0.406 for the median new violator firm, which is comparable to the net worth ratio of median firm in the full sample. The median leverage ratio of new violators is 0.303, which is slightly higher than median leverage ratio of the full sample. When we compare credit ratings of violator firms to the ratings of the full sample, we see that violator firms are slightly more risky than median firm in the full sample. The S&P credit rating of the median new violator firm is BB-. Finally, we observe that the median new violator firm's sales ratio (sales scaled by average assets) is almost identical to the sales ratio of the median firm in the full sample. The median annual sales growth at the time of the violation is very small (0.001), compared to the median sales growth in the full sample. Overall, we can conclude that financial covenant violations indicate a deterioration of the performance rather than an indicator of a low level of performance.

2.4. Results on sales growth

2.4.1. Univariate results

We start by analyzing the sales growth around covenant violations. Table 3 reports the sales growth around covenant violations for violator firms and their rival firms. Sales growth is defined as $(Sales_t-Sales_{t-1})/Sales_{t-1}$. Rivals firms are defined as firms which are in the same four-digit SIC code as the violator firm, but do not have a covenant violation in the same quarter. We take the average sales growth of rival firms for each covenant violation to calculate rival firms' sales growth. Table 3 shows that both violating firms and their rivals have increased sales growth following covenant violations. When we look at the difference for violators and their rivals, however, violators have lower sales growth compared to their rivals in the past-violation period we examined. The difference in the mean (median) sales growth from the violation quarter to quarter +4 is -5.12 (-7.43) percent, statistically significant at one percent level. When we look at the sales growth from the violation quarter to quarter +8, the difference in the mean (medina) sales growth is -9.14 (17.73) percent.

We then examine the adjusted sales growth for firms that violate a covenant. Adjusted sales growth is calculated by subtracting control firms' sales growth from the violator's unadjusted sales growth. We use two different control firm definitions. For the industry-adjusted sales growth, we use a non-violator firm with the same four-digit SIC code that has book value of assets closest to that of the violator firm. For the performance-adjusted sales growth, we use rival firms that have similar pre-event sales growth and market-to-book ratios following Lie (2005).[7] For each violator firm, we

[7] Lie (2005) use a similar sample construction method to generate control firms with similar pre-event operating performance in or der to investigate the effect of open market share repurchase announcements on operating performance.

choose non-violator firms in the same four-digit SIC code with sales growth (market-to-book) within +/- 20 percent of violator firms at the violation quarter when sales growth (market-to-book) is less than five percent or within +/- 0.01 when sales growth (market-to-book) is less than five percent. If there is no matching firm satisfying the above criteria we relax the industry criterion to three, two, one and no SIC code. Then, we choose the matching firm which has the closest value of the sum of absolute value of ((Sales $_{t}$ -Sales $_{t-4}$)/Sales $_{t-4}$ for the violating firm - (Sales $_{t}$ -Sales $_{t-4}$)/Sales $_{t-4}$ for the matched firm) and absolute value of ((Sales$_t$-Sales$_{t-1}$)/Sales $_{t-1}$ for the violating firm - (Sales$_t$-Sales$_{t-1}$)/Sales $_{t-1}$ for the matched firm), where *t* is the violation quarter. If we are not able to calculate sales growth in the prior four quarters; we only use the previous quarter's sales growth. The performance-adjusted performance is the paired difference between sales growth of sample firms and sales growth of their respective control firms.

Table 4 reports the unadjusted and adjusted sales growth. Although the mean sales growth during the year from the violation quarter to quarter 4 is 8.04 percent (significant at one percent level), when we look at the adjusted sales growth, results are just the opposite. Both the mean industry-adjusted sales growth and mean performance-adjusted sales growth show that relative to their peers, violator firms' sales decline by around -5 percent (significant at one percent) in the year following the violation. The median industry-adjusted sales growth is -3.57 percent and median performance-adjusted sales growth is -1.74, both significant at one percent level.

2.4.2. Multivariate results

We estimate the effect of covenant violations on market share of firms by using the following regression:

$$\Delta \text{ Market Share} = \boldsymbol{\beta_1}\textbf{*Violation Dummy}_{\mathbf{i,t}} + \Theta_1*\text{Covenant Controls}_{i,t} + \Theta_2*(\text{Covenant Controls}_{i,t+4} - \text{Covenant Controls}_{i,t}) + \Theta_3*(\text{Covenant Controls}_{i,t} - \text{Covenant Controls}_{i,t-4}) + \Theta_4*(\text{Covenant Controls}_{i,t})^2 + \Theta_5*(\text{Covenant Controls}_{i,t})^3 + \text{SIC}_i + \text{Year}_t + \varepsilon_{i,t} \quad (1)$$

In this equation, *Δ Market Share* is annual sales growth minus its industry-year average in relation to that of its competitors, or equivalently, is a proxy for market share growth; *Violation* is an indicator variable that equals 1 for a new financial covenant violation. *SIC* represents one-digit SIC industry indicator variables, and *Year* represents year indicator variables, which is included because firm outcomes may change over time.[8] We include the most common ratios used in debt agreements in my analysis. These ratios include: operating cash flow to lagged assets, leverage (debt-to-assets), interest expense to lagged assets, net worth to assets, and the current ratio (current assets / current liabilities).

As pointed out by Roberts and Sufi (2009), violations may occur due to deterioration of firm performance and results, therefore, are mechanically driven by the performance of violators. To alleviate sample selection problems, Roberts and Sufi (2009) use a "quasi-discontinuity" approach and exploit the discontinuity created in the violation quarter. We adopt this approach and add variables on which covenants are written as linearly, squared, and cubed controls. The causal inferences from regression discontinuity approach are argued to be more credible than the typical natural experiment strategies such as difference-in-differences or instrumental variables methods (Lee and Lemieux (2009)).[9]

Another potential issue is the difficulty in identifying the effect of violations separately from expected changes in outcomes related to differences in the underlying fundamentals of violators and non-violators. In order to address this issue, we follow Nini et al. (2009) and use both the level and first-differences of the control variables

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[8] The results are robust if we use the two-digit SIC industry indicator variables.

[9] Since we do not observe the debt agreements, we cannot use a standard regression-discontinuity design.

before and after violations. This way, we hope to control for the differences of time-invariant and firm-level effects between non-violators and violators, and identify the effect of a violation based on differences in outcomes for violators relative to differences for non-violators with a similar pre-violation pattern in performance.

Panel A of Table 5 presents the results on how a covenant violation affect firm's market share. We restrict the sample to firm-quarter observations in the fourth quarter of each year to avoid overlapping observations, and use the fourth quarter since financial covenant violation announcements are more common in 10-K filings than in 10-Q filings. All specifications include year and industry indicator variables. Consistent with the univariate results, we show a decrease in market share after firms violate a covenant. There is a 6.8 percent decline in violator firms' market share following the violation. The estimated effect of a covenant violation remains statistically significant and economically important in all specifications. The inclusion of control variables tend to reduce the estimated impact, but even in our strictest specification, covenant violations are estimated to have an important effect on firms' market share.

Panel A of Table 5 only includes the covenant violations that are announced in the fourth quarter, which prevents the overlapping observations but ignores three-quarters of the sample. In Panel B, we use all observations in the sample. Since we have overlapping observations that induce a mechanical serial correlation in the dependent variable *Market Share*, we cluster our standard errors by firm and quarter, as in Petersen (2009). The results are very similar to the ones in Panel A. The market share of violator firms decrease by 5.5 percent in the year following the violation. This economically and significant decline in market share once firms violate a covenant suggests that violator firms lose their market share to their rivals following violations.

2.5. Profit margin and long-run stock returns around covenant violations

The results above suggest that creditor control over borrowing firms following violations has negative effects on firms' product market performance. To provide some evidence on the valuation consequences of the covenant violation, we examine how measures of profitability and stock returns are relative to the rival firms. In the first subsection, we examine the changes in profit margin around covenant violations and the second subsection explores the long-run stock performance following covenant violations.

2.5.1. Profit margin

We define profit margin as sales minus cost of goods sold minus selling, general, administrative expenses scaled by sales. We examine unadjusted profit margin, rival firms' profit margin and adjusted profit margin around violations. We especially focus on changes from the end of the violation quarter to quarters +4 and +8 relative to the violation quarter to avoid that results are driven by the seasonal effects on sales. Panel A shows that profit margin starts to decline in the year prior to the violation but then starts to improve in the year following the violation. Not surprisingly, we see a similar pattern for the rival firms (rival firms are defined as non-violator firms in the same quarter, with the same four-digit SIC code). Panel B shows superior performance of violating firms relative to their rivals following violations.

In Panel C and Panel D, we use different definitions for control firms and calculate adjusted profit margin. Adjusted profit margin is calculated by subtracting control firms' profit margin from the violator's unadjusted profit margin. The construction of control firms for the profit margin analysis is similar to the one for the

sales growth. For the industry-adjusted profit margin, we use a non-violator firm with the same four-digit SIC code that has book value of assets closest to that of the violator firm. For the performance-adjusted profit margin, we use rival firms that have similar pre-event profit margin and market-to-book ratios. For each violator firm, we choose non-violator firms in the same four-digit SIC code with profit margin within +/- 20 percent or within +/- 0.01 of the performance of the violating firm. If there is no matching firm satisfying the above criteria we relax the industry criterion to three, two, one and no SIC code. Then, we choose the matching firm which has the closest value of the sum of absolute value of ((Profit margin$_t$ –Profit margin$_{t-4}$) for the violating firm - (Profit margin$_t$ –Profit margin$_{t-4}$) for the matched firm) and absolute value of (Profit margin$_t$ for the violating firm - Profit margin$_t$ for the matched firm). If we are not able to calculate profit margin in the prior four quarters; we only use the previous quarter's profit margin. The performance-adjusted performance is the paired difference between profit margin of sample firms and profit margin of their respective control firms.

The industry adjusted changes in profit margin reveals that the mean change in profit margin in the year following the violation is 0.0367, which corresponds to a 0.0367/0.0957=70%. Since mean reversion may cause such a change in profit margin, we use a performance-matched comparison. We see that performance-adjusted profit margin shows some improvements following violations. However, the mean and median changes during the year from quarter 0 to quarter +4, and the mean and median changes during the year from quarter 0 to quarter +8 are not economically significant at a reasonable level.

2.5.2. Long-run stock returns

We explore the impact of violations on stock returns on Table 7 and Table 8. Table 7 presents standard event-time estimates of long-run abnormal stock returns to

firms following a covenant violation. Table 8 presents calendar-time estimates of long-run abnormal stock returns.

We use two different approaches to calculate event returns: portfolio matching approach and asset pricing model approach. For portfolio matching approach, we calculate the size and book-to-market adjusted monthly returns for each firm. The size and book-to-market adjusted returns are calculated following Fama-French portfolio matching procedure. Next, we compute the average monthly abnormal returns for the violator firm portfolio and rival firm portfolio. Finally, we calculate average monthly abnormal returns for violating firm for months (+1, +12), (+1, +24) and (+1, +36). We use the same procedure for rival firms, which are defined as non-violator firms in the same four-digit SIC with the violator firm. After calculating size and book-to-market adjusted monthly returns for rival firms, we calculate the value-weighted returns for rival firms. We compute the average monthly abnormal returns for the rival firm portfolio for up to three years following the covenant violation.

