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Essays in corporate finance

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Essays in Corporate Finance

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by

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Abstract

This dissertation studies the impact of credit rating on firms' financing behavior and investigates insider trading activities.

The first essay documents how firms' concerns about credit rating change affect their choice between the use of debt and lease. Firms approaching a credit rating change tend to use less debt relative to operating leases to finance their new projects. In this paper, I propose a new method of measuring the potential of a credit rating change. Using the new measures, I find that not only the concerns about being downgraded but also the attempts to get upgraded have significant impacts. The result is surprising because rating agencies are fully aware of firms' use of off-balance-sheet finance and make corresponding adjustments when they assess firms' creditworthiness. There are two possible reasons for the result. First, the operating lease obligations are usually underestimated. Second, auditors tolerate more misstatement for disclosed off-balance-sheet items than they do for recognized balance sheet items.

In the second essay, we examine the effectiveness of board monitoring over independent directors' (IDs) tenure in the case of the board's oversight of insider trading. We show that the profitability of executive trades increases in IDs' tenure. Executives are more likely to trade opportunistically and during informationally more sensitive times when IDs serve longer on the board, and these trades are more profitable. The impact of IDs' tenure on executive trading is weaker in firms that have specific guidelines in place on insider trading (and thus the board has less leeway in its oversight) or where other governance mechanisms are at work. Overall, it suggests that longer-tenured IDs are less effective monitors of exploitative executive trading. Further evidence shows that longer-tenured IDs are more likely to have their independence compromised, for example, being friends with the firm's CEO or conducting collusive trading with the firm's executives.

In the third essay, we find that corporate insiders on average trade very little on their own companies' stocks. Using a two-stage estimation method, we document a significant negative effect of insider stock purchase decisions on their abnormal trading profitability. After accounting for the endogeneity of insiders' purchase decisions, their purchases are significantly more profitable than what the literature has documented. It suggests that insiders do not purchase their own companies' stocks unless their informational advantage is sufficiently substantial. Moreover, we find the purchase profitability gap between executives and independent directors is larger than when their purchase decisions are not accounted for. Independent directors seem to be less sensitive to their informational advantage than executives. Our study calls for a better understanding of insiders' trading decisions and highlights the importance of their trading decisions on their trading profitability.

Keywords: Credit Rating; Off-balance-sheet Finance; Corporate Governance; Board of Directors; Insider Trading

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– "Effort will lie, but will never be in vain."

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1 Operating Lease and Credit Rating

1.1 Introduction

The importance of credit rating has been elaborated over and over. It directly impacts firms' cost of debt through its influence on bond marketability and bond liquidity. Stock price and equity returns are also associated with credit rating level and credit rating prospect. In addition, credit rating affects firms' access to alternative financial market and firms' bargaining power against many counterparts. The evidence provided by the survey paper of Graham and Harvey (2001) indicates that CFOs consider credit ratings second only to financial flexibility as a determinant of financing choice. Other than credit rating level, Kisgen (2006) proposes a method to proxy for firms' concern about credit rating change and he finds that the rating change concern also affects firm's capital structure decision. Loss associated with a credit downgrading and benefits associated with a credit upgrading are large enough to affect corporate behavior. There are several follow up papers showing that credit rating change concern also affects firms' earning management, capital investment, cash holdings and dividend payout decisions.

In Kisgen's paper, he assumes that there are only two forms of finance: either debt or equity. However, lease is also an important alternative source of finance. The role of lease in capital structure has been ignored from time to time since it can be incorporated as a special form of debt obligations. On one hand, lease payment is obligations to make interest and principal payment which is comparable to secured debt. On the other hand, lease contract is associated with more financial and operating flexibility, and is more secure and has higher priority than normal debt. In the pecking order perspective, firms use lease because it is less information sensitive than normal debt. In the tradeoff perspective, firms choose to use debt and lease to obtain lowest financing and tax cost. Specific to the problem of credit rating change, moving to lease contract is apparently one way to undertake leverage-reducing activity. My focus is on the use of operating lease for three reasons. First, capital lease is immediately included in debt obligations. Second, the amount of capital lease used is negligible compared to the use of debt and operating lease. Third, restructuring capital lease to operating lease leads to the absence of capital lease.

The motivation of restructuring is to move debt off balance sheet. However, rating agencies such as Standard & Poor's or Moody's would take into account the use of operating lease when they assess the credit quality of the firms [1]. They treat operating lease indifferently as debt obligations. Thus, the relative use of debt and operating lease should not be affected by the concern about credit rating change (H1). Alternatively, former studies indeed demonstrate that operating lease has a much less significant effect on firms' credit rating compared to normal debt. Accordingly, firms would reduce their use of debt relative to operating lease when their concerns about credit rating change are strong (H2).

By employing the method developed by Kisgen (2006), I find empirical evidences supporting the second hypothesis. This is consistent with the empirical findings that credit rating is less sensitive to the use of operating lease. This is not due to ignorance since rating agencies already adjust the operating lease obligations when they are assessing the firms, but is mainly caused by the insufficient disclosure and information location of operating lease. Sometimes, firms' concern about credit rating change would be even stronger, such as firms on the borderline of investment and non-investment grade and firms that have just been downgraded. Under such circumstances, firms would replace debt by operating lease more aggressively to maintain their current rating level, to get upgraded to a more favorable rating level or to regain their original rating level. I also introduce two new proxies to measure firms' concern about their current credit rating: whether the firm is placed on the Credit Watch or assigned a credit Outlook by the rating agencies. In Kisgen's paper, he measures firms' proximity to rating change concern by the sign of "+" or "-" additional to the broad rating level. Firms with a plus are on the top tier of the broad rating group and are more likely to be upgraded while firms with a minus are on the bottom tier of the broad rating group and are more likely to be downgraded. By this measurement, he ignores the concern about the micro rating change such as from AA- to AA. This is reasonable in the sense that firms in the same broad rating groups are treated indifferently. The problem is, firms' credit ratings are usually very stable. If a firm has been AA- for many years, it's hard to argue that its rating change concern is very strong.

[1] According to Standard & Poor's (2001, 2006, 2008) and Moody's (1999, 2006), for example: "Our analytic goal is to simulate a company's financial statements assuming it had bought and depreciated the leased assets, and financed the purchase with a like amount of debt..."

Kisgen also uses the credit score model. Firms are ranked by their predicted credit scores which are based on several financial ratios within each micro rating group. The top and bottom 30% firms are considered to be closer to the rating change. Using this method, I can also replicate the main results. But when I check the validity of the method, I find that the firms on the middle tier are actually more likely to be upgraded or downgraded instead, from the ex-post perspective. Rating agencies are exempt from the regulation fair disclosure, and the most valuable aspect of credit rating would be the private information it contains acquired through inquiring the management team. Thus, credit score model which solely rely on accounting ratios might not be a good proxy for credit rating. To my best knowledge, this is the first paper to use the two new proxies to measure firms' concern about credit rating change. Rating agencies will reassess their issued rating at least annually. If they find some firms are with a higher probability of rating change than normal, the firms will be placed on Credit Watch. Similarly, credit Outlook indicates firms' long-term potential for a rating change. Credit Watch and Outlook are set up by the rating agencies themselves to reflect their opinion about the firm's likelihood of rating change. Hence, they could be considered as better indicators of measuring the potential of a credit rating change. The rating change concerns for these two kinds of firms are quite material. Accordingly, the results associated with these firms are also stronger.

One straightforward explanation of the main finding is because leasing can increase firm's borrowing capacity to some extent. However, when assessing firms' credit quality, the rating agencies ignore all these benefits of leasing contract. They mechanically treat all operating lease as equivalent to debt and make the corresponding adjustments. The alternative explanation comes from the special nature of operating lease as off-balance-sheet finance. Rating agencies have to estimate capitalized operating lease by themselves using public information from the financial statements, and the computed lease obligation is very likely to be understated due to the insufficient disclosure under current accounting standards. Firms tend to take advantages of this favorable accounting treatment and try to hide part of their true leverage. I find several evidence that support the alternative explanation. First, there is no similar pattern for firms' use of other alternative sources of finance, such as capital lease and trade credits. These alternative sources of finance

also have tax advantages, or can provide operational and financial flexibility to the firm, just like operating lease. But, they are either already recognized on the balance sheet as part of debt, or included in the trade line account and provided directly to rating agencies. As a response to the increasing criticism about the abusive use of operating lease, SEC and FASB issued interpretation letters reiterating existing GAAP and clarifying the regulators' view on some controversial lease accounting issues in 2005 [2]. At the meantime, Standard & Poor's introduced a more sophisticated method to estimate operating lease obligations [3]. I find that the effect of rating change concern on firms' relative use of lease and debt alleviates afterwards. It can be inferred that the effectiveness of this strategy indeed depends on the opinion of the credit rating agencies. Besides, there are some industries where the benefits of using operating lease over debt are even greater and these industries are generally considered to be heavy user of operating lease. If the motivation behind this strategy is not to hide their leverage, we should expect stronger results in these industries. In contrast, my results disappear in these industries. This is because the credit rating agencies are more careful in dealing with firm's use of operating lease for these heavy user industries and it's less easy to trick them.

The results are concentrated on firms with no financing deficit, and pecking order theory fails to explain the use of operating lease. The finding is not too surprising. First of all, the use of lease contract is mostly constrained by the supply side. Moreover, lease contract generally applies to fixed assets only and a large amount of spending causing financing deficit is difficult to be funded by lease. Kisgen (2006) assumes firms' effort of reducing the use of debt to maintain their credit rating is only relevant when they need to raise new fund to finance their new project. In fact, firms usually issue equities to reduce their debt obligations when they feel it essential to improve their credit quality. Or in the

[2]The Sarbanes-Oxley Act of 2002 required the Securities and Exchange Commission ("SEC") to study filings by issuers and report on the extent of off-balance sheet arrangements, particularly those involving leases. In 2005, the SEC reported that there "may be approximately $1.25 trillion in non-cancellable future cash obligations committed under operating leases that are not recognized on issuer balance sheets, but are instead disclosed in the notes to the financial statements." Accordingly, the SEC Report requested the Financial Accounting Standards Board ("FASB") to craft new rules to record more lessee liabilities on the balance sheet.

[3]Prior to the March 2005 revision, S&P used a 10 percent rate to discount lease obligations across the board. Commencing in March 2005, the discount rate is based on an estimate of an issuer's actual borrowing costs and will naturally respond to changes in borrowing cost with each year of analysis, and the "thereafter" value is also incorporated in the estimation.

framework of lease, they sell the assets to use the proceed to pay down debt and then lease the assets back. In this case, firms with no financing deficit may have more discretion to do so. On the other hand, there are also some advantages of using operating lease rather than equity to replace debt. For example, it is generally much easier to restructure debt by lease compared to equity, especially through the use of capital lease. And sometime equity finance is not feasible or very costly, and then replacing debt by operating lease would become an appealing strategy. Consistent with that, I find the results are also much stronger when the equity market is cold or when firm's stock is undervalued.

This paper contributes to the literature in several aspects. First, it provides further evidence that rating change concern impacts firm's behavior, especially how they choose between different forms of finance. Firm's inclination of using more operating lease than debt indicates room for the manipulation of off-balance-sheet finance at the critical point of credit assessment. I find the replacement between debt and equity finance is much less significant, compared to Kisgen (2006), which fails to take into account the use of operating lease. In that paper, he assumes that there are only two forms of finance: either debt or equity. And he finds firms using equity to replace debt when they are close to a credit rating change. I revisit Kisgen's work, taking operating lease as part of the debt obligations. This time, the result becomes much less significant, both in economical and statistical sense. This is because for firms approach to credit rating change, the increase in their use of operating lease offset a great portion of the decrease in their use of traditional debt. To measure firm's concern about credit rating change, I further introduce two new proxies which indicate whether firms are on the Credit Watch or assigned a credit Outlook. Credit Watch and Outlook are set up by the rating agencies to reflect their opinion about the firm's likelihood of rating change. Hence, Credit Watch and Outlook are more closely related to firm's rating change concern. Second, this paper also belongs to the leasing and buying decision literature. Given the fact that the disclosure of operating lease is not sufficient and not as reliable as recognized items, it is reasonable to argue that the cost of using operating lease is lower than using debt obligations when firms are associated with higher risk of downgrading or higher likelihood of upgrading. Based on this assumption, the credit rating change concern can be reconciled with the theory of leasing and buying

decision. Although it is hard to argue that this is a first-order determinant, it would be an important driving factor that sometimes can distort firm's behavior. Third, the results and findings support the proposed new accounting rule associated with the disclosure of operating lease (FASB 2012). The new rules almost eliminate the distinction between capital lease and operating lease, requiring all lease with a maximum term longer than 12 months capitalized on the balance sheet. Voices opposed to this regulation change, such as American Bankers Association, state that the current disclosure is sufficient and they do not believe the new rule will make any improvement. In addition to stock market and bond market participants as well as the commercial banks, the results of this paper show that the rating agencies who are among the most sophisticated financial experts also cannot fully adjust firms' use of operating lease. Therefore, recognizing and disclosing all leasing is reasonable and necessary.

1.2 Operating lease and credit rating analysis

Bond ratings receive wide publicity and appear to be influential in determining risk premiums and even the marketability of bonds (West (1970)). First of all, credit rating affects firm's cost of debt. For example, West (1973) finds that bond rating systematically affects the yields of bonds even after controlling for firm-specific factors. One channel is through the private information a credit rating conveys. Regulation FD excludes rating agencies, such that they continue to be allowed to receive non-public information. Hence, credit ratings contain information which is not public and can speed up the dissemination of information about the firm [4]. Another channel is directly through their impact on the marketability of bonds affected by many rating-based regulations and rules in the credit market. For example, saving and loans were prohibited from investing in junk bonds. Insurance companies and commercial banks are also restricted in investing non-investment-grade bond. Many institutional investors, such as mutual fund and pension fund, are restricted to invest in bond with credit rating above a particular level [5]. Credit rating also affects firm's access to alternative financial markets. For example, commercial

[4] See Millon and Thakor (1985); Boot, Milbourne, and Schmeits (2004)

[5] See also Partnoy (2002); Boot, Milbourn, and Schmeits (2003); Kisgen and Strahan (2010).

paper is only assigned to firms above AA-. Besides, credit rating has great influence on bond liquidity. Lower rating is associated with lower liquidity. Since credit rationing is very common. So, those firms with lower rating might not be able to raise enough debt capital when they need (Patel, Evans, and Burnett (1998); Stiglitz and Weiss (1981)). And, credit downgrading may trigger a covenant violation which will limit firm's ability to issue more debt in the future. Moreover, credit ratings can also affect the stock price. Schwendiman and Pinches (1975) find that there is a monotonic relationship between a firm's bond rating and its common stock beta. In addition, lower ratings affect firm's relationship with suppliers, employees and customers. Lower rating implies a higher probability of bankruptcy. This reduces the firm's bargaining power against many counterparts. Overall, rating change would impact on firm's cost of external finance and thus could be a great concern when firms are making decisions, especially for the firms which are on the borderline of the rating class. Therefore, firms would have great incentives to avoid being downgraded and to attempt being upgraded. And concerns about rating change might distort firm's behavior. Former studies have shown that rating change concern affects firm's behavior: The survey paper of Graham and Harvey (2001) demonstrate that CFOs consider about the credit rating when making decisions about firm's capital structure. Kisgen (2006) provides the evidence that firms near a rating change issue less debt relative to equity compared to other firms which are not near the borderline. Jung, Soderstrom, and Yang (2013) show that firms near a rating change would have a higher absolute value of accruals, and Shah (2008) shows that firm will reduce capital investment in order to avoid falling into a lower rating level.

In the point of view of the literature, lease is an alternative form of finance. Lease contract utilizes a firm's debt capacity because it reduces firm's ability to borrow through other channels. Lease shares a lot in common with debt. In this sense, lease is considered to displace debt. Lease agreements are contractual obligations, with a commitment on cash flow through fixed rental payments over the life of the lease. It could include some stringent covenants which constrain the lessee's financial flexibility. If lessees fail to comply with the lease agreement, it will constitute a default and might trigger the default or acceleration of other debt obligations. There are also penalties associated with the

termination of lease agreement prior to maturity. According to Myers, Dill, and Bautista (1976) and many other following papers, the lease payment is hardly distinguishable from obligations to make interest and principal payment on the firm's debt and should be compared with secured debt. Under this framework, the value created from a lease contract is mainly due to the tax shield transfer from the lessee to the lessor as well as the reduced premium on external fund by leasing for firms facing high financial contracting cost.

Lease also possesses unique characteristics. Lease has much more financial and operating flexibility which can guard against the business cycle and demand fluctuates compared to both debt and equity finance. Although lease is essentially considered as secured debt, it has greater debt capacity than secured lending (Sharpe, and Nguyen (1995); Eisfeldt, and Rampini (2009)). There are many remedies to protect the lessor after the firm's file of bankruptcy. If the leased asset is really critical, the firm might choose to assume the lease contract, and the lessor will continue to receive the rental payment. Even if the firm rejects the lease obligation, it is much easier for the lessor to repossess the asset than the case for a secured debt. The lease contract has the same priority as administrative expenses, which is higher than the normal debt. Besides, lessors are more willing to renegotiate outstanding obligations or grant additional obligations, whereas banks are more likely to liquidate borrowers upon default. Under this framework, financial market imperfection also is a key factor which causes firms to switch from debt to lease.

The major idea behind the leasing vs. buying decision is that firms try to minimize taxes and financial cost. There is a long controversial about whether leasing is a substitute [6] to debt finance or a complement [7]. The empirical results are mixed. One hypothesis is that they are sometimes substituting and sometimes complementary, depending on whether firms are large or small and whether firms are financially constrained or not. Yan (2006) develops a concise model that can explain the relative use of lease and debt which do not solely rely on the requirement of tax status difference between lessor and lessee or financial market imperfection. Most of the theory or empirical evidence about

[6] This strand of literature include important works by Myers, Dill, and Bautista (1976); Marston, and Harris (1988); Beattie, Goodacre, and Thomson (2000); Deloof, Lagaert, and Verschueren (2007).

[7] See Ang, and Peterson (1984); Branson (1995); Mehran, Taggart, and Yermack (1999); Lewis, and Schallheim (1992); Lasfer, and Levis (1998).

the choice between lease and debt do not distinguish capital lease and operating lease. Sharpe, and Nguyen (1995) and Graham, Lemmon, and Schallheim (1998) focus on the use of operating lease and they find similar results as capital lease.

So far, the differential accounting for lease in the US is based on the four "bright-line" criteria proposed by SFAS No.13 (FASB (1976)). Under SFAS No.13, the differentiation between capital lease and operating lease is based on ownership risk. Operating lease bears insufficient risk to treat the leasehold as an asset and the associated obligation as a liability. However, some lease contracts contain guaranteed residual value clauses which explicitly transfer residual value risk to the lessee. These RV clauses contribute to design the lease contracts which aim to obtain operating lease accounting treatment. Operating lease expenses are treated as part of the operating expense and only the expenses used to create current period revenue are included. The lessor possesses the ownership of the asset in an operating lease, so the lessee bears little or no risk of the obsolete asset. On the other hand, capital lease imposes substantial risk on the lessee. If firm purchases the asset, the depreciation and interest expenses are tax deductible. Tax treatment of capital lease is similar to the acquired asset. For operating lease, the lease payments are operating expense and tax deductible. Compared to operating lease, capital lease leads to greater deductions earlier and less later on. Another important difference is that the operating lease (or all lease other than capital lease) is off-balance-sheet. Hence, one of the important incentives of the use of operating lease might be to mask the true leverage. Firms would prefer operating lease because it can hide potential liabilities and lower the financial leverage.

SFAS No.13 tightened the conditions under which a lease contract can be classified as an "operating lease". The regulation change aimed to specify the use of various types of lease but incurred unintended consequences. SFAS No. 13 increased the cost of using capital lease and therefore resulted in the reduction of the proportion of assets financed by capital lease. Much of the unexpected decline in capital lease is offset by the increase in operating lease, suggesting that many capital lease were restructured during the transition period to qualify as operating lease. Actually, the four "bright-line" criteria provide the exact guidance to companies on how to structure lease contracts to get a favor financial

reporting treatment (Imhoff and Thomas (1988)). And the existences of lease contract items such as RV clauses ensure that the lessees are fully capable of restructuring capital lease as operating lease. Cornaggia, Franzen, and Simin (2013) show that the use of operating lease as a fraction of total debt has increased over seven times from 1980 to 2007. At the same time, the use of capital lease fell by half. And according to my sample which includes a more recent time period, the use of capital lease is only about one-tenth of the operating lease. This fact is consistent with the proposition by the regulators and many financial presses that firms structure lease to quantify for off-balance-sheet accounting treatment in order to hide non-cancellable commitment. Benefits of the off-balance-sheet accounting treatment of operating lease contribute a lot in distorting the use of operating lease. Firms are criticized to structure lease in order to remain off-balance-sheet, and the disproportional use of operating lease reflects an attempt to distort firm financial statement (Miller and Bahnson (2008)).

As a response to this concern, FASB (and IASB) proposed a significant change in accounting rule which requires all lease to be included in the balance sheet on May 16, 2013. Under the new rule, all lease with a maximum term longer than 12 months will be capitalized on the balance sheet. Although the new rule is not expected to take effect until January 2018, firms and the CFOs have already started to worry about the overwhelming use of lease that are currently off-balance-sheet. Based on Franzen, and Simin (2013)'s finding, this new accounting rule will alter both the cardinal measures and the ordinal ranks of the firms by several common metrics. And the use of off-balance-sheet lease causes the underestimate of the firm's risk and overstatement of the firm's performance. It is shown that firms are making effort to develop a strategy to minimize the negative impact of the accounting rule change.

The planned revision of the standard intends to abolish the distinction between capital and operating lease. There exist a lot of controversies and objections against this new standard change. For example, the American Bankers Association commented to FASB/IASB that most banking credit officers are satisfied with current accounting rule and do not think the new rule will lead to any improvement in capital decision.

There are still loopholes in the new accounting standards allowing firms to avoid

balance-sheet recognition of lease if they really have the incentive to do so (Hales, Venkataraman, and Wilks (2012)). Under the new rule, all lease with a maximum term longer than 12 months will be capitalized on the balance sheet. But as long as the distinction between Type A and Type B exists, there is still room to structure the lease contract off-balance-sheet. The new classification criteria also focus on the renewal or termination options, option to purchase the asset and fair market value of the leased asset. They do not seem to substantially different from the criteria before.

The international use of lease is quite different from the one in US. European countries rely even more heavily on lease to finance their fixed investment. The differential accounting for lease is also different. For example, all lease are treated as operating lease in France and Japan. This is based on the idea that it is more efficient to disclosure and differentiates the lease by their true economics, instead of simply based on some stereotype criteria.

As mentioned in the previous section, one of the most important incentives to use operating lease is that operating lease is off-balance-sheet. Debt covenants often restrict the payment of dividends and the issuance of additional debt. To deal with a tightened covenant, firms usually choose to issue equity capital and redemption of outstanding debt. Otherwise, managers can mitigate debt covenant constraints by leasing assets (El-Gazzar (1993)). Cornaggia, Franzen, and Simin (2013) find that operating leasing allows firms to better manage debt covenants limiting debt or capital expenditures. This finding is supported by the fact that excess operating leasing is diminished by scrutiny of institutional investors, and firms investigated by the SEC or DOJ for financial misrepresentation usually are associated with high levels of excess operating lease. There are also empirical evidences that firms use costly and complex off-balance-sheet financing arrangements through special purpose entities (SPE) to obscure debt levels (Mills and Newberry (2005); Altamuro (2006)). Compared to SPE, operating lease activity is more transparent.

The motivation behind the more intensive use of operating lease could be scrutinized. It might be just for financial flexibility or an effort to mask true leverage. Moreover, the use of operating lease can distort many other aspects of firms' performance. Stock market participants do not appropriately impound the effects of operating lease into the stock

price (Imhoff and Wright (1993)), and investors do not adequately estimate the effect of operating lease on future earnings (Ge (2008)). Ge, Larson, and Sloan (2011) find that firms with overstatements to earnings have more operating lease in the year of overstatement. Ge, Imhoff, and Lee (2008) conclude that market participants are inefficient in their information processing, and the market measures of risk and return do not seem to reflect the economic substance of operating lease.

Although firms might try to fool the shareholder or even the market by using off-balance-sheet lease, it does not necessarily mean that they can successfully do so to the experts such as analyst, financial institutions, and rating agencies. However, the early studies in this area find that operating lease had little effect on credit risk [8]. But at that time, the use of operating lease was not as popular as today. After Enron scandal and the passage of the Sarbanes-Oxley Act of 2002, investors and regulators have treated off-balance-sheet items, including operating lease, with a lot more scrutiny and skepticism. As shown in Dhaliwal, Lee, and Neamtiu (2011), at least to a certain extent, investors view the risk of ownership associated with the operating leased assets as staying with the lessees. Chu and Zhang (2007) find that banks set the spread as an increasing function of operating lease. However, the level of the impact is lower than the one predicted under perfect information.

The off-balance-sheet operating lease includes the non-cancellable, long-term lease contract with fixed cost claims and bankruptcy priority. It is fundamentally equivalent to conventional debt obligations. Hence, both Standard & Poor's and Moody's incorporate the use of operating lease into their credit assessment procedure. They capitalize the operating lease and adjust the financial ratios by this capitalized lease. There are eleven financial ratios S&P analyze in assessing a firm's creditworthiness. Three of them are associated with interest coverage; the other three of them measure profitability and five of them are related to the use of debt (S&P (2008)). Bond raters rely heavily on numbers produced by the firm's accounting system rather than from the stock and bond markets (Kaplan and Urwitz (1979)). Credit rating agencies collect public information from firm's financial statement and annual reports and they also gather nonpublic information through

[8] See Abdel-khalik, Thompson, and Taylor (1978); El-Gazzar (1993).

a private conversation with the firm's managers. Bond raters care about the probability of default as well as the loss given default. Default on a promised lease or debt payment both can force a firm into bankruptcy. Capitalizing off-balance-sheet lease increases the probability of technical default. "True" lease is not likely to affect the loss given default. Rather, operating lease cannot be simply considered as "true" lease and it is very likely that it also affects the loss given default. S&P focuses more on the probability of default and it capitalizes operating lease when assigning credit rating to evaluate the probability of default (S&P (2008)). However, the work of Lim, Mann, and Mihove (2003) implies that there is still room for firms to manipulate the off-balance-sheet finance. According to their findings, the effect of the on-balance-sheet debt is much stronger than the off-balance-sheet lease obligations on both firms' borrowing cost and credit rating. This result is similar for existing and new issued bank loan and credit rating. That's to say, one dollar amount of operating lease obligation is much less important than one dollar amount of the balance sheet debt for firm's credit rating.

Leasing standard requires sufficient disclosures for users to interpret a disclosed amount as if it had been recognized. Current GAAP requires recognition of liabilities arising from capital lease arrangements, but only disclosure of current and future payments associated with operating lease arrangements. The empirical evidence shows that the disclosure is not sufficient. In Chu and Zhang (2007), the authors explain their findings by arguing that the estimated operating lease obligations are lower than the true operating obligations. They put forward three reasons for why banks would underestimate the operating lease obligations. First, only the minimum lease payments are disclosed. Second, the minimum lease payments are disclosed for only next five years and the amount beyond five years is aggregated. Third, according to the argument in the 2005 AICPA report, some lease are simply not disclosed in the notes. It is costly and complex to consider every lease contract and obtain all necessary information. Therefore, even if the lender recalculates the firm's liabilities by referring to the financial statement notes, it is likely that it will only have an estimate of the total lease obligation that understates the true liability. According to Oak (1999), the present value method is very likely to understate the debt equivalence of the lease contract since the future minimum lease payment tends to be lower than actual

because certain lease terms contain payment escalators in line with inflation or revenue generated from the leased property.

Evaluating the effective amount of off-balance-sheet debt is very complicated due to the limited disclosure. Moreover, the capitalization of operating lease incorporates some measurement errors, because of the estimation of implicit discount rate and the amount and time of future payments. The most reliable discount rate to use should be the rate implicit in the lease contract which is not publicly available. S&P uses the average rate on firms' secured debt or uses a rate imputed from firms' total interest expense and average debt. The bond raters used to use even more naive method of estimating discount rate in early years. Thus, market participants would find it too difficult or too costly to perfectly adjust the on-balance-sheet information for the effect of off-balance-sheet lease transaction (Imhoff and Thomas (1988)).

The items used to capitalize operating lease are not recognized in the financial statement, but disclosed in the footnotes. Accounting information disclosed in the footnotes is not treated equally as the information recognized in the body of the financial statements (Libby, Nelson, and Hunton (2006)). One rationale for relegating amounts to the footnotes is that the information is less reliable due to significant uncertainty associated with measurement of the amount (Johnson and Storey (1982)). Anyway, determining lease asset and liability amounts involves little subjectivity. Therefore, there should be little uncertainty. Besides, the information of operating lease is specified in the lease contract and hence there should not be very much uncertain. Actually, the specifics of a leasing contract determine its information location and the information location is the real reason that influences its reliability. As Libby, Nelson and Hunton (2006) argue, audit partners require greater correction of misstatements in recognized amounts than in the equivalent disclosed amounts. They view recognized amounts as more material and also spend more time on correction decisions for recognized information. Accordingly, auditors may be more willing to allow errors in disclosed items compared to recognized items.

Therefore, capital market reacts differently to items included in financial statement and those only disclosed in the footnote. In other words, market participants do not fully

incorporate footnote information [9]. The same logic can be applied to those bond raters. They take the capitalized operating lease less into account comparing to debt obligations due to the relative unreliable, imprecise and insufficient information associated with estimated operating lease obligations. Although their underlying economics are equivalent, using operating lease enables firms to ease the pressure of credit rating change. According to Altamuro, Jhonson, Pandit, and Zhang (2014), when banks assess the credit risk of the firm, they indeed take the use of operating lease into account. The predictive power of the financial ratios improved a lot when they are adjusted by the capitalized lease. But for those firms with a credit rating, banks think the credit rating already contains all the information about the use of operating lease, and the adjustment no longer improves the explanation power. Based on their findings, using operating lease to replace debt, in order to maintain existing credit rating level, would be even more worthwhile.

1.3 Data and Methodology

1.3.1 Sample construction

The sample period is from 1985 to 2014. The sample starts form 1985 because it is the first year credit rating data available in Compustat. Credit rating is monthly reported so I merge S&P rating with the firm's fiscal year end month. Then I exclude firms with a total asset as missing value or smaller than 1 million. I further exclude the utilities and financial firms (SIC 4900-4999, 6000-6999). All accounting data are winsorized by 1%.

I focus on a subsample containing only the firms with available credit rating. I exclude firms with credit rating lower than CCC-, since these firms might have totally different financial policies. D is used for a bond that is in default and C is a special rating applied only to income bonds on which no interest is currently being paid [10]. These firms are also excluded. However, defaulted firms (with rating D) actually use extremely high operating lease.

I also exclude the firms with a negative value of common equity and the observations with extremely large debt offer in a single year. As indicated by Kisgen (2006), extremely

[9] See Aboody (1996); Davis-Friday, Folami, Liu, and Mittelstaedt (1999).
[10] I use similar sample filter strategy as Kisgen (2006).

large debt offer matters for firms both near and far from a rating change, so any firm would expect a downgrading after that. Besides, large debt offers are usually associated with merger and acquisitions. These will compromise the result about rating change concerns. The extremely large debt offer is defined as a debt offer larger than 10% of the firm's total asset. I also try different cutoffs (5%, 10% or 20%) and the main results do not change. In the resulted sample, I have 24,370 firm-year observations with 3300 unique firms.

Rating agencies start to implement the use of additional sign since early 80s. Moody's do it once for all in 1982. S&P has gradually refined its ratings (implemented sub-rating categories for AA, A, BBB, and BB from 1973 to 1978 and then for B and CCC in 1983). The proportion of ratings placed on credit watch list or assigned credit outlook has sharply risen in recent years. Moody's publish list of ratings on review since 1985 but consider watch list assignments as formal rating action on October, 1991. However, S&P instituted a watch list in November 1981, so taking credit watch or outlook into account wouldn't affect my sample period.

1.3.2 Dependent variable

To obtain the debt equivalent value of operating lease, we need to capitalize it by estimating its present value:

$$\text{Capitalized operating lease} \;=\; \text{Rental expense} \;+\sum_{\mathrm{t}=1}^{5}\frac{\mathrm{MLP_t}}{(1+\mathrm{d})^{\mathrm{t}}} \tag{1}$$

Here, rental expense (item 47) is from the current year and MLP_t (t=1, 2 ... 5) represent the minimum rental expense due in the first (or second, third, fourth, or fifth) year from the Balance Sheet date under all existing non-cancelable lease (item 96, 164, 165, 166, 167). Accounting rules in the US require that the operating lease commitments for the next five years to be reported as part of the footnotes. Following Graham, Lemmon, and Schllheim (1998), I use 10% as the discount rate. In fact, S&P no longer uses 10% as discount rate since 2005. Instead, it calculates the average interest rate from a company's most recent annual statements as a proxy for its cost of funds. Former empirical studies show that using very complicated method would give us an estimated discount rate which

is very close to 10%.

The key dependent variable of interest is the relative use of operating lease to the use of debt:

$$\text{Net lease to debt} = \frac{\Delta\text{Operating lease}_{\text{it}} - \Delta\text{D}_{\text{it}}}{\text{Total asset}_{\text{i,t}-1}} \tag{2}$$

Assuming firms already exhaust their internal fund and need to raise capital to fund their new project, there are three sources of finance: debt, lease and equity. To see how firms fund their new projects, focusing on the incremental financing choice is more suitable. ΔD_{it} equals to the debt issuance minus debt reduction plus the change in current debt. One important thing is that this item already includes the change of capital lease which is also considered as obligations. Operating lease is just the change of capitalized operating lease from last year. Thus, this variable measures the relative choice between the debt finance and operating lease to fund the new project for the current year. This item is scaled by the book value of firm asset from the last period.

1.3.3 Proxy for rating change concern

In this paper, I focus on firm's concern about their Domestic Long-Term Issuer Credit Rating issued by Standard & Poor's. This corporate credit rating variable contains a broad group creditworthiness indicator ranging from AAA to CC, representing firm's capacity to meet financial obligations from strong to vulnerable. The three-letter broad rating groups contain most of the information regarding firm's ability to make debt obligations repayment (S&P (2006)). As S&P (2006) states, Long-term rating from "AA" to "CCC" could be modified by the additional plus or minus sign to show the relative standing within the major rating categories. Standard & Poor's assigns a plus or minus to the rating to indicate that the bond is at the upper or lower end of the rating category.

Following the methodology of Kisgen (2006), I use dummy variables indicating whether there is a "+" or "-" in firm's S&P rating to proxy its concern about rating change. Dummy variable "Plus" equals to one when firm's S&P rating contains a "+". A "+" additional to major rating indicator implies that the firm is in the top tier of the broad rating group.

Thus it is more likely to be upgraded. Meanwhile, a "-" additional to a major rating indicator implies that the firm is on the bottom tier of the broad rating group which is more likely to be downgraded. Hence, dummy variable "Minus" equals to one when there is a "-" in firm's S&P rating and is a proxy for the firm's concern about being downgraded. "POM" is a dummy variable equals to one if the firm's credit rating contains either a "+" or a "-", which represent firms' overall concern about their corporate credit rating. People would expect that the downgrading concern is much pronounced than upgrading attempts, but sometimes the attempt to be upgraded could also be very strong.

In this framework, basically, only firms' concerns about the change among broad rating groups are considered. This is reasonable since most investors and regulations focus more on the difference among firms belonging to different broad rating groups and do not treat firms in the same broad rating group very differently. In Kisgen (2006), he also uses the credit score model to rank firms among each minor rating group and uses the top tier and bottom tier in each group to proxy firms' rating change concern. As a complementary test, I also adopt this approach and find results supporting my hypothesis. But when I check the validity of this minor rating change proxy, I find that firms belonging to the top tier of each minor rating group are not necessarily more likely to be upgraded and firms belonging to the bottom tier of each minor rating group are not necessarily more likely to be downgraded. In fact, the probabilities of being downgraded or upgraded are both much higher for firms in the middle layer. Rating agencies use very complicated procedure to evaluate firms' creditworthiness. Corporate credit rating not only contains public information based on accounting data but also includes non-public information gathered through the discussion with firms' manager. Therefore, using the credit score model to proxy firm's adjacency to a rating change might not be very effective.

Firms' credit ratings are usually criticized to be rather stable over time. Rating agencies voluntarily maintain credit rating stability, because market participants who are more rely on the use of credit rating, e.g. those naive investors, are not able to timely follow the revision of credit rating. Besides, firms would find the contracting or renegotiation costs increase sharply when credit ratings stability is impaired. If firms have been associated with AA- for ten years, it is hard to say how much they concern about their current

rating level. In the robust test, I try to identify several cases when firms concern about credit rating change would be stronger. Most of the rating-based market regulations and rules are targeting on the non-investment grade firms. Thus, a BBB- firm would be even more reluctant to be downgraded to a lower level and a BB+ firm would find it even more attractive to be upgraded to a higher level. Likewise, a firm has just been downgraded would put extra effort and try to be upgraded back to its prior rating level and a firm has just been upgraded would be afraid of being drawn back to the former lower rating level. Therefore, these firms would concern more about their credit rating compared to ordinary firms.

The rating agencies such as S&P will review their ratings at least in annual basis even without any suspicious events. And they might find it necessary to reassess the rating or outlook. They will place the ratings on Credit Watch if they believe the likelihood of a rating change is sufficiently high (S&P (2008)). The ratings placed on CreditWatch list are usually associated with a significant chance of rating change, roughly 50% or more. To confirm the potential rating change, the raters will gather more information including both public and private information which usually involves meeting with the firm's management team. Rating agencies place firms on Credit Watch to attract the market's attention and force the firm to take actions to improve credit quality (Boot, Milbourn, and Schmeits (2006)). This special surveillance would be a warning sign to the firm's management and this would significantly raise their concerns about the firm's current credit rating. Sometimes, a rating outlook would be assigned to the long-term debt issuers to assess the potential for rating change (S&P (2008)). Although being placed on the outlook does not always lead to an actual rating change, firms with a positive outlook are more likely to receive upgrading and firms with a negative outlook are more likely to receive downgrading. Being placed on the Credit Watch also raises the difficulties of equity finance which would make the use of operating lease even more appealing. Hence, I also use whether the firm is on the list of Credit Watch or Outlook as a proxy for their rating change concern.

1.3.4 Other determinants of buying or leasing decision

Based on the former literature, there are several other factors which would also affect the use of lease relative to debt and I should control them when investigating the effect of rating change concern. Yan (2006) develops a conclusive model to incorporate different theories predicting the substitute or complementary use of debt and lease. This model reconciles the tradeoff theory and tax arbitrage theory, and shows that the use of lease relative to debt is based on firm's financial cost function. Generally, the determinants of the use of debt can be separated as due to tax incentives or non-tax incentives, and there is no difference in determining the use of operating lease or capital lease. I mainly follow the framework in Graham, Lemmon, & Schallheim (1998) and Sharp & Nguyen (1995) because these two papers focus more on investigating the use of operating lease.

Firm size is proved to be an important determinant of the use of lease. On one hand, smaller firms should use more lease due to their higher asymmetric information. This is also true from the supply side since lease contracts can be helpful to reduce the uncertainty around the firms. Larger firms are usually more diversified, thus are with more stable cash flow. Larger firms are more likely to have economies of scale in issuing securities. Therefore, larger firms bear lower cost to raise external fund. Meanwhile, it is much harder for the smaller firms to predict the future need for the assets, so they usually use more lease. On the other hand, lease and firm size could be positively correlated. Large firms are facing greater political cost and have more incentive to adopt income decreasing method and hence tend to use fewer lease. (Holthausen and Leftwich (1983), Watts and Zimmerman (1978)) The empirical results for the relation between firm size and firm's use of lease are mixed. Some find evidences support the first prediction; others find evidence consistent with the latter. There are also some works find that the effect of firm size on lease is not significant or is changing over time (Ang and Peterson (1984)). These papers measure firm size using book value of total assets, market capitalization, total sales, or total number of employees. In this paper, firm size is measured by the natural log value of the book value of the total asset. I also use total sales as an alternative measurement, and main results do not change.