We then use Fama-French three-factor model and Carhart four-factor model for asset pricing model approach. We run three- or four-factor models using (1) the monthly returns in excess of the one-month treasury bill rate, (2) the average return on a small capitalization portfolio minus the average return on a large capitalization portfolio, (3) the average return on a value (high book-to-market) minus the return on a growth (low book-to-market) portfolio, (4) the difference in the monthly return of stocks with high returns over the trailing 11 months and stocks with low returns over the trailing 11 months. All four monthly series are downloaded from Kenneth French's web-based data library. We use the past 12 months' returns to get the factor loadings, and then we compute future abnormal monthly returns for up to three years following the violation. For rival firm portfolio, we follow the same procedure. For each violating firm, we compute its rivals' value-weighted portfolio returns. We report the average monthly abnormal returns for all rival portfolios.

Table 7 shows event-time estimates of long-run stock performance following a covenant violation. Violating firms have significantly negative monthly abnormal returns in the year after the violation. One year abnormal returns of violating firms following the violation is 13.28 percent using portfolio matching approach and 10.83 (9.28) percent using the three(four-)-factor model, all of which are statistically significant at one percent level. In contrast, rival firms gain 2.48 (3.20) percent using portfolio matching (four-factor model) approach, both are statistically significant at one percent level. The poor performance of violating firms continues for the three years we examine following the violation.

Table 8 reports calendar-time estimates of abnormal performance of violators and rival firms. As in event-time, we compute the long run abnormal returns using portfolio matching approach as well as asset pricing model approach. For portfolio matching approach, we calculate the size and book-to-market adjusted monthly returns for each firm. The size and book-to-market adjusted returns are calculated following Fama-French portfolio matching procedure. Then we compute the average monthly abnormal returns for violating firm portfolio and value-weighted rival firm portfolio. This process generates two time series portfolio returns. The mean returns for the time series abnormal returns for each portfolio are reported in Panel A of Table 8. For asset pricing model approach, we obtain the average monthly abnormal returns for violating firms and rival firms in the same way as the portfolio matching approach. The difference is the risk free rate adjusted returns. After that, we run the time-series regression for monthly risk-free rate adjusted returns of each portfolio using Fama-French three-factor model and Carhart (1997) four-factor model. The intercepts of the regression are the abnormal returns reported in Table 8 Panel B and Panel C.

We see negative monthly abnormal returns for violator firms in the year following the violation. However, the results are significant only when portfolio matching technique is used. When portfolio matching technique and three-factor model are used,

the poor performance of violating firms continues till the end of the period we examine (not significantly significant though). In contrast, rivals firms experience significantly positive abnormal returns in one year, two years and three years after their peer firm violates a covenant.

Violating firms gain negative (or zero) long-run abnormal returns following violations. In contrast, rivals firms gain significantly positive abnormal returns following violations. These results show that rival firms benefit from the covenant violation of their peer firm. This may be because rivals may see violating firm impeded and take actions to increase their market share.

2.6. Conclusion

There is a large body of work which examines how firms' capital structure affects product market behavior. While previous studies focus on the level of leverage, there are other dimensions of leverage that may also affect product market decisions. In this study, we investigate how debt covenants impact product market behavior of borrowing firms and their rivals. Restrictive covenants might lead "to managers manage the covenants, rather than their business", resulting in unintended outcomes in the product market. To explore the mechanism between debt covenants and product market outcomes, we look at financial covenant violations. Recent papers show that following financial covenant violations, creditors increase their control over borrowing firms in ways that significantly affect borrowing firms' corporate policies.

Our paper is the first to examine the effect of covenant violations on product market and rival firm behavior. We show that firms that violate a financial covenant lose their market share to their rivals. We also show that these firms have poor long-run abnormal stock performance following covenant violations. In contrast, rival firms gain market share and exhibit positive long-run abnormal returns following their peer firm's

covenant violation. Taken together, results suggest that covenant structure of debt agreements can indeed have dramatic effects on firms' product market outcomes of the firm.

Table 2.1 Sample distribution

	N	Fraction
By year		
1997	277	7.29%
1998	464	12.20%
1999	471	12.39%
2000	467	12.28%
2001	489	12.86%
2002	392	10.31%
2003	285	7.50%
2004	256	6.73%
2005	247	6.50%
2006	243	6.39%
2007	217	5.71%
By fiscal quarter		
Quarter 1	630	16.57%
Quarter 2	695	18.28%
Quarter 3	777	20.44%
Quarter 4	1700	44.71%
By industry		
Agriculture, minerals, construction	233	6.13%
Manufacturing	1751	46.05%
Transportation, communication, and utilities	374	9.84%
Trade- wholesale	211	5.55%
Trade- retail	288	7.57%
Services	822	21.62%
Other	123	3.24%
Total	3802	100.00%

Note: This table presents the distribution of the sample of new covenant violations by the year of the violation announcement, by the fiscal quarter of the announcement, and by major industry group. A new covenant violation is a financial covenant violation by a firm that has not violated a covenant for the previous four quarters. The full sample includes and 8,236 firms 184,189 firm-quarter observations.

Table 2.2 Descriptive statistics

	N	Mean	10th	25th	Median	75th	90th	Full Sample Median
Market-to-book ratio	3612	1.491	0.768	0.922	1.168	1.617	2.443	1.422
Leverage ratio	3701	0.331	0.032	0.147	0.303	0.467	0.640	0.201
Current ratio	3701	1.926	0.648	1.017	1.497	2.305	3.479	1.950
Net worth / assets	3802	0.384	0.072	0.238	0.406	0.573	0.715	0.497
Interest expense / average assets	3078	0.008	0.001	0.003	0.006	0.011	0.018	0.004
Operating income / average assets	3308	-0.002	-0.064	-0.017	0.011	0.027	0.044	0.026
Assets (Log_Atq)	3802	5.058	3.034	3.764	4.860	6.111	7.340	5.263
Sales / average assets	3624	0.306	0.081	0.163	0.261	0.392	0.570	0.246
Sales growth	3139	0.087	-0.334	-0.154	0.001	0.176	0.486	0.073
S&P credit rating	740	BB-	BBB	BB	BB-	B	B-	BB+
Operating cost / average assets	3308	0.310	0.085	0.167	0.267	0.401	0.579	0.227

Note: This table shows the distribution of variables for new covenant violations at the time of the violation. A new covenant violation is a financial covenant violation for a firm that has not experienced a financial covenant violation in the previous four quarters. All change variables are one year changes. Please see Appendix A for a detailed description of the variables.

Table 2.3 Sales growth

	Panel A. Quarterly sales growth							
	New Violators			Rival firms			Difference	
Quarter	N	Mean	Median	N	Mean	Median	Mean	Median
-4	2942	0.064***	0.027**	3404	0.056***	0.046***	0.009	-0.019***
-3	3087	0.030***	0.003**	3475	0.046***	0.040***	-0.016***	-0.037***
-2	3204	0.050***	0.018***	3515	0.054***	0.044***	-0.004	-0.026***
-1	3450	0.039***	0.008***	3561	0.047***	0.037***	-0.008	-0.029***
0	3611	0.033***	0.001	3576	0.049***	0.037***	-0.015***	-0.036***
1	3455	0.021***	-0.001	3569	0.039***	0.029***	-0.018***	-0.031***
2	3290	0.038***	0.014***	3548	0.049***	0.038***	-0.011**	-0.024***
3	3179	0.036***	0.010***	3525	0.047***	0.037***	-0.011*	-0.027***
4	3035	0.036***	0.011***	3501	0.045***	0.035***	-0.009	-0.024***
5	2765	0.028***	0.007***	3442	0.040***	0.030***	-0.012**	-0.022***
6	2619	0.041***	0.021***	3391	0.048***	0.038***	-0.007	-0.017***
7	2480	0.041***	0.013***	3332	0.041***	0.031***	-0.001	-0.018***
8	2316	0.030***	0.008***	3274	0.043***	0.032***	-0.013**	-0.024***
	Panel B. Sales growth							
0 to +1	3455	0.021***	-0.001	3569	0.038***	0.029***	-0.017***	-0.030***
0 to +2	3317	0.054***	0.010***	3548	0.079***	0.064***	-0.025***	-0.054***
0 to +3	3211	0.073***	0.021***	3527	0.109***	0.092***	-0.037***	-0.071***
0 to +4	3062	0.080***	0.035***	3502	0.132***	0.110***	-0.051***	-0.074***
0 to +5	2800	0.123***	0.032***	3444	0.188***	0.151***	-0.065***	-0.118***
0 to +6	2655	0.168***	0.047***	3393	0.239***	0.189***	-0.071***	-0.143***
0 to +7	2512	0.192***	0.059***	3336	0.273***	0.215***	-0.082***	-0.156***
0 to +8	2345	0.209***	0.056***	3276	0.300***	0.234***	-0.091***	-0.177***

Note: This table presents the levels of and changes in sales growth for new covenant violators compared to their rival firms. A new covenant violation is a financial covenant violation for a firm that has not experienced a financial covenant violation in the previous four quarters. Rival firms are defined as firms which are in the same industry (4-digit SIC code), but do not have the new covenant violation in the same calendar quarter. Sales growth is defined as $(Sales_t - Sales_{t-1})/Sales_{t-1}$. Quarter 0 is the quarter of financial covenant violation announcement. Panel A shows the quarterly sales growth. Panel B shows sales growth from quarter 0 zero up to quarter 8. ***, ** and * denote 1%, 5% and 10 % levels of significance, respectively.

Table 2.4 Adjusted Sales Growth

	Panel A. Quarterly sales growth								
	New Violators			Industry-adjusted			Performance-adjusted		
Quarter	N	Mean	Median	N	Mean	Median	N	Mean	Median
-4	2942	0.064***	0.027**	2629	0.010	0.003	2746	0.011	0.009***
-3	3087	0.030***	0.003**	2841	-0.012	-0.013***	2962	-0.005	-0.002
-2	3204	0.050***	0.018***	3038	0.000	-0.004	3048	0.001	0.003
-1	3450	0.039***	0.008***	3338	-0.013*	-0.008**	3305	-0.005	-0.001
0	3611	0.033***	0.001	3611	-0.017**	-0.015***	3601	0.003**	0.000**
1	3455	0.021***	-0.001	3282	-0.014*	-0.013***	3263	-0.025***	-0.013***
2	3290	0.038***	0.014***	2976	-0.008	-0.008**	2954	-0.003	-0.007
3	3179	0.036***	0.010***	2735	-0.021***	-0.014***	2740	-0.003	-0.006
4	3035	0.036***	0.011***	2504	-0.013*	-0.009**	2502	-0.018***	-0.003
5	2765	0.028***	0.007***	2276	-0.017*	-0.013**	2273	-0.011	-0.011**
6	2619	0.041***	0.021***	2104	-0.004	-0.005	2103	-0.006	-0.005
7	2480	0.041***	0.013***	1934	-0.005	-0.008	1951	0.004	0.003
8	2316	0.030***	0.008***	1773	-0.013	-0.014***	1773	-0.010	-0.010***
				Panel B. Sales growth					
0 to +1	3455	0.021***	-0.001	3282	-0.013*	-0.013***	3263	-0.024***	-0.013***
0 to +2	3317	0.054***	0.010***	2973	-0.014	-0.019***	2954	-0.030***	-0.022***
0 to +3	3211	0.073***	0.021***	2731	-0.034***	-0.025***	2739	-0.028**	-0.022***
0 to +4	3062	0.080***	0.035***	2499	-0.057***	-0.036***	2501	-0.050***	-0.017***
0 to +5	2800	0.123***	0.032***	2273	-0.074***	-0.052***	2272	-0.048***	-0.039***
0 to +6	2655	0.168***	0.047***	2102	-0.080***	-0.053***	2103	-0.055***	-0.033***
0 to +7	2512	0.192***	0.059***	1934	-0.094***	-0.067***	1951	-0.053**	-0.033***
0 to +8	2345	0.209***	0.056***	1770	-0.115***	-0.080***	1773	-0.031	-0.052***

Note: This table presents levels of changes in sales growth around new covenant violations. A new covenant violation is a financial covenant violation for a firm that has not experienced a financial covenant violation in the previous four quarters. Sales growth is defined as $(Sales_t-Sales_{t-1})/Sales_{t-1}$. Quarter 0 is the fiscal quarter of financial covenant violation announcement. Industry-adjusted sales growth is the paired difference between the sales growth of the new violator firms and the operating performance of their respective industry- and size-matched control firms. Performance-adjusted sales growth is the paired difference between the sales growth of new violator firms and the sales growth of their respective industry-, performance-, and M/B- matched control firms. Panel A shows quarterly sales growth. Panel B shows sales growth from quarter 0 zero up to quarter 8. ***, ** and * denote 1%, 5% and 10 % levels of significance, respectively.