Firms from certain *industries*, such as transport and retailing, use more lease com-

pared to others. Service and utility companies also use more lease while construction companies tend to lease less. The "industry" determinants are related to the industry-wide differences in investment tax credit, nature of asset and collateral and the characteristics of secondary markets. Moreover, the supply side is also a very important factor of the industry differences in the use of lease. In early studies when the use of lease was generally not very popular, the probability of using lease contract or not was also proved to be significantly different among industries. To capture the differences in the use of lease contracts in different industries, I include the industry fixed effects in the regressions.

Companies use more lease when its assets are less *specific*. These kinds of assets are easily transferable and usually are already available in the leasing market. General fixed asset is the most unspecific asset. Redeployable assets are suitable both for lease and for use as collateral in debt structure. On the other hand, higher collateral also increases firm's debt capacity, which would allow them to use more debt. This determinant is measured by the net Property, Plant and Equipment scaled by the total asset.

Firms with higher *leverage* use more lease. Firms that already have a high level of leverage tend to have lower debt capacity, more constraint by the debt covenants and are more likely to bankrupt. Lease, especially operating lease, has been found an important alternative mean to avoid debt financing. Thus, firms with high leverage would choose to use more lease in order to avoid large capital outlays, violation of covenants and to get more favorable financing terms (from lessor rather than creditors). Here, leverage is measured by the sum of long-term debt and short-term debt divided by the total asset.

Firms facing greater *financial constraint* would use more operating lease. Again, firms with greater financial constraint are usually more information asymmetry. Lease contracts provide creditors with more security, higher priority in bankruptcy and an effective way of reducing adverse selection and moral hazard problems that arise from information asymmetries (Eisfeldt and Rampini (2008) and Sharpe and Nguyen (1995)). These firms also would face higher cost of external finance and would prefer to lease assets to reduce investment cost. In this paper, the financial constraint is proxied by a "no dividend" dummy. However, the firms with available credit rating are considered to be less financial constrained compared to other firms.

Taxes are a very important factor in the leasing-buying decision. Operating lease is a tool that can shift tax shield from lessee to lessor. Tax arbitrage theory suggests that lessee can sell its tax shields to lessor through lease, and more lease reduce the potential redundancy of tax shield. As mentioned in Yan (2006), for firms with higher tax rate, the cost of tax shield redundancy would be higher. Thus, firms with lower effective tax rate would prefer leasing to buying.

Firms with more *growth option* in their investment opportunity set should retain the ability to fund future investment with higher priority claims. These firms should have a lower proportion of secured debt and lease in their capital structure. On the contrary, such firms would allocate more fixed-claim obligations to operating lease rather than debt since lease are more flexible and can mitigate debt overhang problem for firms with a lot of investment opportunities. Here, we use market-to-book ratio adjusted by operating lease to proxy the investment opportunity. Yan (2006) suggests that cost of debt financing increases in lease financing more for high growth firms than for low growth firms.

In robustness check, I further include a lot more control variables. Lease contracts have higher priority than debt in bankruptcy, thus firms with a higher probability of *financial distress* would arrange more leasing. If so, there should be a positive relation between leasing and ex-ante measure of financial distress. Financial distress is measured by a modified version of Altman's (1986) Z-score. Alternatively, I use ECOST as the measure of financial distress. Unlike Z-score, ECOST measures the ex-ante expected cost of financial distress. I also include firm age as a proxy for information asymmetry. Liquidity and profitability might also have an important impact on firm's choice between lease and debt.

1.4 Empirical Results

1.4.1 Some stylized facts

In this paper, I focus on the firms with available Standard & Poor's credit rating. These firms are expected to be larger, older, more mature and less financially constrained. As we can see from panel A of table 1.1, compared to ordinary firms in Compustat, rating

firms usually are larger, more mature and with fewer growth opportunities. They also use higher leverage and with more fixed assets. On average, these rating firms are more profitable than ordinary Compustat firms.

I further separate the rating firms into three groups according to their S&P rating. Minus group consists of all firms having a "-" in their S&P ratings. Plus group consists of all firms having a "+" in their S&P ratings. Neutral group consists of firms in the middle tier which contain neither "-" nor "+". According to panel B in table 1.1, the firm characteristics among these three groups of firms are very similar. The neutral group seems to be slightly larger and perform better than firms in other two groups, which can be mainly attributed to the AAA firms contained in this group.

Rating firms are certainly not identical to unrated firms. But they make up a large fraction of the debt user and market asset universe of public non-financial firms. As pointed out by Rauh and Sufi (2010), almost 95% of the total debt and 90% of the total assets is from firms rated for at least one year. According to former literature, firms with credit ratings generally have higher leverage and increase their use of debt finance (Faulkender and Peterson (2006), Sufi (2007)). In table 1.2, I compare firms' use of debt, capital lease and operating lease. In the full sample, over 99% of the firms use debt and about 85% use operating lease. On the contrary, only 33% of the firms report the use of capital lease. In early studies of leasing finance, people see much higher use of capital lease. For example, Barclay and Smith (1995a, b) find that 46% of their firm-year observations have capital lease and back to early 70s, the percentage goes up to around 70%. There exists huge substitution of capital lease by operating lease since the regulation change of FASB (1976).

The percentages of debt and lease user are both slightly higher among rating firms. Moreover, rating firms use debt more intensively and use less operating lease compared to ordinary Compustat firms. Rating firms usually face much more favored terms in issuing debt and have more access to alternative finance market. These hence boost their use of debt and reduce their use of operating lease. Although there are evidences that lease supply is more generous to rating firms, it seems that the effect from demand side overrides the effect from supply side on average.

Operating lease can be considered as an important source of finance. As we can see from figure A.1, the amount of operating lease is almost as much as a half of the amount of total debt in the full sample. Figure A.2 plots the use of operating lease as a proportion of total debt for all firms and rating firm respectively. Mean and median statistics show a similar pattern that operating lease is a much more important source of finance for unrated firms. In the full sample, the mean is much higher than the median operating lease to total debt ratio. Thus, there exist some firms intensively using operating lease. These outlier firms are very likely to be highly financial constrained and even financial distressed. These kinds of firms choose to lease assets instead of buying them to avoid further use of debt. On the other hand, the operating lease to total debt ratio is also positively skewed for the rating firms, but the skewness is not that large as in full sample. Besides, the ratio of operating lease to total debt is around 30% on average for rating firms. Therefore, the use of operating lease is quite comparable to the use of debt even for the rating firms. According to Leaseurope, lease is even more popular in Europe where on average 28% of the investment is financed by lease contract, excluding real estate.

Cornaggia, Franzen, and Simin (2013) show that operating lease as a fraction of total debt has increased over seven times from 1980 to 2007. And they find this trend to be significant after controlling several determinants of the use of lease and this trend is not due to any decreasing trend in total debt. From figure A.2, we can see that the trend is very likely to be dominated by unrated firms and not so pronounced for rating firms. Moreover, the trend seems to revert in recent years, especially after the rumor of potential regulation change in capitalizing all lease use. Recent decade sees more and harsher attentions on off-balance-sheet finance, especially in the use of operating lease. Firms' use of operating lease experiences a rather flat period right after the financial scandals in the early 2000s and decrease sharply after the year 2010. Cornaggia, Franzen, and Simin (2013) find evidence that the lessors also grow during the 1980s to 2000s. The boom of supply side could facilitate the increasing trend but it is unlikely to cause the reversion even if the lessors stopped to growth. Since the new accounting regulation is expected to be effective in 2018, it is more likely that firms are trying to "smooth" the effect of this regulation on their use of operating lease.

Some industries generally use more lease, as we can see from the upper panel of figure 1.1. Firms in retail, transport, meals and personal services industries use more lease. This is determined by their business model. Again, the figure shows firms' ability to structure capital lease as operating lease since the amount of capital lease is negligible compared to the use of operating lease even in the lease intensive industries. The use of operating lease decreases all the way as the credit rating level enhances. The literature has shown that more financial constrained firms use more lease. Anyway, rating firms are generally considered to be less financial constrained. But the effect is still shaping the use of operating lease even within the rating firms group. Firms with higher level of credit rating are also more profitable and face less cost of debt. These all lead them to use fewer lease. The trend is not that significant in the use of capital lease, which is probably because of the negligible amount of the use of capital lease.

Kisgen (2006) constructs the proxy for rating change concern by implicitly assuming that firms are more sensitive to the broad rating change and less sensitive to the rating change within each broad group. Also, he assumes that firms with a "-" in their credit rating are more likely to be downgraded to a lower broad rating group and firms with a "+" in their credit rating are more likely to be upgraded to an upper rating group. This argument is natural and intuitive in the eye of the market and is consistent with the construction of a credit rating according to the rating agencies. Table A.3 is organized based on a rating change transformation matrix as shown in table A.1. If a firm belongs to the minus group, its probability of being downgraded to a lower broad rating group is 6.3% higher than the unconditional probability. Moreover, this probability is about 8.5% higher than firms belonging to neutral group and 9.8% higher than firms belonging to plus group. On the other hand, if a firm belongs to the plus group, its probability of being upgraded to an upper broad rating group is 5.4% higher than the unconditional probability. Moreover, this probability is about 6.9% higher than firms belonging to neutral group and 9.3% higher than firms belonging to minus group. These findings confirm the validity of using borderline indicator as proxy for firms' rating change concern.

Firms with a "-" in their credit rating are more likely to be downgraded and firms with a "+" in their credit rating are more likely to be upgraded. Hence these firms are

considered to be more concerning about credit rating change. The left panel of figure 1.2 shows that firms near a credit rating change would choose to issue less debt relative to firms far from the credit rating change. This is consistent with the finding of Kisgen (2006). On the other hand, the firms near a credit rating change would choose to use more operating lease as illustrated in the right panel of figure 1.2. In figure 1.3, the firms are further separated into three major rating groups. A major group includes all firms with S&P credit rating belonging to "AAA", "AA" or "A" broad categories. B major group includes all firms with S&P credit rating belonging to "BBB", "BB" or "B" broad categories. C major group only includes firms with S&P credit rating belonging to "CCC" broad categories because we exclude the firms with credit rating lower than CCC-. As we can see, the effect of credit rating concern on the use of operating lease is uniform across all major rating groups. These naive facts roughly support my hypothesis that firms near a rating change would try to use more operating lease relative to debt.

1.4.2 Baseline regressions

Table 1.3 demonstrates the results of the baseline regression. All control variables are from the previous fiscal year, as well as the rating concern proximities. The regressions are all adjusted by clustering at the firm level. There are only a few clusters in the time dimension and clustering by both time and firm yields very similar results. Industry fixed effect is based on Fama and French 48 classification. Firms that are smaller, riskier, more constrained and with lower tangible assets would prefer to use more operating lease relative to debt. The results also show that firms with more growth options should use less fixed payment obligations.

The effect of rating change concern is statistically significant. Its economic significance is also evident. On average, firms near a credit rating change would use 0.0023 more operating lease relative to debt compared to firms far away from the rating change. Given that the sample mean (median) of the use of operating lease relative to debt is 0.0125909 (0.0071418), firms concern about rating change would increase their use of operating lease relative to debt by approximately 18.3%. The effect of rating change concern for the minus group and plus group are quite different. This is probably because

the loss from downgrading would be much greater than the benefits from upgrading. In the equity market, there exist negative significant responses to credit downgrading, but no statistically significant reaction for upgrading (Holthausen and Leftwich (1986), Hand, Holthausen and Leftwich (1992), Dichev and Piotroski(2001)). Only downgrading will lead to covenant violations which cannot be resolved by upgrading. And, institutional investors are forced to sell the bond after the firm received a downgrading, but they don't necessarily increase the holding of the bond of the firm is upgraded. Besides, the gap between the probabilities of broad upgrading among plus group with the other two groups is not as large as the gap between the probabilities of broad downgrading among minus group with the other two groups.

Several other factors have also been found to be associated with firms' choice between lease and debt. I also try to include these factors in the regression. The main results remain unchanged after controlling firms' profitability, liquidity, ex-post financial distress measured by Z-score and ex-ante financial distress measured by E-cost. I also replace the log value of the total asset by log value of firm age and the results are still the same.

If the concern about credit rating is a driving factor impacting firms' relative use of operating lease and debt, we would expect that the effect should be more pronounced when this rating change concern becomes stronger. Corporate bond can generally be separated into two classes. Bonds rated in the top four categories ("AAA", "AA", "A" and "BBB") are commonly known as investment grade ratings. On the other hand, bonds rated in the lower categories are known as speculative bonds or junk bonds. The junk bonds generally are regarded as not eligible for institutional investment. Firms with a speculative grade rating would also be constricted from alternative financial market. Thus, firms' concern about credit rating downgrading and also their efforts in attempting credit rating upgrading should be stronger around the investment-grade boundary.

Likewise, firms just being downgraded should have more incentive to get back their former level of credit rating while firms just being upgraded would be rather indifferent. This unsymmetrical relation between the actual rating change and the use of operating lease relative to debt would be amplified for fallen angels and rising stars. Here, actual rating change includes not only the change among broad rating groups but also the change

among minor rating groups. Fallen angel refers to firms being downgraded from an investment bond to a speculative bond. Rising star refers to firms being upgraded from a speculative bond to an investment bond. Fallen angel and rising star usually involve rating changes of more than one minor layer.

Firms with credit rating of "BBB-" and "BB+" take up about 8.27% and 6.02% of the firm-year observations respectively. Credit quality of the US firms has declined since 1978 to 1995 due to the use of more stringent rating standards in assigning ratings (Blume, Lim, and MacKinlay (1998)). As we can see from table A2, the percentage of downgrading is always higher than the percentage of upgrading in each year. The tests for stronger rating change concerns are demonstrated in table 1.4. As we expect, the impact of the rating change concern on firms' use of operating lease relative to debt is larger for firms around the investment-grade boundary, where regulations based on ratings are most prevalent and significant. The impact is further amplified for downgrading firms and especially fallen angels. Rising stars actually decrease their use of operating lease relative to debt, although the effect is not significant. Unlike fallen angels who are downgraded given unexpected business condition shocks, rising stars often come out due to actively reduce their leverage ratios by paying down debt before the upgrade (Nini, Smith, and Sufi (2012)). Thus it is very likely that rising stars will try to recover the strategic debt issuance reduction afterwards.

Then, I revisit Kisgen (2006), which fails to take into account the use of operating lease. As shown in table 1.5, I find the replacement between debt and equity finance is much less significant, compared to Kisgen (2006). And this is not due to the change of sample firm or sample period. In that paper, Kisgen assumes that there are only two forms of finance: either debt or equity. And he finds firms using equity to replace debt when they are close to a credit rating change. I revisit his work, taking operating lease as part of the debt obligations. This time, the result becomes much less significant, both in economical and statistical sense. This is because for firms approach to credit rating change, the increase in their use of operating lease offset a great portion of the decrease in their use of traditional debt. Firms can trick the rating agencies to some extent without truly improving their ability to repay fixed claim.

One criticism about the firm's credit rating is that it is rather stable over time. Thus, it is hard to argue that a firm associated with AA- rating for over ten years would have very material concern about its own credit rating. Rating agencies' assessment of firm's creditworthiness is an ongoing process and they have mechanisms like Credit Watch and Outlook that focus on the scenarios when the potential for future rating change is higher than usual. Here, I use whether firms are placed on the Credit Watch or assigned the Outlook as indicators about their concern about rating change. These proxies are more direct and relevant than just using the indicators about the additional signs to firm's broad rating. The portion of firms placed on the Credit Watch is not very high, generally around 10% on average. The probability of being assigned a valid Outlook is even lower. I only focus on the Credit Watch and Outlook to the issuer of long-term debt in domestic currency. S&P would release a "developing" Credit Watch or "developing" Outlook to firms in unusual situations when future events are unclear. This kind of Credit Watch or Outlook is also excluded because the assessments of these firms are expected to be pending and they often are going through great transitions.

As shown in table 1.6, firms under Credit Watch or Outlooks are reducing their use of debt relative to operating lease. This confirms our main results. The results for Outlook resemble the results of the baseline regression with larger magnitudes. The results for Credit Watch are more significant. Outlooks have a longer time frame than Credit Watch, typically two years for investment-graded firms and one year for non-investment-graded firms in the future. Thus, the concerns about being placed on the Credit Watch could be more urgent. Another interesting finding is that the effect of positive Credit Watch is much stronger than the effect of negative Credit Watch, for both significance level and magnitude. Kisgen (2006) mentions that firms in really bad circumstances may find it beyond their capacity to maintain their current credit rating, and have no other choices but to live with it. This also explains the reason why the baseline results for "distressed" firms are insignificant.

Although whether firms are on the borderline of the broad rating group do not seem to be associated with whether it will be placed on the Credit Watch or Outlook, it is also possible that the results of baseline regression are driven only by the firms with material

rating change concern. Hence, it is meaningful to see how the firms on borderline of broad rating group but not on the Credit Watch list behave. The related results can be found from the appendix.

For Credit Watch, the upgrading attempts are concentrated on firms with Credit Watch but the concern of being downgraded is also significant even for firms without Credit Watch which drive them to replace debt by operating lease. Besides, firms without any Outlook also exhibit rating change concern in spite of less significance level and magnitude. For firms on the downgrading borderline, no Outlook pressure even gives them more freedom to do so. These evidences ensure that the effects of Credit Watch and Outlook do not dominate the effect of rating change concern. In fact, the results for rating change concern measured by the additional sign to the broad rating groups are still significant after excluding all firm-year observations with Credit Watch.

There are flaws in capitalizing the operating lease. In table 1.7, I try to estimate the operating lease obligations more precisely by including the thereafter proportion. Thereafter aggregates the cumulative total of all future rental commitments after year five excluding the capitalized lease obligations. The rest life of the operating lease contract is estimated as the thereafter portion of lease divided by the fifth year's lease payment. The average lease payment for the rest of the life of the operating lease contract is estimated as the thereafter portion of lease divided by the number of year in the rest life. Then the future lease payments are discounted from each future year to present. The new capitalized operating lease revises the old one by adding a term containing the lease obligation beyond the five-year horizon. The item "thereafter" is required to be disclosed only after the year 1995. So in this table, our sample period is from 1996 to 2014.

As we can see, the main results do not change after further including the thereafter term. Moreover, the magnitudes of the coefficients associated with the rating change concern even increase. I also get similar results by capitalizing the operating lease using the perpetuity method. Thus, the results are robust to alternative methods of estimating the capitalized operating lease.

Since using lease can lower firm's observed tax rate, effective tax rate would be endogenously related to the use of lease (Graham, Lemmon and Schallheim (1998)). To

solve this problem, Graham et al. use a simulation method to estimate the firm's marginal tax rate before financing. The data of before financing marginal tax rate is obtained from Graham's website. In table 1.8, I control the estimated marginal tax rate instead of the effective tax rate. Again, the main results do not change and are even enhanced in magnitude. Besides, the negative effect of the marginal tax rate is consistent with the former literatures. This also confirms the endogeneity of corporate tax status associated with the use of lease since the effect of effective tax rate is positive in the baseline regression.

Using capitalized operating lease including the thereafter term or controlling for the estimated marginal tax rate compromises the sample size by reducing the regression observations by almost a half. Since these two concerns do not really affect our main results, I will keep using the specification in the baseline regression in the following tests.

1.4.3 Evidence supporting the alternative explanation

Why firms think using operating lease to replace debt could be a successful strategy in mitigating concerns about their credit standing? One explanation is because leasing can increase firm's borrowing capacity to some extent. However, when assessing firms' credit quality, the rating agencies ignore all these benefits of leasing contract and mechanically treat all operating lease as equivalent to debt and make the corresponding adjustments. The alternative explanation comes from the special nature of operating lease as off-balance-sheet finance. Rating agencies estimate capitalized operating lease using public information from the financial statements, and the computed lease obligation is very likely to be understated due to the insufficient disclosure under current accounting standards. Firms tend to take advantages of this favorable accounting treatment and try to hide part of their true leverage. I find the results support my alternative explanation.

First of all, I don't see a similar pattern for the use of other alternative source of finance, such as capital lease and trade credits. These alternative sources of finance also have tax advantages, or can provide operational and financial flexibility to the firm, just like operating lease. But, they are already either recognized on the balance sheet as part of debt, or included in the trade line account and provided to rating agencies.

As reported in table 1.9, concerns about credit rating change, either upgrading or

downgrading has no significant effect on firms' use of trade credit. Trade credit is as a form of short-term debt, and yet it does not require any outright interest, is often in the form of an informal contract, and is not issued by any bank or financial institution. Generally the supplier has a vested interest in the survival of the company to which it has extended the trade credit. This ongoing business relationship is different from that of a typical bank and loan borrower in that the supplier can choose to be more flexible with repayment terms; and in fact, often chooses to do so. Trade credit is used by approximately 60% of small businesses in the U.S., rendering it the second most popular financing option after that of banks and other financial institutions. Firm's use of trade credit would be included in trade line. It is the credit account record, and would be provided directly to the credit rating agency during the process of credit assessment. Standard & Poor's, Moody's and Fitch all have such record.

Similarly, rating change concern also has no significant effect on firms' use of capital lease, which is illustrated in table 1.10. Capital lease has a tax savings advantage over operating leases (occurs in the early life when a capital lease reports a larger expense, interest expense plus depreciation expense, than an operating lease that only reports the lease payment as an expense). Anyway, firm's use of capital lease has been decreased dramatically since 1970s, and now it only take up about 10% of total debt outstanding.

There are some industries where the benefit of using operating lease over debt is even greater and these industries are generally considered to be heavy user of operating lease. If the motivation behind this strategy is not to hide their leverage, we should expect stronger results in these industries. In contrary, my results almost disappear in these industries, which can be seen from table 1.11. This is because the credit rating agencies are more careful in dealing with firm's use of operating lease for these heavy user industries and it's less easy to trick them. For example, Moody's use factor model to estimate the capitalized operating lease, and they usually use 8 to multiply the current year rental expense to calculate the amount of debt-equivalent operating lease. But the factor they use could increase to 10 or even 15 for those heavy user industries, which make it less attractive to use operating lease to replace debt.

Besides, after year 2005, rating agencies started to incorporate more comprehensive

model to estimate operating lease. And I find my results become significantly weaker after that. The effectiveness of this strategy indeed depends on the opinion of the credit rating agencies.

In the early 2000s, a lot of financial scandals and frauds raised the public attention about the abusive use of operating lease. In 2005, SEC and FASB issued interpretation letters reiterating existing GAAP and clarifying the regulators' view on some controversial lease accounting issues. In the same year, Standard & Poor's introduced a more sophisticated method to estimate operating lease obligations. Prior to the March 2005 revision, S&P used a 10 percent rate to discount lease obligations. S&P believed the 10 percent rate likely resulted in lower capitalization of lease in the current lower interest rate environment. Commencing in March 2005, the discount rate is based on an estimate of an issuer's actual borrowing costs and will naturally respond to changes in borrowing cost with each year of analysis. Occasionally, better information on interest factors inherent in actual lease may be available, or the average cost of funds is judged unrepresentatively and an alternative discount rate is chosen (Berman and Jones (2007)). If the incentives of using operating lease to replace debt rely mostly on markets' and bond raters' "casual" response to operating lease obligations, this inclination would become weaker during the period when extensive attentions are paid on the use of operating lease and the bond raters can more precisely evaluate the amount of operating lease obligations.

In table 1.12, I assume the effects of the rating change concern on the use of operating lease relative to debt are heterogeneous in the before-period and after-period. The results show that this effect is more pronounced in the before-period, which is consistent with our expectation. If the sample period is restricted to only the after-period when more market attention and more sophisticated estimation on operating lease obligations are introduced to the market, the effect would still be significant although the significant level and magnitude are both reduced.

1.4.4 Advantages and limitations on the use of operating lease to fund projects

Lease payments are contractual obligations, hardly distinguishable from debt obligations. Tax shields generated by the lease payments are treated in the same way as debt.

Some assets are not suitable to be leased: firm-specific assets; assets needs maintenance. A firm can use leases only to finance a purchase of an asset, while it also can use debt to finance working capital or change capital structure. Marginal cost of both debt and lease increase in additional use of lease. So, theoretically, there will be an optimal mix of using lease and debt.

I find that external fund dependent firms do not seem to induce more operating lease to replace debt in order to maintain their existing credit rating level. Since the measure of external fund dependence only captures the capital need of capital expenditure, it generally ignores many important aspects of firms' spending. Hence, I introduce the measure of financing deficit which evaluates firms' needs of external finance more comprehensively. In this measurement, current portion of the long-term debt is not included since Frank and Goyal (2003) find that empirically this part should not belong to financing deficit. Cash is correlated with debt and equity issuance due to the lumpy debt and equity issuance when firms hold excess cash from the proceeds. Thus, changes in cash and equivalents are included in financing deficit. If financing deficit is larger than zero, firm has already exhausted all its internal capital and needed to raise external fund. Otherwise, firm's internal cash flow would be enough to support its operations.

The percentage of firms with a positive financing deficit seems to decline after 1995. On average, 57.59% of firms near credit rating change are with no financing deficit while 58.74% of the firms far away from the credit rating change are with no financing deficit. The percentage is similar if we separate the rating change concern to downgrading concern and upgrading concern. By assuming rating change concerns have different impacts on firms with or without financing deficit, we can find that the effects are significant for both types of firms but with opposite signs. As shown in table 1.13, firms with financing deficit increase the use of debt relative to operating lease while firms with no financing deficit decrease the use of debt relative to operating lease when their concerns about rating change are relatively higher. The magnitudes of the two opposite effects are almost comparable. Financing deficit has a great influence on firm's use of different source of finance. According to the pecking order theory, firms should not only prefer internal fund to external fund, but also would prefer safe securities to the risky securities. Here safe

securities refer to securities with lower information cost, or in other words, information insensitive. Hence, different sources of finance can be ranked based on their sensitivities to the revealed inside information in a descending order: lease, secured debt, convertible bonds as well as preferred stocks, and equity (Myers and Majluf (1984)). Based on this argument, firms should first consume all their resources from lease contract before they issue debt and equity, especially when this can also facilitate the maintaining of credit rating level. But the results show the opposite. In real cases, the use of lease contract is largely constrained by the supply side. Moreover, lease contract usually can only be used to finance fixed assets such as capital investment. Even the R&D expenditure is scarcely funded using lease contract. Through the construction of the firm's financing deficit, we can see that a large portion of the financing deficit captures the needs for funding cash dividends, working capitals and non-cash items which are not easily financed by lease contract.

One of Frank and Goyal (2003)'s original findings is that net equity issues track the financing deficit more closely than net debt issues. Our results are contradictory to their findings, but more consistent with the recent work of Chang and Song (2013). Chang and Song (2013) aim to explain the puzzle found by Frank and Goyal (2003) by showing that pecking order provides good prediction of firms' financing behavior after controlling the financial constraint condition. They use KZ index, WW index and HP index as measures of financial constraint and find that less constrained firms track the financing deficit more by debt rather than equity. My sample is restricted to rating firms which are generally considered as less financially constrained. In unreported figures, I find that the debt issuance is almost perfectly tracing the financing deficit. The level of equity issuance is quite stable. The use of operating lease captures the tendency of financing deficit better in recent years but there is an abnormal peak around the year 2000 which is contradictory to the financing deficit and debt issuance and is very likely to be associated with the abusive use of off-balance-sheet finance in the early 2000s. Firm's financial constraint has a great impact on its use of lease, and usually unconstrained firms use much less lease than constrained firms. Moreover, financial constraint also affects the choice between buying and leasing. As internal funds fall, constrained firms tend to increase leasing and decrease

borrowing while less constrained firms tend to decrease leasing and increase borrowing. And a debt change will lead to a greater change in leasing for more constrained firms than less constrained firms (Lin, Wang, Chou and Chueh (2013)). Thus, less constrained rated firms are very likely to choose to use debt rather than lease when the financing need is urgent.

Kisgen (2006) assumes that if there is an adequate amount of retained earnings, firms will just use their internal fund to finance all the investment opportunities. However, this argument is not necessarily true. When it is necessary to maintain their current credit rating level, firms may find it beneficial to reduce existing debt obligations. They can choose to issue equities or sell and lease back to pay down debt and this has nothing to do with their need for external fund. Moreover, firms without financing deficit probably possess more freedom to do so. This also explains the reason why firms with positive Credit Watch are more aggressive in replacing debt by operating lease to pursue being upgraded. In my sample, most of the firms are without financing deficit and the debt issuance is negative on average.

Firms may feel it feasible to issue equity in order to pay down debt so that they can maintain a good credit rating. A Higher level of the use of debt may induce the concern about default probability while the impact of the use of equity is faintly discernable. Under this circumstance, firms would consider it more efficient to use equity to replace debt rather than use lease. Therefore, the results should be more evident when equity financing is not a feasible choice or is very costly. Even though firm can always use equity to replace debt when they feel needed, substitution between operating lease and debt through structuring capital lease (which is part of debt) as operating lease is much easier than substitution between debt and equity. In addition, equity finance is sometimes costly or not feasible, such as during the cold equity market or when firm stock is undervalued, when using operating lease to replace debt would be more attractive.

Firms would prefer equity finance when the cost of equity capital is temporarily low. The issue conditions might vary based on macroeconomic criteria (Choe, Masulis, and Nanda (1993); Moore (1980)). Thus, the hot market during which equity issues are clustering can be considered as the period when equity can be raised at favorable terms. Bay-

less and Chaplinsky (1996) find that information cost for all firms are reduced in the hot market by showing that firms experience lower prediction errors on average in hot markets. Information asymmetry could be a great deterrent of equity issuance, and hence managers will confront great disadvantage of issuing equity in the cold market. In former literature, the volume of issuance, e.g. number of new offerings, is used to identify hot versus the cold market. The data associated with IPOs and SEOs are obtained from the SDC and I use the number of IPOs or the total number of IPOs and SEOs to measure equity issues condition respectively. Spinoffs and unit offers are excluded, and equity issuances by financial and utility firms are also excluded. My results are comparable to Ritter's data of IPO and SEO. I do not directly use Ritter's data because I need results for very recent sample period which is not covered by him. I calculate the centered three months moving average of the number of offers for each month to remove the effect of seasonality. The month is defined as cold if the number of offers is below the median across all month in the sample. The year is defined as cold if it contains more than six cold months. I also aggregate the offers for each year. And I simply consider a year as cold if the total number of offers in this year is below the sample median. Therefore, I get four measurements of cold market based on monthly or yearly method, and IPOs or IPOs plus SEOs.

A Higher level of IPOs and SEOs imply hotter equity market. The partition of hot and cold equity market seems to be highly correlated with the macroeconomic condition and the whole situation of the economy. The monthly measure and the yearly measure are highly correlated. The correlations between the measure based on IPOs only and the measure based on the total number of IPOs and SEOs tend to decrease but are still very high. Assuming the effect of the rating change concern on firms' use of operating lease to debt to be different in the hot equity market and cold equity market, the tests are reported in table 1.14 using four alternative measure of the cold equity market. As we expect, the effect is more pronounced when equity finance is with less advantage.

Equity misvaluation is also very important for firms' financing decisions. Firms would have greater incentive to use equity finance when their stocks are overvalued. CFOs report that stock market valuations are an important consideration in their firms' decision

to issue common stock (Graham and Harvey (2001)). Overvaluation is associated with greater capital expenditures and R&D expenditures (Gilchrist, Himmelberg, and Huberman (2005); Polk and Sapienza (2009); Titman, Wei and Xie (2004)), and predicts greater total and equity issuance (Dong, Hirshleifer and Teoh (2012)). The sensitivity of equity issuance to overvaluation is greater than that of debt issuance, and overvalued firms substitute debt by equity issuance. The measure of misevaluation is following Rhodes-Kropf, Robinson, and Viswanathan (2005) as described in table 1.15. In my sample, about 33% of the firm-year observations are undervalued and this percentage is consistent for firms near or far from the credit rating change.

If we assume the rating change concern has heterogeneous effects on firms' relative use of lease or debt for firms with undervalued stock or overvalued stock, we would expect that the effect should be stronger for undervalued firms. The results shown in table 1.15 confirm this expectation. If firm stock is overvalued, firms would find it more efficient to fund the project using equities and also more efficient to reduce debt obligations using equities. On the other hand, if firm stock is undervalued, firms would feel reluctant to issue equities. Meanwhile, if they need to reduce the level of debt obligations to maintain credit rating, firms would choose to lease new fixed assets instead of buying or may sell some fixed assets to pay down debt and then lease it back.

1.5 Discussion and Conclusion

In this paper, I find that firms near a credit rating change would use more operating lease relative to debt compared to firms far away from the credit rating change. Firms' concern about their current credit rating is not only perceived by whether they are on the borderline of the broad rating group, but also detected by whether they have been placed on the rating agencies' Credit Watch or assigned a credit Outlook. The effect is mostly driven by the downside concern. However, if the firm is placed on the Credit Watch and the prospect is "positive", the firm will see a promising chance of being upgraded and the attempts to pursue it will give rise to even stronger significant results.

This behavior is not solely to move debt off the balance sheet since rating agencies treat operating lease just as debt obligations and adjust financial ratios by incorporating

the capitalized operating lease. However, former empirical works provide evidence that credit rating is indeed less sensitive to operating lease obligations than to debt obligations. Bond raters treat operating lease less serious probably because the information associated with operating lease is with poor quality. Data items used to estimate operating lease obligations are disclosed in the footnotes, rather than recognized in the body of the financial statement. Items are allocated to the footnotes for the reason that the measurement may not be very reliable. Another possibility is that auditors would allow more errors associated with disclosed items rather than recognized items, and this in turn leads to the unsoundness of disclosed items. Inevitably, the capitalization of operating lease incorporates some measurement errors including the estimation of implicit interest rate and the amount and length of future payments. Therefore, rating agencies view operating lease obligations less material. In addition, firms can manage to hide part of their operating lease due to the insufficient disclosure. Only the minimum lease payments are disclosed and some lease is simply not included. The future minimum lease payment is very likely to be lower than the actual payment because some lease contracts contain payment escalators in line with inflation or revenue generated from the leased property. Besides, the disclosure is only for following five years. Firms start to disclose the amount beyond five years in an aggregated manner only after 1995. The preference to use operating lease facing the prospect of credit rating change does not root in the nature of leasing but in the nature of off-balance-sheet finance.

The reasons stated above explain why the cost of using lease instead of debt would be lower for firms concerning about potential rating change. Thus, the rating change concern can be incorporated into the theory of leasing vs. buying decision and reconciled with the trade-off model developed by Yan (2006). Accounting standard setters are proposing a new accounting concept, right of use, whereby most lease should be capitalized as obligations (FASB 2012). The proposal faced immediate opposition. For example, the American Bankers Association commented to FASB/IASB that most banking credit officers are satisfied with current accounting rule and do not think the new rule will lead to any improvement in capital decision. They were right under the condition that people are both fully aware of the possibility of structured operating lease and fully capable of

adjusting it. The former could be true for experts such as institutional investors, analysts or rating agencies, but is not necessarily true for the whole market, especially retail investors. Some market participants, even including the experts like commercial banks, rely on firm's credit rating to coordinate the information associated with the use of off-balance-sheet finance. The finding of this paper suggests that this is not sufficient at all. The latter condition is even more unrealistic given the results illustrated in preceding sections. Rating agencies such as S&P are very strict with the use of operating lease. They ignore the true nature of the leasing contract and uniformly take them as fixed obligations. They employ a sophisticated method to estimate the operating lease obligations and consider adjusting operating lease as the inevitable to assess firm's creditworthiness. Their failure of doing so implied by the findings of this paper is largely due to insufficient disclosure of the operating lease data. As a footnote item, the disclosure is not only insufficient but also less reliable.

Off-balance-sheet finance was a hot topic in the SarbanesOxley Act. But even after that, the aggressive use of operating lease and the associated financial misconduct still prevail. In 2006, FASB and IASB landed a joint project and for the first time proposed to develop a new method to completely and transparently recognize the use of operating lease. The proposal has received a lot of objections from the leasing parties, the CFOs and the bank association. They argue that the sophisticated agents should be able to capitalize operating lease by themselves under current standards. However, my findings provide evidence showing that even experts like rating agencies cannot fully evaluate the amount of operating lease used. And according to the literature, not only the general market participant, but also the banks will rely on credit rating to take into account the effect of operating lease on firm's credit worthiness. It gives strong support to the upcoming new accounting standards. However, I don't think the new accounting standards will solve all the problems. Although in the eye of lenders and rating agencies, the difference of capital lease and operating lease is artificial. The new standards still retain two types of leases. The only difference is: before, the distinguish rules provide some bright-line criteria which makes it easier for managers to purposely structure capital lease as operating lease, while the new distinguish rule is very vague, involving no specific numbers or

thresholds, so not that easy to manipulate. The new standards also leave great discretions to rating agencies and require them to better understand the true nature of the leasing contract. In the future, I think the credit rating agencies still need to be careful when dealing with firm's use of leasing. It would be better if they can solicit more private information from the management team, and rely more on soft information rather than merely the hard information from the financial statement. It also should be combined with improved internal governance and reporting integrity of the firm to make the accounting rule changes to be effective in mitigating the abusive use of off-balance-sheet fixed claim.

2 Tenure of Independent Directors and Corporate Governance: Insights from Insider Trading

2.1 Introduction

Representation of independent directors on the board (board independence and its effect on the quality of board oversight) is an issue of central interest in corporate governance. The interest has been intensified following the high-profile corporate scandals involving Enron, Worldcom, and Tyco International, and the implied failure of effective board monitoring in these firms. Subsequently, the Sarbanes-Oxley Act passed in July 2002 mandates that corporate audit committees comprise entirely of independent directors. And the NYSE and Nasdaq regulation approved by the SEC in 2003 requires a majority of independent directors and fully independent nominating, compensation, and audit committees on the board.

A number of studies, however, have raised issues that could undermine the true independence of the board and the effectiveness of monitoring by independent directors under current rules and regulations[11]. While they are reasonable and important, these critiques approach board independence as static in time. What does not seem to have yet received adequate attention is the rising tenure of independent directors and its implications to corporate governance. In fact, as shown in Figure 2.1 and 2.2, independent directors' tenure has been rising over time[12]. The proportion of long-serving independent directors with over 10 years of tenure increases substantially in the last decade[13]. How may the rising tenure of independent directors ("IDs" hereinafter) impact corporate governance? How

[11] Independent directors can be handpicked by CEOs (co-opted) (Coles, Daniel and Naveen, 2014), too busy to exercise effective monitoring (e.g., Ferris, et al., 2003; Perry and Peyer, 2005; Fich and Shivdasani, 2006; Field, et al., 2013), or socially connected with management (their independence thus compromised) (Fracassi and Tate, 2012). Cohen, Frazzini, and Malloy (2012) find that management tends to hire friendly analysts as independent directors who are in fact cheerleaders rather than monitors of management.

[12] The median tenure of independent directors in the 2010's is 7 years, compared to 6 years in the 2000s and 5 years in the earlier time.

[13] The proportion of independent directors with over 10 years of tenure increases from 29% in 2005 to 37% in 2014. In contrast, the proportion of independent directors with less than 3 years of tenure decreases from 35% in 2005 to 27% in 2014. Consistent with the low turnover of directors, two thirds of S&P 500 companies explicitly disavowed tenure limits, according to the news report by Francis and Lublin (2016). Only 13 had limits on director tenure in 2015, down from two dozen in 2010.

do interactions between executives and IDs and thus the roles of the board evolve over IDs' tenure? This paper intends to shed light on these issues.

Board plays two primary roles advisory and monitoring (Adams and Ferreira, 2007; Adams, Hermalin, and Weisbach, 2010). For its advisory role, IDs can arguably better advise with more firm-specific knowledge accumulated over their tenure, but IDs' long tenure could also result in stagnation in strategic decision making due to lack of fresh thinking and ideas. Katz (1982) suggests that extended tenure reduces intra-group communication and isolates groups from key information source. This would in turn affect firms' responsiveness to changing business opportunities and ultimately their competitiveness (Young, 2011).

For the board's monitoring role, prior literature suggests that effective board monitoring hinges crucially on firms' information environment and the board's access to information (Hermalin and Weisbach, 1998 and 2003; Raheja 2005; Harris and Raviv, 2008; Duchin, Matsusaka, and Ozbas, 2010). IDs, however, often rely on executives for inside information, which limits their ability to monitor effectively. This problem is alleviated when IDs serve long, as they accumulate firm-specific information and knowledge over time (Vance, 1983). Moreover, IDs can enhance their commitment to the firm and their competence (Buchanan, 1974). Therefore, longer-serving IDs are likely to be stronger monitors and the effectiveness of board oversight can thus be improved over their tenure. On the other hand, IDs are likely to become more personally connected and thus be cozy with executives over tenure (Vafeas, 2003). Also, greater overlap and closer interactions with executives over time can lead to more cohesiveness among IDs and management, and the desire for more agreement and consensus may prevent IDs from critically challenging management[14]. Therefore, the independence of IDs, while still appeasing regulatory requirements, is likely to be compromised and the effectiveness of board oversight can decrease over their tenure.

The above analysis suggests that the effectiveness of both of the board's roles may vary over IDs' tenure, calling for a dynamic view in understanding board independence and its

[14]Coles, Daniel, and Naveen (2015) term this group behaviour among directors as groupthink, and show that groupthink is negatively related to firm value in dynamic and complex industries. Groupthink can moderate board monitoring to the extent that it leads directors to ignore or discourage dissenting opinions.

implications on corporate governance. The net impact from IDs' lengthening tenure, as discussed, is nonetheless ambiguous. How the quality of corporate governance varies over IDs' tenure is thus an empirical question. However, existing empirical evidence from prior studies is at best mixed, highlighting the varying trade-offs of the benefits and costs associated with IDs' tenure in different governance scenarios (see a brief review of the literature in Section 2). More fundamentally, there is lack of direct evidence in prior literature on how executives and IDs may interact differently over IDs' tenure, without which any inference on the relation between corporate governance and IDs' tenure is indirect and subject to interpretations. The empirical challenge is that their interactions are mostly not observable for researchers like us. In this paper, we attempt to circumvent this challenge and examine the impact of IDs' tenure on corporate governance by focusing on insider trading on the open market. Our investigation of insider trading is motivated out of two reasons as follows.

First, although it is an ongoing debate whether insiders should be prohibited from private trading of their own firm's stock on the open market[15], insider trading is shown to be informed and it is possible that some insiders exploit their information advantage for private gains [16]. This has serious negative implications on firms, shareholders, and the market. Theory suggests that unchecked informed insider trading can crowd out other investors' trading, leading to lower stock liquidity and higher cost of equity (Easley and O'hara, 2004). It has met with much empirical support from studies on internal insider trading policies and cross-country analyses of insider trading enforcement [17]. Federal regulators have stepped up with a series of rules and laws to govern insider trading activities[18].

[15] See Bhattacharya (2014) for a complete review of the debates.

[16] For examples, see Jaffe (1974b), Seyhun (1986), Rozeff and Zaman (1988), Lin and Howe (1990), Fishman and Hagerty (1992), Khanna, Slezak, and Bradley (1994), Lakonishok and Lee (2001), Jeng, Metrick, and Zeckhauser (2003), Marin and Olivier (2008), and Jagolinzer, et al. (2011), among many others.

[17] See, for examples, Bhattacharya et al., 2000; Bhattacharya and Daouk, 2002; Easley, Hvidkjaer, and O'Hara, 2002; Bushman et al., 2005; DeFond et al., 2007; Choy and Silvers, 2009; Fernandes and Ferreira, 2009; and Griffin et al., 2011. The evidence echoes the early theoretical work suggesting that the cost of informed insider trading is likely to be greater than its benefits (e.g., Manove, 1989; Ausubel, 1990; Khanna, Slezak, and Bradley, 1994).

[18] These rules and laws specify the definition of insiders (Rule 10b-5-1), enhance the disclosure of insider trading activities (Rule 10b-5; Regulation Fair Disclosure), and pin down the penalty against the violators (Insider Trading Sanctions Act of 1984) and the rewards to the informants as well as the responsibility of

However, with few exceptions (e.g., Bettis, Coles, and Lemmon, 2000; Jogolinzer et al., 2011; and Dai, Fu, Kang, and Lee, 2017), less attention has been paid to firms' internal regulation. In particular, to our knowledge, no studies have specifically examined the effect of board characteristics on insider trading, although internal regulation and monitoring of insider trading is indispensable and our research suggests that board plays a key role in it (more details follow in Section 2)[19]. But because there are no laws or regulations on whether and how firms should regulate insider trading, boards are arguably left with great discretions on this issue. Therefore, to the extent that IDs are primary monitors and from what we have discussed above on the implication of IDs' tenure on corporate governance, we expect IDs' tenure to be related to their monitoring effectiveness of insider trading[20].

Second, and probably more importantly, because it is mandatory for insiders to timely file their trading to SEC, the rich data allow us to examine not only insiders' private gains from trading but also their behavior and interactions through their trading. Specifically, by examining both executives' and IDs' trading, we can conduct the following investigations. First, we can see how executives' trading profitability varies with IDs' tenure to shed light on IDs' monitoring effectiveness along their tenure. If IDs' monitoring effectiveness improves over tenure, we shall expect executives to be less likely to exploit their informational advantages for gains in private trades and thus their trading profitability to be lower. Alternatively, if IDs' monitoring effectiveness is more likely to get compromised over tenure, we shall expect the opposite. Of course, if longer-serving IDs advise better and thus executives obtain new information from IDs and incorporate the information into their trading decisions, we shall also expect to see higher executive trading profitability. It is thus important to distinguish between the two possibilities poorer monitoring versus better advising over IDs' tenure, which leads to the second investigation.

top management for failure to comply with insider-trading regulation by any employee of the firm (Insider Trading and Securities Fraud Enforcement Act (ITSFEA) of 1988).

[19] Board initiates firm-level insider trading rules and policies, reviews the adequacy of them to comply with all applicable laws and regulations, and more importantly, ensures the enforcement of them.

[20] Moreover, there seems to be less scrutiny and pressure from shareholders on board monitoring of insider trading than on other governance scenarios such as executive turnover, managerial compensation, and financial reporting integrity. There is thus a higher likelihood for IDs to adjust their monitoring of insider trading with their tenure, while not concerning for being confronted by shareholders. Therefore, the impact of IDs' tenure on corporate governance is likely to be more discernible in the case of insider trading.

That is, we can also examine IDs' own tenure-along trading and its profitability, whereby assessing whether IDs have better access to firm-specific information and thus can advise better over time.

Third, and more interestingly, we can examine the interaction between executives and IDs over IDs' tenure by looking at their trading jointly (i.e., whether they tend to trade more consistently). If more overlap and interaction over time lead to more cohesiveness in beliefs among executives and IDs, we shall observe greater consistency in their trading over IDs' tenure. In short, this insider trading setting presents a unique opportunity for us to examine IDs' monitoring and advising effectiveness over their tenure and disentangle between them, which is otherwise often difficult. Also, it can provide direct evidence on the interaction between executives and IDs that would enhance our understanding of the dynamics of corporate governance along IDs' tenure.

Our empirical investigation is based on a sample of 2530 unique S&P 1500 firms for the period of 1998-2014. We find that private trades by executives become more profitable as IDs' tenure gets longer. This finding is unlikely driven by any (time-invariant) firm-specific factors or time trend in insider trading, because both firm- and time-fixed effects are accounted for in explaining executives' trading profitability ("ETP" hereinafter). It is also robust to a rich set of controls for firm and board characteristics as well as transaction details, which are meant to capture executives' trading motivations and factors that the literature has shown to contribute to insider trading profitability. In particular, the results continue to hold when we control for inside directors' and CEOs' tenure. This finding is consistent with weakened monitoring of insider trading, or improved advising by longer-serving IDs, or both.

Further tests yield more evidence that support the weakened monitoring explanation. First, we examine the nature of trades by executives, and find that executives are more likely to conduct exploitative trades that are informationally more sensitive with higher profitability when IDs' tenure increases. Specifically, when IDs' tenure increases, executives' trades are more likely to be "opportunistic", defined following Cohen, Malloy, and Pomorski (2012). Also, executives are more likely to trade either outside the designated safe window specified in a firm's internal trading policy (if any) when insiders are autho-

rized to trade free of charge, or outside a time window that is commonly regarded to be less informationally sensitive (e.g., in the month following an earnings announcement). These trades are found to be more profitable.

Second, we examine characteristics of IDs and their impact on the relation between IDs' tenure and ETP. Consistent with the weakened monitoring explanation, we find that the positive tenure-profitability relation only holds for the tenure of those IDs who are expected to be more effective monitors of insider trading when they join the board; their monitoring effectiveness then declines over tenure. Intuitively, for those IDs whose independence or monitoring effectiveness is challengeable ex-ante, we shall not expect a significant change in their monitoring effectiveness along their tenure. The literature suggests that IDs with ties to management, busy IDs, and co-opted IDs who are appointed after the CEO assumed office tend to be weaker monitors (Fich and Shivdasani, 2006; Fracassi and Tate, 2012; Coles, Daniel, and Naveen, 2014). Consistently, we find that the positive tenure-profitability relation only holds for the tenure of non-co-opted, not-initially-connected, or less busy IDs.

Third, we document several governance factors that are effective in disciplining IDs from being lenient towards exploitative trading. Specifically, we find that the effect of IDs' tenure on ETP is significantly weaker in firms that have internal trading policies in place specifying clear guidelines on insider trading. It suggests that when executive trading is not bound by specific rules, boards tend to have more discretion on its regulation and thus longer-serving IDs are less likely to be a deterring factor for exploitative trading. Also, consistent with blockholders being an effective monitor, the effect of IDs' tenure is significantly mitigated in firms where blockholders sit on the board as directors. Moreover, possibly due to their greater awareness of litigation risk associated with insider trading, IDs with working experience in legal practice are more likely to play a deterring role against exploitative trading. We find that the effect of IDs tenure on ETP is weaker when IDs with legal background sit on the board.

Our analysis suggests that improved advising by longer-serving IDs is less likely to explain the positive relation between IDs' tenure and ETP. First, as discussed, we find that the positive relation does not hold for busy, co-opted, or connected IDs. But it is exactly

these IDs who are supposed to be better advisors and can provide better advisory services when they stay longer with the firm [21]. Also, if it is improved advising by longer-serving IDs that underlies the positive tenure-profitability relation, we should not have observed the dampening impact of governance factors, discussed above, on this relation. It is hard to see why these governance factors can undermine the effectiveness of IDs' advising. Second, in distinguishing between insider purchases and sales by executives, we find that the impact of IDs' tenure on trading profitability only holds for sales. This is against inconsistent with the improved advising explanation, because it is hard to imagine that longer-serving IDs do not advise better with more positive information leading to more profitable executive purchases. Third, we focus specifically on the subgroup of IDs who are hired arguably for providing advisory services and examine how ETP is related to these IDs' tenure. If higher ETP is due to better ID advising, we shall expect to see a significant and positive relation between ETP and these IDs' tenure. However, this is not the case.

Lastly, we show direct evidence that independent directors are more likely to be connected with executives (and thus less likely to be independent) over their tenure, if they are not initially connected when they join the board. Following the literature, we identify their acquisition of connections through their joint membership in leisure clubs and charities. Moreover, we find that, in their own private trades, independent directors tend to trade more consistently with executives (purchase or sell contemporaneously in the same direction) over their tenure. This is consistent with more cohesiveness in beliefs among independent directors and management possibly due to greater overlap and interactions over time, which is likely to weaken their monitoring incentives and effectiveness [22].

We conduct a few additional tests for the robustness of our finding. First, we examine how independent director turnover may affect the profitability of executive trades. We find that when a larger percentage of independent directors experience turnover or there is

[21] Co-opted IDs and IDs who are socially connected with management can arguably provide better advisory services precisely because of their connection with management. Busy IDs, defined as those with multiple directorships, can also provide more valuable advisory services because of their extended experience and skills.

[22] Beneish, Marshall, and Yang (2016) find that outside directors who benefit from selling stocks in a firm's financial misreporting period as the CEO does are less likely to fire the CEO. They interpret the director-CEO joint selling as a high level of alignment between them.

a larger percentage of new independent directors on board, executive trading profitability drops more significantly. Second, while independent director turnover is associated with lower executive trading profitability, the relation between independent directors' tenure and executive trading profitability also holds for firms that do not experience independent director turnover. That is, even for the same group of independent directors, executive trading profitability increases over their tenure, consistent with the *compromise view* of the independence of independent directors. Lastly, to address the potential endogeneity concern of independent directors' tenure, we utilize the sudden death of independent directors as an exogenous shock to the tenure of an independent board. We show that the exogenous negative change in the tenure of independent directors due to the addition of new independent directors to the board results in a decrease in profitability of executive trading.

We note that the empirical support for the *compromise view* of the independence of independent directors over tenure is confined to the setting of executives' private trades, and can be a partial equilibrium outcome. Whether and to what extent a board of long-tenured independent directors is detrimental or beneficial to the overall firm value is out of the scope of this paper. Firms need to balance the advisory and the monitoring role of the board (Adams and Ferreira, 2007). Theories suggest that the effectiveness of monitoring by independent directors depends on the information environment of the firm (Hermalin and Weisbach, 1998 and 2003; Raheja 2005; Harris and Raviv, 2008). Duchin, Matsusaka, and Ozbas (2010) provide empirical support that the value of board independence varies across firms. Shareholders in some firms may find it preferable to keep certain independent directors for long due to their valuable advisory services, while being aware of their jeopardized independence over their tenure. Indeed, the inconclusive findings in the literature on the effect of independent directors' tenure on other corporate decisions and firm value, to be reviewed next, are suggestive of this view.

2.2 Hypotheses Development and Delineation of Marginal Contribution

In this section, we develop two competing hypotheses about how independent director's tenure would be associated with the effectiveness of their monitoring of executive trading. Also, we discuss the contribution of our study to the literature.

2.2.1 Hypotheses development

It is a consensus in the literature that executives are informed in their private trades (in particular, purchases), evidenced by their ability to predict stock returns (e.g., Jaffe, 1974b; Seyhun, 1986; Rozeff and Zaman, 1988; Lin and Howe, 1990; Lakonishok and Lee, 2001; Jeng, Metrick, and Zeckhauser, 2003; Marin and Olivier, 2008). There is empirical support that managers have both market-timing ability and private information about firm operations in their private trades (e.g., Piotroski and Roulstone, 2005). The main argument in favor of insider trading is that it allows communication of information to the market and thus stock prices will fully incorporate information, leading to higher valuation and returns from financing real investment (Leland, 1992) [23].

On the other hand, investors and regulators are also concerned with executives' abuse of their informational advantages for private gains at the expense of outside investors. This is warranted by rich empirical evidence shown in the literature. For examples, Cheng and Lo (2006) find that, to maximize private gains when litigation risk is sufficiently low, executives may disclose negative news and purchase depressed shares to exploit the temporary underpricing from the news. Similarly, Niessner (2015) shows that executives are more likely to disclose positive news prior to their private sales. Jagolinzer (2009) provide evidence of opportunistic behavior in insider trading by showing that even the pre-specified trades under the 10b5-1 plans are timed to firm performance. Wu (2016) find that insider trading profitability increases following an exogenous shock that results in an increase in firm opaqueness, consistent with insiders exploiting their informational

[23] Hu and Noe (2001) suggest that permitting insider trading would allow information about hidden managerial actions to be impounded into asset prices, which in turn helps shareholders make better personal portfolio-allocation decisions.

advantages.

The potential expropriation from insiders' informational advantage has serious negative implications on firms, shareholders, and the market. In the presence of more informed insiders, investors would either invest less or require higher compensation for their investment. This leads to lower stock liquidity and higher cost of equity, which reduces firm value and shareholder wealth (Easley and O'hara, 2004). In contrast, the literature shows that imposing strict internal trading policies or strengthening their enforcement will reduce the cost of equity for firms (e.g., Masson and Madhavan, 1991; Easley, Hvidkjaer, and O'Hara, 2002; Choy and Silvers, 2009). It echoes the early theoretical work suggesting that the cost of informed insider trading is likely to be greater than its benefits (e.g., Manove, 1989; Ausubel, 1990; Khanna, Slezak, and Bradley, 1994). Therefore, it highlights the importance of regulation and board oversight of insider trading to prevent insiders' exploitative trading.

To enhance the market quality, regulators have stepped up with a series of rules and laws to govern insider trading activities [24]. At the corporate level, board of directors is the governing body of insider trading activities with General Counsel or a related officer often being delegated to be responsible for the routine implementation of governance. The board initiates insider trading rules and policies, reviews the adequacy of them to comply with all applicable laws and regulations, and more importantly, ensures the enforcement of them. Independent directors are critical in playing the governing role. However, the effectiveness of their monitoring is likely to be affected by their independence that is in turn related to their tenure.

The Compromise view supports the conjecture that independent directors' independence may be compromised over their tenure. Fracassi and Tate (2012) and Hwang and Kim (2009) show that outside directors who are connected with management (through social ties and networks) exhibit weaker effectiveness in monitoring management. Working together in the same firm fosters such a connection. Moreover, Katz (1982) suggests

[24]These rules and laws specify the definition of insiders (Rule 10b-5-1), enhance the disclosure of insider trading activities (Rule 10b-5; Regulation Fair Disclosure), pin down the penalty against the violators (Insider Trading Sanctions Act of 1984) and the rewards to the informants and the responsibility of top management for failure to comply with insider-trading regulation by any employee of the firm (Insider Trading and Securities Fraud Enforcement Act (ITSFEA) of 1988).

that extended tenure reduces intra-group communication and isolates groups from key information source. The change in business condition and demand for fresh idea also encourage director replacement [25]. Also, spending time together over a prolonged period creates cohesiveness among the board of directors which in turn lead to groupthink (Coles, Daniel, and Naveen (2015)). Groupthink can deteriorate board monitoring to the extent that it leads directors to ignore or discourage dissenting opinions.

Note that for those directors who are seemingly independent based on the regulator's definition but are not truly independent due to their co-optedness or prior social connection with executives, their monitoring effectiveness shall not be affected by their tenure (because they are not so effective monitors anyway). That is, the compromise view shall apply only to those independent directors who are truly independent and are thus likely to be more effective monitors when they join the board. We thus have the following hypothesis:

Compromise hypothesis: Executive trading profitability will increase as the tenure of independent directors increases. And this relation should only hold for those independent directors who are truly independent and are likely to be more effective monitors when they join the board.

Alternatively, the *Improvement view* suggests that as the independent directors sit on board longer and longer, they will possess more firm-specific knowledge. Since the monitoring effectiveness of independent directors requires them to have sufficient information about the business model of the firm [26], this will hence improve their monitoring quality. Besides, director's tenure is also positively related to their experience and competence as well as their organizational commitment to the firm , which will also improve their monitoring quality. Jiang, Wan, and Zhao (2015)'s finding implies that directors are more willing to debate and express their strong opinion when they no longer feel beholden to the managers for their appointment or have great concern about their reappointment which mostly happens during the latter period of their tenure. This will also lead to more intensive monitoring. Therefore, we have the alternative hypothesis as follows:

Improvement hypothesis: Executive trading profitability will decrease as the tenure of

[25] See National Association of Corporate Directors (1996).
[26] See Vance (1983), Buchanan (1974) and Salancik (1977).

independent directors increases.

2.2.2 A literature review and delineation of marginal contribution

Our study contributes to the literature in several ways. First, it sheds light on how board independence and its effectiveness in monitoring evolve over time, and contributes to a better understanding of the dynamic board behavior and its impact on firms. Our finding is particularly relevant given the great concern on board independence by regulators, the market, and large institutional investors. The premise of the regulatory requirement for a majority of independent directors on the board is that an independent board is conducive to greater monitoring effectiveness. This is because independent directors are less subject to potential conflict of interest, have incentives to monitor due to their reputation concerns, and are capable of monitoring due to their technical expertise in management and decision-making (Fama and Jensen, 1983) [27]. Our study shows that an unintended consequence of the regulation is the lengthening tenure of independent directors, which can have negative implications on the independence of independent directors and hence the quality of board oversight. Therefore, our study calls for a more fine-tuned view of board independence and in particular, the terms of independent directors [28]. Nguyen and Nielsen (2010) show that independent directors are valuable to shareholders by documenting a negative stock price reaction to the sudden deaths of independent directors. However, consistent with the Compromise view, they find that stock prices react less negatively when the deceased independent directors have long tenure.

There are a few studies that have examined the relation between directors' tenure and the effectiveness of board monitoring of other corporate decisions and found mixed results. For example, some show that independent directors' tenure is positively related to the level of CEO pay (Vafeas, 2003) and the probability of a firm experiencing gover-

[27] Studies showing that independent directors are better monitors include, for example, Weisbach (1988), Byrd and Hickman (1992), Brickley, Coles, and Terry (1994), Cotter, Shivdasani, and Zenner (1994), Duchin, Matsusaka, and Ozbas (2010), Chen, Cheng, and Wang (2015), and Guo and Masulis (2015).

[28] Surprisingly, the issue of director terms does not seem to have received enough attention among shareholders, especially during the early years. In a study of shareholder proxy proposals in the period of 1987-1994, Gillan and Starks (2000) find that proposals on the limitation of director terms are usually made by the so-called "gadfly" investors, but often receive low votes. But as we show, the tenure of independent director has on average increased substantially, especially following the reforms in the early 2000's.

nance problems like major litigations, accounting restatements, and corporate scandals (Berberich and Niu, 2011). In contrast, others find that the likelihood of financial statement frauds decreases (Beasley, 1996) and dividend payout increases (Sharmar, 2011) in outside directors' tenure. Dou, Sahgal, and Zhang (2015) focus on independent directors with a substantial tenure of more than 15 years and find that firms with a higher proportion of these directors on the board have lower CEO pay, higher CEO turnover-performance sensitivity, and a lower likelihood of intentional misreporting of earnings. The contrasting results can arise from different samples, sample periods, and director characteristics covered in these studies. Our sample is comprehensive to date for all independent directors ("grey" or affiliated directors are excluded). Moreover, our finding suggests that when independent directors face less scrutiny from shareholders in their monitoring of certain corporate activities (like insider trading here), compared to those always at the spotlight (such as managerial turnover, financial misconduct, and executive pay polices), their monitoring effectiveness is more likely to be attenuated over their tenure.

Huang (2013) finds an inverted U-shape relation between firm value and the tenure of outside directors [29]. He explains that sitting on board for long would be good for the board to play its advisory role (value-enhancing), but not necessarily so for it to play its monitoring role (value-decreasing). Thus, tenure of outside directors is not likely to be unambiguously related to firm value. However, the effectiveness of board monitoring depends on directors' access to information, which is arguably positively related to the board tenure. Moreover, he focuses on outside directors who are either independent or affiliated (or "grey") directors. Unlike him, we focus on independent directors only, who are shown in the literature to be better monitors than affiliated directors. Another advantage of our study is that we examine a governance event, which helps to isolate the effect of independent directors' tenure on their monitoring effectiveness without any confounding impact of their tenure on their advisory role.

Second, we add to the literature on board characteristics and the effectiveness of board monitoring. In addition to board independence, prior studies show that board's monitoring effectiveness is also affected by the existence of certified inside directors (Masulis

[29] A similar finding can also be seen from Livnat, Smith, Suslava, and Tarlie (2016).

and Mobbs, 2011), directors' social connections with the CEO (Fracassi and Tate, 2012), director busyness (e.g., Ferris, Jagannathan, and Pritchard, 2003; Perry and Peyer, 2005; Fich and Shivdasani, 2006; Field, Lowry, and Mkrtchyan, 2013), director co-option (directors elected after the CEO takes office) (Coles, Daniel and Naveen, 2014), director gender (Adams and Ferreira, 2009; Eckbo, Nygaard, and Thorburn, 2016), director age (Masulis, Wang, Xie, and Zhang, 2016), director reelection pressure (Fos, Li, and Tsoutsoura, 2016), board diversity (Giannetti and Zhao, 2016), and directors hired as cheerleaders (Cohen, Frazzini, and Malloy, 2012). These studies examine characteristics of directors to identify the cross-sectional variations in the effectiveness of board oversight and call into question the independence of certain directors that are defined to be independent technically. But less attention has been paid on how the effectiveness changes over the tenure of independent directors.

Third, our study is also related to a burgeoning literature on individual directors' behavior while most of the existing studies examine the behavior of the board as a whole. Ravina and Sapienza (2010) examine independent directors' private trades and find that they are on average informed. But they do not show how this informational ability changes over independent directors' tenure. Jiang, Wan, and Zhao (2015) find that directors are more likely to dissent in voting before the end of their term. Adams, Ragunathan, and Tumarkin (2015) provide evidence about individual directors' board committee activities and show how these would affect their informativeness. We examine independent directors' private trades over their tenure and their consistency with executives' trades. Our finding suggests that independent directors behave more cohesively with executives over tenure.

Lastly, we contribute to the vast literature on insider trading, and in particular, on the impact of corporate governance on insider trading activities. Bettis, Coles, and Lemmon (2000) suggest that internal governance plays an important role in regulating insider trading activities, notwithstanding the government and market regulations. Cziraki, Goeij, and Renneboog (2013) show that insider trading profits can be used as a kind of compensation to executives for more stringent corporate governance that executives face. Skaife, Veenman, and Wangerin (2013) find that the profitability of insider trading is significantly

greater in firms displaying material weaknesses in internal control. This highlights the necessity of monitoring on insider trading.

In a related paper, Dai, Fu, Kang, and Lee (2016) construct an index of a firm's quality of internal governance, and show that firms with better internal governance are more likely to adopt internal trading policies and observe lower insider trading profitability. However, they do not show which individual factors matter in the governance index for insider trading profitability. Our focus is on the tenure of independent directors, and we find that it has a significant impact on executive trading profitability [30]. Our finding holds after controlling for most of the governance index constituents in Dai, et al. (2016), such as board size, board independence, multiple-directorship held by independent directors, CEO-Chairman duality, and institutional ownership, etc. In addition, we also control for independent directors' share ownership. We show that insider trading profitability is higher in firms with larger boards, CEO-Chairman duality, busy independent directors (with more directorship), and lower institutional ownership. More interestingly, we find that the tenure of independent directors, but not board independence, is significantly related to executive trading profitability. It suggests that it is not the board independence per se, but rather the true independence of independent directors, that matters for board monitoring.

2.3 Data and Sample Construction

The insider trading data is obtained from the Thomson Reuters insider trade files. We use the data from table1 which contains the conventional and non-derivative transactions. We exclude all transactions with low levels of reliability (cleansing records S and A). Records that are reported on forms other than Form 4 are also excluded, thus we also delete the exempt small and unregistered private transactions. And we restrict our sample to open-market purchase or sale. Moreover, we focus on the insiders trading initiated by the executives only. According to Thomson Reuters insider trading files, 32.13% of the insider trading are initiated by executives. Here, executives are defined following the

[30] This finding only holds for insider sales but not for purchases. They explain that sales are more subjected to legal risks. We find that the impact of independent directors' tenure on executive trading profitability holds for both purchases and sales.

classification of Thomson Reuters.

To calculate the profitability of insiders trading, we follow the method of Ravina and Sapienza (2010). We calculate the return from investing one dollar in the same way as the insider does, by either purchasing one dollar worth of the company stock when she buys, or by selling one dollar worth of the company stock when she sells. Market-adjusted buy-and-hold returns (BHARs) are calculated by subtracting the market return from the firm return, (R_it-R_mt) and compounding it over time. We try 30, 60, 90, and 180 calendar days as alternative holding horizons and we use the value-weighted market index to proxy market returns. The results are multiplied by 100 to make the coefficients in percentage form.

We further separate the insider trading into three types based on the information it may contain following the method developed by Cohen, Malloy, and Pomorski (2012). The classification is made for each year and each insider. First, we require the insiders to have at least one trade in each of the three preceding years to be classified. Otherwise, we categorize all his trade in this year as "unclassified". If the insiders trade in the same month for at least three consecutive years, then his trades in the same month in this year are considered as "routine" and his trades in other months of this year are considered "opportunistic". If the insider traded in past three consecutive years but no trade in the same month, all his trade in this year are considered "opportunistic". Based on this classification, we find that 31.94% of the executives' trading are "unclassified", 64.62% of them are "opportunistic" and 2.35% of them are "routine". Generally, opportunistic trading should contain more information than routine trading while unclassified trades are more closely resemble opportunistic trades rather than routine trading according to the finding of Cohen, Malloy, and Pomorski (2012). By replicating Cohen, Malloy, and Pomorski (2012), we find that opportunistic purchase transaction has very significant predictability power of future returns while the predictability of routine buy is not significant. On the other hand, opportunistic and routine sales transaction both can significantly predict future returns. But the predictability power of opportunistic sell is much greater than routine sell. Meanwhile, the unclassified transaction has almost as much predictability power as opportunistic transaction.

The board data come from the IRRC. Tenure for each director is calculated as the current year minus his year of "director service since". The calculated tenure is replaced by zero if it equals to -1. The tenure is considered to be "missing" if the calculated tenure is longer than 90 years. These kinds of observations are very small and do not change the overall results. We need to consolidate the information about each director's tenure to firm specific features. Thus, we calculate independent director tenure as the mean of the tenure of all independent directors on the board for each year. Similarly, the insider director tenure is calculated as the mean of the tenure of all inside directors. We also control other board characteristics such as board size, board independence, CEO Chairman Duality dummy, number of directorships held by the independent director as well as the total percentage of firm's equity shares held by all independent directors. Board characteristics such as board size and board independence are not winsorized.

We include a rich set of control variables not only allows us to provide further insights into the determinants of returns from insider trading, but also minimizes the omitted variable bias which may arise in the empirical analysis. Several firm characteristics are included. The scrutiny of investors is much greater in larger firms and top executives are more likely to possess valuable information in smaller firms. Therefore, firm size is controlled. MB Ratio is generally taken as a predictor of future stock returns. Firms with higher R&D intensity are perceived to be with greater information asymmetry problems. Analyst dispersion is also controlled as a proxy for information asymmetry. Loss dummy is included to control for the potential reversal of poor accounting performance. Institutional ownership ratio is included as a measurement for internal governance. Transaction-level characteristics are also included. Transaction size controls for the possible link between the importance of private information and trade size. 180 days buy-and-hold returns prior to the transactions control for insiders' contrarian behaviour. Insiders may exhibit contrarian behavior, so we expect a negative relation between the past returns and the subsequent returns. The dollar value of shares held on the day of the transactions controls for the possible link between the trading activity and ownership of the insider. Total shares traded by all insiders of the firm during ten days prior to the transaction scaled by total shares outstanding control for either pre-emptions of a trade's

information content or reinforcements of prior signals. Stock return volatilities over the last month prior to the transaction control for the information environment of the firm right before the trading. These data are obtained from various sources such as Compustat, CRSP, IBES and Thomson Reuters.

In order to mitigate the potential bias caused by omitted unobservable characteristics, we include firm fixed effects. We also include year fixed effects to control for potential time trend effects. The regressions are transaction level, and we cluster the standard error by each individual and corrected for heteroskedasticity. The results are unchanged if we cluster by each firm.

We start with firms in Thomson Reuters because this database has data on insiders trading. To incorporate the information of board characteristics, the Thomson Reuters database needs to be merged with the IRRC data. IRRC only include S&P 1500 firms. Thus there are a lot of firms in Thomson Reuters which cannot be found in IRRC. We exclude the firms not in the universe of IRRC. The sample period is from 1998 to 2014, since the data of "director service since" is only available after the year 1998. Finally, our sample contains 2530 unique firms during the 17 year sample period.

As shown in Figure 2.1, the distribution of independent directors' tenure has been shifted to the right in the last few years (median tenure = 7 years) compared to 2000s (6 years) and earlier (5 years). And this shift has occurred to all four main committees of the board (nominating, compensation, governance, and audit). Interestingly, the composition of independent directors has also been undergoing a significant change since the reforms. Figure 2.2 shows that the proportion of senior independent directors (defined as those with over 10 years of tenure, the top 30 percentile of all independent directors' tenure during 1998-2014) among all independent directors increases from 29% in 2005 (the effective year of the exchanges' new listing rules) to 37% in 2014. In contrast, the proportion of junior independent directors (those with less than 3 years of tenure, the bottom 30 percentile) decreases straightly from 35% in 2005 to 24% in 2012 and only rebounds to 27% in 2014. This change in the composition of independent directors is evident in all four main committees of the board. These significant changes in the tenure of independent directors are possibly due to the limited pool of talent and search costs on

the director market. Firms tend to retain long-tenured independent directors to fulfill the board independence requirement because it is difficult or costly to find replacement directors.

Table 2.1 reports summary statistics for these variables. Our sample includes S&P 1500 firms only which lead to larger mean and median of firm size and MB ratio than representative Compustat firms. 39% of the firm-year observations are associated with non-zero R&D expenditure and 30% report negative profitability. The average tenure of the insider directors is longer than the independent directors. There are more than nine directors sit on the board on average. 90% of the observations actually have an independent director majority board and 67% have CEO as the chairman of the board. Boards are relatively more concentrated on gender and ethnicity while more dispersion on age. The independent directors hold less than one outside directorship and around 1.2% of voting rights on average. Additional to opportunistic or routine trading, we also distinguish the transactions by sales and purchase. The number of purchase transaction only takes up about 25% of the total number of transaction, but the trading volume of the purchase transaction is more comparable to the sales transaction. We can infer that the transaction size of the purchase transaction would be larger than sales transaction on average.

2.4 Main Empirical Analyses and Results

2.4.1 Baseline results

2.4.1.1 Main regression

The baseline regression is directly related to our entrenchment hypothesis. We estimate a transaction level panel specification in which we regress the insider trading profitability for different holding horizons on the tenure of the independent directors. Here the tenure of the independent directors is aggregated for each firm and each year as the average among all independent directors. The dependent and control variables are defined in the previous section.

Table 2.2 illustrates the results for the baseline regression. We can find a consis-

tently significant positive relation between insider trading profitability and the independent directors' tenure. And the magnitude keeps increasing as the holding horizon become longer. The executives of the firms which have independent directors sit on the board for a longer time will earn more from their insiders trading. Insider directors' tenure also has a positive impact on executives' insider trading profitability, but the effect is mostly not significant. We would expect these insider directors to play a much less important role in monitoring the insider trading activities of the firm. As we expect, executives in larger firms or firms with higher institutional holdings will earn less from their insider trading. This could be due to the more intensive monitoring or less severe information asymmetry among these firms. The results associated with MB ratio, Loss dummy and prior return indicates prominent contrarian strategy. Opaque information environment revealed as the higher return volatilities prior to the transaction lead to higher insider trading profitability. Other proxies for information asymmetry such as analyst dispersion or R&D dummy have no significant impact on insider trading profitability. Information environment should be considered as one of the most important determinants of insider trading profitability. However, since we have a much richer control variable set than former literature, their effects perhaps are already captured by the firm size and institutional holdings or the return volatilities. We find that transaction size has a slightly negative relation associated with the insider trading profitability. If the executives expect the trading to earn higher profitability, they are very likely to cut the transaction into small pieces to avoid potential scrutiny. Executives' insider trading profitability is higher if firms have larger board or CEO of the firms also hold the position of board chairman. The results confirm the finding of former literature that the small board dominates in monitoring role and duality of CEO and board chairmen compromise the monitoring effectiveness of the board. Since market regulations and corporate internal policies are not sufficient to prevent informed insiders trading, weaker monitoring leads to higher insider trading profitability. Busy board also increases the insider trading profitability. The effect of the independent directors' ownership is not very strong. Surprisingly, board independence has no significant impact on insider trading profitability across all holding horizon. The empirical results associated with the general measure of board independence are usually insignificant. This is the

reason why we want to focus on the "true independence" of the board.

We also investigate the relation between independent director tenure and the incidence of insiders trading which are measured by number of trading and trading intensity. We use Negative binomial model instead of Possion model to test the incidence of insiders trading because of the over-dispersion problem which frequently holds in real data. The results of the count model show that the number of insider trading is smaller for firms with longer independent director tenure. Nevertheless, the relation between trading intensity and independent director tenure is insignificant. The result is still insignificant if we simply use the trading volume which is not scaled by the total shares outstanding. Furthermore, we check how the independent director tenure would affect executives' total profits. Here, total profits are calculated as the profitability multiply the transaction size for each transaction and is aggregated for each individual and each firm in each year. We find that the executives' total profits are also higher for firms with longer independent director tenure. All these three measures are for each individual and each firm in each year. So, all the transaction level characteristics cannot be included. But we further control the executives' holding at the beginning of the year [31].

2.4.1.2 Different types of transaction and different types of firms

Except for the overall results, we also see how the independent directors' tenure affect executives' insider trading profitability for different types of transactions and for different types of firms. Some sorts of insiders trading are considered to contain more information, such as the purchase transaction and the opportunistic transactions. As shown in panel A of table 2.3, the results are stronger for sales transaction but not for purchase transaction. Although purchase transactions are more likely to be motivated by possessing some valuable information, sales transaction can be triggered by reasons other than private information such as liquidity needs or diversification concerns. However, sales transactions are subjected to higher probability of litigation risk (Cheng and Lo (2006)). Hence, sales transactions are more closely scrutinized by the market, and facing more intensive monitoring from the board.

[31] The results for the tests related to trading incidence and total profits are not reported since the results associated to trading incidence is not significant and the results about total profit is implied by the significantly increasing profitability and insignificant effect on trading volume.

Panel B reports the results for the subsample test for different types of firms. Here we implement the subsample test by separating the full sample into two subsamples based on different dimensions. In panel B1 to B3, firms are separated into subsamples based on variables measuring the information transparency faced by the outsiders or the independent directors: analyst dispersion, operation complexity, and R&D intensity. Complex firms and firms with higher analyst dispersion are more information asymmetric. Firms spending more on R&D usually are high-tech firms with more uncertain environment, and thus firm specific knowledge is more valuable. All measurements of information asymmetry give the same results: the pattern of increasing insider trading profitability along the increasing of independent director tenure is stronger for those opaque firms. As shown in Rogers and Stocken (2005) as well as Huddart and Ke (2007), information asymmetry tends to be one of the most important factors in explaining the abnormal return earned by informed insiders. If the information asymmetry between the insider and outsider of the firms are higher, the insiders are more likely to possess valuable private information and earn insider trading profitability. As for those transparent firms, insiders are not very likely to have great information advantage over the outsiders. Thus, the effect of board monitoring on insider trading profitability is no longer crucial.

2.4.2 Further evidence of weakened monitoring by long-tenured independent directors

2.4.2.1. Nature of insider trading

As the independent director tenure increase, not only the profitability of executives' private trading increase, the nature of the trading also changes. As shown in table 2.4, firm's executives tend to do more opportunistic trading both in the sense of frequency and intensity.

Policymakers have placed various restrictions on insider trading, such as Rule 10b-5 of the Securities Exchange Act of 1934, the Insider Trading and Securities Fraud Enforcement Act, and the Stock Enforcement Remedies and Penny Stock Reform Act. Given the fact that the existing regulation and enforcement mechanisms are not sufficient in

preventing informed insider trading [32], many companies have increasingly adopted internal insider trading policies. Such policies, which are mainly intended to protect a company against liabilities posed by its employees' insider trading, can be in the form of a general ban on trading or tipping on material nonpublic information, allowed trading windows, blackout periods, or pre-clearance requirements (Bettis, Coles, and Lemmon (2000); Jagolinzer, Larcker, and Taylor (2011)). There is a quote from the insider trading policy documents of General Motors. It represents the typical form of internal trading policy: "(insiders) are prohibited from engaging in any transaction involving a GM security except: (i) during specified trading windows, which generally begin after the second full trading day following the release of quarterly financial results and end on the last day of the second month of each quarter ..... For greater clarity, as described above, even during the trading window period, all securities transactions must be approved in advance by the Deputy General Counsel & Corporate Secretary....."