Table 2.5 Multivariate results on change in market share

Panel A. Observations in the fourth quarter of the year				
	Model 1	Model 2	Model 3	Model 4
New Violation	-0.078***	-0.074***	-0.070***	-0.068***
Operating Cash flow/ average assets	-1.858***	-1.893***	-0.878***	-0.939***
Leverage Ratio	0.226***	0.208***	0.162***	0.116
Interest Expense / average assets	-1.836	-0.768	2.030	8.980*
Net Worth / assets	0.171***	0.189***	0.226***	0.289***
Current ratio	0.007***	0.006**	0.001	-0.002
Market-to-book ratio	0.046***	0.042***	0.051***	0.112***
Lagged first difference covenant controls	No	Yes	Yes	Yes
First difference covenant controls	No	No	Yes	Yes
Higher order covenant controls	No	No	No	Yes
Number of observations	25,936	23,192	21,240	21,240
R-squared	0.07	0.07	0.15	0.15

Panel B. All observations				
	Model 1	Model 2	Model 3	Model 4
New Violation	-0.061***	-0.060***	-0.058***	-0.055***
Operating Cash flow/ average assets	-1.865***	-1.732***	-1.871***	-1.704***
Leverage Ratio	0.224***	0.189***	0.409***	0.357***
Interest Expense / average assets	-1.915***	-4.759***	-7.529***	-9.241***
New Worth / assets	0.179***	0.080*	0.247***	0.151***
Current ratio	0.005***	-0.008***	-0.001	-0.010*
Market-to-book ratio	0.044***	0.047***	0.096***	0.110***
Lagged covenant controls	No	Yes	No	Yes
Higher order covenant controls	No	No	Yes	Yes
Number of observations	97,231	87,937	97,231	87,937
R-squared	0.06	0.06	0.07	0.07

Note: This table presents the marginal effect of new covenant violations on market share of firms from the quarter of the violation to four quarters after the violation. The dependent variable is change in market share which is defined as the change in sales growth in the year following the violation adjusted by the industry average. Covenant controls includes the following: operating cash flow scaled by average assets, leverage ratio, interest expense scaled by average assets, net worth scales by assets, current ratio and market-to-book ratio. First difference covenant control variables are differences from the quarter of the violation to one year after the violation. Lagged first difference covenant control variables are differences from one year ago to the present quarter of each of these variables. Higher order covenant controls refer to the second and third power of the covenant control variables. Panel A is limited to firms-quarter observations in the fourth quarter of each year. All specifications in Panel A include year fixed effects, and industry fixed affects. Standard errors are clustered by firm. Panel B includes all

Table 2.5 Continued

observations. All specifications in Panel B include industry, calendar quarter, and fiscal quarter fixed effects. Standard errors are clustered by firm and calendar quarter. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 2.6 Quarterly profit margin

	Panel A. Levels of profit margin							
	New Violators			Rival firms			Difference	
Quarter	N	Mean	Median	N	Mean	Median	Mean	Median
-4	2808	0.016*	0.077***	3271	0.012*	0.055***	0.004	0.022***
-3	2906	0.007	0.071***	3339	0.013***	0.052***	-0.006	0.019***
-2	3138	-0.010	0.063***	3394	0.006*	0.048***	-0.016*	0.015***
-1	3280	-0.024***	0.053***	3423	-0.005	0.046***	-0.019**	0.007***
0	3472	-0.096***	0.025***	3437	-0.024***	0.034***	-0.072***	-0.009***
1	3256	-0.035***	0.039***	3430	-0.003	0.046***	-0.031***	-0.007**
2	3126	-0.025***	0.046***	3407	0.002	0.046***	-0.028***	0.001
3	3013	-0.011	0.052***	3388	0.010***	0.049***	-0.020**	0.003
4	2890	-0.024***	0.052***	3364	0.013***	0.048***	-0.037***	0.004
5	2626	0.006	0.058***	3304	0.028***	0.053***	-0.022**	0.005
6	2492	-0.002	0.061***	3256	0.028***	0.054***	-0.030***	0.007**
7	2350	0.012	0.061***	3205	0.036***	0.056***	-0.025**	0.005**
8	2213	0.010	0.062***	3140	0.033***	0.056***	-0.023***	0.006**
	Panel B. Changes in profit margin							
0 to +1	3256	0.040***	0.009***	3430	0.007***	0.002***	0.033***	0.007***
0 to +2	3126	0.041***	0.013***	3407	0.005***	0.001***	0.036***	0.013***
0 to +3	3013	0.051***	0.019***	3388	0.007***	0.003***	0.043***	0.015***
0 to +4	2890	0.036***	0.013***	3364	0.006***	0.001***	0.030***	0.012***
0 to +5	2626	0.064***	0.019***	3304	0.014***	0.004***	0.050***	0.015***
0 to +6	2492	0.059***	0.023***	3256	0.013***	0.003***	0.046***	0.020***
0 to +7	2350	0.069***	0.023***	3205	0.019***	0.004***	0.050***	0.019***
0 to +8	2213	0.055***	0.018***	3140	0.013***	0.000***	0.042***	0.018***

Table 2.6 Continued

Panel C. Levels of unadjusted and adjusted profit margin

	Unadjusted			Industry-Adjusted			Performance- Adjusted	
Quarter	N	Mean	Median	N	Mean	Median	Mean	Median
-4	2808	0.016*	0.077***	2509	0.004	-0.006**	0.008*	0.000
-3	2906	0.007	0.071***	2672	-0.003	-0.013***	0.005	0.003***
-2	3138	-0.010	0.063***	2919	-0.011	-0.016***	0.016**	0.008***
-1	3280	-0.024***	0.053***	3142	-0.009	-0.025***	0.015**	0.004***
0	3472	-0.096***	0.025***	3472	-0.052***	-0.053***	-0.003**	0.000***
1	3256	-0.035***	0.039***	3066	-0.008	-0.038***	0.016**	0.000
2	3126	-0.025***	0.046***	2808	-0.015	-0.032***	0.008	0.000
3	3013	-0.011	0.052***	2572	-0.008	-0.027***	0.020**	-0.001
4	2890	-0.024***	0.052***	2370	-0.019	-0.029***	0.000	-0.002
5	2626	0.006	0.058***	2126	-0.002	-0.016***	0.020**	0.000
6	2492	-0.002	0.061***	1968	-0.018	-0.019***	0.014	0.000
7	2350	0.012	0.061***	1795	-0.015	-0.018***	0.018	0.000
8	2213	0.010	0.062***	1669	0.006	-0.018***	0.018	-0.001
Panel D. Changes in unadjusted and adjusted profit margin								
0 to +1	3256	0.040***	0.009***	3066	0.036***	0.011***	0.013***	0.000
0 to +2	3126	0.041***	0.013***	2808	0.042***	0.017***	0.007	0.000
0 to +3	3013	0.051***	0.019***	2572	0.044***	0.021***	0.015***	0.000
0 to +4	2890	0.036***	0.013***	2370	0.037***	0.014***	-0.001	0.000
0 to +5	2626	0.064***	0.019***	2126	0.052***	0.022***	0.013*	0.000
0 to +6	2492	0.059***	0.023***	1968	0.049***	0.026***	0.014*	0.001
0 to +7	2350	0.069***	0.023***	1795	0.049***	0.024***	0.015**	0.001
0 to +8	2213	0.055***	0.018***	1669	0.055***	0.020***	0.005	0.000

Note: This table presents the levels of and changes in profit margin for new covenant violators compared to their rival firms. A new covenant violation is a financial covenant violation for a firm that has not experienced a financial covenant violation in the previous four quarters. Rival firms are defined as firms which are in the same industry (4-digit sic code), but do not have the new covenant violation in the same calendar quarter. Profit margin is defined as $Sales_t$-Costs of Goods Sold-Selling General and Administrative Expenses /$Sales_t$. Quarter 0 is the quarter of financial covenant violation announcement. Panel B shows the changes in profit margin from quarter 0 zero up to quarter 8. Panel C and D presents the adjusted profit margin for the new violator firms. Industry-adjusted profit margin is the paired difference between the profit margin of the new violator firms and the profit margin of their respective industry- and size-matched control firms. Performance-adjusted profit margin is the paired difference between the profit margin of new violator firms and the profit margin of their respective industry-, performance-, and M/B- matched control firms. ***, ** and * denote 1%, 5% and 10 % levels of significance, respectively.

Table 2.7 Event study estimates of stock price performance following a covenant violation

Panel A. Size and Book-to-Market Portfolio Matching			
Mean monthly abnormal returns	Event months [1,12]	Event months [1,24]	Event months [1,36]
New violator firms	-0.0111***	-0.0097***	-0.0101***
Rival firms	0.0021***	0.0023***	0.0018***
Panel B. Three Factor Model			
	Event months [1,12]	Event months [1,24]	Event months [1,36]
New violator firms	-0.0090***	-0.0083***	-0.0077***
Rival firms	0.0001	0.0012*	0.0025***
Panel C. Four Factor Model			
	Event months [1,12]	Event months [1,24]	Event months [1,36]
New violator firms	-0.0077***	-0.0054**	-0.0055**
Rival firms	0.0027***	0.0041***	0.0046***

Note: This table reports event time estimates of stock price performance of new violator firms and their rivals by estimating event-study monthly abnormal returns of stock following a new covenant violation. A new covenant violation is a financial covenant violation for a firm that has not experienced a financial covenant violation in the previous four quarters. Panel A reports the monthly abnormal returns when size and book-to-market portfolio matching is used. For the portfolio matching approach, we calculate the excess returns by subtracting the size and book-to-market benchmark return from individual firm's return and then compute the return for each firm each month. Then we calculate average monthly returns for firms for the period we are interested in. Panel B reports mean monthly abnormal returns, which are measured against a three factor model using the risk free rate, the difference between the returns on small and big stock, and the return performance of value stocks relative to growth stocks. Panel C reports mean monthly abnormal returns, which are measured against a four factor model. The fourth factor is the return performance of high momentum stocks relative to low momentum stocks. When monthly excess returns for rival firms are calculated, we use the value-weighted return of all rival firms for each approach. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 2.8 Calendar study estimates of stock price performance following a covenant violation

Panel A. Size and Book-to-Market Portfolio Matching			
Mean monthly abnormal returns	Event months [1,12]	Event months [1,24]	Event months [1,36]
New violator firms	-0.0064*	-0.0031	-0.0021
Rival firms	0.0090***	0.0093***	0.0092***
Panel B. Three Factor Model			
	Event months [1,12]	Event months [1,24]	Event months [1,36]
New violator firms	-0.0064	-0.0024	-0.0013
Rival firms	0.0083***	0.0085***	0.0084***
Panel C. Four Factor Model			
	Event months [1,12]	Event months [1,24]	Event months [1,36]
New violator firms	-0.0015	0.0023	0.0023
Rival firms	0.0102***	0.0103***	0.0103***

Note: This table reports the monthly abnormal returns following a new covenant violation announcement according to the calendar time approach. A new covenant violation is a financial covenant violation for a firm that has not experienced a financial covenant violation in the previous four quarters. We form a *Covenant Violator Portfolio* and *Rival Firms Portfolio* and estimate future abnormal returns using three approaches. Panel A reports the abnormal returns when portfolio matching approach is used. For the portfolio matching approach, we calculate the excess returns by subtracting the size and book-to market benchmark return from individual firm's return and then compute the average return of covenant violator portfolio (rival firms portfolio) for each month. The average returns are shown in the table. Panel B (C) presents the abnormal returns when three (four) factor model is used. We calculate the risk-free rate adjusted return for each individual firm. Then we compute the average of risk-free rate adjusted return for each portfolio. Last, we run the time-series regression for the monthly risk-free rate adjusted returns of each portfolio using Fama French three-factor model or Carhart (1997) four-factor model. The abnormal returns shown below are represented by the intercept of the regressions. When monthly excess returns for rival firms are calculated, we use the value-weighted return of all rival firms for each approach. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

CHAPTER 3

MERGER WAVES, PSEUDO MARKET TIMING AND POST-MERGER PERFORMANCE

3.1. Introduction

The late 1990s witnessed one of the largest merger and acquisition waves in U.S. history. This merger wave was associated with high stock market prices and frequent use of equity as the method of payment (Andrade et al. (2001)). The positive correlation between market prices and merger activity has spurred the development of models in which merger waves result from managerial market timing (Shleifer and Vishny (2003), Rhodes-Kropf and Viswanathan (2004)).[1, 2] The idea is that managers time the market by using their stock to purchase the assets of other firms when they believe their stock is overvalued. Consistent with mispricing-driven merger activity, Dong et al. (2006), and Ang and Cheng (2006) show a positive relation between market-level mispricing and merger volume.

One of the important predictions of market timing theory is that stock acquirers earn negative long-run returns due to the correction of misvaluation (Baker, Ruback, and Wurgler (2007)). Consistent with this argument, Loughran and Vijh (1997), and Rau and Vermaelen (1998) report long-run underperformance on acquiring firms when mergers are paid in stock. Bouwman et al. (2003) show that returns subsequent to mergers in

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[1] The positive correlation between market valuation and merger activity has also been documented in other periods (Golbe and White (1988), Martin (1996), Verter (2002)). This relation is stronger when stock is used as the method of payment (Savor and Lu (2009), Maksimovic and Phillips (2001)).

2 There are also neoclassical arguments that the merger waves are caused by clustering of shock-driven industry mergers waves, not by attempts to time the market. In this view, the negative performance following mergers can be viewed as a response to a negative industry shock –the merged firm performs better than it would have done without the merger (see Harford (2005)).

high-valuation periods are lower than returns subsequent to mergers in low-valuation periods (see also Rosen (2006)). Moeller et al. (2005) find poor post-merger performance of acquiring firms with very high valuations.

While the historical trend of merger waves and the post-merger long-term underperformance following stock mergers support market-timing theories, Schultz (2003) recently has introduced the "pseudo market timing" hypothesis which provides a novel explanation on long-run abnormal performance following endogenous events.[3] He explains the clustering of equity offers during bull markets that are then followed by negative returns. The pseudo market timing hypothesis challenges the basic notion of managerial timing by showing that underperformance exists if manager's equity issuance decision depends on the stock price, even with no ability to predict future returns (i.e. markets are efficient).

Pseudo market timing provides a compelling alternative to managerial timing theories that should be carefully considered. Since the introduction of the pseudo market timing hypothesis, several studies have investigated whether it explains the abnormal performance following equity issuances and have found mixed results (Butler et al. (2005), Baker et al. (2006), Dahlquist and de Jong (2008), Viswanathan and Wei (2008)).[4] While studies focus on the implications of pseudo market timing on the equity-

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[3] An extant literature raises important questions about empirical estimation issues in long-run performance studies. Many papers argue that long-run returns are sensitive to the method used to measure abnormal performance, the choice of benchmark, and/or the time period. See Fama (1998), Eckbo et al. (2000), Brav and Gompers (1997), Brav et al. (2000), Mitchell and Stafford (2000), Gompers and Lerner (2003). It is important to note that pseudo market timing does not suffer from estimation problems.

[4] Butler et al. (2005) show that the relation between aggregate equity issues and aggregate market returns is explained by pseudo market timing. Baker et al. (2006), however, argue that pseudo market timing explains only a small portion of the observed predictive power of the equity share in new issues (see also Dahlqusit and de Jong (2008)). Viswanathan and Wei (2008) study endogenous events and show that the expected abnormal return is negative for any fixed sample and the underperformance is larger for longer event periods. Chan et al. (2007) study share repurchases and show that evidence is more consistent with managerial timing ability than pseudo market timing.

issuance puzzle, Schultz's argument extends to other corporate events. In this paper, I study pseudo market timing in the context of (stock) mergers since mergers have been investigated extensively for managerial market timing. This environment provides a fresh setting to examine the important question of pseudo market timing.

Using a sample of 2,009 stock mergers from 1985 to 2004, I investigate whether pseudo market timing explains the observed long-term underperformance following stock mergers. I show that acquirers significantly underperform the market when event-time is used. When calendar-time approach is used; however, the underperformance disappears. I then use simulations to investigate if pseudo market timing drives the negative long-run returns following mergers and find evidence consistent with the pseudo market timing explanation.

The key assumption of pseudo market timing is that managers make price contingent decisions, which implies more merger announcements will occur at higher levels of stock prices. I find that there are more stock merger announcements in bullish markets. I also show that a large number of merger announcements are followed by poor market-wide returns. These findings confirm that the main assumption of pseudo market timing holds for stock mergers.

An important implication of pseudo market timing is that it applies only to event-time studies. When event time is used, each deal is weighted equally even if they take place in different times. In calendar time, each calendar month is weighted equally even though deals cluster in time. To test whether long-run stock performance following mergers is different in event time and calendar time, I calculate abnormal returns using the cumulative abnormal return (CAR) and the buy-and-hold abnormal return (BHAR) approach both in event and calendar time. Event-time analysis shows that acquiring firms significantly underperform the CRSP value-weighted and equal-weighted market index following the merger. In calendar time, however, there is no/little evidence of abnormal performance.

Although stronger underperformance in event time suggests that pseudo market timing drives the results, it can also indicate managerial market timing ability. Loughran and Ritter (2000) argue that the calendar-time approach is weak at detecting abnormal returns because it averages over months of high and low event activity. Therefore, the event-time approach is widely used by proponents of market timing theories to investigate market timing. If managers can time the market, they will engage in merger activities more when stock prices are high. Returns will be particularly poor following periods with high merger activity. Therefore, using an event-time approach results in larger negative returns compared to calendar-time approach.

Pseudo market timing predicts that abnormal stock performance is highly likely to be observed in event-time studies when managers make price contingent decisions even if they do not have the ability to time the market. In order to differentiate pseudo market timing from market timing, I use simulations to calculate long-run performance following mergers, where ex-ante expected abnormal return is zero (managers have no market timing ability) by construction. Simulations reveal that long-run returns following mergers will be negative more than 60 percent of time. Moreover, these simulations produce long-run returns comparable to the underperformance observed in the actual data. Overall, the results support the pseudo market timing explanation in the context of mergers. Even when the ex ante expected return is zero, long-run underperformance ex post is not surprising.

The main contribution of the paper is to the mergers and acquisitions literature. The long-run underperformance following stock mergers in event time is widely shown in the literature (Laughran and Vijh (1997), Rau and Vermaelen (1998)). The underperformance has been shown to be weaker when a calendar-time portfolio approach is used (Mitchell and Stafford (2000), Savor and Lu (2009), Betton et al. (2008)). Consistent with the literature, I find evidence of underperformance in event time, but not in calendar time. Proponents of market timing explanations consider this finding of

acquirer underperformance in event time a key piece of evidence for their theory. My paper, however, shows that negative performance following stock mergers is observed even when managers do not have market timing ability and markets are efficient.

This paper also contributes to the wide literature exploring whether corporate managers have the ability to time the market when they make important corporate decisions. Several papers attribute the abnormal performance following events (such as equity issuances and stock repurchases) to managers' market timing abilities.[5] Whether abnormal returns are due to mispricing, or simply the results of measurement problems is an unresolved issue among financial economists.[6] In this paper, I investigate an alternative explanation, which does not suffer from estimation problems, to investigate whether managers time the market when they make one of their largest investment decisions.

This paper also adds to the growing literature on pseudo market timing. The extent which pseudo market timing explains the equity issuance puzzle is widely investigated in the literature. Butler et al. (2005) argue that pseudo market timing explains the relation between aggregate equity issuance and aggregate market returns. Baker et al. (2006), however, argue that pseudo market timing explains only a small portion of the observed predictive power of the equity share in new issues (see also Dahlqusit and de Jong (2008)). Viswanathan and Wei (2008) show that the expected abnormal return is negative for any fixed sample and the underperformance is larger for longer event periods. Chan et al. (2007) study share repurchases and show that the evidence does not support pseudo market timing explanation. My paper investigates

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[5] Studies also argue that managers' market timing activities may have long-term effects on capital structure (Baker and Wurgler (2002)) and investment levels (Baker et al. (2003)). Jenter (2005) argues that managers time their personal trades.

6 See Kothari and Warner (2006) for an excellent review on event studies.

pseudo market timing in a fresh setting and shows that pseudo market timing explains the abnormal performance following stock mergers.

The remainder of the paper is organized as follows. The following section describes the data and the methods used in the paper. Section 2 examines the pseudo market timing hypothesis. Section 3 investigates long-run stock performance following mergers. Section 4 describes the simulation process and the results. Section 5 provides interpretations of results and some concluding remarks.

3.2. Data and methods

3.2.1. Data

I obtain U.S. merger and acquisition data from the Thomson Financial Securities Data Corporation (SDC) Worldwide Mergers and Acquisitions database. To be included in the final sample, a bid has to satisfy the following criteria:

Both the acquirer and the target are U.S. public firms included in CRSP database.