Even though literature have proven that internal trading policy can restrict informed insider trading, there is little evidence on how internal governance mechanisms, especially board monitoring, would affect the enforcement of these internal trading policies. We manually collect the information associated with firms' internal trading policies by screening the keywords from the firms' website. We consider the firm to have internal trading policies if we can find evidence that the firm has its own policies in addition to market rules to regulate insiders trading activities. Firms that have no official website, no files related to insider trading or firms with files about insider trading but do not mention or imply that they have firm-specific insider trading policies are all considered to be with no internal trading policy. Like a lot of the former studies about internal trading policy, we are unable to identify the precise adoption date for each policy. We have to assume the terms of policies are relatively stable at least during our sample period. We find 594 (22.5%) of the sample firms have adopted internal trading policy (ITP), but 360 of them just claim they have these policies and there is no evidence about the trading window

[32] Jaffe (1974a) finds no significant changes in the volume and profitability of insider trading after the most important changes in insider trading regulation. Seyhun (1992a) finds that the increased statutory sanctions in the 1980s did not have much effect on the volume and profitability of insider trading. Bris (2005) finds that insider trading enforcement increases both the incidence and the profitability of insider trading using international sample.

or any details about the policies. Within the firms that already adopted ITP like trading window restriction, some of them further require the insiders to get approval or pre-clear by the general counsel before initiating any transaction. Besides, insider can also trade outside the safe window with the permit or approval of the general counsel. Among these 594 ITP firms, 100 (16.8%) of them have mentioned about general approval for all insiders trading and 11 (1.8%) of them accept exemption with general counsel approval. 74 firms provide effective details about their insider trading policy, e.g. the beginning day and ending day of the restriction or safe windows. Using the data of these 74 firms, we can investigate how independent directors' tenure affects the enforcement of the ITP. We convert all information about restriction window to the safe window which identified the window when insiders can trade. We assume one fiscal quarter is 90 days, one month is 30 days and one week is 7 days. If the firm does not specify the ending day of the window, we just let it be the last day of the quarter period.

For the enforcement of ITP, we define the transaction to be "safe" if the insider trading is executed during the safe window following an earnings announcement. Whether the transactions are safe or not is defined according to the detail information for each firm. Not surprisingly, insiders do not always obey the policies. 20.06% of the transactions are actually executed outside the safe window. From table 2.4, we can find that as the independent director tenure increase, the probability that the executives do the insider trading outside the safe window required by the firm is increased. Here we use the Logit model and the firm fixed effect and year fixed effect are included. The results are still the same if we use Probit model or if the fixed effects are omitted.

Since only 74 of the sample firms have the specified information of the safe trading window, we try to generalize the results in the full sample. Roulstone (2003) use an indirect way to identify whether the firm has adopted internal trading policy or not. He assumes firms with 75% or more of insider trading initiated within one month after earnings announcements as those with insider trading restriction policies. One month after earnings announcements is a period of time when the information asymmetry between the insiders and the outside market are relatively lower. We can call it "transparent period". The single most common internal trading policy aims to restrict the insider trading

activities to this kind of period. Based on a similar spirit, we consider the transactions happened within one month following the previous earnings release to be more transparent and we find that executives are more likely to trade outside the transparent window as independent director tenure increase. This either reflects the failure of board monitoring or merely because the insiders are getting more permission granted. These results may offer a possible explanation to the fact that insider trading profitability increase as the independent director tenure increase. This is probably because they trade more and more intensively during the period when the information asymmetry against the outside market is high as the independent director tenure increase. From some unreported results, we find that the transaction happens outside the safe window (or the transparent period) is more profitable than other transaction on average.

2.4.2.2. Independent directors who are not truly independent

From the previous section, we have already known that executives would profit more from their private trading as independent director tenure increase and this is because they can better exploit their information advantage. In the following section, we will show that this is due to the weakened monitoring form the independent directors.

If the independent director is already captured at the time he joined the board, his independence would be less likely to be compromised along his tenure. There is a rich literature on investigating the cross-sectional difference in the features of independent director. Following Coles, Daniel and Naveen (2014), we define co-opted independent director as those appointed after the CEO assume office. These directors are more likely to pledge loyalty to the CEO who was involved in their initial appointment. Coles, Daniel, and Naveen (2014) find that non-co-opted board independence can better explain the monitoring effectiveness rather the conventional measure of board independence. Based on similar spirit, we separate the independent director into two groups according to whether they are co-opted or not and calculate the average tenure for these two groups of independent directors respectively. The date become CEO is obtained from Execucomp. If the independent director joined the board during the year the firm change its CEO, we consider him to be appointed by the old CEO. Thus, he is not co-opted by the new CEO. As shown in panel A of table 2.5, the effect of independent director tenure on insider trading

profitability is concentrated on the non-co-opted independent directors.

Second, we try to check whether the independent directors are linked with the CEO in other ways at the time he joined the board. Following Fracassi and Tate (2012), we consider three types of connection between the independent directors and the CEO: overlapping employment (past or current), education and other activities. The information about the connection between independent directors and the CEO is obtained from the Boardex database. We use CIK code to merge our sample with the Boardex database. 2110 (79.5%) of the sample firms can be directly merged with Boardex using CIK code [33]. We identify firms' CEO and independent directors from the employment file because the board summary file does not distinguish independent director. From the employment file, we can also identify the year the CEO or independent directors started to work for the firm and year they leave their position. We have compared the independent directors covered by the Boardex and IRRC for each firm and each year. In some years, Boardex includes more independent directors than IRRC and in some years IRRC includes more independent directors than Boardex. But the discrepancy is acceptable.

We want to specify whether the independent directors and the CEO are connected through some external connection or not at the time when the independent director is assigned to the firm. In the year when the independent director come to the board, if the independent director and the CEO have been worked together before (or if they still work together) in any firms other than the firm for which we are measuring social connection between the CEO and the board, they are considered to be connected through overlapping employment. If the independent director and the CEO graduated from the same institution or university, they are considered to be connected through education. Independent director and the CEO can also be connected through other activities such as golf club or charity membership. The independent director is defined as "connected" if he has at least one connection with the CEO in the year he comes to the board. During the year when the firms change their CEO, we will investigate whether the independent director is connected

[33] Boardex database has a larger coverage than IRRC, but it lack firm identifier which can be easily combined with other datasets. Therefore, we have to rely on the merged sample based on CIK code. Some of the firms are associated with multiple Boardex Company IDs, since Boardex will assign different Company IDs to the firm after the firm change its name.

with the new CEO again. In our sample, only 7% of the independent director has at least one connection with the CEO at the year he joined the board. This percentage is lower than Fracassi and Tate (2012) who focus on outside directors rather than independent directors. If the firms have no connected independent director, the connected independent director tenure would be equal to zero. In the regression, we constrict our sample to the firms with at least one connected independent director during the whole sample period. The results are reported in panel B of table 2.5. Similar to what we find for co-opted and non-co-opted directors, the relation between insider trading profitability and independent director tenure are only significant for those independent directors who are not connected with the CEO at the time they joined the board.

There are other features of the independent directors which are not directly related to their independence but are also important to their monitoring effectiveness. Here we consider the busyness and the power of the independent directors. The independent director is considered to be busy if he or she holds more than three directorships, e.g. more than two outside directorships. Busy directors are considered to be valuable in advisory role but relatively less effective in monitoring role. From panel C of table 2.5, we find that the effect of independent director tenure is mainly driven by the not busy directors. Unlike busy directors, those who are not very busy would devote more effort on their job and the compromising of this type of independent director would have a greater influence on insider trading activities. We try to separate the IDs based on their committee membership and we find the results hold no matter they sit on the audit and compensation committee or not. But it disappears for the IDs who do not sit on governance committee. Directors on governance committee usually are in charge of board assessment and evaluation, as well as monitoring of governance structures and processes of the whole firm. Besides, the results also not hold for IDs with profession backgrounds who are scientists, politicians or university professors. These people are either considered as with more career concerns or recruited mainly to perform the advisory role.

There are controversies about the internal trading policies which argue that these trading policies appear to be a public relations contrivance, rather than an effective tool in reducing informed trading. And these internal policies make it more difficult for the SEC

to prove insiders' reckless activities (Horowitz and Bitar (1998)). Our findings support the argument that these internal policies play an important role in affecting the abuse of nonpublic information in insider trades. In our sample, we can see that firms with or without ITP are systematically different from each other in many dimensions. Firms that adopted ITP are larger, have higher MB ratio and analyst dispersion, are more likely to do R&D investment and less likely to experience negative profit. They are more likely to be associated with larger, busier and more independent board. CEO is more likely to perform as the chairman of the board and tenure of the independent or insider directors are both more likely to be longer on average. All these difference are significant according to the simple t-test. These firms are complex and less transparent, so informed insider trading activities could be more intensive. Their board monitoring seems to be less effective reflecting in larger, busier and longer tenured board as well as the dual role of the CEO. The only exception is the board independence. These firms actually have a more independent board. This is partially contradictory to the finding of Dai, Fu, Kang, and Lee (2016) who shows that firms with better internal governance are more likely to adopt voluntary restriction policies measured by a complicated index [34].

Besides, we still have no idea whether firms adopt internal trading policy or not would impact the effect of independent directors' tenure on executives' insider trading profitability. If we separate the sample into two subgroups based on whether firms adopt ITP or not, we would see that the relation between the insider trading profitability and the independent director tenure are almost the same in the two subsamples, except that it is slightly stronger for firms without internal trading policy. In table 2.6, we use the interaction term to capture the effect of ITP on the relation between insider trading profitability and the independent director tenure. Here, we do not include the ITP dummy because it is absorbed by the firm fixed effect. As shown in table 2.6, adopting internal trading policy attenuates the effect of independent director tenure. Insider trading activities is a sort of

[34]They use standardized values of six individual governance variables to obtain their main composite internal governance score: the percentage of outside directors on the board, the percentage of outside directors in the compensation committee, CEO pay-performance sensitivity, an indicator for firms in which any non-executive directors receive stock or options as a part of their compensation, the percentage of ownership held by institutional investors, the percentage of shares held by the top five independent, long-term, and dedicated/quasi-indexer institutional investors as defined in Chen et al. (2007).

grey area which is easier for the independent directors to turn a blind eye to the executives who have a closer relation to them. If there exist explicit rules, the indulgence would be much more difficult since the independent directors have their own career concerns.

A portion of these ITP firms also require general counsel prior to the transaction. According to Jagolinzer, Larcker and Taylor (2011) [35], general counsel play a much more important role in mitigating informed trading by corporate insiders than merely the restriction policies. The percentage of firms that is with explicit evidence of general counsel approval in our sample is very small. The result shows that general counsel approval has no additional effect on the relation between the insider trading profitability and the independent director tenure given the existence of internal trading policy.

There are some other governance factors that can help counter the weakened monitoring form independent director as their tenure extended: the presence of outside block-holder on board or IDs with legal backgrounds such as attorneys, Judges or legal counsel. The block-holder is more aligned with the interest of shareholders and also has great power to influence board decisions. Firms choose to hire legal IDs because they are more concerned about their firm's governance, or more sensitive to legal issues. In any case, if there is block-holder or IDs with legal background sitting on board, the firm insiders are supposed to be more careful about their exploitation behavior. As shown in table 2.6, the positive relation between executives' insider trading profitability and independent director tenure becomes weaker for firms adopted internal trading policies, with at least one outside block-holder or IDs with legal background sitting on board. On contrary, for firms located in states where the universal demand laws have passed, it would be even harder for the shareholders to file lawsuits on board. As expected, the positive relation between executive trading profitability and IDs tenure becomes stronger for those firms.

2.4.2.3. Direct evidence of compromised independence of independent directors

In this section, we will provide direct evidence illustrating how the independence of independent directors is compromised along their own tenure.

First, we want to see whether independent director's connection with the CEO has been strengthened as their tenure increase. We will only focus on their connections

[35] They find over 80% of the ITP firms also adopt GC approval. But in our sample, this percentage is much lower.

through other activities such as leisure club or charity membership. The education background is stable because most directors have received their degrees (including MBA) long before they joined the board. Overlapping employment is the most important source of connection between independent directors and the CEO, but it is not suitable for our investigation. On one hand, the employment is determined by the employer to a great extent instead of the independent director or the CEO themselves. On the other hand, tenure is highly correlated with the age and people may reduce their employment as they become older. Besides, independent director and CEO might also try to reduce their overlapping position to avoid being accused of collusion.

To see whether independent director's connection with the CEO through other activities increase after they joined the board, we need to identify the start year of each connection. Unfortunately, there are a lot of missing data about the starting year for the connection through other activities. We focus on the director-CEO connections which have the non-missing starting year information only. Since over 97.31% of the independent directors in the sample and their CEO have zero (34.67%) or only one (62.64%) connection through other activities, binary model would be more suitable instead of count model. We are not going to test whether the number of social connections increases or not. Rather, we check whether the directors are more likely to socially connected with the CEO as they sit on board longer and longer. In the binary model, dependent variable equals to one if there exists at least one connection through other activities between the dependent variable and his firm's CEO. Since the existence of connection through other activities between CEOs and firm's independent directors is relatively rare, we utilize the Penalized maximum likelihood estimation. The results are reported in table 2.7. In column 1 and 2, we include a dummy variable "After" which equals to one after the director and the CEO are connected through the investigated firm: either after the director comes to the board or the CEO comes to the firm. The result shows that the independent director and the firm's CEO are more likely to have social connections after they are bonded together through the position in the firm. In column 3 and 4, we break the independent director's entire tenure into for periods: early period which is from year zero to year one, the first middle period which is from year two to year three, the second middle period

from year four to year five and the late period is from year six thereafter. Penalized maximum likelihood estimation is used to deal with the rare event problem. Based on the results, we can see that the social connections between the independent directors and the CEO are significantly strengthened as they sit on the board longer and longer. We control for firm, board and individual characteristics in the regression. Some of them also have a significant impact on the probability of social connection between the independent directors and the CEO. For example, older directors or directors from the US are more likely to be connected with the CEO while the effect of gender is insignificant. Directors in larger firms or firms with larger or more independent board are less likely to be connected with the CEO. Interestingly, gender and ethnicity diversity of the board increases the probability that the independent directors and the CEO are socially connected.

Next, we want to investigate how the trading behaviors of the independent directors change as they sit on the board longer and longer. We test the likelihood of collusive trading between independent directors and other firm's executives. First, we calculate the total shares of sale transaction and purchase transaction initiated by the non-director executives respectively for each firm in each month. We require the executives not to be directors of the firm so that it does not include the trading of insider directors. Then we calculate the net shares traded by executives for each firm in each month which equals to the total purchased shares minus the total sale shares. Next, we calculate the net shares traded by the independent directors. Trading is defined as "conflicting" if the director trades in opposite direction with the executives of the firm in this month. Trading is defined as "silent" if the director trades but the executives of the firm do not trade in this month, or the director does not trade but the executives of the firm trade in this month. Trading is defined as "consistent" if the director trades in the same direction with the executives of the firm in this month. The three types of trading are defined for each director of each firm in each month. Consistent trading takes up 49.58% of the full sample. For the rest of the transaction, 89.08% of them are silent trading. Conflicting trading only takes up 5.51% of the full sample. The consistency is categorized into three levels in an ascending order: conflicting, silent and consistent. Here we use ordered Logit model to test the trading consistency. We report both the coefficient and the marginal effect in the

following table. We can only interpret the sign of the coefficients. A positive sign means the variable is with better consistency. A negative sign means the variable is with worse consistency. The marginal effect is reported for different level of consistency. It can be interpreted in the way that if the control variable increases by one unit or if the dummy equals to one, then the transaction is how much less or more likely to be in each level of consistency. The marginal effects sum up to zero for each variable among all categories.

Table 2.8 reports the result of the ordered Logit regression. The intercept parameters are significantly different from each other, so the three categories should not be combined. The independent directors become more and more likely to do consistent trading and less and less likely to do conflict and silent trading as their tenure increases. The main results will not change if we use alternative measures of consistency level which the estimation window is no longer each month but are each quarter and each half year respectively. When the window extends to half a year, the likelihood of silent trading decreased a lot. And distinguishing conflict trading and silent trading is not as meaningful as when we use monthly or quarterly window, since cut1 constant is not significant anymore.

Beneish, Marshall, and Yang (2016) use the collusive trading between outside directors and firm's CEO as a new proxy for their independence. They find this new dimension to the assessment of board independence can explain the board monitoring effectiveness to a great extent. Consistent with them, we see the increasing collusive trading between independent directors and firm's other executives along their tenure as evidence of their compromising in independence. A potential explanation for independent director to be more generous in monitoring insider trading might be that they also want to trade themselves. According to unreported results, we find that the independent director's ownership of the firm shares increase with their tenure. similar to the case for firm's managers, greater equity ownership not only increases the ability of the directors to influence firm decisions, but also provides them with more flexiblility to trade. On the other hand, independent directors might have more incentive to protect their own investment in the firm. Acharya and Johnson (2010) predict that a greater number of insiders lead to more insider trading since the probability of being detected is reduced. As the independent directors sit on board longer, they become more likely to be considered as "insider". This hence

increases the overall insider trading profitability.

In order to be differentiated from the improved information story, we check whether the independent directors would have better access to firm-specific information as their tenure increase. This can be reflected in the increased or decreased profitability in their own insider trading. However, we cannot find any evidence that independent directors can earn more from their private trades of their own firms' shares as they sit on board longer and longer.

There are several interesting pieces of evidence about how the behaviors of independent directors change along their tenure which are not reported in the table. For example, we find that long-tenured independent directors hold less outside directorship than short-tenured independent directors. Their ownership of own firms' shares increase. Their participants in board committees increase because they become more likely to sit on compensation, nomination and governance committees. However, long-tenured independent directors are actually less likely to sit on audit committee than short-tenured independent directors. Related to independent directors' insider trading activities, their number and size of insider purchase would be decreased along their own tenure. Their size of opportunistic and total trading would also be decreased given the fact that they will be granted more own firms' shares. They tend to do more routine trading instead.

The unreported results also show that the independent directors are less likely to sit on audit committee as their tenure becomes longer. In this sense, they are not necessarily to possess more firm-specific knowledge. According to Ravina and Sapienza (2010), the independent directors sitting on audit committee are those obtain relatively more valuable information about the firm reflecting in their higher insider trading profitability. And the position in audit committee is the only committee position that matters compared to nomination, compensation and governance committee. There is no significant effect of tenure on independent directors' probability of attending less than 75% of the board meeting. On one hand, this measure of board meeting attendance is too rough to capture any useful information. On the other hand, working harder does not mean boards work better (Vafeas (1999)). These simple fact about independent behavior related to their tenure are substantial challenges to the learning story about the independent director tenure rather

than simply hypothetical less effective communication argument.

2.5 Robustness Checks and Discussions

2.5.1 Robustness with more controls for board characteristics

We further add board diversity measures, classified board dummy and interlocking dummy to see whether these will add explanations to insider trading profitability. Unlike Huang (2013), we do not include the tenure diversity which equals to the standard deviation of independent directors' tenure because this item is highly correlated with average independent directors' tenure. We do not find any significant effect from these variables and controlling all these board characteristics leads to multicollinearity [36]. We restrict our sample to post-SOX period only, and we find the results still hold. We also try to include the squared term of independent director tenure to capture its potential non-linear relation with insider trading profitability. The coefficient of the quadratic term is not significant and including this variable does not change the effect of other variables. The entrenchment hypothesis seems to dominate the learning hypothesis. As robustness tests, we use alternative measures of the independent director tenure. First, we use the median among all independent director tenure which reflects a central tendency as the measure of the aggregate independent director tenure. Also, we use the tenure of the most senior independent director, e.g. the longest tenure among all independent directors. Then, we restrict to a group of independent directors who continuously serve the board, e.g. their tenure extend to at least five years (or ten years). We excluded those independent directors who merely sit on board for a very short period of time and calculate the average tenure only among those loyal independent directors. Finally, we define senior independent directors as those with tenure longer than the sample median among all independent directors in our sample firm during our sample period. And we calculate the percentage of senior independent directors for each firm in each year as a proxy for independent director tenure. Not surprisingly, these alternative measures of independent director tenure

[36] We do not report the results for including all these board characteristics. After further controlling board gender diversity, age diversity, ethnicity diversity, classified board dummy and interlocking dummy, CEO-Chairman dummy and analyst dispersion are omitted. But the coefficient associated with independent director tenure is still positive significant.

are highly correlated and they all capture the same positive significant relation between insider trading profitability and independent director tenure.

2.5.2 Turnover of independent directors

Change in the composition of board construction also can lead to the change in the independent director tenure, for example, when the old independent directors leave the board or the new independent directors come to board. We use two measurements to proxy these situations. One is the percentage of independent director's turnover which reflects how many portions of the independent directors was on the board last year but leaves this year. To identify the director's turnover, we require the firm to have at least two consecutive years of board information. The other is the percentage of new independent director come to board. It is necessary to check whether the results are mainly driven by the change in board composition or due to the time effect of the same bunch of independent director sitting on the board. This investigation is made by interacting the independent director tenure and an indicator variable identifying whether there is any change in board construction or not.

The results are reported in table 2.10. If a larger portion of independent directors leaves board this year, the insider trading profitability will become lower. Likewise, in the years with a greater portion of new independent directors come to the board, the insider trading profitability also would be lower. Notably, incumbent independent director leaving the board not necessarily cause the average tenure to be decreased. More importantly, even if there is no change in the composition of independent directors, the executives' insider trading profitability will still increase as the independent directors sit on board longer and longer. And the isolated time effect is greater than the general results across all holding horizons.

2.5.3 Endogeneity of independent directors' tenure

We believe that endogeneity is less of a concern in our study. Regardless, we cannot rule out that endogeneity could be driving our results unless we have a clean instrument or natural experiment. Accordingly, we take a difference-in-difference approach to eliminate

these concerns about the endogeneity of board construction. We use the sudden death of independent directors following the method of Nguyen and Nielsen (2010). We separate the treatment firms into two types: one is that the sudden death of a relative junior independent director causes the average tenure of the board to be increased; the other is that the sudden death of a relative senior independent director causes the average tenure of the board to be decreased. The test window is the 730 days before and after the date when the news of the sudden death is released. Control firms are those without any reported death of board members during the whole sample period, and are matched with the treatment firms by industry and independent director tenure during the fiscal year before the sudden death is released. If there is no insider trading transaction for the firm during the test window, this firm will be mechanically dropped. We further require the treatment firms do not hire new independent directors in two years following the sudden death event. We identified 257 cases of independent director decease. After excluding death that is not considered as "sudden", and implementing the previous filter process, only 89 cases are used in the difference-in-difference test. In 63 cases, the dead independent director has tenure longer than the average tenure of all independent directors during the year he died, thus these are the cases that will decrease the average independent director tenure. In the rest of the 26 cases, the death of the independent director should increase the average independent director tenure.

As shown in table 2.11, we find an asymmetric result using the difference-in-difference setting. The executives' insider trading profitability drops after the exogenous decrease in independent director tenure, but the effect is not significant after the exogenous increase. This is probably because the latter case is very rare which challenge the statistical significance of the test. The results would be similar if we include the firm and year fixed effect and omit the treatment and post variable correspondingly.

2.6 Conclusion

We find that executives tend to profit more from their private trades as independent directors' tenure increases. In firms with longer-tenured independent directors, executives are more likely to conduct opportunistic trades, trade outside the designated safe win-

dow of insider trading, or trade during informationally more sensitive time. Our finding suggests that the independence of independent directors is likely to be compromised and thus the effectiveness of board monitoring of insider trading weakens over independent directors' tenure. As a result, executives can better exploit their informational advantages for private gains through trades. As further evidence that is consistent with the compromised independence of independent directors over tenure being the leading explanation, the profitability-tenure association does not hold for those directors who are defined to be independent but are not truly independent when they join the board. We also show that independent directors are more likely to get socially connected with executives, if they are initially not, and their own private trades become more consistent with executives' trades over their tenure.

While our finding suggests weakened board oversight of insider trading over the tenure of independent directors, we do not imply or advocate that a board with more newly incorporated independent directors is always preferred. As indicated by Adams and Ferreira (2007), the advisory and monitoring role of the board of directors are sometimes in conflict with each other. Some firms may find it more beneficial for independent directors to stay on the board for longer to better serve their advisory role. But the downside of a long-tenured independent board is that its monitoring effectiveness can be compromised. Our finding in the context of insider trading is consistent with the downside impact, but it does not speak to the overall value implication of a long-tenured independent board.

There has been an intense interest in board structure and behavior and their relevance for shareholder value. The explicit rules and regulations for a majority independent board aside, there are also public and institutional pressures for a more devoted board. The National Association of Corporate Directors, the Council of Institutional Investors, and Institutional Shareholder Services (2012), have all recommended various limitations on the number of boards on which directors serve. When the supply of independent directors dwindles, firms might find it more difficult to have new independent directors, which results in incumbent independent directors serving longer than optimal. Our finding implies that one need take the tenure of independent director into consideration in assessing the effectiveness of board independence.

3 Do Insiders Trade Too Little?

3.1 Introduction

To investigate individual's trading behavior, literature mostly focuses on actual transactions. For example, they use an insider's trading profitability to assess the information he or she possesses [37], or use the trading profitability gap to measure the relative information-advantage of two different groups of firm insiders [38]. All these works have one precondition that insiders have actually traded. In contrast to the existing studies, we try to understand those insiders' participation in trading their firms' shares as the first step.

We identify insiders from IRRC and Execucomp and merge them with Thomson Reuters insider data file to track their insider trading activities, specifically speaking, the buy and sell of their own firms' share on the open market. Astoundingly, the participation rate of insider trading activity is very low. Even from a yearly perspective, less than half of the insiders actually trade. CEO is the one that most likely to do insider purchase, then it is independent directors. Suppose there are ten independent directors on board this year, only one of them would buy the firm's shares. If we exclude all the sales transaction related to option exercise, participating in insider sales would drop a lot.

In this sense, studies on actual transactions are restricted to a very small subsample. This may or may not cause problems. The basic selection problem arises in that the sample consists only of insiders who choose to trade and they may differ in important unmeasured ways from women those do not trade. There wouldn't be any problem if insiders choose to trade or not trade completely at random. However, the decision on whether to trade or not on each plausible trading day is made by each insider themselves, and clearly not random. If the unobservable in the selection equation are correlated with the unobservable in the outcome equation, we have biased estimates without correction. Note that a selection problem does not exist in two types of situations. First and obviously, there is no selection problem if every variable influencing selection is controlled in the outcome

[37] See Eckbo and Smith (1998); Seyhun (1998); Jeng, Metrick, and Zeckhauser (2003), etc.

[38] See Ravina and Sapienza (2010); Ozkan and Trzeciakiewicz (2012); Billett, Chen, Martin, and Wang (2014), etc.

equation. The problem is that most selection processes are complex and the complete list of variables influencing selection is often not measured, cannot be measured, or unknown. Second and more importantly, it might be the case that the unmeasured factors influencing the selection equation are uncorrelated with the unmeasured factors influencing the outcome equation. In the selection stage, we would control for the insiders' information advantage, herding with other insiders, or contrarian strategy. It is possible that the unobservable term consist of their liquidity needs, overconfidence, or holding requirement, which is sort of unrelated to the potential trading profitability and randomly assigned. In this case, we would expect no presence of selection bias. Alternatively, it is more likely that the unobservable term is related to insider's possession of private information at the moment, or their abilities to time the market, which is also correlated with their potential trading profitability and will lead to significant selection bias. Then, Heckman model would allow us to use information from non-trading observations to improve our understanding about insider trading behavior.

Before implementing the Heckman correction, we first illustrate some general facts about the insiders trading decision. Firm fixed effect and Insider fixed effect explain a great portion of variation in insider trading decision. They increase the adjusted R-square by a lot, and the F-test on these fixed effects is very significant. The magnitude of Firm fixed effect on trading participant rate is even larger than on other firm policies such as leverage or investment and R&D expenditure. However, there is no persistence in the participation rate for either individuals or firms. As shown in Figure 3.1, each panel presents the average trading intensity of four portfolios in event time, where year zero is the portfolio formation period. That is, for each calendar year, we form four portfolios by ranking firms based on their insider trading intensity. Holding the portfolios fixed for the next 20 years, we compute the average trading intensity for each portfolio. As we can see, they converge very fast together and keep that way. So, there is no firm or individual that is associated with on-going low or high participation rate. In addition, we find that trading decision is indeed information-related. For example, when the information advantage of the insiders are relatively higher, such as in complex firm or firm with higher information asymmetry, insiders tend to more likely to trade. Similar, insiders who have more access

to valuable information of the firm, such as audit committee membership or those attend more board meeting, tend to more trade more. On contrary, busy directors trade less. Based on all these results, it can be inferred that insiders' decision on whether to trade or not is related to their information set.

In the major part of the paper, we would focus on insider purchase. Because insider sales are usually argued to be associated with liquidity needs when insiders are simply selling their holding or granted shares and options. And insider purchase is more likely to be information driven. We construct a decision sample for each individual on each plausible trading day. Someone would say that it is unlikely that insiders make their trading decision on a daily basis, but some investigations such as blackout period require a daily frequent sample. However, it produces similar results if we use a monthly or yearly sample. We start with two-step Heckman model with basic selection equation and outcome equation.

Technically, the Heckman model is identified when the same independent variables in the selection equation appear in the outcome equation. However, identification only occurs on the basis of distributional assumptions about the residuals alone and not due to variation in the explanatory variables. Identification is essentially possible due to the non-linearity in the selection equation (the non-linearity is introduced into the outcome equation through the inverse Mill's ratio). However, this is not the only problem that arises if you have all of the variables from the selection equation in the outcome equation. You will probably get imprecise estimates in the outcome equation. The selection equation should contain at least one variable that is not in the outcome equation. Here, we use three variables that serve to satisfy the exclusion restriction. Return volatility during the previous period proxy for the information asymmetry of the firm and hence the information advantage of the insiders. Insiders trading usually herding together as information would impel them trade together, so recent trade of firms' other insiders is included. Prior return is used to capture insiders' contrarian behavior which is commonly indicated in former literature. Ideally, the exclusionary variables would affect the selection equation but not the outcome equation. Empirically, it is a very challenging task. Many people will either just drop a variable from the outcome equation or add a variable to the selection

equation. However, this is often theoretically unmotivated and means that the outcome or selection equation is incorrectly specified. Since we want to compare the information content of trading by different groups of insiders, our variable of interest are independent director dummy and CEO dummy. Other controls such as individual or firm characteristics are also included; not only to make sure the correct model specification, but also to see correcting selection bias would change the understanding of how these variables affect insider trading activities.

Heckman estimation would produce several interesting statistics. The coefficient on the inverse Mill's ratio (lambda) will indicate if there is selection bias. If the coefficient is statistically significant, then we know that there was selection bias. In addition to lambda, maximum likelihood procedure also produces rho and chi-square to indicate the selection bias issue. In addition to comparing with the result of OLS, it is also interesting to compare the coefficient of Heckman estimation with the marginal effect in observed sample and the corresponding p-value. Heckman model use the information form two stages and the sample sometimes could be mechanically different from those in the OLS.

Counterintuitively, we find a negative selection bias. In other words, the unobservable factor in the selection equation is positively related to the choice of trading but is negatively related to trading profitability. The negative selection bias in insider purchase is very significant and exists across different sub-samples of time periods, firm characteristics, and insider positions. It is somehow less significant during the pre-SOX period and for managers.

Sometimes Heckman is preferable than OLS, but sometimes it is not, particularly if there is severe collinearity problem between first stage and second stage, e.g., there is high degree of collinearity between X_2 and inverse Mills ratio. However, we can provide some evidences that collinearity problem is not a big concern in our model. Firstly, the coefficient of inverse Mills ratio (lambda) is very significant in the second stage. More importantly, lambda is still significant after we control for a rich set of explaining variables. And the estimation of selection bias is not very sensitive to the model specification. It is still possible that you will have high multicollinearity even if you don't include all of the variables from the selection equation in the outcome equation. Basically, the point

is that if the selection equation is not very good at determining selection, then you are likely to get imprecise estimates in the outcome equation. However, when we regress inverse Mills ratio on those control variables in the second stage, the R^2 is only about 7.7%. In addition to the existence of exclusion, another factor that affect collinearity problem is the censoring rate when high censoring rate would compromise Heckman. Based on the individual-level test, we also aggregate all independent directors and all managers as groups respectively and only keep one observation for each group. For the group-level test, the censoring rate is dramatically reduced but we get very similar results to the individual-level tests. There are mainly two-ways of estimating the Heckman model. We use both two-step procedure and maximum likelihood estimation. When using Two-step Heckman, the conventional standard error estimates are inconsistent because the regression model is intrinsically heteroskedastic due to selection. Therefore, we correct for the standard error by ourselves. Two-step Heckman would perform worse when there is high degree of collinearity between hazard ratio and explanatory variables. However, we already clarify that this is not true for our model. Maximum likelihood estimation is generally more efficient but will raise computational difficulty. The Maximum likelihood estimation will not converge when the true value of rho is close to -1 or +1, and the result would be inconsistent even if converged if rho is close to -1 or +1. However, in our sample, the rho equals to -0.7 on average and we haven't encountered any problem in converging. Overall, maximum likelihood estimation and two-step procedure produce very similar results.

We document a significant negative effect of insider trading decisions on their abnormal trading profitability. The observed trading profitability is biased downward compared to estimated potential profitability. By contrasting based on all plausible trading days, we have made unrealistic assumption that insiders can trade whenever they want to. This is not true in the real world because insiders face explicit and implicit trading limits. Ideally, insiders should not trade whenever they are aware of any private information. There are explicit rules upon insider trading. For example, there should be no matched purchase and sell trades within a six-month period [39] and no directly or indirectly purchase, sell or other-

[39] Section 16(b).

wise acquire or transfer any equity security of the issuer during the pension plan blackout period [40]. There is corporate self-regulation associated with insider trading, which impose restricted trade windows. There are also some implicit rules restricting insider trading. Threats of SEC scrutiny, litigation and adverse publicity restrain insiders profiting from foreknowledge of corporate disclosures. Insiders usually trade well in advance of (three to nine quarters ahead), as opposed to immediately prior to, major corporate disclosures [41]. Huddart, Ke & Shi (2007) also show that insiders avoid profitable trades before quarterly earnings are announced and sell (buy) after good (bad) news earnings announcements. To verify this, we try to control for firm's adoption of internal trading policy and blackout periods. As expected, it is negatively related to the choice of trading and is positively related to trading profitability. If this day is within the blackout period, even if it is just a hypothetical blackout period, the chance of insider purchase is largely reduced. In the OLS regression, blackout period don't seem to have significant effect on purchase profitability. However, after correcting for selection bias, insider purchase during blackout period is substantially more profitable. Anyway, even after including blackout period and internal trading policy dummy, the presence of negative selection bias still significant.

Although old literature document insider trading during problematic periods such as restatement announcements (Anderson & Yohn, 2002) or fraudulent financial reporting (Beneish, 1999; Summers and Sweeney, 1998), recent literature, especially those after the SOX, shows that insiders actually trade in a pattern that minimizes the possibility of insider trading allegations or violating internal corporate insider trading policies. For example, while insiders tend to trade profitably prior to some events (such as stock repurchases, earnings announcements, and bankruptcy filings), they appear to refrain from active insider trading prior to merger announcements. Agrawal and Nasser (2012) distinguish "active" inside trading (actual purchases or sales based on favorable and unfavorable inside information, respectively) vs. "passive" insider trading (withholding purchases or sales based on unfavorable or favorable inside information, respectively). They do not detect active insider trading in target firms prior to the takeover announcement. Instead, they find that insiders of targets of takeovers reduce their purchases of shares prior to takeover

[40] Section 306(a) of SOX.
[41] Seyhun and Bradley (1997); Ke, Huddart and Petroni (2003).

announcements. However, these insiders reduce their sales of shares to a greater degree than they reduce their purchases, thereby engaging in "passive" insider trading. Gao, Ma, and Ng (2015) shows that insider silence actually indicates bad news. Future returns are significantly lower following insider silence than following insider net selling. Further, the silence-sell return difference is wider among firms with worse information environment and firms at higher litigation risk. For fear of litigation risk, rational insiders do not sell own-company shares when they withhold bad news; neither would they buy, given unfavorable prospects; thus they keep silent. By contrast, insiders sell shares when they do not anticipate significant bad news. Hong and Li (2017) explore the information content of insider sudden silence. They hypothesize that insiders strategically choose to be silent when they possess private information not yet reflected in stock prices. Consistent with the hypothesis, insider silence following a routine selling (buying) schedule predicts positive (negative) future abnormal returns as well as earnings surprise. The return predictability of insider silence is stronger among firms with worse information environment and facing higher arbitrage costs. Insider silence forecasts future firm fundamentals (ROA, cash flows, and analyst forecast revisions) and that sophisticated investors' trade in the direction predicted by insider silence.

Not necessarily restrict to prominent event like merger and acquisition, completely silence of all firm insiders or routine traders. The negative selection bias provides general evidence of how insiders are restrained from trading upon their information. At least, they move slower than institutional investors and short sellers on those corporate events. The SEC acknowledges this belief as a motivation for changing the disclosure rule: "Many investors believe that reports of directors' and executive officers' transactions in company equity securities provide useful information as to management's views of the performance or prospects of the company and that more timely and transparent access to reports will be even more useful." However, this is questionable given insiders' trading pattern now.

Ravina and Sapienza (RFS2010) find that both independent directors and other executives earn positive abnormal return when they are trading their company stock. The difference between their earnings is relatively small. Therefore, the independent directors are informed. This result is natural for good times, but it also holds during bad times.

They find that the director's earning from trading their company stocks are considerably large, corresponding to over a half of their total compensation. The result implies that the independent directors have enough information to be able to monitor firms' executives effectively. They suggest, however, that in firms with weak corporate governance, the gap between the information set available to a firm's executives and that of independent directors widens. We find that independent directors are more likely to engage in insider purchase than executives, and after correcting for selection bias, the wedge between independent directors' and executives' return further increased. In addition, independent directors experience less herding in their trading and less likely to be profit-seeker. They are also less sensitive to their information advantages. In a word, independent directors trade more like an outsider, rather an insider. This again raises the question about whether independent directors possess information set that is comparable to managers. Seyhun (1986) and Lin and Howe (1990) find that CEO insider transactions are potentially more informative than CFO trading. CEOs are among the most informed insiders and they earn higher abnormal returns on their trades than other insiders. Again, we find contrary results using Heckman rather than simple OLS. CEO is more likely to engage in insider purchase than lower-ranked managers. But their purchase is significantly less profitable than other managers after correction for selection bias.

It is argued that greater equity ownership held by the trading executive not only increases the ability of directors to influence firm decisions, but also provides them with more flexibility to trade (Denis, Denis and Sarin (1997), Eckbo and Thorburn (2003)). To the extent that this happens, people expect that the informative content of insider transactions increases with higher equity ownership. Fidrmuc, Goergen and Renneboog (2006) find that an increase in the equity ownership would not significantly impact the informative content of purchase transactions if it is made by executives who already hold large stakes. However, our results show that insiders with higher equity ownership even initiate more purchase, and are associated with lower purchase profitability.

Bricker & Markarian (2015) reveal a positive relationship between institutions and the profitability of insider purchases, indicating an incentivizing role. Institutions constrain the profitability of opportunistic insider sales, but not opportunistic purchases, suggesting

profitable purchasing before price run-ups is an acceptable practice. This is in line with Carlton and Fischel's (1983) and Leland's (1992) arguments, allowing insider trading acts as an incentivizing mechanism that induces effort and increases shareholder welfare. On the contrary, we find that higher institutional ownership effectively reduce insider purchase and purchase profitability. Institutional investors have greater voting power as well as more incentives to monitor management, promoting good corporate governance (Agrawal and Knoeber (1996), Shleifer and Vishny (1997)). Second, institutional investors are better than other investors at collecting and processing information, which will equip them with an informational advantage over other investors. Therefore, in the presence of large shareholders the degree of information asymmetry between insiders and outsiders is likely to be reduced, resulting in a lower predictive power of the insider trading and smaller profitability.