The acquisition is announced between 1985 and 2004. I choose the 2004 cutoff in order to provide five years of return data for each firm after the initial announcement.

The mode of payment is all–equity since market timing theory has clear predictions for such cases.

The form of acquisition is coded as ‘Merger’, ‘Acq. Maj. Int.’, or ‘Acq. of Assets’.

Transactions must be greater than US $10 million.

The acquirer holds at least 51 percent of target shares after acquisition.

The final sample consists of 2,009 mergers. Table I reports summary statistics for the sample. The number of mergers per month ranges from zero to 28 with a mean of 8.37.

3.2.2. Methods

I measure long-term stock performance using the buy-and-hold returns (BHAR) and the cumulative abnormal return (CAR) approach. Both methods have strengths and weaknesses. Although CAR is straightforward to estimate, it is biased upward due to bid-ask bounce resulting from the frequent rebalancing assumption. Since the works of Ikenberry et al. (1995), Barber and Lyon (1997) and Lyon et al. (1999), BHAR has been widely used in the literature. The BHAR approach better resembles investors' actual investment experience than periodic rebalancing, and avoids the rebalancing bias in CAR approach. It does, however, suffer from severe skew (Kothari and Warner (1997), Barber and Lyon (1997)).[7]

In my calculations, I use CRSP value-weighted and equally-weighted market index as the benchmark.[8] I use the following formula to create average long-run cumulative abnormal returns for both real data and simulations:

$$\overline{CAR} = \sum_{e=1}^{E} \frac{\sum_{j=1}^{N} r_{j,e} - r_{m,e}}{N} \tag{1}$$

where N is the total number of mergers, E is the number of event months, $r_{j,e}$ is the return of stock j for event month e, and $r_{m,e}$ is the return of the market for event month e.

Buy-and-hold abnormal returns for the T months following a merger are calculated as:

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[7] Lyon et al. (1999) proposes a bootstrapped version of BHAR method, which can avoid the potential bias caused by skewness in long-run returns. As a robustness check, I use this version to calculate BHAR using the data. Results are nearly identical.

[8] Pseudo market timing hypothesis is robust to the assumptions about the benchmark, bid-ask bounce, estimation of standard errors, and the distribution of returns (Schultz, 2003).

$$BHAR = \prod_{e=1}^{E}(1 + r_{j,e}) - \prod_{e=1}^{E}(1 + r_{m,e}) \quad (2)$$

where N is the total number of mergers, E is the number of event months, $r_{j,e}$ is the return of stock j for event month e, and $r_{m,e}$ is the return of the market for event month e.

3.3. The pseudo market timing hypothesis

3.3.1. The pseudo market timing hypothesis illustrated using stock mergers

This central assumption of pseudo market timing is that managers engage in merger activities based on current stock prices- more deals occur in bull markets.[9] This assumption is consistent with market driven merger models and empirical evidence (Shleifer and Vishny (2003), Rhodes-Kropf and Viswanathan (2004)).[10]

The following example replicates Schultz (2003)'s pseudo market timing explanation but based on stock mergers rather than equity offerings. Firms in the economy are assumed to follow a simple binomial process. These firms experience either a positive or negative 10% with equal probability in both periods. This assumption implies that the expected return for all stocks and for the market overall is zero and abnormal returns are equal to raw returns. At time zero, all stock prices are equal to $100. Suppose that each period, no companies initiate a merger if stock prices are less than $95. One firm initiates a merger if the price is between $95 and $105, and three

9 This might be due to having more investment opportunities when prices are high or managers believing that they are timing the market. It is important to note that the reason why more mergers occur in high stock market periods is insignificant for pseudo market timing (Schultz, 2003).

10 This assumption is also consistent with neoclassical explanations on why mergers occur. Harford (2005) argues that high stock market periods are associated with high aggregate capital liquidity and may trigger mergers.

firms initiate a merger if prices exceed $105.[11] There are four possible paths with equal probability and the outcome of each path is shown in Table II.

Consider the price path shown in the second row of Table II. At time zero, the price is set at $100 so one firm announces a merger. Suppose that at the end of the period, the price increases to $110. The acquirer firm earns an abnormal return of 10 percent. Since the price at time one is $110, three firms will initiate a merger at time one. Now suppose that the price at time two is 99 (as opposed to 121 which is illustrated in the first row), each of these new mergers will generate a -10% abnormal return. If we weight each event equally and calculate event-time average abnormal return, we find that this path will generate -5% return (= (+10%*1+ -10%*3)/4).[12] This path also illustrates one of the key characteristics of pseudo market timing. There are more merger announcements at market peaks ex post. Although abnormal returns at the end of time one is negative (compared to positive abnormal returns at the end of time zero), there are more offerings at time one compared to time zero because of the price increase.

Schultz (2003) points out the other characteristics of pseudo market timing in the example. 1) Mergers occurring during heavy merger periods are more likely to underperform compared to mergers occurring in light merger periods. 2) Number of events is uncorrelated with future abnormal returns. It depends on current prices. 3) Ex ante expected return for any deal is zero, even if ex post return is negative three out of four cases.

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[11] Target managements accept overpriced bidder stock because they are assumed to have a short-time horizon (Shleifer and Vishny (2003)). Rhodes-Kropf and Viswanathan (2004) argue that target management accept overpriced bidder stock during market valuation peaks because they overestimate synergies during these periods.

[12] If abnormal returns are calculated in calendar time, then we weight each event time equally, rather than weighting events equally. In this case, the average abnormal return across all mergers will be equal to zero.

This simple example shows that even if managers have no timing skills, negative abnormal returns is observed 75 percent of time because of pseudo market timing.[13] Another important implication of pseudo market timing is that it only applies to event time studies. In the example, when each event is weighted equally, post-announcement abnormal return is -3.75%. When the calendar-time approach is used, where each time period is weighed equally, the mean abnormal return is zero. It is because path dependency is broken in calendar time by weighting high and low merger activity periods equally.

3.3.2. Testing the main assumption of pseudo-market timing

The key assumption of pseudo market timing is that managers make price contingent decisions.[14] As a result, more events will occur at higher levels of stock prices. In this section, I investigate whether more stock mergers take place when market prices are high.

I first study the relation between market prices and takeover activity by regressing the number of merger announcements over different trailing market returns. Panel A of Table III displays the coefficients of value- and equally-weighted CRSP market index using the past month, two months, three months, six months and twelve months. The slope coefficients are consistently positive; supporting the assumption that managers make merger decisions based on past merger returns. Figure 1 shows the number of

[13] The results do not change if we relax the assumptions that the market earns zero return and there are only two periods. Schultz (2003) also shows that underperformance is more likely in a long series so pseudo market timing is not a small sample bias.

[14] The second assumption is that merger decision is endogenous (i.e. event-firm abnormal returns are positively cross-correlated). This assumption holds for mergers (see Mitchell and Stafford (2000)).

merger announcements in a given month sorted by past market returns over different trailing periods (three months, six months, twelve months). The trend is consistent with Panel A of Table III. There is more merger activity following high market returns.

Table III also shows that market as a whole performs poorly following mergers. Panel B of Table III reports correlations between the number of merger announcements in a month and the return on the CRSP value-weighted and equally-weighted market index over the next month, the next three months, and the next twelve months for different five-year periods. In general, correlations between the number of announcements and the succeeding market returns are negative and increases as the market return is measured over a longer time period.

Overall, these results show that the higher the past market returns the greater is the number of takeover announcements, supporting the fundamental assumption of pseudo market timing in the context of stock mergers.

3.4. Long-run stock performance and stock mergers

Pseudo market timing applies only to event-time studies. To test whether long-run stock performance following mergers is different in event time and calendar time, I calculate abnormal returns using the cumulative abnormal return (CAR) and the buy-and-hold abnormal return (BHAR) approach both in event and calendar time. The difference between these approaches is that in event time, each deal is weighted equally even if they take in different times. This method tests a strategy of investing equal amounts in each deal. In calendar time, however, each calendar month is weighted equally even though deals cluster in time. This approach tests a strategy of investing equal amounts in mergers each month. Although the calendar-time approach has been used in the literature since Fama (1998), Lyon et al. (1999) and Loughran and Ritter (2000) prefer the event-time portfolio approach. Loughran and Ritter (2000) argue that the calendar-time

approach is weak at detecting mispricing since it averages over months of high and low event activity. Therefore, it is important to measure long-run returns following mergers both in event and calendar time.

3.4.1. Event-time portfolio returns

Table IV reports the raw returns and abnormal returns of acquiring firms in the sample before and after the merger announcement using both the CAR and the BHAR approach. Panel A reports raw returns. Panel B (C) reports abnormal returns relative to the CRSP value-weighted (equal-weighted) index. In all cases, acquiring firms have positive abnormal returns before merger announcements. After announcements, however, they significantly underperform the market. The cumulative abnormal return is -1.10 percent relative to the CRSP value-weighted index and -8.44 percent relative to the CRSP equally-weighted index over the 60 months following merger announcements. Consistent with the literature, the underperformance is stronger when the BHAR approach is used. The compounded abnormal return is -2.88 percent relative to the CRSP value-weighted index and -20.48 percent relative to the CRSP equally-weighted index over 60 months.

3.4.2. Calendar-time portfolio returns

I next calculate long-run returns using the calendar time approach using the Fama and French (1993) three factor model. Here, each month receives equal weight. Moreover, each deal within a month is weighted equally since this approach is more likely to detect the abnormal performance (Chan et al. (2007)). Under the null hypothesis of no abnormal performance, the intercept should be zero. The first row of Table V reports the intercept and coefficients using ordinary least squares (OLS). The intercept is positive but insignificant, consistent with no abnormal performance. The second row

reports the results when weighted least squares (WLS) approach is used. In this case, each month is weighted according to the number of merger announcements in the portfolio each month, similar to the event-time approach. The intercept is much lower in value but significant. The difference in intercepts between OLS and WLS models suggests that pseudo market timing may be driving the negative returns following mergers.

The stronger abnormal performance following stock mergers in event-time relative to the abnormal performance in calendar time should be interpreted with caution. Behavioralists consider this finding evidence in favor of the market timing explanation. When managers time the market, there will be high merger activity when stock prices are high and returns will be particularly low afterwards. Therefore, event-time approach will produce more negative returns following mergers. However, this finding also suggests that pseudo market timing might be driving the results.[15] The key difference between market timing and pseudo market timing is that long-run underperformance using event-time approach is observed even if managers have no market timing ability, because the likelihood of the event of interest increases with stock price. In the next section, I investigate the extent pseudo market timing explains long-run abnormal performance.

3.5. Testing the pseudo market timing hypothesis

In this section, I use simulations, similar to those used by Schultz (2003), to calculate long-run returns following mergers where managers have no market timing ability by construction. The first subsection explains the regressions used to calculate

[15] It is important to note that pseudo market timing does not predict zero abnormal returns following events. Schultz (2003) argues that "ex-post, the poor performance of equity issuers is real and significant. That is, IPOs have underperformed relative to their ex-ante expected return. Nevertheless, this is consistent with an efficient market (page 490)."

number of mergers in a month. The coefficients from the regression will be used to predict number of deals in simulations in the following subsection.

3.5.1. Estimating the relation between price levels and number of mergers

In this section, I estimate the number of merger announcements using stock prices over 1985 through 2004. Since one of the key premises of pseudo market timing is that more firms are likely to do mergers as stock prices increase, I use a merger index and a market index to estimate the number of mergers in a month. I use an index of returns for firms with recent mergers as a proxy of potential merger values. I also calculate a market index using the CRSP value-weighted index. Both the merger and market indices are set to 100 at the beginning of the first month in the sample.

For each following month, I calculate an average return for firms that had a merger in the prior five years. Then the index level at the beginning of the month is multiplied by one plus the average return during the month to obtain the index level for the beginning of the next month. The market index is updated similarly using each month's value-weighted returns. The number of mergers is then regressed on the market and the merger indices at the beginning of each month in the sample period.

Table VI shows the results of the regression. In the first row, the number of mergers is regressed on the levels of merger index, market index and a time variable. The time variable counts months from the beginning of the sample period. The coefficient on the market index is 0.1951, indicating that the number of mergers increases with the level of the market. The significant positive coefficient (0.0847) on the merger index suggests that the number of mergers also increases with the level of the merger returns. The second row shows the results of the regression in which prior three and twelve month levels of the market and merger index are included. These lagged values

are included to capture possible delays in bringing the mergers to the market. Since the adjusted R^2 in the second specification is higher, the coefficients from this regression are used to calculate the number of mergers in the simulations to in the next section.

The regression above is a very simple model to capture the relation between the number of mergers, and market and merger indices. Although industry differences are ignored, the model does a good job capturing the actual frequency of the number of takeovers per month. Figure 2 graphs the actual and predicted number of mergers from the regression which uses both the current and lagged values of the market and merger indices.

3.5.2. Simulations of long-term stock performance

For the simulations, I follow Schultz (2003) and first estimate the relation between the market and the average returns on firms which had a merger in the prior 60 months. The merger portfolio is formed by equally weighting each merger that happened in a particular month. Then, I regress these portfolio returns on the CRSP value-weighted index return for all months from 1985 and December 2004. The slope coefficient of this regression is 1.09 with a residual standard deviation of 2.30 percent. Next, I calculate the monthly distribution of value-weighted market returns over the same time period. The average monthly market return is 1.10 percent and the standard deviation is 4.51 percent.

In order to simulate market returns, I generate returns from a normal distribution using the actual mean and standard deviation of value-weighted market returns over 1985-2004. The monthly return on the merger portfolio is generated by multiplying the simulated market returns by the slope coefficient of 1.09 and adding a residual that is generated from a normal distribution with a mean zero and a standard deviation 2.30 percent. I then subtract 0.10 percent from the merger returns so that the expected return

on the merger portfolio and the market are the same. This step ensures that ex ante expected excess return is zero.

Next, I obtain the simulated number of mergers in a month using the coefficients from the regression of the monthly number of mergers on time, the levels of the market and merger indices in the previous section. I set both the merger and the market index to 100 for the first month and then multiply last month's index by one plus the simulated return during the month to calculate the index. I run simulations of the 240-month sample path of returns 5000 times. The number of merger announcements in a month is obtained from the simulated levels of the market index, the market index, and the coefficients from the regression of the monthly number of merger announcements on time, and current and lagged levels of the market and merger indices.

In each month, abnormal returns are calculated by subtracting the simulated market return from the simulated merger return. Event-time excess returns are calculated by cumulating abnormal returns in the calendar month before and after the merger. For each month, the abnormal returns are weighted by the number of mergers happened in that month.

Panel A of Table VII reports the mean cumulative abnormal returns across 5000 simulations for a variety of event periods. The first five columns show the performance prior to the merger announcement. For instance, the mean cumulative abnormal return over 36 months before a merger is 0.78 percent with a t-statistic of 13.23. In all event-periods, excess returns are positive prior to a merger even though ex-ante excess returns are zero, which is simply the result of the number of mergers increasing as the level of merger index increases.

The last six columns show the excess returns after a merger. The last column shows the cumulative abnormal returns over 60 months after a merger. Cumulative abnormal returns following mergers are negative and decline monotonically with the length of holding period. The median cumulative excess return is -1.43 percent,

indicating that even if ex-ante excess returns are zero, the mean cumulative abnormal return over 60 months will be -1.43 percent over half the time. There is a 25 percent chance of observing excess returns less than -7.97 percent. The last row in Panel A reveals that underperformance is likely to be observed following mergers more than 55 percent of time.

Panel B shows buy-and-hold returns before and after mergers. Buy-and-hold abnormal returns are calculated by compounding merger returns and subtracting compounded market returns. Consistent with previous studies, BHARs are lower than CARs over the same event-time periods. For instance, over the 60 months after a merger the median BHAR is -6.37 percent as compared to median CAR of -1.43 percent. This result is not surprising due to the compounding involved in calculating BHAR. The possibility of observing negative abnormal returns is higher than 60 percent.

Simulations reveal that even when managers cannot time the market and markets are efficient, underperformance following mergers is observed more than half of the time. Moreover, simulations produce long-run returns comparable to the returns observed in the actual data. Overall, these results support pseudo market timing explanation in the context of mergers.

3.6. Conclusion

Mergers cluster in time, particularly in bull market periods. One explanation put forth in the literature is that these waves result from market timing where managers believe their stock is overvalued and use their stock to purchase less overvalued targets. The long-run underperformance following stock mergers in event-time studies is considered as evidence for market timing explanation.

In this paper, I revisit the idea of whether the underperformance following stock mergers is evidence of market timing by investigating an alternative explanation, pseudo

market timing. Pseudo market timing has been introduced to explain the appearance of market timing in the data in event-time studies even when managers have no market timing ability. I investigate whether pseudo market timing explains the poor long-run performance following mergers using a sample of 2,009 stock mergers from 1985 to 2004. I show that more mergers take place following high market returns, consistent with the main assumption of pseudo timing hypothesis.

I calculate calendar- and event-time returns following mergers and find significantly negative abnormal returns using event-time. The underperformance disappears when calendar-time analysis is used. In order to differentiate pseudo market timing from market timing I use simulations. According to pseudo market timing, underperformance following mergers is observed in event time even when managers have no market timing ability. The simulations with parameters estimated from historical data the underperformance following stock mergers are very likely even when managers cannot predict the future returns and markets are efficient. Moreover, pseudo market timing can lead to negative abnormal returns following mergers comparable to that documented in the data even when managers do not have the market timing ability. In sum, the results presented in the paper suggest that pseudo market timing explains the long-run underperformance following stock mergers.

Table 3.1 The distribution of the merger announcements

	Monthly Number of Takeovers
Mean	8.37
Median	6
Minimum	0
Maximum	28
First order autocorrelation	0.80
Total number of mergers	2,009
Number of months with no merger activity	8

Note: The number of merger announcements is obtained each month from January 1985 through December 2004 from SDC database. The sample includes completed deals with following criteria: 1) Both the acquirer and the target are U.S. public firms included in the CRSP database. 2) The transaction form is categorized as "Merger", "Acq. of Assets", or "Acq. of Maj. Interest". 3) The transaction form of payment is all-stock. 4) Deal value is higher than $10 million. 5) The acquirer obtains at least 51 percent of target shares in the deal.

Table 3.2 Pseudo market timing on acquirer firm returns

Time 0		Time 1			Time 2		Overall		
Price at time 0	Number of mergers announced at time 0	Price at time 1	Abnormal return from time 0 to time 1 (%)	Number of mergers announced at time 1	Price at time 2	Abnormal return from time 1 to time 2 (%)	Total number of mergers announced	Number of mergers followed by pos/neg return	Mean abnormal return
100	1	110	10	3	121	10	4	4/0	10
100	1	110	10	3	99	-10	4	1/3	-5
100	1	90	-10	0	99	10	1	0/1	-10
100	1	90	-10	0	81	-10	1	0/1	-10

Note: This table replicates Schultz's (2003)'s Table I, but based on stock mergers rather than on equity offerings. The table reports abnormal returns for two periods for each of four possible paths which are equally likely. Price is set to $100 at time zero. Prices can either increase or decrease by 10%. No mergers take place if prices are below $95, one merger occurs if prices are between $95 and $105, and three mergers occur if prices are above $105. Each period the market earns a return of zero.

Table 3.3 The relation between merger activity and market performance

Panel A. Correlation between the number of mergers and past market returns

	Value Weighted			Equally Weighted		
	a	b	Adj. R^2 (%)	a	b	Adj. R^2 (%)
One month	8.29	10.58	0.06%	8.69	11.00	0.25%
	(18.12)	(1.07)		(17.75)	(1.24)	
Two months	8.15	13.05	1.12%	8.65	8.92	0.67%
	(17.46)	(1.92)		(17.42)	(1.56)	
Three months	8.09	10.72	1.13%	8.67	5.53	0.20%
	(16.86)	(1.93)		(17.13)	(1.19)	
Six months	18.94	11.14	2.80%	14.86	6.31	1.06%
	(5.01)	(2.78)		(4.46)	(1.80)	
One year	7.02	12.11	8.05%	7.99	8.59	3.86%
	(12.41)	(4.57)		(13.17)	(3.03)	

Panel B. Correlation between the number of mergers and the market return afterwards

	Value Weighted			Equally Weighted		
	Market Return First Month After	Market Return First Three Months After	Market Return First Twelve Months After	Market Return First Month After	Market Return First Three Months After	Market Return First Twelve Months After
Jan 1985 - Dec 1989	-0.0883	-0.1088	0.0050	-0.1292	-0.1976	-0.0341
Jan 1990 - Dec 1994	-0.0191	-0.1428	0.0144	-0.0841	-0.1249	-0.2785
Jan 1995 - Dec 1999	-0.2600	-0.2936	-0.4245	-0.3338	-0.4052	-0.5128
Jan 2000 - Dec 2004	-0.0627	-0.2769	-0.5451	-0.1015	-0.2814	-0.4380
Full period	0.0011	-0.0102	0.0132	-0.0619	-0.0926	-0.1295

Note: The table displays the relation between merger activity and past and future market performance. Panel A reports results of the regression: Number of merger announcements= a+b*Past market performance + e. The number of merger announcements in each month is regressed on a variety of past market return. The first three columns report the regression coefficients where the CRSP value-weighted index is used. The last three columns report the regression coefficients where the CRSP equally-weighted market index is used. Numbers in parentheses are t-statistics. Panel B reports the Pearson correlation coefficients between the number of merger announcements and the future market return following the merger. In the first (last) three columns, the CRSP value-weighted (equally-weighted) index is used.