We use the insider sales transaction as placebo test. Since sales transaction is less likely to be information driven compared to purchase transaction, our prediction is that the selection bias might be less significant. Some of the insider sales are partially or completely related to the exercise of option grants. So I include a dummy variable to indicate whether each sales transaction is related to option exercise. This dummy also equals to one even if the transaction is only partially due to the option exercise. Besides, I also delete all sales transaction related to option exercise and keep the rest of them. Option-related sales (partially or completely) take up about 48.7% of all sales transaction in our sample. On one hand, insiders can still pick time to sell the exercised option. On the other hand, the insider sales not related to option exercise can also merely due to liquidity need and not necessarily to be information-driven. Overall, there seems to be no significant selection bias for insider sales, and neither for managers or independent directors. However, there is still negative selection bias during the post-SOX period for insider sales. And what drives the result of the overall sample is the significant positive selection bias during pre-SOX period, especially for manager sales. The significant positive selection bias during pre-SOX period for insider sales is seemingly troublesome due to the rho very close to 1 which implies failure of Heckman selection using maximum likelihood estimation. But the two-step Heckman actually produces very similar results. Regard-

less of propensity to exploit inside information, many insider sales will be for liquidity purposes. But this might not be true. On one hand, even if insiders trade due to their liquidity needs, they can still time their trades to benefit from the private information they possess (Garfinkel, 1997; Huddart, Ke and Shi, 2006). On the other hand, insider sales face much higher litigation risk (e.g., Cheng and Lo (2006)). Insider sales followed by significant price declines can attract lawsuits as investors who suffer losses due to such declines can allege that managers traded on material private information. Lawsuits are less likely following insider purchases because price increases following purchases only result in opportunity costs for investors. The coefficient on the inverse Mill's ratio will indicate if there is selection bias. If the coefficient is statistically significant, then we know that there was selection bias. However, it is somewhat hard to say much if the coefficient is not significant. We can say that there is no selection bias as we have formulated the selection equation. However, this is assuming that we have the selection equation correct.

The following paper is constructed by following sections. Section 2 illustrates how we construct our sample by merging the information from IRRC and Execucomp with TFN insider trading file as well as the daily-level trading decision. Section 3 is the empirical results for insider purchase. Section 4 is the placebo test using insider sales transaction. And section 5 is conclusion.

3.2 Data Description

3.2.1 Sample firms and insiders

In order to track down insider trading activities of firm insiders, we merge directors from IRRC and top managers from Execucomp with the TFN insider trading file.

We start with matching directors from IRRC (ISS) dataset to TFN. The sample period is from 1996 to 2014 based on the calendar year of the board meeting date, and the corresponding fiscal year also span form 1996 to 2014. There are 179 firms from IRRC that do not have any records in TFN insider trading files at all (after we delete all the TFN data with low quality, e.g. cleanse code of A or S), so we exclude these 179 firms from the sample.

We merge IRRC with TFN by the name of the directors in addition to the 8-character CUSIP identifier. In IRRC, the first name (and middle name) and last name are in separate data item, while in TFN, the owner's name is combined together in the order of last name, first name, middle name and suffix. We slit the name by spacing, removed all punctuation to keep the alphabet only and convert all to uppercase. For example, in IRRC, a director who has first name "GERALD F." and last name "FITZGERALD JR." would has first name1 "GERALD", first name2 "F", last name1 "FITZGERALD" and last name2 "JR". We take first name1 as first name and first name2 as middle and last name1 as last name. In TFN, the corresponding owner's name is "FITZGERALD GERALD F JR". It is split into owner1 "FITZGERALD", owner2 "GERALD", owner3 "F" and owner4 "JR". We take owner1 as last name, owner2 as first name and owner3 as middle name.

In our IRRC sample, 88.76% of the firm-directors can be uniquely identified by their last name and first name only. For these firm-directors, we merge them with TFN by firm, first name and last name. To verify the matching quality, we extract the first letter from the director's middle name and compare the results between IRRC and TFN. We don't simply use the full middle name because the two datasets sometimes use the abbreviation. If a single firm-director in IRRC is merged with multiple owners in TFN, we delete the duplicates with different middle names. But if a firm-director in IRRC only matched to a unique owner in TFN, we do not delete it even if the first letter of the middle name are different. In this step, we successfully matched 35330 firm-directors. Among these 35330 firm-directors, 98.99% of the initial middle names are consistent.

For the IRRC firm-directors that cannot be uniquely identified using only first name and last name, we merge them with the TFN by firm, first name, last name and middle name. This time, we get 4881 more IRRC firm-directors matched with TFN.

For the rest of the unmatched IRRC firm-directors, we merge them with the TFN by firm and last name. 3439 firm-directors are merged and then we manually check whether the matching is correct. We consider full name and abbreviation can be matched. For example, "Charles Daniel" can be matched to "Charles D", "C Daniel" or "C D". We consider full name and nick name can be matched. For example, "Catherine" can be matched with "Kate". We consider name from their native language can be matched to

their English name. For example, we google "FENG XUDONG" and find her English name is actually "SHARON", so the two can be matched. We also correct the case with spelling mistake, wrong sequence, or confusions caused by prefixes and suffixes such as "Ph.D." or "M.D.". If the first and middle are totally missing in one dataset, generally we consider the firm-last name are matched, unless the last name is too common such as "Brown", "Green" and so on. We are more relaxed on the matching involves kinship and siblings, since the trading initiated by family members are part of the indirect trading. In this step, 2979 more IRRC firm-directors are matched.

In the resulted sample, 96.90% of the matched insiders are also classified as "director" in the TFN. Then, we combine the merged IRRC-TFN firm-directors with the IRRC sample. 86.12% are matched directly by firm, first name and last name (middle name). 4.87% are matched by manually correction. And 9.01% cannot be matched to TFN. Although we can think that this 9.01% never trade, we still drop them from the sample to make sure our results are precise.

We use similar process to merge Execucomp with TFN as well. 182 firms in Execucomp have no any record in TFN, thus are deleted. For top managers in Execucomp, 86.25% are matched with TFN directly by firm, first name and last name (middle name). 3.91% are matched by manually correction. And 9.84% cannot be matched to TFN. We also delete all those managers that cannot be matched.

Then, we combine the two merged insider samples together. For the duplicate insiders, e.g. the inside directors, we keep the records from IRRC which has more individual-level information. 68.62% of our resulted sample comes from the merged sample of IRRC and TFN. Moreover, we only keep the firms existing in both IRRC and Execucomp. Finally, we get 59103 firm-insiders and 2626 unique firms. In the following tests, we use personid assigned by TFN as individual identifier. These insiders with records in TFN do not necessarily mean they execute open market purchase or sales of their own firms' shares. In our sample firms, 36.63% of the TFN records are open market sales (including those related to option sell) and only 5.11% are open market purchases. TFN also track the holding of firms' shares (21.42%), exercise of in-the-money or at-the-money derivative security (12.20%), grant or award transaction (9.65%) and Bona fide gift (2.59%). In the

end, we construct an Insider-Firm-Year sample indicating the trading decision for each individual who is the manager or independent director of the firm during this year.

3.2.2 Variables construction

To calculate the profitability of insiders trading, we follow the method of Ravina and Sapienza (2010). We calculate the return from investing one dollar in the same way as the insider does, by either purchasing one dollar worth of the company stock when she buys, or by selling one dollar worth of the company stock when she sells. Market-adjusted buy-and-hold returns (BHARs) are calculated by subtracting the market return from the firm return, $R_{it} - R_{mt}$ and compounding it over time. We try 30, 60, 90, and 180 calendar days as alternative holding horizons and we use the value-weighted market index to proxy market returns. The results are multiplied by 100 to make the coefficients in percentage form. When there is no transaction on that day, the trading profitability would be missing. The dependent variable could also be missing even if there is a transaction because we require the firm to has at least 116 non-missing stock return for the following 180 days to calculate the Market-adjusted buy-and-hold returns. The missing value in trading profitability is scarce, and it takes up less than 1.2% in our individual purchase sample. However, we set up a separate buy dummy to indicate whether there is an actual transaction instead of directly using the non-missing dependent variable. There exist some outliers in the sample, so I replace the dependent variable to be missing if it is greater than top 1% or smaller than bottom 1%. But in the first stage, the buy dummy is still equals to one.

We use a dummy variable to indicate whether the insider is an independent director or not, and the identification is from the classification of IRRC. In the baseline regression, we only include two control variables: insider's ownership and the transaction size. Ownership is the total number of shares owned by this insider during this year scaled by the total number of shares outstanding. Transaction size equals to the number of shares exchanged in the transaction scaled by the total number of shares outstanding. In the first-stage, we use three variables that serve to satisfy the exclusion restriction: return volatility, recent trade, and prior return. Return volatility is the standard deviation of daily market adjusted

returns of the stock measured over the last month prior to each trading day. Recent trade is the sum of absolute values of the numbers of shares traded by all insiders of the firm during ten days prior to each trading day, scaled by the total number of shares outstanding of the firm. Prior return is the hypothetical Market-adjusted buy-and-hold returns for 180 days prior to each trading day.

As an alternative specification, we include more firm-level control variables. Size is the log value of market capitalization. MB ratio is the market-to-book ratio. R&D is a dummy variable equals to one if the firm reports non-zero R&D expense. Loss is a dummy variable equals to one if the firm's net income before extraordinary during the most recent fiscal year is strictly negative. Institutional Ownership Ratio is the percentage of shares holding by the institutional investors. This data is quarterly reported, so we combine it with our sample data for each quarter. Analyst dispersion equals to the standard deviation of EPS forecast divided by the absolute value of average forecast.

3.2.3 Daily level trading decision

We first construct potential trading day with non-missing stock price for each firm in each year. The plausible trading days for our sample firms is 252 days per year on average, with 1% percentile equals to 248 and 99% percentile equals to 254. The first-stage buy-or-not-buy decision for each individual insider would be based on their trading activities on each specific date. If he or she does insider purchase that, the decision dummy would be equal to one, otherwise it will be equal to zero.

In addition to individual-level investigation, we also try to aggregate independent directors and managers as two groups. Therefore, there would be two observations for each firm in each potential trading day, one for executives and one for IDs. In the first stage, buy dummy would be equals to one if any executive (or ID) of the firm make insider purchase that day. Ownership and transaction size are aggregated within each group. The dependent variable and the three IVs are the same for the same firm on the same day, so are the other controls. In the final sample, financial firms and utilities are excluded (SIC 4000-4999 and SIC 6000-6999). In the following investigations, individual-level and group-level test always deliver very similar results. However, the percentage of censored

observations as a fraction of all observations would be much higher for individual-level test. Besides, individual-level tests are clustered by each individual and group-level tests are clustered by firm-level.

Sometimes Heckman is preferable than OLS, but sometimes it is not, particularly if there is severe collinearity problem between first stage and second stage, e.g., there is high degree of collinearity between X_2 and inverse Mills ratio. However, we can provide some evidences that collinearity problem is not a big concern in our model: Firstly, the coefficient of invers Mills ratio (lambda) is very significant in the second stage; Similar, when we regress inverse Mills ratio on those control variables in the second stage, the R^2 is only about 7.7%. In addition to the existence of exclusion, another factor that affect collinearity problem is the censoring rate when high censoring rate would compromise Heckman. When we implement the group-level Heckman correction, the censoring rate is dramatically reduced but we get very similar results to the individual-level tests. Besides, we use both two-step and maximum likelihood to implement Heckman correction, and we get very similar results. When using Two-step Heckman, conventional standard error estimates are inconsistent because the regression model is intrinsically heteroskedastic due to selection. Therefore, we correct for the standard error by ourselves. Two-step Heckman would perform worse when there is high degree of collinearity between hazard ratio and explanatory variables. However, we already clarify that this is not true for our model. Maximum likelihood estimation is generally more efficient but will raise computational difficulty. The Maximum likelihood estimation will not converge when the true value of rho is close to -1 or +1, and the result would be inconsistent even if converged if rho is close to -1 or +1. However, in our sample, the rho equals to -0.7 on average and we haven't encountered any problem in converging.

Firm fixed effect and insider fixed effect are very important in individuals' trading decision. As shown in table 3.2, including firm fixed effect almost triple the R^2, and including insider fixed effect also increase the R^2 by more than two times. Table A.5 investigates how the difference in daily buying decision between IDs and managers change before and after SOX. The benchmark is manager during pre-period. Therefore, we can see that during per-period, IDs are more likely to do insider purchase, but the difference

is not very significant. IDs and managers both become less likely to do insider purchase after the SOX, but the change is greater for managers. This is the reason why IDs are more likely to do insider purchase than manager, and the difference seems to increase after the SOX. For all these regression related to buying decision, the coefficient of IDs and the corresponding interaction terms are multiplied by 10000, so that we could see the difference in the coefficients. As robustness tests, we exclude the crisis period from the post-period (2007, 2008), and cut the post period at year 2008 respectively. Table 3.2 test how the buying profitability gap between IDs and managers change before and after SOX. Again, the benchmark is manager during pre-period. During pre-period, IDs are less profitable in insider purchase than managers. IDs and managers both become more profitable in insider purchase after the SOX, and the increase is greater for managers. Hence, we can conclude that the trading profitability gap between IDs and managers increased after the SOX because the increase in managers' purchase profitability is larger than in IDs'. We can get similar results using group-level transaction.

Statistics of Heckman Selection

Statistics	Description
rho	Correlations of unobservable from two equations
sigma	Standard error of unobservable from second equation
lambda	Estimated selection coefficient (rho*sigma)
$\chi^2(\rho = 0)$	Likelihood-ratio test for rho = 0
athrho	athrho=1/2ln(1+rho/1-rho)
[marginal effect]	Conditional marginal effect of independent variable on y* in the observed sample
p-value	Significance test of the Marginal effect of independent variable
Predicted $\overline{y}$	Expected value of the dependent variable from the underlying distribution of the regression model , regardless of whether they were observed to participate in or not.

Although maximum likelihood estimation is preferred for sample selection model, the classical two-step method can save a lot of time and calculation. Table A.7 compares the results of Heckman correction using two-step and MLE using group-level transaction. The results are quiet consistent, only slightly different in magnitude. The underestimated standard using two-step Heckman model is adjusted. There are several interesting statistics generated by Heckman model, as summarized in the following table. To be consistent, we focus on lambda to check the presence of selection bias. But when we compare across sample periods, we also see the difference in rho and χ^2.

3.3 Results

3.3.1 Supportive results

We find the participation rate of insider trading is very low (Table 3.1). But we find no persistence in the low participation rate across individuals or firms, e.g., trading intensity converge very fast after year 0 (Figure 3.1). Generally, we cannot see some types of insiders or firms more active in insider trading activities. In other words, insiders in all firms seem trying to time the market. However, there are some firm characteristics which have strong impact on the participation rate of insider trading. Here, managers' and independent directors' participation rate is calculated as the number of managers/IDs who trade/buy/sell during this year divided by the total number of managers/IDs in sample for this firm in this year. In most cases, the variables would have opposite effects on buying and selling decisions, and the total trading decision is mostly driven by selling decision.

Based on an Insider-firm-year trading decision sample, we find that independent directors seem to always buy more than any groups of other firm insiders (other directors, inside directors, affiliated directors, non-CEO management team, CFO), the only exception is CEO, who buys more than IDs. Comparing the results for various insiders with different levels of access to nonpublic information could be of interest. In early studies, CEOs are among the most informed insiders and they earn higher abnormal returns on their trades than other insiders (Seyhun (1986); Lin and Howe (1990)). However, Fidrmuc, Goergen and Renneboog (2006) find that the market's positive reaction to the trades made by CEOs is lower than it is for other directors using data from UK firms. Wang, Shin and Francis (2012) provide strong evidence that CFOs earn significantly greater returns from their purchases of company shares than CEOs. They argue that trades made by CFOs reveal more information about future stock returns.

One concern about this argument is that it might because firms require the managers and directors to hold a specific amount of their shares, and IDs' granted shares are not enough to satisfy this requirement (compared to managers who might receive more stock compensation). Therefore, they have to purchase the shares from the market. We also have evidence that IDs purchase less as their tenure increase which could because they

already accumulated enough shares. This type of holding requirement indeed exists, but is voluntary and usually in the form of requiring managers or directors to hold multiple times (two or three times) of their annually compensation. The new-comers generally will get a period of time (two to three years) as buffering in order to comply. Therefore, it is unlikely that they'll have to make the open market purchase. Moreover, it would be hard to explain why IDs purchase less than CEO, and CEO purchase more than other managers if it is simply due to the holding requirement.

Besides, we have further evidences showing that decisions on purchase or not is really related to information possessed. For example, decision of purchase or not has a negative correlation with individuals' absence in board meeting and their busyness as holding other outside directorship. There is little research exists on other personal characteristics of executives associated with inside trading, or on how these personal attributes temper the relation between inside trading and firms' information and control environments. For example, Bhattacharya & Marshall (2012) shows that richer and better paid top managers are more likely to be indicted for illegal insider trading and Davidson, Dey & Smith (2016) find that profitability of both purchases and sales are higher for executives who have a record of legal infractions.

3.3.2 Main results

Former literature use an insider's trading profitability to assess the information he or she possesses. They also use the trading profitability gap to measure the relative information-advantage of two different groups of firm insiders. But these all have one pre-condition: insiders have traded.

One realistic assumption is: insiders will only trade when they have valuable information. If this is the case, we would expect a positive selection bias (H1). On the other hand, there is also evidence that less frequent traders are usually more profitable. For example, Cziraki & Gider (2017) find that insiders generating larger abnormal returns are also the ones who trade infrequently, and in relatively modest amounts. Jagolinzer (2009) also find that infrequent traders are more likely to be those strategically profit from Rule 10b5-1. In this sense, we would expect a negative selection bias (H2). Empirically, we find the

unobservable term of the first-stage selection is negatively correlated with the unobservable term of the second-stage trading profitability, which is consistent with Hypothesis 2. The presence of negative selection bias is very significant across all different subsamples of time periods, firm characteristics or individual positions.

We also estimate the predicted profitability after correcting for selection bias, which is the potential outcome address the profitability insiders would potentially earn irrespective of their actual decision. Insiders could have earned much higher trading profitability than they really did. Indeed, we have made very unrealistic assumption that insiders can trade whenever they want to. This is not true in the real world because insiders face explicit and implicit trading limits. Ideally, insiders should not trade whenever they are aware of any private information. There are explicit rules upon insider trading. For example, there should be no matched purchase and sell trades within a six-month period (Section 16(b)) and no directly or indirectly purchase, sell or otherwise acquire or transfer any equity security of the issuer during the pension plan blackout period (Section 306(a) of SOX). There is corporate self-regulation associated with insider trading, which impose restricted trade windows. There are also some implicit rules restricting insider trading. Threats of SEC scrutiny, litigation and adverse publicity restrain insiders profiting from foreknowledge of corporate disclosures. Insiders usually trade well in advance of (three to nine quarters ahead), as opposed to immediately prior to, major corporate disclosures (Seyhun and Bradley (1997); Ke, Huddart and Petroni (2003)). Huddart, Ke & Shi (2007) also show that insiders avoid profitable trades before quarterly earnings are announced and sell (buy) after good (bad) news earnings announcements.

However, our finding about the potential insider trading profitability shows that regulations, governance and internal policies upon insider trading activities are important and necessary. Cziraki & Gider (2017) show that the dollar profits of insider trading are economically insignificant, but this might not be true if insiders haven't encountered current restrictions on insider trading. In contradictory, we provide evidence that insiders could have earned substantial abnormal returns from trading in their own companies' shares if not well regulated.

In Ravina and Sapienza (RFS 2010), they find that independent director purchase is

significantly less profitable than purchase imitated by executives, although the difference is small. As complement, we find that independent directors are more likely to engage in insider purchase compared to managers and the trading profitability gap between them has increased further after correcting for selection bias.

It is argued that greater equity ownership not only increases the ability of insiders to influence firm decisions, but also provides them with more flexibility to trade (Denis, Denis and Sarin (1997), Eckbo and Thorburn (2003)). To the extent that this happens, we expect that the informative content of insider trading increases with higher equity ownership. In the OLS regression, we find similar results with Fidrmuc, Goergen and Renneboog (2006) that the impact of equity ownership is not very significant. In our Heckman correction model, we find that higher equity ownership indeed increase insider purchases. More interestingly, the effect of equity ownership on purchase profitability now becomes negative and very significant.

In the first-stage, we use three variables that serve to satisfy the exclusion restriction: return volatility, recent trade, and prior return. We could see that insiders trade more during periods with greater information asymmetry (higher return volatility), in a cluster manner (recent trade), and exhibit contrarian behavior.

Market-maker cannot distinguish the informed traders from the uninformed traders, so he would lower his bid (purchase) price and raise his ask (sale) price in order to offset his losses to informed traders by his gains from the uninformed traders. In this sense, Seyhun (1986) predict a positive relation between the bid-ask spread and the informed traders' abnormal profits. Since there is a negative monotonic relation between firm size and the bid-ask spread (Schultz (1983); Stoll & Whaley (1983)), there would be a negative relation between the firm size and insider trading profitability. On the other hand, insiders in larger firms face much greater scrutiny of investors, and their access to valuable information is less compared to insiders in smaller firms. These also predict inverse relation between firm size and the profitability of insider trading (Jeng, Metrick and Zeckhauser (1999)). In our Heckman model, we find that larger firm size reduce insiders' participate in insider purchase but increase the purchase profitability. When we separate insiders into independent directors and managers, we find firm size have opposite impact on their

purchase decision: it in contradictory increase IDs' participate in insider purchase, which makes IDs more like outsiders rather than insiders.

Book-to-market ratio is a proxy for the firm's growth opportunities, and is generally taken as a predictor of future stock returns (Fama and French (1995)). As expected, we also find that the book-to-market ratio exerts a positive impact on returns from insider trading.

Kyle (1985) demonstrates the positive relation between insiders' profits and insiders' informational advantage in his analytical model. Consistent with this line of reasoning, Aboody and Lev (2000) find that insider trading profit is higher in firms with greater information asymmetry, captured by greater research and development (R&D) expenditure. Frankel and Li (2004) find that analyst coverage is negatively associated with the frequency of insider trading.

Bricker & Markarian (2015) find that there is a positive relationship between institutional ownership and the profitability of insider purchases, and higher institutional ownership is associated with more opportunistic purchases. This is because institutional investors allow insider trading acts as an incentivizing mechanism and reward managers by accepting profitable purchasing before price run-ups. However, we find a negative relation between institutional ownership and the profitability of insider purchases after correcting for selection bias and we also find higher institutional ownership reduce insider purchases. This could be because institutional investors reduce the information asymmetry between insiders and outsiders, or they promote good corporate governance.

The insider is defined as "routine trader" if he or she has ever traded (open market purchase or sales) in the same month of three consecutive years (this is an individual-specified variable). Routine month is the month with this consecutive pattern. For example, if John has sold or bought the shares of his own firm (not necessarily to be the same firm) on May in 1998, 1999 and 2000, as well as on October in 2006, 2007 and 2008. John would be considered as routine trader. May and October would be considered as routine month for John. About 9% of the insiders are classified as "Routine trader", and they take up over 25% of all transactions. 64% of the routine traders have only one routine month. Over 90% of the routine traders have less than 4 routine months. In OLS, we don't find sig-

nificant evidence showing that routine trader or trades executed in routine month are less profitable. However, after correcting for selection bias, the effect of routine trade become significant and is associated with the expected sign. Table 3.6 and table 3.7 implement the Heckman correction for managers and independent directors respectively. We can see that the presence of negative selection bias is significant for both groups.

3.3.3 Sub-periods results: the Sarbanes-Oxley Act and the Financial Crisis

Using a middle period (after SOX till crisis) as the benchmark, we find that insiders become less and less likely to do insider purchase. The results are reported in table 3.8. Comparing purchase profitability before and after the SOX, we find similar results of OLS and Heckman: information content of insider purchase increase after the SOX. From OLS, insider purchase profitability reduced during the post-crisis period compared to the middle period. However, the Heckman model shows the opposite results.

The SOX does not specifically address insider trading, but it has implications for firm insiders who trade around corporate events. It increases criminal penalties for defrauding and it requires insiders to report their trades within two day rather than 10 days. Thus, insiders are possibly subject to higher penalty and scrutiny for informed trading, which can potentially restrain informed insider trading activities. Brochet (2010) find that abnormal returns and trading volumes around filings of insider stock purchases are significantly greater after the SOX than before. The evidence suggests that the prompt public disclosures about insider transactions mandated by the new rule are relevant to the pricing of securities. The crisis period is of special importance as the degree of the information asymmetry between insiders and outsiders is likely to be more severe, which possibly makes the insider trading more relevant and valuable. On the other hand, it is possible that outside investors may be more suspicious of the insiders' motives when they trade during the crisis period, which is generally characterized by lower stock prices and higher pressure on the executive directors to perform. It is also likely that the trades of the executive directors during abnormal times are more contrarian rather than initiated by superior information.

Table 3.9 summarizes the presence of selection bias across all insiders, managers and

independent directors during whole sample, pre-SOX, post-SOX and post-crisis periods. As we can see, presence of negative selection bias in insider purchase is very significant and exists across different sub-samples of time periods, firm characteristics, and insider positions. However, it seems to be less so during the pre-SOX period compared to post-SOX period and for managers compared to independent directors.

To distinguish frequent and infrequent traders, we restrict our sample to managers and independent directors who trade at least once (we lost 2/3 observations). Among them, the mean of number of buy is 9.91 for managers and 8.16 for IDs. They are separated based on number of buy divided by total number of years in sample, for managers and IDs respectively. Then, frequent managers and frequent IDs are combined together as frequent trader sample, and infrequent managers and IDs as infrequent trader sample. The difference between managers and IDs in selection stage becomes insignificant. For frequent traders, the profitability gap between managers and IDs is still significant in the OLS, but almost disappear in Heckman model. For infrequent traders, the estimated gaps are very similar using OLS and Heckman. Overall, infrequent traders are associated with higher predicted return. This is also true for IDs, but predicted return for frequent and infrequent managers is very similar and sometimes is even higher for frequent managers.

3.3.4 Subsample tests: Information, Governance and Internal Policy

In the first set of subsample tests, we use analyst coverage to proxy for firms' information environment. Analyst coverage is measured as the number of analyst following the firm during each year. The average analyst coverage of the firm is compared to the full sample median. If it is higher than the sample median, firm is considered to be with "high coverage", otherwise it is with "low coverage".

For all insiders, we find that "low coverage" sample is on average associated with higher predicted trading profitability no matter using OLS or Heckman. But if we separate managers and IDs into two different sub-groups, we find that OLS and Heckman model predict contradictory results. For managers, predicted trading profitability is higher in "low coverage" sample using OLS, but lower if using Heckman. Similarly, predicted trading profitability is also higher in "low coverage" sample using OLS, but lower if using

Heckman for independent directors. Independent directors are more likely to do insider purchase in the "high coverage" sample, but not in the "low coverage" sample. The trading profitability gap between IDs and managers significantly increase after correcting selection bias using Heckman model for the "high coverage" sample. However, the information gap becomes no longer significant in Heckman model for the "low coverage" sample. The gap is still significant but with smaller magnitude using OLS estimation for "low coverage" sample compared to "high coverage" sample.

We use a high coverage dummy to indicate the sample separation and put it in the full sample regression. The results confirm the subsample tests. The difference in trading profitability gap between firms in high or low coverage sample is further increased in Heckman model. We would get similar results as above when we separate firms into large/small firm size samples.

In the second set of subsample tests, we use CEO-Chairman duality as a proxy for corporate governance. For all insiders, we find that predicted trading profitability is higher in "CEO is not Chairman" sample no matter using OLS or Heckman. If we restricted to independent directors sample, it is also true that "CEO is not Chairman" sample is associated with higher predicted trading profitability, using both OLS and Heckman. But for managers, the difference between the two subsamples is smaller and sometimes the predicted trading profitability is even higher in the "CEO is Chairman" sample. The trading profitability gap seems to decrease and even disappear in the "CEO is not Chairman" sample if we use OLS estimation. This is no longer true in Heckman. Although the magnitude of the gap indeed slightly decrease, it is still very significant after correcting for selection bias.

Again, we use a CEO Chairman dummy to indicate the sample separation and put it in the full sample regression, but we do not seem to find any significant effect neither in OLS nor in Heckman. We sometimes find the results associated with the 30 days horizon is contradictory. This is probably because we need to construct a reasonable time window for the diffuse of non-public information into the market.

More and more firms start to implement internal trading policy to restrain insiders' problematic trading activities, specifying a blackout period when insiders are not allowed

to trade. We have hand collect data about firms' adoption of internal trading policy. In the IRRC sample (S&P 1500), we find 594 firms have explicitly disclosed their adoption of internal trading policy till June 2016. Since ITP is a good signal for internal governance, there is no reason to believe that firm would not want to disclose it. Therefore, we assume the rest of the firms don't have ITP. The ITP firms take up about 30.35% of the total observations and 25.24% of all the actual insider purchase. We find that although ITP doesn't seem to significantly reduce the selection of insider purchase, it indeed reduce the insider purchase profitability. The results are much stronger after we correct for selection bias using Heckman model. The effect of ITP is not significant in most cases using OLS.

According to Jagolinzer, Larcker & Taylor (2011), the average restricted trading period is a 48-days window beginning with 46 days prior to earnings announcement and ending one-day after announcement following. We construct this hypothetical blackout period for all of our sample firms and see how it would affect insider purchase. In the OLS, insider purchase during the blackout period is slightly more profitable but not very significant. From the Heckman model, we can find that there is less insider purchase during the black period. However, the insider purchase profitability associated with blackout period becomes significantly higher, and the magnitude is very large. Insider trading during the blackout period is either pre-planned or getting approved by the general counsel.

Our sample separation itself has something related to insider's trading decision. For example, the uncensored rate is 0.0338% for "high coverage" sample and is 0.061% for "low coverage" sample. Interestingly, we find that independent directors seem to be less sensitive to the information environment and slightly more sensitive to the rules of the firms, as shown in table 3.10. For all these regressions related to buying decision, the coefficients of interests are multiplied by 10000, so that we could see the difference in the magnitudes.

3.4 Sales transactions: Placebo test

Now we take the insider sales transaction as placebo test. Since sales transaction is less likely to be information driven compared to purchase transaction, our prediction is that the selection bias might be less significant. Some of the insider sales are partially

or completely related to the exercise of option grants. So I include a dummy variable to indicate whether each sales transaction is related to option exercise. This dummy also equals to one even if the transaction is only partially due to the option exercise. Besides, I also delete all sales transaction related to option exercise and keep the rest of them. Option-related sales (partially or completely) take up about 48.7% of all sales transaction in our sample. On one hand, insiders can still pick time to sell the exercised option. On the other hand, the insider sales not related to option exercise can also merely due to liquidity need and not necessarily to be information-driven.

Table 3.17 summarizes the presence of selection bias in sales transaction across all insiders, managers and independent directors during whole sample, pre-SOX, post-SOX and post-crisis periods. Overall, there seems to be no significant selection bias for insider sales, and neither for managers or independent directors. However, there is still negative selection bias during the post-SOX period for insider sales. And what drives the result of the overall sample is the significant positive selection bias during pre-SOX period, especially for manager sales. The significant positive selection bias during pre-SOX period for insider sales is seemingly troublesome due to the rho very close to 1 which implies failure of Heckman selection using maximum likelihood estimation. But the two-step Heckman actually produces very similar results.

3.5 Conclusion

When talking about insider trading, people would always think it as a bad thing, which is not true. It is a simple activity when corporate insidersofficers, directors, and employeesbuy and sell stock in their own companies. To investigate individual's trading behavior, literature mostly focuses on actual transactions. For example, they use an insider's trading profitability to assess the information he or she possesses, or use the trading profitability gap to measure the relative information-advantage of two different groups of firm insiders. All these works have one precondition that insiders have actually traded. In contrast to the existing studies, we try to understand those insiders' participation in trading their firms' shares as the first step.

Before dealing with the selection problem, we first illustrate some general facts about

the insiders trading decision. Firm fixed effect and Insider fixed effect explain a great portion of variation in insider trading decision. However, there is no persistence in the participation rate for either individuals or firms. That's to say, there is no firm or individual that is associated with on-going low or high participation rate. In addition, we find that trading decision is indeed information-related. For example, insiders in firms with higher information asymmetry, such as in complex or opaque firms, tend to more likely to trade. Similar, insiders who have more access to valuable information of the firm, such as audit committee membership or those attend more board meeting, tend to trade more. On contrary, busy directors trade less. Based on all these results, it can be inferred that insiders trade when they have greater information advantage.

We find the participation rate of insider trading activity is very low. Even from a yearly perspective, less than half of the insiders actually trade. CEO is the one that most likely to do insider purchase, then it is independent directors. If we exclude all the sales transaction related to option exercise, participating in insider sales would drop a lot. In this sense, studies on actual transactions are restricted to a very small subsample. This may or may not cause problems. Selection problem does not exist if every variable influencing selection is controlled in the outcome equation, or the unmeasured factors influencing the selection equation are uncorrelated with the unmeasured factors influencing the outcome equation. Astoundingly, we find a negative selection bias. In other words, the unobservable factor in the selection equation is positively related to the choice of trading but is negatively related to trading profitability. Our results focus on insider purchase, which is more likely to be information driven. We construct a decision sample for each firm-individual on each trading day with non-missing price. We use three variables that serve to satisfy the exclusion restriction: return volatility, recent trade prior return. These exclusionary variables we used provide us very consistent results. The negative selection bias in insider purchase is very significant and exists across different sub-samples of time periods, firm characteristics, and insider positions. It is somehow less significant during the pre-SOX period and for managers.

We document a significant negative effect of insider trading decisions on their abnormal trading profitability. The observed trading profitability is biased downward compared

to estimated potential profitability. By constructing based on all plausible trading days, we have made unrealistic assumption that insiders can trade whenever they want to. This is not true in the real world because insiders face explicit and implicit trading limits. To verify this, we try to control for firm's adoption of internal trading policy and blackout periods. As expected, it is negatively related to the choice of trading and is positively related to trading profitability. If this day is within the blackout period, even if it is just a hypothetical blackout period, the chance of insider purchase is largely reduced. In the OLS regression, blackout period don't seem to have significant effect on purchase profitability. However, after correcting for selection bias, insider purchase during blackout period is substantially more profitable. Anyway, even after including blackout period and internal trading policy dummy, the presence of negative selection bias still significant.

Ideally, insiders should not trade whenever they are aware of any private information. Although old literature document insider trading during problematic periods such as restatement announcements or fraudulent financial reporting, recent literature, especially those after the SOX, shows that insiders actually trade in a pattern that minimizes the possibility of insider trading allegations or violating internal corporate insider trading policies. The SEC acknowledges this belief as a motivation for requesting more timely and transparent disclosure of insider trading: "directors' and executive officers' transactions in company equity securities provide useful information as to management's views of the performance or prospects of the company..." This might not be true given that insiders seem to trade too little.

Even if insiders indeed possess substantial information about their firms, it is seldom reflected in their trading. But if they do so, it has to be followed by substantial gains. Since we find that the results from Heckman and OLS could sometimes be very different, it would not be appropriate to make any conclusion about insider trading activities without considering their trading decision.

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A Appendix

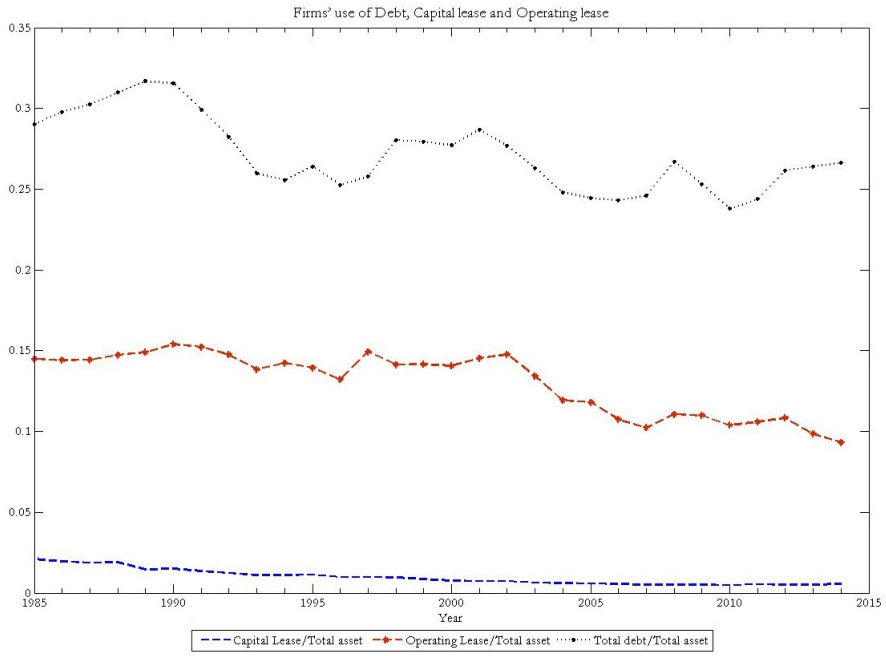

Figure A.1: Firms' use of debt, capital lease and operating lease

This figure compares firms' use of debt, capital lease and operating lease. Debt refers to the total debt including both long-term and short-term debt. Capital lease is the capitalized lease obligation directly recognized in firms' financial reports. Operating lease is the capitalized operating lease calculated based on equation (1). All three items are scaled by total assets. The use of debt already contains the use of capital lease but do not contain the use of operating lease.

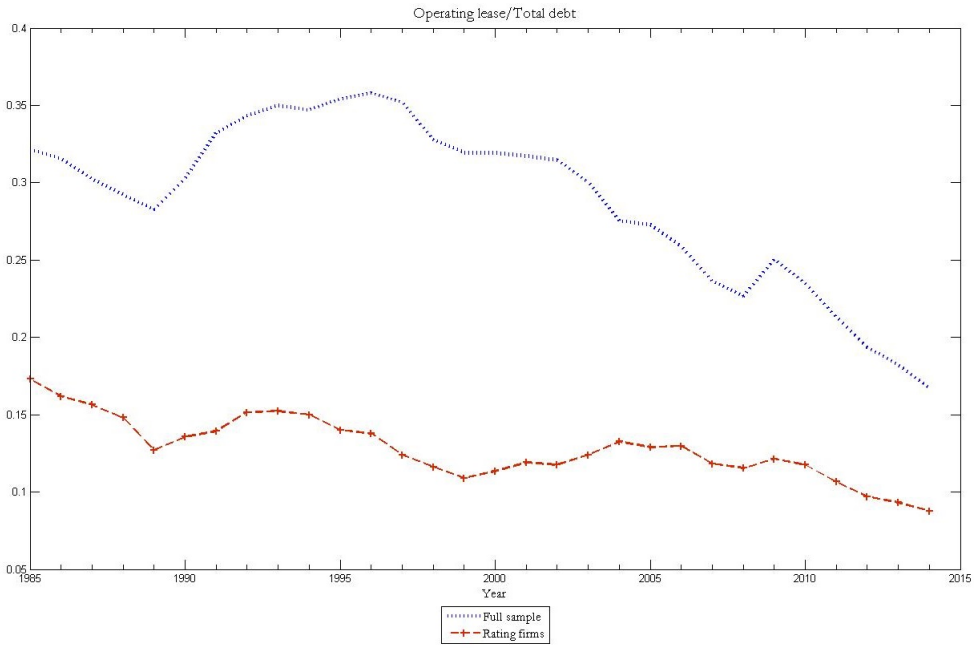

Figure A.2: The use of operating lease relative to total debt

This figure illustrates the use of operating lease as a proportion of total debt for the full sample and rating firms respectively.

Table A.1: Rating change transformation matrix

The column titles indicate the firms' credit rating level for the last year and the row titles indicate the firms' credit rating level in the current year. Each number in this matrix represents the total number of firm-year observations with S&P credit rating as indicated by the column title in last year and S&P credit rating as indicated by the row title in the current year. For example, the number "17" in the first column and second row means that during the sample period from 1985 to 2014, there are altogether 17 firm-year observations when firms are just downgraded from "AAA" in last year to "AA+" in the current year.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-
AAA	522	10	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
AA+	17	122	12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AA	11	24	642	31	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0
AA-	4	6	58	648	51	5	2	0	0	0	0	0	0	0	0	0	0	0	0
A+	3	0	25	80	1135	85	5	5	1	0	0	0	0	0	0	0	0	0	0
A	1	1	13	26	125	1759	130	16	4	0	0	0	0	0	0	0	0	0	0
A-	1	0	2	5	32	167	1307	156	26	6	2	0	1	1	0	0	0	0	0
BBB+	0	0	8	1	14	66	168	1705	204	23	7	2	1	1	0	1	0	0	0
BBB	0	0	1	0	4	23	70	226	2180	239	30	11	4	3	1	1	0	0	0
BBB-	0	0	0	0	1	10	13	54	224	1724	204	55	10	6	0	2	0	0	0
BB+	0	0	1	0	2	7	4	10	57	141	1191	265	60	8	0	0	0	0	0
BB	1	0	0	0	1	4	1	11	23	84	141	1753	349	79	5	0	1	0	0
BB-	1	0	0	0	0	4	0	6	15	27	66	251	2298	382	43	12	5	1	2
B+	0	0	0	0	3	5	2	2	11	11	20	75	286	2870	284	43	12	4	4
B	0	0	0	1	3	0	0	4	2	11	5	18	112	340	1538	154	23	6	2
B-	0	0	0	0	0	0	0	2	2	4	5	9	32	111	201	658	61	20	4
CCC+	0	0	0	0	0	0	0	1	1	2	2	3	13	48	75	81	208	16	6
CCC	0	0	0	0	0	0	0	0	0	0	1	4	7	18	30	33	26	106	8
CCC-	0	0	0	0	0	0	0	0	0	0	1	1	5	8	12	12	13	7	37

Table A.2: Downgrading and upgrading over years

Year	#Firms	#Rating	#Downgrade	Downgrade%	#Upgrade	Upgrade%
1985-1986	5697	930	117	12.58%	43	4.62%
1986-1987	5697	973	112	11.51%	71	7.30%
1987-1988	5562	931	113	12.14%	81	8.70%
1988-1989	5468	912	85	9.32%	97	10.64%
1989-1990	5477	846	118	13.95%	54	6.38%
1990-1991	5611	820	117	14.27%	73	8.90%
1991-1992	6008	861	93	10.80%	99	11.50%
1992-1993	6388	930	78	8.39%	109	11.72%
1993-1994	6750	984	73	7.42%	72	7.32%
1994-1995	7540	1040	89	8.56%	119	11.44%
1995-1996	7803	1149	93	8.09%	95	8.27%
1996-1997	7669	1263	102	8.08%	133	10.53%
1997-1998	7893	1379	139	10.08%	135	9.79%
1998-1999	7794	1437	172	11.97%	76	5.29%
1999-2000	7340	1448	216	14.92%	95	6.56%
2000-2001	6730	1409	271	19.23%	76	5.39%
2001-2002	6352	1395	275	19.71%	73	5.23%
2002-2003	6116	1398	212	15.17%	121	8.66%
2003-2004	5982	1394	156	11.19%	143	10.26%
2004-2005	5855	1328	186	14.01%	142	10.69%
2005-2006	5626	1279	191	14.93%	138	10.79%
2006-2007	5410	1222	166	13.58%	159	13.01%
2007-2008	5194	1183	239	20.20%	130	10.99%
2008-2009	5030	1148	225	19.60%	88	7.67%
2009-2010	4933	1148	91	7.93%	223	19.43%
2010-2011	4892	1155	94	8.14%	186	16.10%
2011-2012	5026	1176	111	9.44%	137	11.65%
2012-2013	5010	1188	87	7.32%	160	13.47%
2013-2014	4654	1212	92	7.59%	174	14.36%

Table A.3: Likelihood of broad rating change

Number of rating is the total number of firm-year observations belongs to each group. Firms are separated into three groups based on their last year credit rating. Number of events represents the total number of broad rating downgrade in panel A and the total number of broad rating upgrade in panel B. %Events is the percentage of broad rating change for minus, plus and neutral groups respectively. It can be considered as the probability of broad rating change conditional on the fact that the firm belongs to the specific group. Expected probability is the unconditional probability of broad rating change which equals to a total number of events divided by total number of observations. Difference equals to the conditional probability minus the unconditional probability.

		Previous year firm group		
Panel A: Broad rating downgrade				
	Total	Minus	Neutral	Plus
#Rating	34183	10395	12633	11155
#Events	1327	1060	217	50
%Events		10.20%	1.72%	0.45%
Expected probability		3.88%	3.88%	3.88%
Difference		6.32%	-2.17%	-3.43%
Panel B: Broad rating upgrade				
	Total	Minus	Neutral	Plus
#Rating	34183	10395	12633	11155
#Events	1941	182	524	1235
%Events		1.75%	4.15%	11.07%
Expected probability		5.68%	5.68%	5.68%
Difference		-3.93%	-1.53%	5.39%

Table A.4: Likelihood of Micro-rating change based on Credit-core method

Number of rating is the total number of firm-year observations belongs to each group. Firms are ranked within each micro rating group based on their predicted credit score during the previous fiscal year. Credit score is estimated following the similar method as Kisgen (2006) based on firms' profitability, leverage and interest coverage. These factors are intensively investigate by the rating agencies when evaluate firm's credit worthiness. The top and bottom 30% firms are considered to closer to the rating change. Number of events represents the total number of rating downgrade in panel A and the total number of rating upgrade in panel B. Here, all Micro-level downgrading and upgrading are considered, e.g. upgrading from AA- to AA or downgrading from BB+ to BB are also included. %Events is the percentage of rating change for Low, Middle and High groups respectively. It can be considered as the probability of broad rating change conditional on the fact that the firm belongs to the specific group. Expected probability is the unconditional probability of broad rating change which equals to a total number of events divided by total number of observations. Difference equals to the conditional probability minus the unconditional probability.

		Previous year firm group		
Panel A: Micro rating downgrade				
	Total	Low	Middle	High
#Rating	34183	10395	12633	11155
#Events	4083	762	3056	265
%Events		7.33%	24.19%	2.38%
Expected probability		11.95%	11.95%	11.95%
Difference		-4.62%	12.25%	-9.57%
Panel B: Micro rating upgrade				
	Total	Minus	Neutral	Plus
#Rating	34183	10395	12633	11155
#Events	3255	160	2343	752
%Events		1.54%	18.55%	6.74%
Expected probability		9.52%	9.52%	9.52%
Difference		-7.98%	9.03%	-2.78%

Table A.5: Daily trading decision OLS

	(1)	(2)	(3)	(4)	(6)	(7)	(8)
Variables	Full-sample	Pre-SOX	Post-SOX till Crisis	Post-Crisis	Full-sample	Exclude Crisis period	Exclude Post-crisis period
Independent director	0.888***	0.466	0.918***	1.081***			
	(0.167)	(0.432)	(0.193)	(0.211)			
Independent director × Pre					0.693	0.636	0.548
					(0.438)	(0.431)	(0.434)
Independent director × Post					-0.761	-0.59	-0.985*
					(0.557)	(0.553)	(0.556)
Manager × Post					-1.712***	-1.723***	-1.849***
					(0.563)	(0.562)	(0.570)
Ownership	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Recent trade	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return volatility	0.024***	0.021***	0.027***	0.026***	0.024***	0.023***	0.023***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Prior return	-0.001***	-0.001***	-0.001***	-0.000***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	43,804,030	10,736,554	16,493,854	16,564,245	43,804,030	38,272,311	27,239,785
R-squared	0.001	0.002	0.001	0.001	0.001	0.001	0.002
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.6: Level of trading profitability before and after SOX

	Full-sample				Exclude Crisis period				Exclude Post-crisis period			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director × Pre	-0.788*	-0.931	-1.347	-3.502**	-0.736*	-0.817	-1.261	-3.476**	-0.853*	-0.813	-1.083	-3.217**
	(0.440)	(0.641)	(0.834)	(1.394)	(0.441)	(0.648)	(0.845)	(1.405)	(0.444)	(0.652)	(0.855)	(1.423)
Independent director × Post	0.716	3.433*	6.817**	7.28	0.881	3.605*	7.016**	8.069*	0.903	3.783*	6.830**	6.813
	(1.254)	(2.057)	(2.725)	(4.564)	(1.269)	(2.096)	(2.791)	(4.651)	(1.282)	(2.071)	(2.760)	(4.654)
Manager × Post	1.583	4.846**	8.188***	9.048**	1.444	4.793**	8.198***	8.921*	1.499	4.904**	8.361***	9.260**
	(1.227)	(2.066)	(2.736)	(4.555)	(1.235)	(2.090)	(2.778)	(4.582)	(1.236)	(2.073)	(2.769)	(4.625)
Ownership	0.135**	0.091	0.141	0.073	0.125**	0.056	0.055	0.017	0.186***	0.232**	0.233*	0.008
	(0.053)	(0.090)	(0.102)	(0.166)	(0.058)	(0.098)	(0.109)	(0.177)	(0.065)	(0.103)	(0.125)	(0.189)
Total transaction size	0.218	0.311	0.283	0.05	0.165	0.22	0.18	-0.035	0.186*	0.29	0.338*	0.134
	(0.146)	(0.218)	(0.260)	(0.442)	(0.120)	(0.191)	(0.212)	(0.422)	(0.108)	(0.209)	(0.174)	(0.292)
Observations	21,751	21,750	21,749	21,739	18,934	18,933	18,932	18,927	16,307	16,307	16,307	16,293
R-squared	0.193	0.233	0.264	0.314	0.208	0.253	0.289	0.339	0.207	0.253	0.29	0.35
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.7: Compare Heckman ML and Heckman two-step

	Heckman (Maximum likelihood)					Heckman (Two-step)				
Variables	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	0.098***	-1.509***	-2.465***	-2.646***	-4.498***	0.098***	-1.369***	-2.149***	-2.386***	-4.408***
	(0.014)	(0.318)	(0.520)	(0.638)	(0.903)	(0.014)	(0.195)	(0.286)	(0.347)	(0.492)
Ownership	0.005***	0.036	0.004	0.049	0.006	0.005***	0.047**	0.025	0.067*	0.013
	(0.001)	(0.033)	(0.054)	(0.064)	(0.092)	(0.001)	(0.020)	(0.029)	(0.035)	(0.049)
Transaction size		0.248	0.336*	0.298	0.046		0.252*	0.341	0.306	0.05
		(0.155)	(0.200)	(0.248)	(0.422)		(0.147)	(0.214)	(0.260)	(0.365)
Recent trade	0.010***					0.010***				
	(0.002)					(0.002)				
Return volatility	5.487***					5.487***				
	(0.349)					(0.349)				
Prior return	-0.454***					-0.454***				
	(0.025)					(0.025)				
athrho		-0.966***	-1.119***	-1.053***	-1.027***					
		(0.109)	(0.123)	(0.110)	(0.095)					
$\chi^2(\rho = 0)$		79.14	83.17	91.09	116.65					
lambda							-8.767***	-14.388***	-17.677***	-28.547***
							(0.510)	(0.746)	(0.906)	(1.291)
Observations	7,761,111	7,761,111	7,761,111	7,761,111	7,761,111	7,761,111	7,761,111	7,761,111	7,761,111	7,761,111
Uncensored Observations	19634	19634	19634	19634	19634	19634	19634	19634	19634	19634
Firm FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.8: Individual OLS and Heckman comparison: Pre-SOX

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.495	-0.249	-0.228	-1.124	0.026	-0.55	-0.271	-0.26	-1.184
	(0.377)	(0.601)	(0.745)	(1.093)	(0.018)	(0.393)	(0.632)	(0.782)	(1.118)
Ownership	0.161**	0.183	0.09	-0.026	0.014***	0.055	-0.002	-0.157	-0.276
	(0.077)	(0.125)	(0.152)	(0.215)	(0.003)	(0.081)	(0.132)	(0.160)	(0.221)
Transaction size	0.339	-0.102	0.614	0.737		0.335	-0.107	0.623	0.705
	(0.568)	(0.801)	(0.631)	(0.485)		(0.508)	(0.720)	(0.531)	(0.479)
Recent trade					0.006***				
					(0.001)				
Return volatility					3.680***				
					(0.257)				
Prior return					-0.422***				
					(0.024)				
lambda						-7.853***	-14.076***	-17.348***	-21.532***
						(1.281)	(2.553)	(2.725)	(3.926)
Observations						10,736,554	10,736,554	10,736,554	10,736,554
Uncensored Observations	9,173	9,173	9,173	9,164		8848	8848	8848	8848
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.9: Individual OLS and Heckman comparison (Post-SOX till 2008, December, 31th)

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.542	-0.976*	-1.413**	-2.932***	0.061***	-1.438***	-2.210***	-2.668***	-5.047***
	(0.362)	(0.529)	(0.627)	(0.931)	(0.014)	(0.455)	(0.673)	(0.852)	(1.096)
Ownership	0.112	0.101	0.182	-0.09	0.017***	-0.258*	-0.375**	-0.279	-0.878***
	(0.095)	(0.140)	(0.165)	(0.211)	(0.005)	(0.132)	(0.181)	(0.235)	(0.285)
Transaction size	0.119*	0.321***	0.172	-0.232		0.053	0.235***	0.096	-0.388***
	(0.065)	(0.104)	(0.140)	(0.185)		(0.043)	(0.075)	(0.105)	(0.120)
Recent trade					0.007***				
					(0.001)				
Return volatility					5.358***				
					(0.243)				
Prior return					-0.393***				
					(0.027)				
lambda						-20.708***	-27.756***	-28.047***	-48.212***
						(2.384)	(4.280)	(7.748)	(5.481)
Observations						16,493,854	16,493,854	16,493,854	16,493,854
Uncensored Observations	6,936	6,936	6,936	6,931		7101	7101	7101	7101
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.10: Individual OLS and Heckman comparison (Post crisis, 2009-2014)

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-1.074**	-1.853***	-0.951	-1.034	0.090***	-2.288***	-3.757***	-3.243***	-3.989***
	(0.418)	(0.647)	(0.734)	(1.143)	(0.019)	(0.564)	(0.892)	(0.966)	(1.492)
Ownership	-0.044	-0.194	-0.123	-0.096	0.031***	-0.621***	-1.132***	-1.226***	-1.414***
	(0.090)	(0.148)	(0.139)	(0.251)	(0.005)	(0.141)	(0.214)	(0.224)	(0.359)
Transaction size	2.087**	3.451***	2.615*	2.807		2.317**	3.149*	3.402**	3.498
	(0.855)	(1.302)	(1.423)	(2.538)		(1.088)	(1.666)	(1.510)	(3.041)
Recent trade					0.011***				
					(0.002)				
Return volatility					8.721***				
					(0.289)				
Prior return					-0.336***				
					(0.033)				
lambda						-18.898***	-31.093***	-33.831***	-41.981***
						(1.646)	(2.182)	(2.627)	(4.704)
Observations						16,564,245	16,564,245	16,564,245	16,564,245
Uncensored Observations	5,298	5,297	5,296	5,298		5422	5422	5422	5422
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.1: Summary statistics

This table illustrates the basic summary statistics for different groups of firms. Panel A compares the subsample including the rating firms only to the full sample of all firms in the Compustat universe. Panel B compares the firms within the rating sample. Minus group consists of all firms having a "-" in their S&P ratings. Plus group consists of all firms having a "+" in their S&P ratings. Neutral group consists of firms in the middle tier which contain neither "-" nor "+". Sample period is from 1985 to 2014. Size is the natural log value of total book assets. Collateral is the net property, plant and equipment scaled by total assets. Leverage is the market leverage which equals to the total debt divided by the sum of total debt and market value of equity. Profitability is the EBITDA scaled by total sales. Tax rate is the effective tax rate which equals to the total income taxes divided by pretax income. MB ratio is the market-to-book ratio.

Panel A: Full sample and rating firms

	#Obs		Size	Collateral	Leverage	Profitability	Tax rate	MB ratio
Full sample	180956	Mean	4.789	0.281	0.232	-0.694	0.184	2.105
		Median	4.661	0.208	0.147	0.0875	0.227	1.466
Rating firms	34183	Mean	7.753	0.363	0.35	0.141	0.26	1.6
		Median	7.667	0.314	0.301	0.143	0.33	1.358

Panel B: Minus, Neutral and Plus group

	#Obs		Size	Collateral	Leverage	Profitability	Tax rate	MB ratio
Minus	10395	Mean	7.751	0.354	0.355	0.125	0.253	1.56
		Median	7.672	0.302	0.312	0.138	0.327	1.327
Neutral	12633	Mean	7.923	0.374	0.336	0.152	0.269	1.614
		Median	7.829	0.325	0.281	0.148	0.334	1.385
Plus	11155	Mean	7.562	0.359	0.363	0.145	0.256	1.563
		Median	7.464	0.313	0.314	0.144	0.329	1.362

Table 1.2: The use of debt, capital lease and operating lease

This table compares firms' use of debt, capital lease and operating lease. Panel A includes all firms in the Compustat universe while panel B contains the rating firms only. The first two columns show the number and the percentage of firm-year observations reporting the positive use of debt, capital lease or operating lease respectively. Debt refers to the total debt including both long-term and short-term debt. Capital lease is the capitalized lease obligation directly recognized in firms' financial reports. Operating lease is the capitalized operating lease calculated based on equation (1). All three items are scaled by total assets. The use of debt already contains the use of capital lease but do not contain the use of operating lease.

Panel A: Full sample							
	#Obs	%	Mean	Median	Sd	Min	Max
Capital lease	60279	33.31%	0.00843	0	0.0258	0	0.173
Operating lease	152404	84.22%	0.125	0.0635	0.171	0.00225	0.992
Debt	153966	99.60%	0.271	0.207	0.291	0	1.593
Total	180956						
Panel B: Rating firms							
	#Obs	%	Mean	Median	Sd	Min	Max
Capital lease	14146	41.38%	0.00771	0	0.0221	0	0.173
Operating lease	30497	89.22%	0.084	0.0396	0.13	0.00225	0.992
Debt	33891	99.15%	0.392	0.34	0.246	0.00659	1.379
Total	34183						

Table 1.3: The effect of rating change concern on the use of operating lease relative to debt

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Size is the natural log value of total book assets. Collateral is the net property, plant and equipment scaled by total assets. Leverage is the market leverage which equals to the total debt divided by the sum of total debt and market value of equity. No dividend is a dummy variable equals to one if the firm does not pay dividend this year. Tax rate is the effective tax rate which equals to the total income taxes divided by pretax income. MB ratio is the market-to-book ratio. POM is a dummy variable equals to one if there is a "+" or "-" in the S&P rating of the firm. Minus is a dummy variable equals to one if there is a "-" in the S&P rating of the firm. Plus is a dummy variable equals to one if there is a "+" in the S&P rating of the firm. The table reports the regression coefficient and the standard error clustered by firm level.

Variables	(1)	(2)	(3)	(4)
Size	-0.0037***	-0.0035***	-0.0037***	-0.0035***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0209***	-0.0212***	-0.0209***	-0.0211***
	(0.0039)	(0.0040)	(0.0039)	(0.0040)
Leverage	0.0431***	0.0411***	0.0432***	0.0412***
	(0.0040)	(0.0041)	(0.0040)	(0.0041)
No dividend	0.0067***	0.0060***	0.0067***	0.0059***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Tax rate	0.0045***	0.0040**	0.0045***	0.0040**
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
MB ratio	0.0022***	0.0023***	0.0022***	0.0023***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
POM	0.0023**	0.0023**		
	(0.0011)	(0.0011)		
Minus			0.0030**	0.0028**
			(0.0013)	(0.0013)
Plus			0.0016	0.0017
			(0.0014)	(0.0013)
Constant	0.0163***	0.0258***	0.0161***	0.0256***
	(0.0059)	(0.0073)	(0.0059)	(0.0073)
Observations	13,148	13,148	13,148	13,148
R-squared	0.0541	0.0701	0.0542	0.0702
Industry FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes

Table 1.4: Stronger rating change concern

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Control variables include Size, Collateral, Leverage, No dividend dummy, Tax rate and MB ratio. Their definitions are the same as in table 3. BBB- is a dummy variable equals to one if the firm's credit rating is BBB- last year. BB+ is a dummy variable equals to one if the firm's credit rating is BB+ last year. Downgrading is a dummy variable equals to one if the firm was just downgraded last year. Upgrading is a dummy variable equals to one if the firm was just upgraded last year. Fallen angel is a dummy variable equals to one if the firm was just downgraded from an investment bond to a speculative bond. Rising star is a dummy variable equals to one if the firm was just upgraded from a speculative bond to an investment bond. The table reports the regression coefficient and the standard error clustered by firm level.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0037***	-0.0036***	-0.0038***	-0.0036***	-0.0038***	-0.0036***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0212***	-0.0216***	-0.0211***	-0.0213***	-0.0211***	-0.0213***
	(0.0039)	(0.0040)	(0.0039)	(0.0040)	(0.0039)	(0.0040)
Leverage	0.0438***	0.0418***	0.0409***	0.0398***	0.0426***	0.0409***
	(0.0040)	(0.0041)	(0.0040)	(0.0041)	(0.0040)	(0.0040)
No dividend	0.0067***	0.0060***	0.0069***	0.0061***	0.0069***	0.0061***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Tax rate	0.0043**	0.0038**	0.0047***	0.0041**	0.0045***	0.0040**
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
MB ratio	0.0024***	0.0025***	0.0023***	0.0023***	0.0022***	0.0023***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
BBB-	0.0035*	0.0035*				
	(0.0019)	(0.0019)				
BB+	0.0065**	0.0065**				
	(0.0027)	(0.0026)				
Downgrading			0.0069***	0.0051***		
			(0.0017)	(0.0017)		
Upgrading			0.0001	0.0015		
			(0.0017)	(0.0017)		
Fallen angel					0.0123***	0.0094**
					(0.0045)	(0.0045)
Rising star					-0.003	-0.0015
					(0.0042)	(0.0041)
Constant	0.0173***	0.0268***	0.0185***	0.0275***	0.0183***	0.0277***
	(0.0060)	(0.0073)	(0.0059)	(0.0073)	(0.0060)	(0.0073)
Observations	13,148	13,148	13,148	13,148	13,148	13,148
R-squared	0.0548	0.0708	0.0551	0.0705	0.0545	0.0702
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes

Table 1.5: Revisit Kisgen (2006)

Dependent variable is the use of debt relative to equity. Column (1) replicates Kisgen (2006) using my own sample period and get very similar results. Column (2) is the same as column (1), except that now firms' use of operating lease is included as part of the total debt. Since firm-year observations with missing lease data would be excluded mechanically from the analysis in (2), I replicate Kisgen (2006) again using the sample without those observations with missing lease data in column (3). By comparing column (2) and (3), we can see that the replacement between debt and equity for firms approaching to potential rating change become much less significant after taking into account the use of operating lease.

	(1)		(2)		(3)	
	Full sample		Sample with non-missing lease		Sample with non-missing lease	
Variables	Replicate Kisgen		Include operating lease		Replicate Kisgen	
POM	-0.0029**		-0.0021		-0.0031**	
	(0.0012)		(0.0014)		(0.0014)	
Minus		-0.0039***		-0.0028*		-0.0042***
		(0.0014)		(0.0017)		(0.0016)
Plus		-0.0018		-0.0013		-0.002
		(0.0014)		(0.0017)		(0.0017)
Ln(sales)	0.0111***	0.0112***	0.0105***	0.0105***	0.0114***	0.0114***
	(0.0005)	(0.0005)	(0.0006)	(0.0006)	(0.0005)	(0.0005)
EBITDA/A	0.1156***	0.1151***	0.1447***	0.1443***	0.1181***	0.1174***
	(0.0117)	(0.0117)	(0.0150)	(0.0150)	(0.0141)	(0.0142)
D/(D+E)	-0.0057*	-0.0059*	-0.0065*	-0.0066*	-0.0053	-0.0054
	(0.0032)	(0.0032)	(0.0038)	(0.0038)	(0.0036)	(0.0036)
Constant	-0.1063***	-0.1063***	-0.0985***	-0.0985***	-0.1068***	-0.1067***
	(0.0048)	(0.0048)	(0.0057)	(0.0057)	(0.0056)	(0.0056)
Observations	22,333	22,333	16,284	16,284	16,284	16,284
R-squared	0.0668	0.0669	0.0641	0.0641	0.0696	0.0697
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.6: CreditWatch and rating Outlooks

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Control variables include Size, Collateral, Leverage, No dividend dummy, Tax rate and MB ratio. Their definitions are the same as in table 3. CreditWatch is a dummy variable equals to one if the firm's long-term issuer rating appeared on the CreditWatch last year. Negative CreditWatch is a dummy variable equals to one if the CreditWatch is negative. Positive CreditWatch is a dummy variable equals to one if the CreditWatch is positive. Outlook is a dummy variable equals to one if the firm's long-term issuer rating was assigned a rating outlook last year. Negative Outlook is a dummy variable equals to one if the Outlook is negative. Positive Outlook is a dummy variable equals to one if the Outlook is positive. The table reports the regression coefficient and the standard error clustered by firm level.

Variables	(1)	(2)	(3)	(4)
Size	-0.0037***	-0.0036***	-0.0036***	-0.0036***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0212***	-0.0211***	-0.0213***	-0.0213***
	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Leverage	0.0406***	0.0409***	0.0408***	0.0408***
	(0.0041)	(0.0041)	(0.0041)	(0.0041)
No dividend	0.0061***	0.0060***	0.0061***	0.0061***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Tax rate	0.0041**	0.0041**	0.0041**	0.0041**
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
MB ratio	0.0024***	0.0024***	0.0024***	0.0024***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
CreditWatch	0.0049***			
	(0.0016)			
Negative CreditWatch		0.0037*		
		(0.0020)		
Positive CreditWatch		0.0079***		
		(0.0030)		
Outlook			0.0054**	
			(0.0024)	
Negative Outlook				0.0053**
				(0.0025)
Positive Outlook				0.0061
				(0.0057)
Constant	0.0277***	0.0276***	0.0280***	0.0280***
	(0.0073)	(0.0073)	(0.0074)	(0.0074)
Observations	13,148	13,148	13,148	13,148
R-squared	0.0706	0.0707	0.0702	0.0702
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 1.7: Capitalized operating lease including the thereafter item

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. In this table we further include the thereafter item in calculating the capitalized operating lease following the formula: $\text{Capitalized operating lease} = \text{Rental expense} + \sum_{t=1}^{5} \frac{\text{MLP}_t}{(1+d)^t} + \sum_{t=6}^{6+\text{Addyrs}} \frac{\text{EMLP}_t}{(1+d)^t}$. Here, Addyrs =Thereafter Portion of Leases (item 389)/ MLP_5 and EMLP_t = Thereafter Portion of Leases (item 389)/ Addyrs. The item "thereafter" is required to be disclosed only after the year 1995. So in this table, our sample period is from 1996 to 2014. Control variables include Size, Collateral, Leverage, No dividend dummy, Tax rate and MB ratio. Their definitions are the same as in table 3. POM dummy, CreditWatch dummy and Outlook dummy are used to proxy for credit rating change concern. Minus dummy, Negative CreditWatch dummy and Negative Outlook dummy are used to proxy for negative rating change concern. Plus dummy, Positive CreditWatch dummy and Positive Outlook dummy are used to proxy for positive rating concern. The table reports the regression coefficient and the standard error clustered by firm level.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0046***	-0.0046***	-0.0049***	-0.0048***	-0.0048***	-0.0048***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Collateral	-0.0234***	-0.0233***	-0.0232***	-0.0229***	-0.0233***	-0.0233***
	(0.0050)	(0.0050)	(0.0051)	(0.0051)	(0.0051)	(0.0051)
Leverage	0.0324***	0.0325***	0.0321***	0.0327***	0.0326***	0.0328***
	(0.0049)	(0.0049)	(0.0051)	(0.0051)	(0.0051)	(0.0051)
No dividend	0.0045**	0.0045**	0.0048**	0.0047**	0.0048**	0.0047**
	(0.0018)	(0.0018)	(0.0019)	(0.0019)	(0.0019)	(0.0019)
Tax rate	0.0034*	0.0033*	0.0037*	0.0036*	0.0037*	0.0037*
	(0.0019)	(0.0019)	(0.0020)	(0.0020)	(0.0020)	(0.0020)
MB ratio	0.0026***	0.0026***	0.0029***	0.0028***	0.0028***	0.0028***
	(0.0009)	(0.0009)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Rating concern	0.0030**		0.0068***		0.0066**	
	(0.0013)		(0.0020)		(0.0028)	
Negative concern		0.0040***		0.0048**		0.0052*
		(0.0015)		(0.0024)		(0.0029)
Positive concern		0.0019		0.0117***		0.0148*
		(0.0017)		(0.0036)		(0.0078)
Constant	-0.0785***	-0.0798***	-0.0740***	-0.0744***	-0.0742***	-0.0743***
	(0.0091)	(0.0091)	(0.0093)	(0.0093)	(0.0094)	(0.0094)
Observations	8,576	8,576	8,576	7,293	8,576	8,576
R-squared	0.0859	0.0862	0.0836	0.0815	0.0826	0.0828
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.8: Using estimated marginal tax rate

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. In this table, I control the estimated marginal tax rate obtained from Graham and Mills (2008) to eliminate the concern about the endogeneity of corporate tax status in the setting of buy and lease decision. Other control variables include Size, Collateral, Leverage, No dividend dummy and MB ratio. Their definitions are the same as in table 3. POM dummy, CreditWatch dummy and Outlook dummy are used to proxy for credit rating change concern. Minus dummy, Negative CreditWatch dummy and Negative Outlook dummy are used to proxy for negative rating change concern. Plus dummy, Positive CreditWatch dummy and Positive Outlook dummy are used to proxy for positive rating concern. The table reports the regression coefficient and the standard error clustered by firm level.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0035***	-0.0035***	-0.0040***	-0.0040***	-0.0040***	-0.0040***
	(0.0007)	(0.0007)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Collateral	-0.0225***	-0.0225***	-0.0242***	-0.0241***	-0.0244***	-0.0244***
	(0.0053)	(0.0053)	(0.0057)	(0.0057)	(0.0057)	(0.0057)
Leverage	0.0426***	0.0427***	0.0476***	0.0478***	0.0477***	0.0474***
	(0.0054)	(0.0054)	(0.0059)	(0.0059)	(0.0059)	(0.0059)
No dividend	0.0061***	0.0061***	0.0053**	0.0052**	0.0053**	0.0053**
	(0.0020)	(0.0020)	(0.0021)	(0.0021)	(0.0021)	(0.0021)
Marginal tax rate	-0.0122**	-0.0121**	-0.0045	-0.0045	-0.0047	-0.0047
	(0.0048)	(0.0048)	(0.0097)	(0.0097)	(0.0097)	(0.0097)
MB ratio	0.0026***	0.0026***	0.0030***	0.0030***	0.0030***	0.0030***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Rating concern	0.0032**		0.0061***		0.0073**	
	(0.0014)		(0.0021)		(0.0029)	
Negative concern		0.0036**		0.0053**		0.0084***
		(0.0017)		(0.0026)		(0.0032)
Positive concern		0.0027		0.0079**		0.002
		(0.0017)		(0.0040)		(0.0074)
Constant	0.0166	0.0165	0.0179	0.0178	0.0183	0.0183
	(0.0103)	(0.0103)	(0.0115)	(0.0115)	(0.0115)	(0.0115)
Observations	7,293	7,293	7,293	7,293	7,293	7,293
R-squared	0.0795	0.0795	0.0814	0.0815	0.081	0.0811
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.9: Trade credit and rating change concerns

The dependent variable is the use of trade credits scaled by the lagged total asset. POM dummy, CreditWatch dummy and Outlook dummy are used to proxy for credit rating change concern. Minus dummy, Negative CreditWatch dummy and Negative Outlook dummy are used to proxy for negative rating change concern. Plus dummy, Positive CreditWatch dummy and Positive Outlook dummy are used to proxy for positive rating concern. The table reports the regression coefficient and the standard error clustered by firm level.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Short-term debt	-0.0215***	-0.0215***	-0.0215***	-0.0214***	-0.0214***	-0.0213***
	(0.0043)	(0.0043)	(0.0043)	(0.0043)	(0.0043)	(0.0043)
Long-term debt	-0.0036**	-0.0036**	-0.0036**	-0.0035**	-0.0034**	-0.0034**
	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)
Sales	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
ROA	0.0152***	0.0152***	0.0154***	0.0153***	0.0149***	0.0146***
	(0.0033)	(0.0034)	(0.0034)	(0.0034)	(0.0034)	(0.0034)
Current asset	0.0115***	0.0115***	0.0115***	0.0115***	0.0116***	0.0116***
	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)
Cash	0.0052*	0.0052*	0.0052*	0.0052*	0.0051*	0.0051*
	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)
Receivable	0.0054*	0.0054*	0.0054*	0.0054*	0.0053*	0.0053*
	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)
Inventory	0.0093***	0.0093***	0.0093***	0.0093***	0.0092***	0.0092***
	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)
Growth	0.0036***	0.0036***	0.0036***	0.0036***	0.0036***	0.0035***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Rating concern	0.0003		0.0006		-0.0008	
	(0.0004)		(0.0006)		(0.0009)	
Negative concern		0.0003		0.0004		-0.0014
		(0.0004)		(0.0007)		(0.0010)
Positive concern		0.0003		0.0013		0.0017
		(0.0004)		(0.0011)		(0.0018)
Constant	-0.0054	-0.0054	-0.0053	-0.0053	-0.0053	-0.0053
	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)
Observations	16,940	16,940	16,940	16,940	16,940	16,940
R-squared	0.0769	0.0769	0.0769	0.0769	0.0769	0.077
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.10: Capital lease and rating change concerns

The dependent variable is the use of capital lease scaled by the lagged total asset. Control variables include Size, Collateral, Leverage, No dividend dummy, Tax rate and MB ratio. Their definitions are the same as in table 3. POM dummy, CreditWatch dummy and Outlook dummy are used to proxy for credit rating change concern. Minus dummy, Negative CreditWatch dummy and Negative Outlook dummy are used to proxy for negative rating change concern. Plus dummy, Positive CreditWatch dummy and Positive Outlook dummy are used to proxy for positive rating concern. The table reports the regression coefficient and the standard error clustered by firm level.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0021***	-0.0021***	-0.0022***	-0.0022***	-0.0021***	-0.0021***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0186***	-0.0186***	-0.0185***	-0.0185***	-0.0186***	-0.0186***
	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0037)
Leverage	0.0509***	0.0509***	0.0503***	0.0504***	0.0504***	0.0503***
	(0.0037)	(0.0037)	(0.0037)	(0.0038)	(0.0037)	(0.0038)
No dividend	0.0039***	0.0039***	0.0041***	0.0040***	0.0040***	0.0041***
	(0.0014)	(0.0014)	(0.0014)	(0.0013)	(0.0014)	(0.0014)
Tax rate	0.0016	0.0016	0.0017	0.0017	0.0017	0.0017
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
MB ratio	0.0011	0.0011	0.0012	0.0011	0.0011	0.0011
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Rating concern	-0.0001		-0.0001		-0.0002	
	(0.0001)		(0.0001)		(0.0002)	
Negative concern		-0.0001		-0.0001		-0.0002
		(0.0001)		(0.0001)		(0.0002)
Positive concern		-0.0001		-0.0002		-0.0004
		(0.0001)		(0.0002)		(0.0004)
Constant	-0.0053	-0.0053	-0.004	-0.0041	-0.0038	-0.0038
	(0.0080)	(0.0081)	(0.0081)	(0.0081)	(0.0081)	(0.0081)
Observations	11,789	11,789	11,789	11,789	11,789	11,789
R-squared	0.0777	0.0777	0.0782	0.0783	0.0779	0.078
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.11: Heavy user industry

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Control variables are the same as in table 3. Definition of Rating change concern, Negative concern and Positive concern is the same as table 7. Industries such as Transportation, Retail, Personal Services, Meals, Health, and Entertainment, are considered to be "Heavy user" of operating lease.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0035***	-0.0035***	-0.0037***	-0.0037***	-0.0036***	-0.0036***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0212***	-0.0211***	-0.0211***	-0.0211***	-0.0213***	-0.0213***
	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Leverage	0.0412***	0.0412***	0.0406***	0.0409***	0.0408***	0.0408***
	(0.0041)	(0.0041)	(0.0041)	(0.0041)	(0.0041)	(0.0041)
No dividend	0.0060***	0.0060***	0.0061***	0.0060***	0.0061***	0.0061***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Tax rate	0.0040**	0.0040**	0.0041**	0.0040**	0.0041**	0.0040**
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
MB ratio	0.0023***	0.0023***	0.0024***	0.0024***	0.0024***	0.0024***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Rating concern × Heavy User	0.0009		0.0055		0.0034	
	(0.0027)		(0.0038)		(0.0056)	
Rating concern × Non- Heavy User	0.0027**		0.0047***		0.0062**	
	(0.0012)		(0.0018)		(0.0025)	
Negative concern × Heavy User		0.001		0.0027		0.0025
		(0.0032)		(0.0045)		(0.0050)
Negative concern × Non- Heavy User		0.0033**		0.0040*		0.0063**
		(0.0013)		(0.0022)		(0.0028)
Positive concern × Heavy User		0.0008		0.0120*		0.0081
		(0.0032)		(0.0068)		(0.0151)
Positive concern × Non- Heavy User		0.002		0.0066**		0.0055
		(0.0015)		(0.0033)		(0.0058)
Constant	0.0256***	0.0255***	0.0278***	0.0277***	0.0280***	0.0280***
	(0.0073)	(0.0073)	(0.0073)	(0.0073)	(0.0074)	(0.0074)
Observations	13,148	13,148	13,148	13,148	13,148	13,148
R-squared	0.0702	0.0702	0.0706	0.0707	0.0702	0.0702
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.12: SEC and FASB's interpretation letters and Standard & Poor's introduction of more comprehensive method to capitalize operating lease

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Control variables are the same as in table 3. Definition of Rating change concern, Negative concern and Positive concern is the same as table 7. The table reports the regression coefficient and the standard error clustered by firm level. In 2005, SEC and FASB have issued interpretation letters reiterating existing GAAP and clarifying the regulators' view on some controversial lease accounting issues. And the rating agencies, S&P's and Moody's have started to improve their estimation of the capitalized operating lease using more comprehensive methodology. The key variable proxies for the concern about credit rating change are interacted with two dummy variables: Before-and After- to incorporate the heterogeneous effect during these two sample periods. The before-period includes the observations in the year 2005 and the after-period starts from the year 2006.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0034***	-0.0034***	-0.0038***	-0.0038***	-0.0038***	-0.0038***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0099***	-0.0099***	-0.0092***	-0.0092***	-0.0093***	-0.0092***
	(0.0030)	(0.0030)	(0.0029)	(0.0029)	(0.0029)	(0.0029)
Leverage	0.0383***	0.0383***	0.0378***	0.0379***	0.0380***	0.0379***
	(0.0038)	(0.0038)	(0.0039)	(0.0039)	(0.0039)	(0.0039)
No dividend	0.0084***	0.0084***	0.0081***	0.0081***	0.0082***	0.0082***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Tax rate	0.0040**	0.0040**	0.0044**	0.0044**	0.0044**	0.0044**
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
MB ratio	0.0022***	0.0022***	0.0023***	0.0023***	0.0023***	0.0023***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Rating concern× Before	0.0042***		0.0073***		0.0088***	
	(0.0013)		(0.0023)		(0.0033)	
Rating concern× After	-0.0003		0.0046**		0.005	
	(0.0014)		(0.0022)		(0.0032)	
Negative concern× Before		0.0047***		0.0066**		0.0098***
		(0.0016)		(0.0026)		(0.0034)
Negative concern× After		0.0009		0.0051*		0.0056
		(0.0016)		(0.0029)		(0.0034)
Positive concern× Before		0.0038**		0.0093**		0.0041
		(0.0017)		(0.0047)		(0.0078)
Positive concern× After		-0.0017		0.0034		0.0017
		(0.0018)		(0.0037)		(0.0077)
Constant	0.0192***	0.0191***	0.0234***	0.0234***	0.0234***	0.0235***
	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0048)
Observations	13,148	13,148	13,148	13,148	13,148	13,148
R-squared	0.0426	0.0427	0.0427	0.0427	0.0422	0.0422
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.13: How financing deficit impacts the effect of rating change concern