Table 3.4 Event-time analysis of abnormal performance following mergers

	Prior one-year return	$Returns_{0,1}$	$Returns_{0,3}$	$Returns_{0,12}$	$Returns_{0,24}$	$Returns_{0,36}$	$Returns_{0,60}$
Panel A. Raw returns							
CAR	4.34%***	1.16%***	3.56%***	12.19%***	18.78%***	30.30%***	53.01%***
BHAR	4.50%*	1.10%***	3.57%	11.64%*	20.18%***	32.89%***	55.13%***
Panel B. Value-weighted excess returns							
CAR	1.64%**	-1.27%***	-1.00%**	-1.23%**	-3.06%***	-3.16%*	1.10%***
BHAR	1.77%**	-1.34%***	-1.04%***	-3.52%***	-8.03%***	-6.67%***	-2.88%***
Panel C. Equal-weighted excess returns							
CAR	1.45%***	-1.18%***	-0.73%	-2.10%*	-8.67%***	-9.03%***	-8.44%***
BHAR	1.53%**	-1.31%***	-0.87%***	-2.94%***	-8.26%***	-9.95%***	-20.48%***

Note: This table reports long-term return around all stock mergers in the sample from 1984 to 2004. All returns are calculated in event time. Raw returns and market adjusted returns are calculated for various event periods following mergers. Each event is weighted equally. The first column reports the return of the acquiring firm in the year leading to the merger announcement. Columns 2-7 report the returns in one-month, three-month, one-year, two-year, three-year, and five-year horizons following the mergers. Panel A displays the raw returns. Panel B reports excess returns which are the difference between merger returns and the CRSP value-weighted index. Panel C reports excess returns which are the difference between merger returns and the CRSP equal-weighted index.

Table 3.5 Calendar-time analysis of abnormal performance following mergers

	Intercept	R_m-R_f	SMB	HML	Adj. R^2 (%)
OLS	-0.0015	1.0869	0.3602	0.2441	85.58%
	(-1.11)	(24.83)	(5.76)	(3.94)	
WLS	-0.0004	1.1011	0.6924	0.0186	71.87%
	(-3.99)	(73.31)	(37.12)	(0.75)	

Note: This table reports abnormal returns following all stock mergers in the sample from 1985 through 2004. R_m-R_f is market risk premium where R_m is market return and R_f is the risk-free rate. SMB represents the small minus big firm return premium. HML represents the high book-to-market ratio minus low book-to-market ratio return premium. The first two rows reports the results for ordinary least squares (OLS) where each calendar month is weighted equally. In weighted least squares (WLS), each month is weighted according to the number of merger announcements in each month. Numbers in parentheses are t-statistics.

Table 3.6 Estimation of the number of mergers each month

Dependent Variable	Intercept	Time	$Market_t$	$Market_{t-3}$	$Market_{t-12}$	Takeover $Index_t$	Takeover $Index_{t-3}$	Takeover $Index_{t-12}$	Adj R^2
Monthly Number	-3.1824	-0.2450	0.1951			0.0847			67.24%
Takeovers	(-5.27)	(-2.84)	(5.79)			(2.04)			
Monthly Number	-3.7032	-0.1209	0.0932	0.0158	-0.0177	0.1027	-0.0220	-0.0079	70.16%
Takeovers	(-5.41)	(3.37)	(1.93)	(-2.00)	(-3.56)	(2.31)	(-2.54)	(-1.20)	

Note: The number of offerings each month is regressed on time, the CRSP value-weighted portfolio, and indices based on returns of past mergers. The time variable is one for January 1985, and is incremented by one each month. The market and merger indices are set to 100 for the end of January and are incremented every month by the market or return of the portfolio with mergers in the prior 60 months. T-statistics are in parentheses under coefficient estimates.

Table 3.7 Simulations of post-merger excess returns

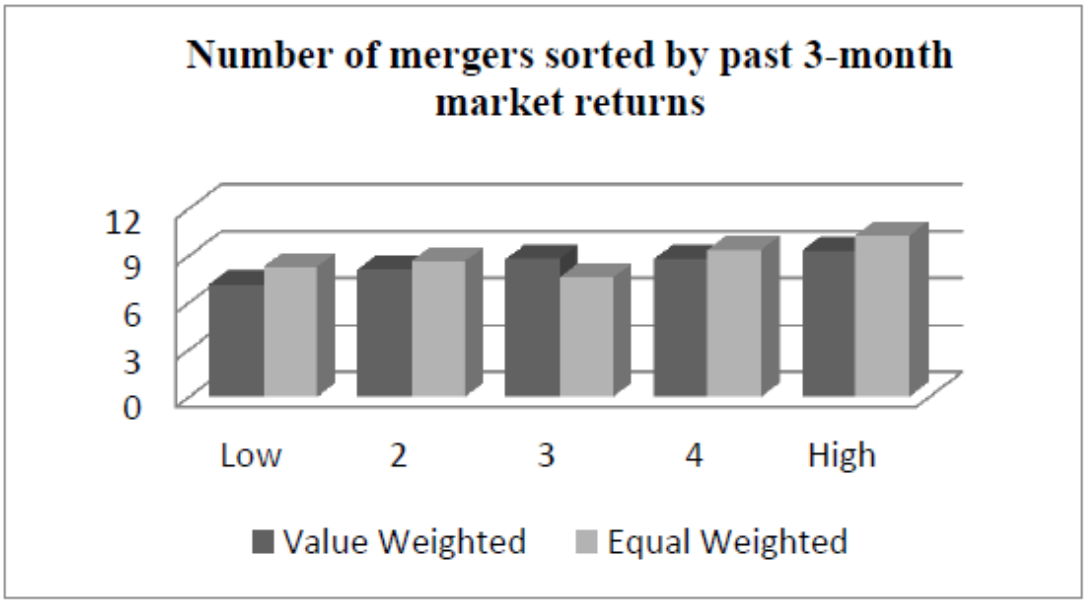
Panel A. Cumulative Abnormal Returns											
	BEFORE					AFTER					
Months	36 months	24 months	12 months	3 months	1 month	1 month	3 months	12 months	24 months	36 months	60 months
Median	0.63%	0.36%	0.14%	0.00%	-0.01%	-0.04%	-0.13%	-0.47%	-0.79%	-1.06%	-1.43%
Mean	0.78%	0.54%	0.23%	0.01%	-0.01%	-0.04%	-0.11%	-0.40%	-0.73%	-1.01%	-1.44%
Std. error	5.90%	4.05%	2.09%	0.54%	0.18%	0.19%	0.55%	2.17%	4.23%	6.20%	9.83%
t-statistic	13.23	13.38	11.11	2.44	-3.85	-20.80	-20.33	-18.54	-17.31	-16.34	-14.62
10th percentile	-14.06%	-4.40%	-2.35%	-0.65%	-0.23%	-0.27%	-0.80%	-3.13%	-5.97%	-8.74%	-14.06%
25th percentile	-7.97%	-2.28%	-1.18%	-0.35%	-0.13%	-0.16%	-0.48%	-1.85%	-3.55%	-5.15%	-7.97%
75th percentile	5.07%	3.11%	1.53%	0.35%	0.11%	0.08%	0.24%	1.00%	2.00%	3.11%	5.07%
90th percentile	11.08%	5.69%	2.95%	0.70%	0.22%	0.20%	0.59%	2.33%	4.55%	6.78%	11.08%
Percent<0	45.80	46.18	49.92	50.28	52.42	59.70	59.50	58.48	57.80	57.26	55.70

Table 3.7 Continued

Panel B. Buy-and-Hold Abnormal Returns											
	BEFORE					AFTER					
Months	36 months	24 months	12 months	3 months	1 month	1 month	3 months	12 months	24 months	36 months	60 months
Median	0.52%	0.32%	0.14%	-0.01%	-0.01%	-0.04%	-0.14%	-0.54%	-4.16%	-1.25%	-6.37%
Mean	1.26%	0.74%	0.27%	0.01%	-0.01%	-0.04%	-0.12%	-0.46%	-3.71%	-0.95%	-5.75%
Std. error	10.22%	5.84%	2.50%	0.56%	0.18%	0.19%	0.57%	2.49%	9.57%	5.62%	20.60%
t-statistic	12.33	12.66	10.62	2.33	-3.85	-20.80	-20.38	-18.35	-38.78	-10.89	-27.90
10th percentile	-10.80%	-6.20%	-2.75%	-0.67%	-0.23%	-0.27%	-0.82%	-3.50%	-15.35%	-7.68%	-29.99%
25th percentile	-5.43%	-3.15%	-1.41%	-0.36%	-0.13%	-0.16%	-0.49%	-2.12%	-9.91%	-4.75%	-18.98%
75th percentile	7.12%	4.18%	1.77%	0.36%	0.11%	0.08%	0.24%	1.13%	2.28%	2.52%	6.43%
90th percentile	13.87%	8.14%	3.49%	0.73%	0.22%	0.20%	0.60%	2.69%	8.36%	6.14%	19.85%
Percent<0	47.74	47.24	47.72	50.44	52.42	59.70	59.90	59.36	67.18	58.60	63.90

Note: This table reports the simulation results on post-merger stock returns. The estimates are based on actual data from 1985 through 2004. The expected return on the CRSP value-weighted index is 0.0110, with a variance of 0.0020. The return on the portfolio of recent mergers is 1.09008*Market Return+residual-0.001. Residuals are generated from a normal distribution with a mean zero and a standard deviation of 0.00230. The constant is chosen so that the expected return of recent mergers is the same as the expected market return. The relation between the number of mergers and the level of the CRSP value-weighted index and the merger index is estimated using the regression: -3.703 - 0.1209 (time) + 0.0932 (market index$_t$) +0.0158 (market index$_{t-3}$) -0.0177(market index$_{t-12}$) +0.1027 (merger index$_t$)-0.0220(merger index$_{t-1}$) - 0.0079 (merger index$_{t-1}$2). Cumulative abnormal returns are obtained for event periods by summing abnormal returns for each month. Buy-and-hold abnormal returns are obtained by compounding merger returns and subtracting compounded market returns.

Figure 3.1 Average number of merger announcements per month sorted by past market return quintiles