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Control variables are the same as in table 3. Definition of Rating change concern, Negative concern and Positive concern is the same as table 7. This table reports the regression coefficient and the standard error clustered by firm level. Financing deficit equals to the sum of cash dividends, net investment, and change in working capital minus the cash flow after interest and taxes. The three latter terms are calculated respectively. Net investment equals to the sum of capital expenditures, increase in investment, acquisitions, and minus sale of PPE, sale of investment, change in short-term investment and other investment activities. Change in working capital equals to change in cash and cash equivalents minus the sum of decrease in receivable, decrease in inventories, increase in payable, increase in tax and accrued, other change in asset and liabilities, other financing activities and change in current debt. Cash flow after interest and taxes equals to the sum of income before extraordinary items, extraordinary items and discontinued operations, depreciation and amortization, deferred taxes, net equity change, sale of property, plant and equipment and investments and other funds from operations and exchange rate effect. This method is following Frank and Goyal (2003) but I recode the missing value of the variables in Table 8 of Frank and Goyal (2003) with zero.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0041***	-0.0041***	-0.0035***	-0.0035***	-0.0036***	-0.0036***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0162***	-0.0162***	-0.0202***	-0.0201***	-0.0213***	-0.0213***
	(0.0038)	(0.0038)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Leverage	0.0376***	0.0376***	0.0393***	0.0396***	0.0402***	0.0403***
	(0.0038)	(0.0038)	(0.0040)	(0.0041)	(0.0041)	(0.0041)
No dividend	0.0065***	0.0065***	0.0065***	0.0065***	0.0061***	0.0060***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Tax rate	0.0028*	0.0028*	0.0033*	0.0033*	0.0038**	0.0038**
	(0.0016)	(0.0016)	(0.0017)	(0.0017)	(0.0018)	(0.0018)
MB ratio	0.0021**	0.0021**	0.0023***	0.0023***	0.0023***	0.0023***
	(0.0009)	(0.0009)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Rating concern× No deficit	0.0228***		0.0270***		0.0224***	
	(0.0012)		(0.0020)		(0.0025)	
Rating concern× Deficit	-0.0292***		-0.0251***		-0.0189***	
	(0.0014)		(0.0024)		(0.0041)	
Negative concern× No deficit		0.0229***		0.0252***		0.0213***
		(0.0014)		(0.0023)		(0.0028)
Negative concern× Deficit		-0.0296***		-0.0252***		-0.0193***
		(0.0017)		(0.0029)		(0.0040)
Positive concern× No deficit		0.0227***		0.0311***		0.0284***
		(0.0015)		(0.0036)		(0.0053)
Positive concern× Deficit		-0.0288***		-0.0252***		-0.0171*
		(0.0018)		(0.0041)		(0.0098)
Constant	0.0165**	0.0165**	0.0139*	0.0138	0.0154*	0.0154*
	(0.0075)	(0.0075)	(0.0084)	(0.0084)	(0.0084)	(0.0084)
Observations	12,994	12,994	12,994	12,994	12,994	12,994
R-squared	0.1876	0.1876	0.0944	0.0945	0.0759	0.0759
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.14: How the effect of rating change concern varies in cold equity market and hot equity market

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Control variables are the same as in table 3. Definition of Rating change concern, Negative concern and Positive concern is the same as table 7. The key variables are interacted with a dummy variable indicating whether the equity market this year is hot or cold. Here I report the results using a total number of IPOs and SEOs as the proxy for the cold or hot market in a yearly basis, but the results from other three methods are very similar. This table reports the regression coefficient and the standard error clustered by firm level. Year fixed effect cannot be included in these regressions since the proxy of cold equity market varies by year.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0036***	-0.0036***	-0.0038***	-0.0038***	-0.0038***	-0.0038***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0206***	-0.0205***	-0.0208***	-0.0208***	-0.0210***	-0.0211***
	(0.0039)	(0.0039)	(0.0039)	(0.0039)	(0.0039)	(0.0039)
Leverage	0.0433***	0.0433***	0.0424***	0.0425***	0.0425***	0.0424***
	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
No dividend	0.0065***	0.0065***	0.0067***	0.0067***	0.0068***	0.0068***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Tax rate	0.0043**	0.0043**	0.0046***	0.0046***	0.0046***	0.0046***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
MB ratio	0.0021***	0.0021***	0.0022***	0.0022***	0.0022***	0.0022***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Rating concern× Cold Market	0.0065***		0.0108***		0.0112***	
	(0.0014)		(0.0025)		(0.0035)	
Rating concern× Hot Market	-0.0003		0.0026		0.0035	
	(0.0012)		(0.0021)		(0.0030)	
Negative concern× Cold Market		0.0082***		0.0102***		0.0125***
		(0.0018)		(0.0029)		(0.0036)
Negative concern× Hot Market		-0.0002		0.002		0.0034
		(0.0014)		(0.0027)		(0.0033)
Positive concern× Cold Market		0.0047**		0.0130**		0.0042
		(0.0019)		(0.0058)		(0.0095)
Positive concern× Hot Market		-0.0003		0.0037		0.0041
		(0.0016)		(0.0036)		(0.0071)
Constant	0.0158***	0.0156***	0.0181***	0.0180***	0.0185***	0.0186***
	(0.0059)	(0.0059)	(0.0059)	(0.0059)	(0.0060)	(0.0060)
Observations	13,148	13,148	13,148	13,148	13,148	13,148
R-squared	0.0562	0.0564	0.0556	0.0556	0.0547	0.0548
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.15: How equity valuation impacts the effect of rating change concern

The dependent variable is the use of operating lease relative to debt scaled by the lagged total asset. Control variables are the same as in table 3. Definition of Rating change concern, Negative concern and Positive concern is the same as table 7. The key variables are interacted with a dummy variable indicating whether the firm's stock is undervalued or overvalued. Firm's mispricing is calculated as: $\mathrm{Ln}(\frac{\mathrm{M}}{\mathrm{v}}) = \mathrm{Ln}(\mathrm{M_{it}}) - [\overline{\alpha}_{0\mathrm{j}} + \overline{\alpha}_{1\mathrm{j}}\mathrm{Ln}(\mathrm{B_{it}}) + \overline{\alpha}_{2\mathrm{j}}\mathrm{Ln}(|\mathrm{NI_{it}}|) + \overline{\alpha}_{3\mathrm{j}}\mathrm{I}^{-}\mathrm{Ln}(|\mathrm{NI_{it}}|) + \overline{\alpha}_{4\mathrm{j}}(\frac{\mathrm{D}}{\mathrm{v}})]$. Here, $\mathrm{M_{it}}$ is the market value of equity and $\mathrm{B_{it}}$is the book value of equity. $|\mathrm{NI_{it}}|$ is the absolute value of net income. I^{-} is a dummy variable that equals one if net income is negative. $\frac{\mathrm{D}}{\mathrm{v}}$ is the market leverage ratio. Subscript i stands for firm, t stands for year and j stand for industry. The average estimated coefficient is from the following process: $\mathrm{Ln}(\mathrm{M_{it}}) = \alpha_{0\mathrm{j}} + \alpha_{1\mathrm{j}}\mathrm{Ln}(\mathrm{B_{it}}) + \alpha_{2\mathrm{j}}\mathrm{Ln}(|\mathrm{NI_{it}}|) + \alpha_{3\mathrm{j}}\mathrm{I}^{-}\mathrm{Ln}(|\mathrm{NI_{it}}|) + \alpha_{4\mathrm{j}}(\frac{\mathrm{D}}{\mathrm{v}}) + \varepsilon_{\mathrm{it}}$. The firms are classified into 12 industries according to Fama and French (1997) and the coefficients are estimated for each industry and each year. Then, the coefficients are averaged across years. Firms are considered to be overvalued if the mispricing is positive and are considered to be undervalued if the mispricing is negative.

	POM		CreditWatch		Outlook	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.0035***	-0.0035***	-0.0036***	-0.0036***	-0.0036***	-0.0036***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Collateral	-0.0209***	-0.0209***	-0.0210***	-0.0209***	-0.0213***	-0.0213***
	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Leverage	0.0422***	0.0422***	0.0408***	0.0412***	0.0408***	0.0408***
	(0.0041)	(0.0041)	(0.0041)	(0.0041)	(0.0041)	(0.0041)
No dividend	0.0059***	0.0059***	0.0060***	0.0060***	0.0060***	0.0060***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0016)	(0.0016)
Tax rate	0.0040**	0.0040**	0.0041**	0.0041**	0.0040**	0.0040**
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
MB ratio	0.0029***	0.0029***	0.0025***	0.0025***	0.0024***	0.0024***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Rating concern× Undervalue	0.0057***		0.0096***		0.0108***	
	(0.0014)		(0.0027)		(0.0040)	
Rating concern× Overvalue	0.0003		0.0024		0.0024	
	(0.0013)		(0.0020)		(0.0027)	
Negative concern× Undervalue		0.0049***		0.0062*		0.0107**
		(0.0017)		(0.0034)		(0.0044)
Negative concern× Overvalue		0.0016		0.0023		0.0024
		(0.0015)		(0.0024)		(0.0028)
Positive concern× Undervalue		0.0065***		0.0180***		0.0115
		(0.0018)		(0.0047)		(0.0082)
Positive concern× Overvalue		-0.001		0.0027		0.0022
		(0.0016)		(0.0039)		(0.0077)
Constant	0.0239***	0.0238***	0.0272***	0.0271***	0.0278***	0.0278***
	(0.0074)	(0.0074)	(0.0073)	(0.0073)	(0.0074)	(0.0074)
Observations	13,148	13,148	13,148	13,148	13,148	13,148
R-squared	0.0713	0.0715	0.071	0.0713	0.0705	0.0705
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 2.1: Summary Statistics: sample period 1998 to 2014

Size is the log value of market capitalization. MB ratio is the market-to-book ratio. R&D is a dummy variable equals to one if the firm reports non-zero R&D expense. Loss is a dummy variable equals to one if the firm's net income before extraordinary during the most recent fiscal year is strictly negative. Institutional Ownership Ratio is the percentage of shares holding by the institutional investors. This data is quarterly reported, so we combine it with our sample data for each quarter. Analyst dispersion equals to the standard deviation of EPS forecast divided by the absolute value of average forecast. Board size is the number of director on the board for each firm in each year. Board independence is the percentage of independent directors on the board for each firm in each year. CEO-Chairman is a dummy variable equals to one if the CEO is also the chairman of the board. Multi-directorship is the average number of outside directorship held by the independent directors. Independent director ownership is the total percentage of firm's equity shares held by all independent directors. Independent director age is the average age of all independent directors for the firm for each year. Co-opted independent director is co-opted independent directors as a fraction of the total board. Directors are considered to be "co-opted" if they joined board after the CEO assumes office. Independent director tenure is the average tenure of all independent directors for the firm for each year. Inside director tenure is the average tenure of all insider directors for the firm for each year.

Variables	#Obs	Mean	Median	P10	P25	P75	P90	Stan. Dev.
Size	18,881	7.71	7.601	5.885	6.657	8.747	9.858	1.501
MB Ratio	18,881	1.972	1.516	1.012	1.147	2.224	3.365	1.589
R&D dummy	18,894	0.436	0	0	0	1	1	0.496
Loss	18,894	0.134	0	0	0	0	1	0.341
Institutional ownership ratio	18,825	0.721	0.74	0.451	0.599	0.858	0.949	0.213
Analyst dispersion	18,026	0.799	0.296	0.0328	0.115	0.747	1.619	6.381
Board size	18,894	9.466	9	6	8	11	13	2.691
Board independence	18,894	0.717	0.75	0.5	0.625	0.857	0.9	0.164
CEO-Chairman	18,894	0.679	1	0	0	1	1	0.467
Multi-directorship	18,871	0.919	0.833	0.125	0.4	1.333	1.778	0.657
Independent director ownership (%)	18,881	1.393	0.346	0.039	0.119	0.894	2.361	4.437
Independent director age	18,893	60.54	60.81	55.1	58	63.38	65.56	4.264
Co-opted independent director	17,157	0.37	0.333	0	0.143	0.571	0.75	0.26
Independent director tenure	18,865	7.667	7.3	3.571	5.25	9.571	12	3.517
Insider director tenure	18,812	9.957	8	2	4	14	21	7.613

Table 2.2: How independent directors' tenure affect executives' insider trading profitability

The dependent variable is the Market-adjusted buy-and-hold returns for different holding horizons. Independent director tenure is the average tenure of all independent directors for the firm for each year. Inside director tenure is the average tenure of all insider directors for the firm for each year. Size is the log value of market capitalization. MB ratio is the market-to-book ratio. R&D is a dummy variable equals to one if the firm reports non-zero R&D expense. Loss is a dummy variable equals to one if the firm's net income before extraordinary during the most recent fiscal year is strictly negative. Institutional Ownership Ratio is the percentage of shares holding by the institutional investors. This data is quarterly reported, so we combine it with our sample data for each quarter. Analyst dispersion equals to the standard deviation of EPS forecast divided by the absolute value of average forecast. Transaction size equals to the number of shares exchanged in the transaction scaled by the total number of shares outstanding. Prior return is the Market-adjusted buy-and-hold returns for 180 days prior to the trading. A negative sign is added to the prior return for sales transactions. Recent trade equals to the sum of absolute numbers of shares traded by all insiders of the firm during ten days prior to the transaction date and it is scaled by the total number of shares outstanding of the firm. Return volatility is the standard deviation of daily market adjusted returns of the stock measured over the last month prior to the transaction. Independent director age is the average age of all independent directors for the firm for each year. Co-opted independent director is co-opted independent directors as a fraction of the total board. Directors are considered to be "co-opted" if they joined board after the CEO assumes office. Board size is the number of director on the board for each firm in each year. Board independence is the percentage of independent directors on the board for each firm in each year. Multi-directorship is the average number of outside directorship held by the independent directors. Independent director ownership is the total percentage of firm's equity shares held by all independent directors. CEO-Chairman is a dummy variable equals to one if the CEO is also the chairman of the board. Firm and year fixed effect are included and the standard error is clustered by individual-level and corrected for heterogeneity.

Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0381**	0.1155***	0.1511***	0.3193***
	(0.0185)	(0.0293)	(0.0397)	(0.0664)
Inside director tenure	0.0183*	0.0290*	0.026	0.042
	(0.0097)	(0.0168)	(0.0224)	(0.0401)
Size	-1.0513***	-2.1332***	-3.1528***	-5.2290***
	(0.1354)	(0.2009)	(0.2574)	(0.4527)
MB ratio	-0.5664***	-1.0390***	-1.4014***	-2.0715***
	(0.0546)	(0.0910)	(0.1228)	(0.2233)
R&D dummy	0.1774	0.3607	-0.439	-0.6185
	(0.3305)	(0.5248)	(0.6519)	(1.0300)
Loss	1.0429***	1.7041***	2.0847***	3.4221***
	(0.1681)	(0.2801)	(0.3915)	(0.6715)
Institutional Ownership Ratio	-1.9096***	-3.6482***	-4.9372***	-8.9839***
	(0.4035)	(0.6610)	(0.8913)	(1.4799)
Dispersion	-0.005	0.002	0.0091	0.0098
	(0.0070)	(0.0117)	(0.0163)	(0.0184)
Transaction size	-0.5469***	-0.7524***	-0.5444**	-0.5443
	(0.1740)	(0.2352)	(0.2744)	(0.4257)
Prior return	-0.0113***	-0.0236***	-0.0392***	-0.0550***
	(0.0024)	(0.0036)	(0.0046)	(0.0069)
Recent trade	0.0164	0.0368	0.2041	0.118
	(0.0511)	(0.1091)	(0.1511)	(0.1715)
Return volatility	20.2152***	27.9846***	16.0751**	20.1042
	(4.0609)	(6.1221)	(7.6559)	(12.5555)
Independent director age	-0.0542***	-0.0946***	-0.0752*	-0.2109***
	(0.0197)	(0.0317)	(0.0450)	(0.0744)
Co-opted independent directors %	0.292	0.01	-0.2742	0.5628
	(0.2011)	(0.3349)	(0.4291)	(0.7112)
Board size	0.1010***	0.2959***	0.4573***	0.8110***
	(0.0247)	(0.0403)	(0.0545)	(0.0967)
Board independence	-0.9715**	-1.3009**	-1.1566	-1.9722
	(0.4112)	(0.6568)	(0.8868)	(1.4055)
Multi-directorship	0.1189	0.4952***	0.1885	0.9200***
	(0.0898)	(0.1411)	(0.1840)	(0.2925)
Independent director ownership	-0.0153	-0.0553***	-0.1278***	-0.1619***
	(0.0112)	(0.0201)	(0.0296)	(0.0496)
CEO-Chairman	0.1954*	0.3886**	0.5371**	0.5980*
	(0.1081)	(0.1658)	(0.2114)	(0.3431)
Observations	211,188	211,176	211,163	211,059
R-squared	0.0804	0.1064	0.1281	0.1687
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 2.3: How independent directors' tenure affects executives' insider trading profitability: subsample results

The dependent variable is the Market-adjusted buy-and-hold returns for different holding horizons. Independent director tenure is the average tenure of all independent directors for the firm for each year. Control variables are the same as in table 2, including Insider director tenure, Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Transaction size, Prior return, Recent trade, Return volatility, Independent director age, Co-opted independent directors, Board size, Board independence, Multi-directorship, independent director ownership and CEO-Chairman dummy. In panel A, transactions are separated into purchase and sale. In panel B1-B3, firms are separated into subsamples based on some variables measure the information transparency faced by the independent directors. Analyst dispersion equals to the standard deviation of EPS forecast divided by the absolute value of average forecast. Operation complexity is the common factor score of the firm's number of business segments, log value of sales, and leverage. The firm-year observation is the linear combination of the transformed value of these three variables, and is positively related to all three variables. Firm's need of advice is considered to increase with this complexity score. Some firms report segment information multiple times in each year. We only retained the latest record. Firms spending more on R&D usually are high-tech firms with more firm-specific knowledge which are not easily obtained by the outsiders. If the firm's R&D expenditure is missing, we replace it by zero. For these three measures, we calculate the sample median for each year among all firms and the firm is considered to have high dispersion, to be complex firm or to have high R&D expenditure if the measures are larger than the sample median. Otherwise, it is considered to be in the "low" or "simple" group.

Panel A: Purchase or sales transaction								
	Purchase				Sales			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	-0.0572	-0.1226	-0.1913	-0.2463	0.0706***	0.1559***	0.2098***	0.3972***
	(0.0771)	(0.1107)	(0.1433)	(0.2137)	(0.0190)	(0.0308)	(0.0417)	(0.0715)
Panel B1: Analyst dispersion high or low								
	High dispersion				Low dispersion			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0282	0.1234***	0.1773***	0.4239***	0.017	0.0831*	0.1392**	0.2944***
	(0.0277)	(0.0455)	(0.0610)	(0.0951)	(0.0285)	(0.0462)	(0.0631)	(0.1062)
Panel B2: Complex or simple firm								
	Complex				Simple			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0326	0.1517***	0.2058***	0.3535***	0.037	0.1204**	0.1110*	0.2708***
	(0.0254)	(0.0396)	(0.0574)	(0.1019)	(0.0314)	(0.0491)	(0.0632)	(0.1038)
Panel B3: R&D expenditure high or low								
	High R&D				Low R&D			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0712**	0.1610***	0.1567**	0.3407***	-0.0054	0.043	0.1071**	0.2756***
	(0.0277)	(0.0444)	(0.0618)	(0.1051)	(0.0233)	(0.0366)	(0.0475)	(0.0757)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 2.4: Nature of insider trading over independent director tenure

In column (1), we identify whether the insider trading is information-driven or not following the method developed by Cohen, Malloy, and Pomorski (2012). The classification is made for each year and each insider. If the insiders trade in the same month for at least three consecutive years, then his trades in the same month in this year are considered as "routine" and his trades in other months of this year are considered "opportunistic". If the insider traded in past three consecutive years but no trade in the same month, all his trade in this year are considered "opportunistic". We calculate the percentage of the number of opportunistic trading which equals to the number of opportunistic trading divided by the total number of all insider trading for each firm in each year and the percentage of the volume of opportunistic trading which equals to the total trading volume of opportunistic trading divided by the total trading volume of all insider trading for each firm in each year. And we test whether firms' executives tend to do more opportunistic trading as independent director tenure increase. These are firm-year level tests, and control variables include Insider director tenure, Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Independent director age, Co-opted independent directors, Board size, Board independence, Multi-directorship, independent director ownership and CEO-Chairman dummy. In column (2), we use the subsample of the firms which the specified information, e.g. the beginning and ending day of the safe trading window is available. The dependent variable is a dummy variable equals to one if the transaction happens outside the safe window and zero otherwise. Since only 74 of the sample firms have the specified information of the safe trading window, we try to generalize the results in column (3). The dependent variable is a dummy variable equals to one if the transaction is executed outside the transparent window which is defined as one month following the previous earning announcement. The tests reported in column (2) and (3) are all transaction-level tests, and transaction-level control variables such as Transaction size, Prior return, Recent trade, and Return volatility are also included.

	(1)		(2)		(3)	
	Opportunistic	Opportunistic	Trade outside safe window		Trade outside transparent window	
Variables	Number%	Volume%	OLS	Logit	OLS	Logit
Independent director tenure	0.0086***	0.0102***	0.0118**	0.1043***	0.0028***	0.0133***
	(0.0021)	(0.0022)	(0.0054)	(0.0212)	(0.0010)	(0.0033)
Inside director tenure	0.0037***	0.0037***	-0.0012	-0.0136	0.0006	0.0028*
	(0.0010)	(0.0010)	(0.0022)	(0.0100)	(0.0005)	(0.0015)
Size	0.0590***	0.0604***	-0.0486	-0.5894***	-0.0270***	-0.1189***
	(0.0090)	(0.0093)	(0.0370)	(0.0862)	(0.0045)	(0.0142)
MB ratio	0.0102***	0.0102***	0.0301*	0.2545***	-0.0017	-0.0102**
	(0.0032)	(0.0034)	(0.0175)	(0.0372)	(0.0011)	(0.0042)
R&D dummy	0.04	0.0317	-0.0136	-10.131	-0.0134	-0.0688
	(0.0493)	(0.0511)	(0.0847)	(402.8850)	(0.0151)	(0.0607)
Loss	-0.0548***	-0.0501***	0.0116	-0.0713	0.0373***	0.1868***
	(0.0114)	(0.0120)	(0.0541)	(0.1087)	(0.0072)	(0.0238)
Institutional Ownership Ratio	-0.0102	-0.031	-0.2591**	-2.4621***	-0.0380**	-0.2286***
	(0.0297)	(0.0303)	(0.1134)	(0.3882)	(0.0149)	(0.0589)
Dispersion	-0.0005	-0.0005	0.0203	0.0690**	0.0005***	0.0024***
	(0.0004)	(0.0004)	(0.0157)	(0.0298)	(0.0001)	(0.0008)
Transaction size			-0.004	0.007	-0.0291**	-0.2114***
			(0.0384)	(0.4996)	(0.0116)	(0.0602)
Prior return			-0.0003	-0.0036**	0.0003***	0.0012***
			(0.0007)	(0.0016)	(0.0001)	(0.0003)
Recent trade			-0.1798**	-5.9358***	-0.0167***	-0.1590***
			(0.0699)	(0.5497)	(0.0039)	(0.0275)
Return volatility			-2.8717***	-23.1978***	-10.3231***	-68.8735***
			(1.0818)	(3.0468)	(0.2862)	(0.6882)
Independent director age	-0.0036	-0.0045*	0.0003	-0.029	-0.0032***	-0.0167***
	(0.0023)	(0.0024)	(0.0074)	(0.0211)	(0.0012)	(0.0036)
Co-opted independent directors %	0.0658***	0.0729***	0.0513	0.9080***	0.0234**	0.1364***
	(0.0229)	(0.0243)	(0.0571)	(0.2296)	(0.0108)	(0.0379)
Board size	0.0047	0.0051	-0.0007	0.0124	0.0001	-0.0062
	(0.0030)	(0.0033)	(0.0068)	(0.0207)	(0.0014)	(0.0048)
Board independence	-0.0721	-0.061	-0.0316	-0.4235	-0.0221	-0.0996
	(0.0448)	(0.0477)	(0.1180)	(0.4433)	(0.0209)	(0.0715)
Multi-directorship	-0.0270***	-0.0257**	0.0285	0.3154***	0.0090**	0.0373**
	(0.0096)	(0.0100)	(0.0289)	(0.0873)	(0.0045)	(0.0152)
Independent director ownership	-0.0018*	-0.0027**	0.0002	-0.009	0.0003	0.0011
	(0.0010)	(0.0011)	(0.0047)	(0.0240)	(0.0007)	(0.0022)
CEO-Chairman	0.0049	0.0112	0.029	0.1523**	0.0011	0.0164
	(0.0111)	(0.0114)	(0.0208)	(0.0743)	(0.0051)	(0.0178)
Observations	16,039	16,039	20,844	20,016	210,280	208,386
R-squared	0.3832	0.3725	0.2416	0.2372	0.1613	0.1238
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 2.5: Relation driven by independent directors who are expected to play a major role in monitoring

The dependent variable is the Market-adjusted buy-and-hold returns for different holding horizons. Control variables are the same as in table 2, including Insider director tenure, Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Transaction size, Prior return, Recent trade, Return volatility, Independent director age, Co-opted independent directors, Board size, Board independence, Multi-directorship, independent director ownership and CEO-Chairman dummy. In panel A, independent directors are separate into two types: co-opted or non-co-opted. They are considered to be "co-opted" if they joined board after the CEO assume office, in other words, they are assigned by the CEO. In panel B, independent directors are separate into two types: connected with the CEO or not. This is defined at the time when the independent directors join the board or when firms change the CEO, e.g. when directors and CEO are connected through the investigated firm for the first time. The independent directors are considered to be connected with the CEO either they graduate from the same school, have overlapping employment other than the investigated firm or share positions in other organizations such as leisure clubs or charities. In panel C, independent directors are separate into two types: busy or not busy. They are considered to be "busy" if the independent director holds altogether more than three directorships. In panel D, independent directors are separated into two groups based on whether they also sit on governance committee. In panel E, independent directors are separated into two groups based on whether they have a professional career such as a doctor, academic or politician. We calculate the average tenure of different types of independent directors respectively and include the tenures for different types of independent directors in the regression together to investigate their heterogeneous effect on executives' trading profitability.

Panel A: Whether the independent directors are co-opted or not				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Co-opted independent director tenure	-0.0131	-0.0196	0.0021	0.0129
	(0.0216)	(0.0324)	(0.0408)	(0.0694)
Non-co-opted independent director tenure	0.0198***	0.0439***	0.0649***	0.0966***
	(0.0067)	(0.0107)	(0.0140)	(0.0231)
Panel B: Whether the independent directors are socially connected with the CEO or not				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Connected independent director tenure	0.0016	0.0077	0.0184	-0.0037
	(0.0083)	(0.0130)	(0.0171)	(0.0298)
Non-connected independent director tenure	0.0121	0.0714***	0.0943**	0.1690***
	(0.0166)	(0.0265)	(0.0371)	(0.0569)
Panel C: Whether the independent directors are busy or not				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Busy independent director tenure	0.0152*	0.0277*	0.0184	0.028
	(0.0085)	(0.0145)	(0.0196)	(0.0308)
Not busy independent director tenure	0.0291**	0.0867***	0.1267***	0.2478***
	(0.0134)	(0.0210)	(0.0278)	(0.0459)
Panel D: Whether the independent directors sit on governance committee or not				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Governance committee ID tenure	0.0231***	0.0333**	0.0343*	0.0616**
	(0.0086)	(0.0141)	(0.0184)	(0.0302)
Non- governance committee ID tenure	0.0031	0.0226	0.0077	0.0258
	(0.0111)	(0.0175)	(0.0236)	(0.0374)
Panel E: Whether the ID has a professional background (Doctor, academic or politician)				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Profession independent director tenure	-0.0028	-0.0099	-0.0343*	-0.0092
	(0.0086)	(0.0143)	(0.0208)	(0.0424)
Non-profession independent director tenure	0.0406***	0.1161***	0.1670***	0.2768***
	(0.0154)	(0.0263)	(0.0340)	(0.0539)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 2.6: Factors that help counter the weakened monitoring by independent directors

The dependent variable is the Market-adjusted buy-and-hold returns for different holding horizons. Independent director tenure is the average tenure of all independent directors for the firm for each year. Control variables are the same as in table 2, including Insider director tenure, Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Transaction size, Prior return, Recent trade, Return volatility, Independent director age, Co-opted independent directors, Board size, Board independence, Multi-directorship, independent director ownership and CEO-Chairman dummy. ITP is a dummy variable equals to one if the firms have adopted internal trading policies. Outside block-holder is a dummy variable equals to one if there is at least one outside block-holder sitting on the board for the firm in this year. Outside block-holder is a non-employee who has over 1% of firm's voting power. This definition is following Guo and Masulis (2015). Presence of legal independent director is a dummy variable equals to one if there is at least one independent director with a legal background sitting on the board for the firm in this year. Panel D distinguish firms that adopted or not adopted universal demand law. Whether a firm is subject to a UD law depends on its state of incorporation, and we use the data provided by Bill McDonald to identify the historical state of incorporation of the firm. For firms that completely missing from McDonald's datasets, we resort to the geographic information that is provided by Compustat. US firms incorporated in 23 states have adopted the UD laws in year 1989, 1990, 1991, 1992, 1993, 1995, 1996, 1997, 1998, 2001, 2003, 2004 and 2005 respectively. The key variable of interest is UD which equals to one for all firms incorporated in the state after the UD law is passed in that state. Adoption of UD law significantly reduced the likelihood of derivative lawsuits.

Panel A: Internal trading policies Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0595***	0.1456***	0.1595***	0.3115***
	(0.0218)	(0.0345)	(0.0456)	(0.0743)
Independent director tenure × ITP	-0.0617**	-0.0869**	-0.0243	0.0223
	(0.0260)	(0.0393)	(0.0504)	(0.0836)
Panel B: Outside Block-holder on Board Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0521***	0.1359***	0.1689***	0.3496***
	(0.0194)	(0.0310)	(0.0418)	(0.0692)
Independent director tenure × Outside Block-holder	-0.0394***	-0.0573***	-0.0498*	-0.0852**
	(0.0118)	(0.0196)	(0.0257)	(0.0409)
Panel C: Independent director with legal background on board Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0443**	0.1235***	0.1615***	0.3457***
	(0.0186)	(0.0294)	(0.0399)	(0.0660)
Independent director tenure × Presence of legal ID	-0.0307**	-0.0393	-0.0513	-0.1309**
	(0.0149)	(0.0240)	(0.0315)	(0.0563)
Panel D: Adoption of UD law Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure	0.0299	0.1001***	0.1298***	0.2789***
	(0.0194)	(0.0312)	(0.0422)	(0.0697)
Independent director tenure × UD	0.0538*	0.1015**	0.1406**	0.2657***
	(0.0293)	(0.0514)	(0.0637)	(0.1019)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 2.7: Probability of getting socially connected between independent directors and the CEO

The dependent variable is a binary variable equals to one if the independent director and the CEO are connected through positions in other organizations such as leisure clubs or charities. This connection is examined every year and we focus on the connections that the starting years are available. Penalized maximum likelihood estimation is used to deal with the rare event problem. After is a dummy variable equals to one after the director and the CEO are connected through the investigated firm: either after the director come to the board or the CEO comes to the firm. We cut the tenure into four periods: the early period is from year zero to year one, the first middle period is from year two to year three, the second middle period if from year four to year five and the late period is from year six thereafter. The results are robust if we change the cutoffs. Male is a dummy variable equals to one if the director is a male. Age is the director's age. Nationality is a dummy variable equals to one if the director is from the US. Size is the log value of market capitalization. MB ratio is the market-to-book ratio. Board size is the number of director on the board for each firm in each year. Board independence is the percentage of independent directors on the board for each firm in each year. CEO-Chairman is a dummy variable equals to one if the CEO is also the chairman of the board. The three diversities are measured by Blau Index as $1 - \sum p^2$. For Gender diversity, p is the percentage of female directors and male directors respectively. For Age diversity, p is the percentage of directors' age belonging to 1920, 1930, 1940, 1950 and 1960 cohorts respectively. For Ethnicity diversity, p is the percentage of directors belonging to Caucasian, Indian, Asian, Hispanic, Black/African-American and others respectively. Busy board is a dummy variable equals to one if the majority of the independent directors hold more than three directorships. Block-holder on board is a dummy variable equals to one if there exists at least one director on board who holds more than 1% of the firm's common shares outstanding.

Variables	Coefficient	Odd ratio	Coefficient	Odd ratio
After	0.228***	1.257***		
	(0.0458)	(0.0575)		
Tenure (0, 1]			0.232**	1.261**
			(0.1000)	(0.1260)
Tenure [2,3]			0.321***	1.379***
			(0.0729)	(0.1010)
Tenure [4,5]			0.227***	1.255***
			(0.0764)	(0.0959)
Tenure [6, after)			0.203***	1.225***
			(0.0506)	(0.0620)
Male	0.0753	1.078	0.074	1.077
	(0.0607)	(0.0654)	(0.0607)	(0.0653)
Age	0.0217***	1.022***	0.0223***	1.023***
	(0.0025)	(0.0025)	(0.0025)	(0.0026)
Nationality	0.407***	1.503***	0.409***	1.506***
	(0.0493)	(0.0741)	(0.0493)	(0.0743)
Size	-0.0435***	0.957***	-0.0441***	0.957***
	(0.0167)	(0.0160)	(0.0167)	(0.0160)
MB Ratio	-0.0402**	0.961**	-0.0398**	0.961**
	(0.0195)	(0.0188)	(0.0195)	(0.0188)
Board size	0.102***	1.108***	0.102***	1.108***
	(0.0064)	(0.0071)	(0.0064)	(0.0071)
Board independence	-1.131***	0.323***	-1.128***	0.324***
	(0.1560)	(0.0505)	(0.1560)	(0.0506)
CEO-chairman	0.192***	1.212***	0.192***	1.212***
	(0.0503)	(0.0610)	(0.0503)	(0.0610)
Gender diversity	0.797***	2.219***	0.798***	2.221***
	(0.1720)	(0.3820)	(0.1720)	(0.3830)
Age diversity	-0.0363	0.964	-0.0358	0.965
	(0.1880)	(0.1820)	(0.1890)	(0.1820)
Ethnicity diversity	0.625***	1.869***	0.625***	1.869***
	(0.1180)	(0.2210)	(0.1180)	(0.2210)
Busy board	-0.0345	0.966	-0.035	0.966
	(0.0707)	(0.0683)	(0.0707)	(0.0683)
Block-holder on board	-0.434***	0.648***	-0.433***	0.648***
	(0.0589)	(0.0381)	(0.0589)	(0.0382)
Observations	240,156	240,156	240,156	240,156
Year FE	Yes	Yes	Yes	Yes

Table 2.8: Independent director's trading consistency with other executives of the firm

We measure the trading consistency between each individual and all the other insiders in our sample as a total during each earnings report period. The reporting quarter observations are deleted if both this individual and all the other insiders do not trade that quarter. We exclude firm-years report earnings announcement more than four times during the corresponding fiscal year (less than 2% of the sample). The total purchase shares and sales shares are aggregated for each individual in each firm during each reporting quarter. And the net share is calculated as purchase shares minus sales shares. Trading is considered to be "consistent" if the net shares traded by this individual and all the other insiders are in the same direction. Trading is considered to be "conflict" if the net shares traded by this individual and all the other insiders are in the opposite directions. Trading is considered to be "silent" if this individual trade and all the other insiders do not trade, or this individual does not trade while the others trade. The dependent variable is the level of consistency in an ascending order: conflicting, silent and consistent. We encode the consistency by 1, 2 and 3. Tenure and Age are the tenure and the age of each independent director. Female is a dummy variable indicating whether the independent director is a female. Ownership is the total shares of the firm owned by this director scaled by total firm shares outstanding. Number of committee membership is the total number of committees the director sits in. Attend $<$75% meeting is a dummy variable equal to one if the director attends less than 75% of the board meeting this year. Outside boards is the number of other directorship the director holds in this year. Other control variables include Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Board size, Board independence, CEO-Chairman dummy, and CEO tenure. The variables indicated by "quarter" are measured using quarterly level data.

Variables	Consistency Coefficient	Conflict Marginal effect	Silent Marginal effect	Consistent Marginal effect
Tenure	0.0522***	-0.0009***	-0.0024***	0.0033***
	(0.0020)	(0.0000)	(0.0001)	(0.0001)
Female	0.0527*	-0.0009*	-0.0025*	0.0034*
	(0.0312)	(0.0005)	(0.0015)	(0.0020)
Ownership	0.0441***	-0.0008***	-0.0020***	0.0028***
	(0.0084)	(0.0001)	(0.0004)	(0.0005)
Age	0.0080***	-0.0001***	-0.0004***	0.0005***
	(0.0019)	(0.0000)	(0.0001)	(0.0001)
Number of committee membership	0.0297***	-0.0005***	-0.0014***	0.0019***
	(0.0113)	(0.0002)	(0.0005)	(0.0007)
Attend <75% meeting	-0.1638**	0.0031**	0.0066***	-0.0097**
	(0.0709)	(0.0014)	(0.0025)	(0.0039)
Outside Public Boards	-0.0536***	0.0009***	0.0025***	-0.0034***
	(0.0098)	(0.0002)	(0.0005)	(0.0006)
Size (quarter)	0.0007	0.0000	0.0000	0.0000
	(0.0159)	(0.0003)	(0.0007)	(0.0010)
MB ratio (quarter)	0.1030***	-0.0018***	-0.0047***	0.0065***
	(0.0142)	(0.0003)	(0.0007)	(0.0009)
R&D dummy (quarter)	0.1935***	-0.0033***	-0.0094***	0.0127***
	(0.0376)	(0.0006)	(0.0019)	(0.0025)
Loss (quarter)	-0.0742*	0.0013*	0.0032*	-0.0046*
	(0.0420)	(0.0008)	(0.0017)	(0.0025)
Institutional Ownership (quarter)	0.7553***	-0.0132***	-0.0347***	0.0479***
	(0.1397)	(0.0025)	(0.0065)	(0.0089)
Dispersion	-0.0009	0.0000	0.0000	-0.0001
	(0.0011)	(0.0000)	(0.0000)	(0.0001)
Stock volatility (quarter)	1.4878***	-0.0261***	-0.0683***	0.0944***
	(0.3229)	(0.0057)	(0.0148)	(0.0204)
Board size	-0.0507***	0.0009***	0.0023***	-0.0032***
	(0.0119)	(0.0002)	(0.0005)	(0.0007)
Board independence	-0.3617**	0.0063**	0.0166**	-0.0230**
	(0.1486)	(0.0026)	(0.0069)	(0.0094)
CEO-Chairman	-0.0753**	0.0013**	0.0035**	-0.0048**
	(0.0355)	(0.0006)	(0.0017)	(0.0023)
CEO tenure	0.0357*	-0.0006*	-0.0016*	0.0023*
	(0.0210)	(0.0004)	(0.0010)	(0.0013)
Cut1 constant	-3.1013***			
	(0.2448)			
Cut2 constant	3.5220***			
	(0.2446)			
Observations	273,974	273,974	273,974	273,974
Year FE	Yes	Yes	Yes	Yes

Table 2.9: How independent director's insider trading profitability change with their own tenure

The dependent variable is the Market-adjusted buy-and-hold returns for different holding horizons. Tenure and Age are the tenure and the age of each independent director. Female is a dummy variable indicating whether the independent director is a female. Ownership is the total shares of the firm owned by this director scaled by total firm shares outstanding. Number of committee membership is the total number of committees the director sits in. Attend <75% meeting is a dummy variable equal to one if the director attends less than 75% of the board meeting this year. Outside boards is the number of other directorship the director holds in this year. Other control variables include Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Board size, Board independence, CEO-Chairman dummy, Recent trade, Return volatility, Transaction size, and Prior return. Their definitions are the same as in table 2. Firm and year fixed effect are included and the standard error is clustered by director-level and corrected for heterogeneity.