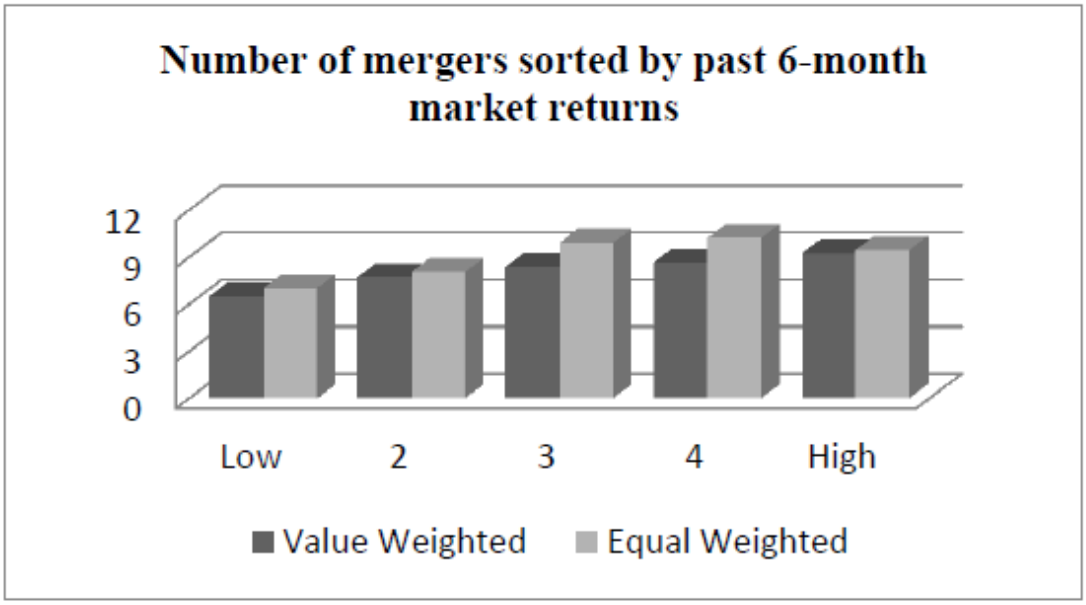
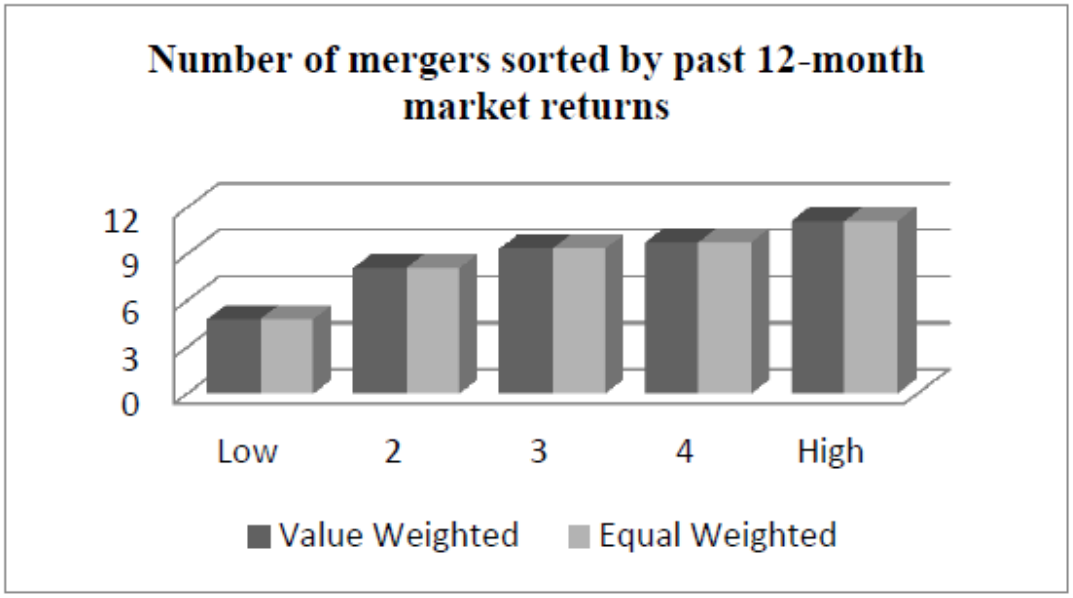
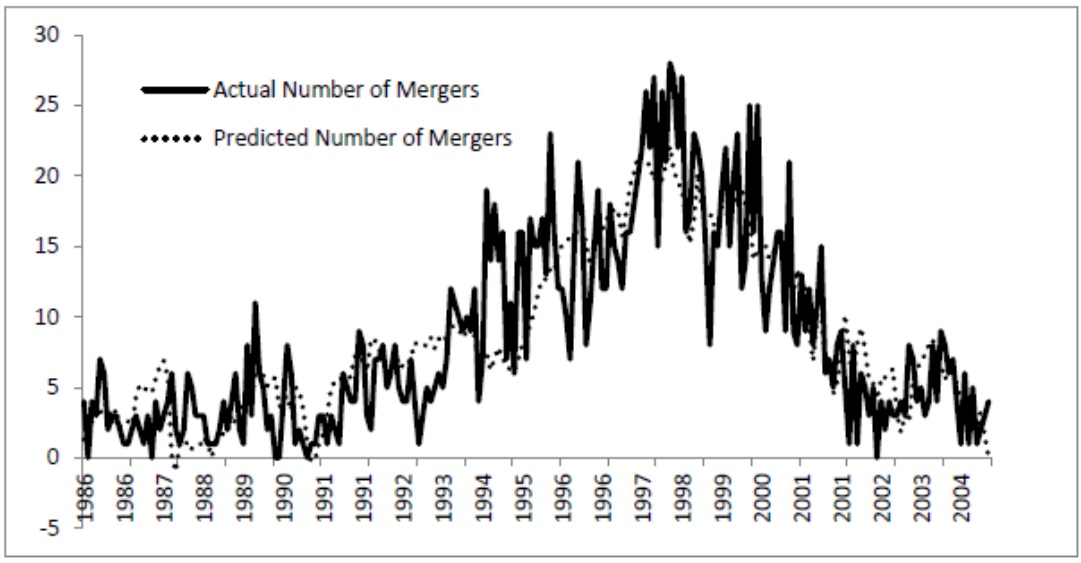


Figure 3.1 Continued



Note: This figure shows the Average number of merger announcements per month sorted by past market return quintiles. Value weighted represents the case where the CRSP value-weighted index is used as the market return. Equal weighted represents the case where the CRSP equal-weighted index is used as the market return.

Figure 3.2 The actual and predicted number of stock mergers



Note: This figure displays the actual and predicted number of stock mergers per month from 1985 through 2004. The predicted number is obtained by regressing the number of merger announcements on time, levels of merger and value-weighted CRSP index at the beginning of the month, 3 months before, and 12 months before.

APPENDIX A

VARIABLE DEFINITIONS FOR CONTROL VARIABLES

All cash flow statement variables are first disaggregated into quarterly flows.

Total assets = atq

Size = lag(atq)

Market-to-book-ratio = Market value / Total assets where

Market value = Market value of equity – book value of equity + Total assets

Market value of equity = Price Close quarterly * Common Shares Outstanding (prccq*cshoq)
Book value of equity = Total assets – Total Liabilities (ltq) + Deferred Taxes and Investment Tax Credit (txditcq)

Total debt = Debt in Current Liabilities (dltcq) + Total Long-Term Debt (dlttq)

Leverage ratio = Total debt / Total assets

Net worth scaled by assets ratio = Total Shareholders' Equity (seqq) / Total assets

Current ratio = Current Assets (actq) / Current Liabilities (lctq)

Interest expense scaled by lagged assets = Interest and Related Expense (xintq) / Lagged total assets

Capital expenditures quarterly = Capital expenditures (capxy) adjusted for fiscal quarter accumulation

Operating income scaled by lagged assets = Operating Income before Depreciation quarterly (oibdpq) / Lagged total assets

Research and Development expense scaled by assets = R&D Expense (xrdq) / Total assets

Research and Development expense scaled by sales= R&D Expense (xrdq) / Sales (saleq)

Free cash flow = Operating income before depreciation (oibdpq) – interest expenses – income taxes (txtq) – capital expenditures, scaled by total assets

PPE scaled by assets = Tangible Assets (ppentq) / Total assets

Total Investment = R&D expenditure + Capital expenditure + Cash acquisition expenditure (aqcy) - Cash receipts from sale of property, plant, and equipment (SPPE) / total assets

Whited-Wu Index = -0.091* Cash Flow (dp+ib) + 0.062 * Dividend Dummy (equals one if the firm pays dividends) + 0.021 * Total Long Term Debt – 0.044 * Size + 0.102 * Industry Sales Growth – 0.035 * Sales Growth

Altman's Z-score = 1.2 (Working capital (nwc) /Total assets) + 1.4 (Retained earnings (req) /Total assets) + 3.3 (Earnings before interest and taxes (nopiq+oibpq)/Total assets) + 0.6 (Market value of equity/ Total liabilities) + 0.999 (Sales/Total assets)

Profit margin = Sales (saleq) – Cost of Goods Sold (cogs) – Selling General and Administrative Expenses (xsgaq)/Sales (saleq)

APPENDIX B

. COMPUTATION OF ASSET VOLATILITY

In Merton's model (1974), equity is viewed as a call option on the value of the firm's assets. Shareholders are the residual claimants to the firm's assets and are only subject to limited liability under bankruptcy. In this framework, the strike price of the call option is equal to the face value of the firm's liabilities and the option expires at time *T* when the debt matures. At time *T*, shareholders will exercise their option and pay off debtholders if the value of the firm's assets is greater than the face value of its liabilities. If the value of the assets is not sufficient to fully repay the firm's debts, then the shareholders will let their call option expire. I estimate the value of equity:

$$V_E = V_A N(d_1) - Xe^{-rT} N(d_2) \tag{1}$$

where $N(d_1)$ and $N(d_2)$ are the standard cumulative normal of d_1 and d_2; V_E is the current market value of equity; V_A is the current market value of assets; X is the face value of debt maturing at time T; r is the continuously compounded risk-free rate;

$$d_1 = \frac{\ln(V_A / X) + (r + \sigma_A^2 / 2))T}{\sigma_A T^{1/2}} \tag{2}$$

$$d_2 = d_1 - \sigma_A T^{1/2} \tag{3}$$

where σ_A is the standard deviation of asset returns.

I estimate values of V_A and σ_A by simultaneously solving the call option equation (equation (1)) and the optimal hedge equation, [$\sigma_E = V_A N(d_1)\sigma_A / V_E$]. V_E is set equal to the total market value of equity based on the closing price at the end of the firm's fiscal year. σ_E is computed using daily return data from CRSP over the entire fiscal year. In order to have sufficient liquidity, I require at least 100 daily equity prices per calendar year. The face value of

the firm's debt (strike price) is set equal to the current liabilities plus half the long-term debt, T equals one year, and r is the one-year Treasury bill rate from Ken French's website. The starting values are determined by setting V_A equal to the book value of liabilities plus the market value of equity and $\sigma_A = \sigma_E V_E/(V_E+X)$. The algorithm is repeated until convergence of asset volatility estimates from two consecutive iterations is obtained. In almost all cases, the process converges within five iterations.

APPENDIX C

COMPUTATION OF MANAGERIAL INCENTIVES (DELTA AND VEGA)

I calculate CEO wealth sensitivity to stock price (Delta) and CEO wealth sensitivity to equity volatility (Vega) using the methodology by Core and Guay (1999, 2002). I value CEO stock options using the Black-Scholes-Merton model (1973). The dollar values of Delta and Vega are:

$$\text{Delta} = S\, e^{-\Phi T} N(Z) * n * 0.01 \quad (1)$$

$$\text{Vega} = S e^{-\Phi T} N'(Z) * n * 0.01 * T^{1/2} \quad (2)$$

where S is the current stock price, Φ is the expected annual dividend rate over the life of the option, n is the number of options, T is time to maturity for options, N(.) is the cumulative probability distribution for the normal distribution function, N'(.) is the normal density function, σ_e is the annualized stock return volatility, K is the strike price of options, and $Z = \ln(S/K) + (r - \Phi + (\sigma_e^2/2))T \; / \; \sigma_e T^{1/2}$.

I obtained the data on executive's option portfolio from Execucomp. Execucomp provides sufficient information on new grants. However, I need to estimate average strike price using current realizable value and time to maturity for of exercisable and unexercisable options. The average exercise price is: year-end price – (realizable value/number of options). Time to maturity of unexercisable options is equal to one year less than time-to-maturity of most recent year's grant (or nine years if no new grant was made). Time-to maturity of exercisable options equal to three years less than time-to-maturity of unexercisable options (or six years if no new grant was made).[1] The other inputs (stock price, expected stock-return volatility, and expected dividend yield) are readily available.

[1] This is due to the assumption that unexercisable options have a time-to-maturity that is three years greater than that of the exercisable options

After calculating dollar value of these different kinds of options (new grants, unexercisable options and exercisable options), I add their values up. This gives me the total dollar values of Delta and Vega.

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