	Purchase				Sales			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Tenure	0.0237	0.0247	0.0096	0.0503	0.0061	0.0083	0.0147	0.0071
	(0.0147)	(0.0224)	(0.0275)	(0.0394)	(0.0084)	(0.0131)	(0.0166)	(0.0248)
Age	0.0121	0.0139	0.0171	-0.0344	-0.0133*	-0.0172	-0.0277*	-0.0299
	(0.0122)	(0.0185)	(0.0224)	(0.0348)	(0.0080)	(0.0124)	(0.0156)	(0.0244)
Ownership	0.1058	-0.2154	-0.295	-0.0687	0.0542	0.0425	0.0685	0.0457
	(0.1009)	(0.1698)	(0.1910)	(0.2392)	(0.0495)	(0.1145)	(0.1585)	(0.3104)
Female	-0.0942	-0.2002	-0.3649	-0.69	0.213	0.2625	-0.1058	0.0268
	(0.2232)	(0.3393)	(0.4257)	(0.6092)	(0.1408)	(0.2233)	(0.2751)	(0.3674)
Outside Public Boards	0.0423	0.0442	-0.1251	-0.1196	-0.0431	-0.094	0.0466	0.1383
	(0.0832)	(0.1257)	(0.1516)	(0.2119)	(0.0542)	(0.0855)	(0.1047)	(0.1571)
Attend <75% meeting	-1.0294	-0.869	-1.4068	-3.1718	-0.7005	-1.2986	-0.4326	0.3705
	(0.8666)	(1.4094)	(1.5239)	(2.2905)	(0.7018)	(1.1195)	(1.3293)	(1.7432)
Number of committee membership	0.0333	-0.0188	-0.0396	0.0404	0.0993**	0.0592	-0.0249	0.0047
	(0.0816)	(0.1246)	(0.1542)	(0.2220)	(0.0506)	(0.0852)	(0.1102)	(0.1692)
Recent trade	0.2351	-0.0959	0.3304	-0.017	-0.2019	-0.3189	-0.5743**	-0.4356
	(0.4516)	(0.5334)	(0.7718)	(0.7446)	(0.1433)	(0.2590)	(0.2767)	(0.3072)
Return volatility	44.7008***	97.1653***	100.5923***	134.7259***	-15.8747*	-41.0659***	-65.8495***	-91.3168***
	(8.9621)	(13.5374)	(17.0092)	(23.1229)	(8.9242)	(12.9744)	(16.4860)	(20.6689)
Transaction size	0.8301**	0.8871	1.1475	-0.1197	-0.2512	0.0355	0.0333	0.3479
	(0.4209)	(0.6122)	(0.9351)	(0.9729)	(0.2152)	(0.2875)	(0.2938)	(0.4750)
Prior return	-3.5530***	-6.2472***	-10.0399***	-14.7614***	-2.0072***	-4.4196***	-7.2443***	-12.8385***
	(0.4384)	(0.7724)	(0.9305)	(1.3451)	(0.4467)	(0.6738)	(0.8743)	(1.1304)
Size	1.3116***	3.0224***	4.6504***	6.1243***	-1.3001***	-2.3018***	-2.9409***	-4.0580***
	(0.3050)	(0.4739)	(0.5831)	(0.9189)	(0.2015)	(0.3371)	(0.4532)	(0.7321)
MB ratio	1.1376***	2.0663***	2.5845***	5.2889***	-0.4994***	-1.2045***	-1.6611***	-2.9400***
	(0.1625)	(0.2365)	(0.3098)	(0.5651)	(0.0923)	(0.1509)	(0.1971)	(0.3675)
R&D dummy	-0.4336	-1.0468	-1.8597	6.4211**	0.1631	-0.6633	-1.6946	-1.3778
	(0.9117)	(1.3712)	(1.5926)	(2.5889)	(0.4750)	(0.9183)	(1.0989)	(1.7701)
Loss	-0.3985	-1.5093**	-2.4294***	-4.2139***	0.9360***	2.8685***	3.5836***	6.5560***
	(0.4008)	(0.6916)	(0.8060)	(1.2012)	(0.3163)	(0.5172)	(0.7182)	(1.2002)
Institutional Ownership Ratio	1.9734**	0.6893	3.7821**	4.9566*	-1.9108***	-3.0698**	-4.7454***	-6.1513***
	(0.9986)	(1.6543)	(1.9035)	(2.9301)	(0.6967)	(1.2266)	(1.6584)	(2.0502)
Dispersion	0.0015	-0.0032	0.0104	-0.0269	0.0264**	0.0153	0.0031	0.0066
	(0.0116)	(0.0191)	(0.0482)	(0.0297)	(0.0104)	(0.0190)	(0.0173)	(0.0266)
Board size	-0.0982	-0.2507***	-0.2350**	-0.4390***	0.0714	0.1887**	0.3922***	0.9106***
	(0.0646)	(0.0907)	(0.1128)	(0.1665)	(0.0480)	(0.0813)	(0.0999)	(0.1439)
Board independence	-0.7679	0.4929	1.4204	0.7867	-2.0205**	-3.4299**	-2.6732	-4.6217
	(1.0685)	(1.6521)	(2.0870)	(3.1470)	(0.8914)	(1.4205)	(1.8793)	(2.8900)
CEO-Chairman	0.3001	-0.2493	-1.5592***	-1.6578**	0.2872*	0.5042*	0.8949**	0.9871*
	(0.2985)	(0.4316)	(0.5090)	(0.8272)	(0.1714)	(0.2853)	(0.3689)	(0.5931)
Observations	20,072	20,072	20,072	20,064	40,152	40,136	40,128	40,085
R-squared	0.2243	0.25	0.2895	0.3637	0.1516	0.1957	0.2273	0.3027
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 2.10: Change in independent director composition and isolated time effect

The dependent variable is the Market-adjusted buy-and-hold returns for different holding horizons. Percentage of independent director turnover represents the percentage of independent directors that were on the board last year but are not on the board this year. Percentage of new independent director measures the percentage of independent directors attend the board for the first year. Change is a dummy variable equals to one if the firm changes its composition of independent directors last year. No-change is a dummy variable equals to one if the firm does not change its composition of independent directors last year. Control variables are the same as in table 2, including Insider director tenure, Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Transaction size, Prior return, Recent trade, Return volatility, Independent director age, Co-opted independent directors, Board size, Board independence, Multi-directorship, independent director ownership and CEO-Chairman dummy.

Panel A: Percentage of independent director turnover				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Percentage of independent director turnover	-0.1616	-0.6468	-1.3421**	-1.7631*
	(0.2654)	(0.4248)	(0.5719)	(0.9305)
Panel B: Percentage of new independent directors				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Percentage of new independent director	0.4864	-0.4218	-2.8009***	-3.1365***
	(0.3611)	(0.5848)	(0.7844)	(1.2163)
Panel C: Time effect of the board tenure				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director tenure × Change	0.0377*	0.1134***	0.1323***	0.2617***
	(0.0203)	(0.0314)	(0.0420)	(0.0704)
Independent director tenure × No-change	0.0392**	0.1076***	0.1443***	0.3050***
	(0.0190)	(0.0297)	(0.0409)	(0.0691)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 2.11: Sudden death difference-in-difference

The dependent variable is the Market-adjusted buy-and-hold returns for different holding horizons. Control variables are the same as table 2, including Insider director tenure, Size, MB ratio, R&D dummy, Loss dummy, Institutional Ownership Ratio, Analyst dispersion, Transaction size, Prior return, Recent trade, Return volatility, Independent director age, Co-opted independent directors, Board size, Board independence, Multi-directorship, independent director ownership and CEO-Chairman dummy. Treatment firms are those experienced an independent director sudden death. To construct control firms, we require these firms have never had any independent director passed away during the whole sample period. The control firms are then matched with the treatment firms by industry and average independent director tenure. The pre- and post-periods are 730 calendar days before and after the date when the independent director died. We further require each treatment firm has at least one insider trading transaction during both pre- and post- periods. The results would be similar if we include the firm and year fixed effect and omit the treatment and post variable correspondingly.

Panel 1: ID death cause average ID tenure to decrease				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Treatment	0.2313	1.2124*	1.4563*	3.0040**
	(0.4216)	(0.6950)	(0.8581)	(1.3390)
Post	0.4711**	0.6312*	0.2706	0.887
	(0.2155)	(0.3431)	(0.4691)	(0.7452)
Treatment ×post	-1.2557**	-2.8941***	-2.3709**	-3.7906**
	(0.5176)	(0.8016)	(1.0132)	(1.5309)
Panel 2: ID death cause average ID tenure to increase				
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Treatment	0.209	1.2154	2.5401**	5.9686***
	(0.5537)	(0.9936)	(1.2075)	(1.6442)
Post	-0.0038	0.0918	-0.4027	3.4971***
	(0.3210)	(0.5484)	(0.7598)	(1.3252)
Treatment × post	0.9501	-2.0275	-2.9956	-3.9174
	(0.7455)	(1.3352)	(1.7812)	(2.7428)
Controls	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No
Year FE	No	No	No	No

Table 3.1: Participation rate of insider trading activities

This table summarize participate rate of insider trading, insider sales and insider purchase for all and different groups of insiders. Sell (No option) refers to insider sales that is not (completely or partially) related to exercise of granted options.

	#Obs	Trade	Buy	Sell	Sell (No option)
All sample insiders	304163	32.33%	8.07%	24.96%	14.26%
Independent directors	148976	22.92%	9.14%	14.27%	7.81%
Managers	155187	41.36%	7.04%	35.23%	20.45%
CEO	22216	47.96%	11.47%	38.00%	22.65%
CFO	10619	45.14%	7.05%	39.00%	21.37%

Table 3.2: Participation rate - Firm fixed effect and Insider fixed effect

Variables	Trade (no options)			Purchase			Sales (no options)		
Independent director	-0.133***	-0.134***	-0.148***	0.020***	0.021***	0.030***	-0.155***	-0.157***	-0.180***
	(0.004)	(0.004)	(0.007)	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)	(0.006)
Age	0.000*	0.001***	-0.002	-0.002***	-0.002***	-0.001	0.002***	0.002***	-0.001
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Ownership	0.010***	0.011***	0.006***	-0.000	0.001**	-0.004***	0.011***	0.011***	0.010***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
Female	-0.025***	-0.021***	-0.012	-0.027***	-0.027***	-0.029***	0.000	0.005*	0.018***
	(0.004)	(0.003)	(0.008)	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)	(0.007)
Board size	0.001	0.002***	0.002**	0.003***	0.002***	0.002***	-0.003***	0.000	0.001
	(0.001)	(0.001)	(0.001)	0.00	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Board independence	-0.045***	-0.029**	-0.02	0.016**	-0.007	-0.013	-0.062***	-0.022*	-0.005
	(0.010)	(0.013)	(0.015)	(0.007)	(0.009)	(0.010)	(0.009)	(0.011)	(0.012)
CEO-chairman	-0.010***	-0.006*	-0.004	-0.003*	-0.002	0.000	-0.006**	-0.004	-0.004
	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Size	-0.007***	0.024***	0.032***	-0.011***	-0.026***	-0.028***	0.003***	0.049***	0.059***
	(0.001)	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)
MB ratio	0.016***	0.010***	0.009***	-0.006***	-0.004***	-0.004***	0.022***	0.015***	0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
R&D dummy	-0.020***	-0.001	0.009	-0.016***	-0.01	0.000	-0.006**	0.006	0.007
	(0.003)	(0.011)	(0.012)	(0.002)	(0.007)	(0.008)	(0.003)	(0.009)	(0.010)
Loss	-0.023***	-0.008**	-0.002	0.021***	0.014***	0.012***	-0.046***	-0.022***	-0.014***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Institutional Ownership Ratio	-0.008	-0.005	-0.005	-0.081***	-0.012**	-0.018***	0.071***	0.005	0.011
	(0.007)	(0.009)	(0.009)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)
Dispersion	0.000	-0.000	-0.000	0.000	0.000	0.000	-0.000	-0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Stock volatility	0.292***	0.251***	0.258***	0.182***	0.234***	0.220***	0.138***	0.048**	0.071***
	(0.024)	(0.026)	(0.027)	(0.017)	(0.019)	(0.020)	(0.020)	(0.021)	(0.021)
Observations	184,892	184,861	179,594	184,892	184,861	179,594	184,892	184,861	179,594
R-squared	0.037	0.103	0.336	0.028	0.099	0.314	0.075	0.149	0.397
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Insider FE	No	No	Yes	No	No	Yes	No	No	Yes

Table 3.3: Probability of trading

Dependent variable is a binary variable equals to one if the insider trade/buy/sell his own firm shares this year. Standard error is clustered by individual-level. This table reports the result for OLS regression, but it would be similar if we use logit model.

	Manager and independent director				Independent directors			
Variable	Trade (no options)	Purchase	Sales	Sales (no options)	Trade (no options)	Purchase	Sales	Sales (no options)
Independent director	-0.1336***	0.0212***	-0.2798***	-0.1566***				
	(0.0036)	(0.0022)	(0.0037)	(0.0032)				
Age	0.0007***	-0.0017***	0.0041***	0.0023***	-0.0000	-0.0006***	0.0013***	0.0005***
	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Ownership	0.0114***	0.0010**	0.0034***	0.0111***	0.0148***	-0.0011	0.0139***	0.0165***
	(0.0009)	(0.0005)	(0.0009)	(0.0009)	(0.0018)	(0.0010)	(0.0018)	(0.0018)
Female	-0.0208***	-0.0268***	0.0108***	0.0052*	-0.0209***	-0.0214***	0.0123***	0.0002
	(0.0034)	(0.0021)	(0.0036)	(0.0030)	(0.0045)	(0.0033)	(0.0041)	(0.0034)
Tenure					0.0012***	-0.0046***	0.0102***	0.0058***
					(0.0003)	(0.0002)	(0.0003)	(0.0003)
Outside Public Boards					-0.0082***	-0.0026***	-0.0078***	-0.0058***
					(0.0013)	(0.0010)	(0.0012)	(0.0010)
Attend <75% meeting					-0.0350***	-0.0222***	-0.0154**	-0.0140**
					(0.0095)	(0.0075)	(0.0077)	(0.0063)
Number of committee membership					-0.0040***	-0.0030***	0.0031**	-0.001
					(0.0014)	(0.0010)	(0.0013)	(0.0010)
Board size	0.0024***	0.0020***	-0.0003	0.0003	0.0022**	0.0016*	0.0003	0.0006
	(0.0009)	(0.0006)	(0.0009)	(0.0007)	(0.0010)	(0.0008)	(0.0009)	(0.0007)
Board independence	-0.0286**	-0.0066	-0.0193	-0.0218*	-0.0390**	-0.0228*	-0.013	-0.0159
	(0.0134)	(0.0092)	(0.0136)	(0.0112)	(0.0170)	(0.0134)	(0.0150)	(0.0118)
CEO-chairman	-0.0059*	-0.0021	0.0075**	-0.0035	-0.0094**	-0.0018	0.0034	-0.0073**
	(0.0034)	(0.0022)	(0.0033)	(0.0029)	(0.0041)	(0.0030)	(0.0038)	(0.0031)
Size	0.0237***	-0.0259***	0.0969***	0.0492***	0.0203***	-0.0162***	0.0717***	0.0362***
	(0.0028)	(0.0019)	(0.0029)	(0.0024)	(0.0034)	(0.0025)	(0.0033)	(0.0026)
MB ratio	0.0105***	-0.0042***	0.0264***	0.0146***	0.0034*	-0.0058***	0.0197***	0.0093***
	(0.0014)	(0.0007)	(0.0019)	(0.0014)	(0.0018)	(0.0010)	(0.0021)	(0.0016)
R&D dummy	-0.0015	-0.0099	-0.0016	0.0062	0.0154	-0.0063	-0.0008	0.0224**
	(0.0108)	(0.0069)	(0.0123)	(0.0094)	(0.0129)	(0.0092)	(0.0136)	(0.0100)
Loss	-0.0076**	0.0136***	-0.0454***	-0.0224***	0.0015	0.0109***	-0.0217***	-0.0098***
	(0.0037)	(0.0027)	(0.0034)	(0.0029)	(0.0044)	(0.0036)	(0.0037)	(0.0030)
Institutional Ownership Ratio	-0.0055	-0.0124**	0.0210**	0.0048	-0.0023	-0.0056	0.0128	0.0009
	(0.0088)	(0.0058)	(0.0089)	(0.0074)	(0.0091)	(0.0069)	(0.0086)	(0.0068)
Dispersion	-0.0001	0.0002	-0.0002	-0.0003***	0.0003	0.0002	-0.0000	0.0000
	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Stock volatility	0.2511***	0.2337***	0.0917***	0.0480**	0.3033***	0.2543***	0.1210***	0.0676***
	(0.0259)	(0.0191)	(0.0241)	(0.0206)	(0.0323)	(0.0259)	(0.0278)	(0.0226)
Observations	184,861	184,861	184,861	184,861	110,694	110,694	110,694	110,694
R-squared	0.1028	0.0988	0.226	0.1492	0.1041	0.1263	0.1941	0.1339
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.4: Insider purchase OLS and Heckman comparison

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.897***	-1.423***	-2.014***	-3.215***	0.057***	-1.232***	-1.922***	-2.779***	-4.374***
	(0.232)	(0.362)	(0.455)	(0.694)	(0.011)	(0.240)	(0.385)	(0.478)	(0.729)
						[-0.638]	[-0.988]	[-1.654]	[-2.591]
						p = 0.007	p = 0.008	p = 0.000	p = 0.000
Ownership	0.124**	0.069	0.137	-0.001	0.020***	-0.075	-0.236***	-0.276***	-0.644***
	(0.050)	(0.074)	(0.089)	(0.143)	(0.003)	(0.056)	(0.089)	(0.100)	(0.160)
						[0.134]	[0.093]	[0.121]	[-0.015]
						p = 0.010	p = 0.253	p = 0.184	p = 0.919
Transaction size	0.218	0.327	0.375	0.053		0.206	0.319	0.362	0.02
	(0.162)	(0.259)	(0.390)	(0.486)		(0.146)	(0.244)	(0.373)	(0.472)
Recent trade					0.007***				
					(0.001)				
Return volatility					5.309***				
					(0.178)				
Prior return					-0.404***				
					(0.017)				
Constant	5.57	14.407***	16.052***	8.373	-3.335***	41.599***	68.859***	82.103***	110.051***
	(3.524)	(4.007)	(5.206)	(8.359)	(0.015)	(4.632)	(6.330)	(8.117)	(12.086)
lambda						-11.005***	-17.289***	-20.845***	-32.999***
						(0.937)	(1.483)	(1.890)	(2.796)
Predicted trading profitability	2.899	4.721	6.008	7.456		41.117	64.706	78.307	122.167
Observations						43,804,030	43,804,030	43,804,030	43,804,030
Uncensored Observations	21,428	21,419	21,423	21,409		20,958	20,958	20,958	20,958
Uncensored/All Observations						0.0478%			
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.5: Insider purchase OLS and Heckman comparison - More controls

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-1.069***	-1.744***	-2.230***	-2.378***	0.063***	-1.566***	-1.989***	-3.191***	-5.232***
	(0.316)	(0.499)	(0.642)	(0.890)	(0.020)	(0.448)	(0.737)	(0.951)	(1.324)
CEO	-0.652*	-0.633	-0.256	0.877	0.182***	-2.623***	-3.717***	-4.626***	-8.137***
	(0.382)	(0.617)	(0.797)	(1.130)	(0.025)	(0.562)	(0.917)	(1.203)	(1.744)
Transaction size	0.256	0.393	1.314	0.994		0.176	0.381	1.552	1.764*
	(0.369)	(1.229)	(1.356)	(0.837)		(0.412)	(1.473)	(1.542)	(1.002)
Ownership	0.162***	0.146*	0.123	0.004	0.015***	0.042	-0.114	-0.255*	-0.867***
	(0.055)	(0.081)	(0.105)	(0.150)	(0.003)	(0.073)	(0.109)	(0.138)	(0.175)
Recent trade					0.009***				
					(0.001)				
Return volatility					4.700***				
					(0.201)				
Prior return					-0.408***				
					(0.019)				
Female	-0.11	-0.142	-0.221	-0.154	-0.029	0.974***	1.019	1.548*	1.079
	(0.248)	(0.401)	(0.525)	(0.705)	(0.020)	(0.373)	(0.620)	(0.848)	(1.104)
Tenure	0.037***	0.050**	0.065**	0.119***	-0.012***	0.170***	0.269***	0.346***	0.649***
	(0.014)	(0.024)	(0.029)	(0.038)	(0.002)	(0.024)	(0.041)	(0.048)	(0.065)
Age	-0.014	-0.009	-0.021	-0.073**	-0.001	0.004	0.002	-0.009	-0.04
	(0.013)	(0.020)	(0.024)	(0.037)	(0.001)	(0.019)	(0.029)	(0.034)	(0.051)
Routine trader	0.625**	0.264	-0.252	0.311	0.136***	-1.451***	-3.250***	-4.369***	-5.676***
	(0.296)	(0.429)	(0.536)	(0.814)	(0.026)	(0.497)	(0.719)	(0.959)	(1.498)
Routine month	-1.443***	-0.84	-0.814	-1	0.401***	-6.410***	-9.331***	-11.514***	-20.470***
	(0.345)	(0.515)	(0.654)	(1.003)	(0.036)	(0.778)	(1.145)	(1.485)	(2.232)
Size	0.229	1.065**	2.887***	3.877***	0.005	0.946**	3.354***	6.098***	7.692***
	(0.341)	(0.508)	(0.607)	(0.981)	(0.006)	(0.458)	(0.668)	(0.815)	(1.342)
MB ratio	0.932***	2.427***	3.025***	6.820***	-0.034***	1.753***	3.305***	4.156***	9.772***
	(0.237)	(0.551)	(0.489)	(0.866)	(0.007)	(0.318)	(0.672)	(0.577)	(1.155)
R&D dummy	0.247	-0.689	-2.899	-2.899	-0.044***	0.097	-0.657	-2.934	-1.07
	(1.090)	(1.558)	(1.972)	(3.375)	(0.014)	(1.078)	(1.728)	(2.194)	(4.065)
Loss	-0.128	-0.234	0.165	-0.986	0.028*	-0.841*	-0.902	-1.066	-2.946*
	(0.449)	(0.711)	(0.859)	(1.264)	(0.015)	(0.502)	(0.878)	(1.035)	(1.557)
Dispersion	0.006	-0.002	0.021	-0.012	-0.002	0.025	0.051	0.099	0.05
	(0.010)	(0.027)	(0.054)	(0.042)	(0.002)	(0.029)	(0.042)	(0.071)	(0.093)
Institutional Ownership Ratio	-0.952	-2.474	1.116	-1.769	-0.182***	-1.518	-5.899***	-10.585***	-27.761***
	(1.179)	(1.904)	(2.366)	(3.509)	(0.030)	(1.336)	(2.155)	(2.638)	(4.103)
Constant	3.65	6.279	-4.408	-25.312**	-3.100***	43.116***	78.220***	83.704***	125.343***
	(5.537)	(6.621)	(7.331)	(11.913)	(0.070)	(6.925)	(9.564)	(11.433)	(18.043)
lambda						-14.404***	-25.188***	-32.825***	-53.633***
						(1.269)	(2.076)	(2.476)	(3.604)
Predicted trading profitability	2.327	3.615	4.628	5.339		51.735	89.849	116.806	188.817
Observations						25,383,850	25,383,850	25,383,850	25,383,850
Uncensored Observations	25,931	25,941	25,973	25,931		14,350	14,350	14,350	14,350
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.6: Manager purchase OLS and Heckman comparison

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Ownership	0.120**	0.154*	0.203*	-0.031	0.020***	-0.089	-0.200*	-0.306**	-0.720***
	(0.060)	(0.087)	(0.104)	(0.148)	(0.004)	(0.074)	(0.103)	(0.125)	(0.188)
						[0.118]	[0.155]	[0.099]	[-0.023]
						p = 0.088	p = 0.102	p = 0.371	p = 0.892
Transaction size	0.173	0.281*	0.229	0.071		0.152	0.274*	0.225	0.033
	(0.107)	(0.155)	(0.186)	(0.460)		(0.095)	(0.151)	(0.216)	(0.468)
Recent trade					0.007***				
					(0.001)				
Return volatility					5.196***				
					(0.240)				
Prior return					-0.481***				
					(0.025)				
Constant	4.980*	9.226***	17.835***	11.023**	-3.334***	42.209***	72.104***	86.182***	129.428***
	(2.808)	(2.985)	(4.377)	(4.771)	(0.021)	(5.505)	(8.344)	(10.439)	(14.953)
lambda						-11.056***	-18.990***	-21.641***	-37.285***
						(1.430)	(2.224)	(2.803)	(4.197)
Predicted trading profitability	3.406	5.672	7.033	8.886		42.235	72.348	83.595	139.891
Observations						19,921,371	19,921,371	19,921,371	19,921,371
Uncensored Observations	9,967	9,967	9,967	9,953		9,287	9,287	9,287	9,287
Uncensored/All Observations						0.0466%			
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.7: Independent director purchase OLS and Heckman comparison

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Ownership	-0.026	-0.375*	-0.496**	-0.154	0.023***	-0.236*	-0.707***	-0.912***	-0.822**
	(0.102)	(0.199)	(0.239)	(0.352)	(0.005)	(0.121)	(0.233)	(0.285)	(0.396)
						[-0.007]	[-0.374]	[-0.583]	[-0.158]
						p = 0.952	p = 0.090	p = 0.034	p = 0.683
Transaction size	2.105**	2.834**	5.018***	3.159		2.909***	3.235**	7.822***	2.62
	(0.856)	(1.434)	(1.509)	(1.984)		(0.906)	(1.636)	(1.312)	(1.887)
Recent trade					0.007***				
					(0.001)				
Return volatility					5.351***				
					(0.257)				
Prior return					-0.338***				
					(0.023)				
Constant	4.357	9.355*	12.768**	7.504	-3.278***	40.156***	63.293***	60.994***	97.703***
	(4.686)	(5.111)	(6.224)	(11.401)	(0.019)	(6.895)	(9.523)	(11.237)	(16.549)
lambda						-10.824***	-15.757***	-15.583***	-31.367***
						(1.369)	(2.220)	(2.596)	(3.691)
Predicted trading profitability	1.746	2.660	3.369	4.120		39.714	57.890	57.975	113.961
Observations						23,882,659	23,882,659	23,882,659	23,882,659
Uncensored Observations	11,938	11,937	11,936	11,939		11,667	11,667	11,667	11,667
Uncensored/All Observations						0.0489%			
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.8: Before and after the SOX: OLS and Heckman

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.892***	-1.378***	-1.915***	-3.144***	0.057***	-1.238***	-1.880***	-2.676***	-4.315***
	(0.232)	(0.362)	(0.454)	(0.695)	(0.011)	(0.240)	(0.385)	(0.476)	(0.728)
Pre-SOX	-0.413	-4.025**	-7.780***	-5.666*	0.088***	-0.267	-3.830**	-7.642***	-5.524*
	(1.007)	(1.588)	(2.394)	(3.053)	(0.024)	(1.059)	(1.647)	(2.483)	(3.189)
Post-crisis	-1.427	-4.431**	-9.702***	-6.349	-0.146***	5.243***	5.748***	-0.234	19.452***
	(1.395)	(2.160)	(3.023)	(4.240)	(0.033)	(1.240)	(1.951)	(2.862)	(3.787)
Ownership	0.125**	0.073	0.144	0.003	0.020***	-0.075	-0.228**	-0.257**	-0.632***
	(0.050)	(0.075)	(0.090)	(0.144)	(0.003)	(0.055)	(0.089)	(0.101)	(0.160)
Transaction size	0.218	0.326	0.373	0.053		0.206	0.319	0.36	0.019
	(0.161)	(0.259)	(0.388)	(0.485)		(0.146)	(0.244)	(0.372)	(0.472)
Recent trade					0.007***				
					(0.001)				
Return volatility					5.348***				
					(0.178)				
Prior return					-0.407***				
					(0.017)				
Constant	5.968	18.287***	23.556***	13.836	-3.424***	41.807***	71.485***	87.252***	113.850***
	(3.644)	(4.275)	(5.671)	(8.795)	(0.029)	(4.749)	(6.531)	(8.439)	(12.411)
lambda						-10.980***	-16.962***	-20.178***	-32.522***
						(0.927)	(1.474)	(1.875)	(2.786)
Predicted trading profitability	2.890	4.720	6.000	7.450		41.028	63.565	75.982	120.500
Observations	21,428	21,419	21,423	21,409		43,804,030	43,804,030	43,804,030	43,804,030
Uncensored Observations						20,958	20,958	20,958	20,958
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.9: Presence of selection bias in insider purchase

	rho				$\chi^2(\rho = 0)$			
	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Panel A: Managers + IDs								
Pre-SOX	-0.584	-0.672	-0.687	-0.649	45.98	39.86	53.67	38.38
Post-SOX	-0.948	-0.939	-0.902	-0.939	107.57	62.84	20.19	118.54
Post-Crisis	-0.95	-0.965	-0.954	-0.941	205.5	262.75	248.89	110.14
All	-0.746	-0.807	-0.783	-0.772	79.14	83.17	91.09	116.65
Panel B: Managers								
Pre-SOX	-0.695	-0.891	-0.822	-0.807	32.79	17.53	38.87	25.39
Post-SOX	-0.988	-0.972	-0.973	-0.934	13.15	16.16	20.05	49.84
Post-Crisis	-0.921	-0.942	-0.96	-0.931	38.06	12.24	58.79	25.93
All	-0.712	-0.806	-0.781	-0.787	40.41	38.14	46.26	63.52
Panel C: IDs								
Pre-SOX	-0.565	-0.514	-0.591	-0.56	13.17	6.82	13.21	9.47
Post-SOX	-0.958	-0.959	-0.971	-0.938	76.75	59.19	83.89	98.71
Post-Crisis	-0.99	-0.982	-0.978	-0.977	93.55	152.38	110.32	68.46
All	-0.837	-0.854	-0.839	-0.836	50.39	48.93	59.17	101.72

Table 3.10: Daily buying decisions

Variables	Manager	Independent director	Manager	Independent director	Manager	Independent director	Manager	Independent director
High coverage	-0.178***	-0.091*						
	(0.062)	(0.054)						
CEO-Chairman			-0.857***	-0.411*				
			(0.288)	(0.243)				
ITP					0.048	-0.037		
					(0.305)	(0.250)		
Blackout							-3.548***	-3.436***
							(0.219)	(0.227)
Ownership	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Recent trade	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return volatility	0.025***	0.023***	0.024***	0.023***	0.021***	0.024***	0.024***	0.023***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Prior return	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm FE	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.11: High or low analyst coverage: OLS and Heckman

		OLS				Heckman			
Panel A: Managers + IDs									
Predicted trading profitability	High	2.227	3.532	4.373	6.420	39.081	67.765	79.775	115.514
	Low	3.517	5.750	7.593	8.580	40.865	60.605	76.357	123.037
	More controls								
	High	2.220	3.505	4.359	6.390	49.739	90.302	108.318	166.059
	Low	3.366	5.237	6.582	7.353	53.379	81.742	108.590	180.147
Independent director	High	-1.049***	-2.029***	-2.675***	-3.811***	-2.276***	-4.121***	-5.189***	-7.277***
		(0.336)	(0.504)	(0.619)	(0.961)	(0.382)	(0.555)	(0.683)	(1.068)
	Low	-0.672**	-0.836	-1.320*	-2.918***	-0.32	-0.161	-0.451	-1.734*
		(0.326)	(0.521)	(0.684)	(0.985)	(0.334)	(0.539)	(0.696)	(1.019)
	More controls								
	High	-1.108***	-2.274***	-3.050***	-4.473***	-2.804***	-5.274***	-6.664***	-9.672***
		(0.337)	(0.504)	(0.621)	(0.955)	(0.396)	(0.576)	(0.705)	(1.083)
	Low	-0.810**	-1.390***	-2.146***	-3.517***	-0.468	-0.687	-1.196*	-2.136**
		(0.330)	(0.488)	(0.629)	(0.923)	(0.330)	(0.494)	(0.634)	(0.920)
Panel B: Managers									
Predicted trading profitability	High	3.079	5.535	6.422	8.135	48.406	93.120	112.254	146.763
	Low	3.603	5.768	7.342	9.291	42.995	66.320	76.554	127.583
	More controls								
	High	3.073	5.548	6.489	8.273	83.665	133.367	153.022	190.507
	Low	3.469	5.340	6.429	7.800	58.193	84.809	112.104	181.455
Panel C: IDs									
Predicted trading profitability	High	1.305	1.816	2.533	3.656	55.036	61.865	83.394	94.593
	Low	2.279	3.657	4.346	4.849	43.433	61.802	50.320	91.758
	More controls								
	High	1.305	1.805	2.530	3.623	61.109	76.221	96.861	122.965
	Low	2.115	3.280	3.867	4.149	49.711	87.588	67.809	106.435

Table 3.12: CEO is or is not Chairman of the board: OLS and Heckman

		OLS				Heckman			
Panel A: Managers + IDs									
Predicted trading profitability	Yes	2.876	4.679	5.461	6.687	43.283	64.327	83.348	136.298
	No	3.006	4.848	6.579	8.393	40.643	78.494	95.464	152.988
	More controls								
	Yes	2.799	4.447	5.294	6.510	51.626	85.608	110.172	165.857
	No	2.847	4.483	5.778	7.185	49.068	94.664	123.565	208.234
Independent director	Yes	-0.911***	-1.528***	-2.266***	-2.746***	-1.463***	-2.335***	-3.323***	-4.406***
		(0.340)	(0.503)	(0.608)	(0.872)	(0.347)	(0.517)	(0.629)	(0.896)
	No	-0.796**	-1.272**	-1.05	-2.258**	-1.191***	-1.748***	-1.595**	-3.232***
		(0.348)	(0.518)	(0.692)	(1.111)	(0.361)	(0.550)	(0.747)	(1.168)
	More controls								
	Yes	-0.887***	-1.811***	-2.864***	-3.486***	-1.616***	-2.961***	-4.233***	-5.212***
		(0.343)	(0.511)	(0.630)	(0.886)	(0.349)	(0.523)	(0.647)	(0.891)
	No	-0.858**	-1.117**	-1.099	-1.592	-1.524***	-2.076***	-2.274***	-3.847***
		(0.354)	(0.524)	(0.683)	(1.037)	(0.369)	(0.546)	(0.714)	(1.072)
Panel B: Managers									
Predicted trading profitability	Yes	3.609	5.918	7.432	8.157	52.426	97.197	119.490	179.193
	No	3.281	5.478	6.761	9.643	44.757	74.745	116.699	182.687
	More controls								
	Yes	3.550	5.802	7.225	8.113	66.243	122.214	148.122	221.988
	No	3.111	4.991	5.736	7.691	71.585	87.157	123.087	224.436
Panel C: IDs									
Predicted trading profitability	Yes	1.549	2.324	2.934	3.701	54.618	67.242	80.644	96.497
	No	2.031	3.128	3.955	4.726	69.636	94.700	91.100	154.590
	More controls								
	Yes	1.465	2.082	2.664	3.379	59.880	84.199	92.674	103.174
	No	1.939	3.007	3.751	4.544	79.069	108.409	109.921	165.794

Table 3.13: Adoption of internal trading policy: OLS and Heckman

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.897***	-1.423***	-2.014***	-3.215***	0.058***	-1.234***	-1.925***	-2.783***	-4.379***
	-0.232	-0.362	-0.455	-0.694	-0.011	-0.24	-0.385	-0.478	-0.729
ITP	-3.215	-10.743***	-0.151	0.624	-0.009	-8.256**	-4.502	-28.767***	-41.111***
	-3.605	-3.911	-4.121	-5.302	-0.012	-3.465	-4.174	-5.145	-7.721
Ownership	0.124**	0.069	0.137	-0.001	0.020***	-0.076	-0.237***	-0.277***	-0.644***
	-0.05	-0.074	-0.089	-0.143	-0.003	-0.056	-0.089	-0.1	-0.16
Transaction size	0.218	0.327	0.375	0.053		0.206	0.319	0.362	0.02
	-0.162	-0.259	-0.39	-0.486		-0.146	-0.244	-0.373	-0.472
Recent trade					0.007***				
					-0.001				
Return volatility					5.296***				
					-0.181				
Prior return					-0.403***				
					-0.017				
Constant	5.57	14.407***	16.052***	8.373	-3.333***	41.639***	68.918***	82.181***	110.152***
	-3.524	-4.007	-5.206	-8.36	-0.016	-4.634	-6.334	-8.122	-12.094
lambda						-11.023***	-17.317***	-20.880***	-33.047***
						-0.939	-1.486	-1.893	-2.801
Predicted trading profitability	2.900	4.720	6.010	7.460		41.180	64.800	78.430	122.330
Observations	21,428	21,419	21,423	21,409		43,804,030	43,804,030	43,804,030	43,804,030
Uncensored Observations						20,958	20,958	20,958	20,958
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.14: Blackout period: OLS and Heckman

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.842***	-1.435***	-2.176***	-3.447***	0.058***	-1.246***	-2.042***	-2.915***	-4.551***
	(0.239)	(0.394)	(0.469)	(0.699)	(0.011)	(0.242)	(0.402)	(0.480)	(0.715)
Blackout	2.779**	3.395*	0.422	4.591	-0.370***	6.238***	8.545***	6.759***	14.754***
	(1.342)	(1.746)	(2.288)	(2.910)	(0.029)	(1.383)	(1.850)	(2.364)	(3.015)
Ownership	0.139***	0.072	0.114	-0.013	0.020***	-0.074	-0.259***	-0.292***	-0.643***
	(0.052)	(0.089)	(0.094)	(0.147)	(0.003)	(0.056)	(0.095)	(0.103)	(0.160)
Transaction size	0.213	0.326	0.371	0.047		0.205	0.316	0.358	0.016
	(0.157)	(0.260)	(0.389)	(0.494)		(0.146)	(0.242)	(0.373)	(0.474)
Recent trade					0.007***				
					(0.001)				
Return volatility					5.307***				
					(0.180)				
Prior return					-0.402***				
					(0.017)				
Constant	4.659	11.004***	12.339**	-0.182	-3.331***	41.510***	67.930***	81.592***	108.842***
	(3.601)	(4.053)	(5.194)	(8.090)	(0.015)	(4.635)	(6.366)	(8.156)	(12.024)
lambda						-11.010***	-17.019***	-20.696***	-32.649***
						(0.944)	(1.508)	(1.912)	(2.783)
Predicted trading profitability	2.910	4.750	6.030	7.520		41.110	63.710	77.730	120.780
Observations	20,899	20,895	20,893	20,877		43,572,399	43,572,399	43,572,399	43,572,399
Uncensored Observations						20,862	20,862	20,862	20,862
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.15: Insider sales OLS and Heckman comparison

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.177***	-0.276***	-0.246**	-0.034	-0.460***	-0.289	-0.780**	0.029	0.761
	(0.056)	(0.089)	(0.114)	(0.172)	(0.012)	(0.221)	(0.352)	(0.461)	(0.707)
Ownership	-0.321***	-0.178	0.010	-0.507**	0.034***	0.003	-0.007	-0.078*	-0.137**
	(0.069)	(0.119)	(0.177)	(0.200)	(0.002)	(0.020)	(0.032)	(0.042)	(0.067)
Transaction size	-0.006	-0.041**	-0.048**	-0.073*		-0.365***	-0.235*	-0.153	-0.542***
	(0.011)	(0.018)	(0.023)	(0.038)		(0.080)	(0.142)	(0.149)	(0.210)
Recent trade					0.016***				
					(0.001)				
Return volatility					1.472***				
					(0.249)				
Prior return					0.332***				
					(0.009)				
Constant	6.226***	5.767**	5.366***	3.35	-2.780***	5.515***	3.139	7.549**	6.114
	(1.404)	(2.410)	(1.951)	(4.074)	(0.016)	(2.025)	(3.266)	(3.745)	(5.979)
lambda						0.291	1.17	-0.807	-1.796
						(0.499)	(0.792)	(1.042)	(1.600)
Predicted trading profitability	-0.229	-0.650	-1.179	-2.941		-1.127	-4.112	0.928	1.805
Observations						43,804,028	43,804,028	43,804,028	43,804,028
Uncensored Observations	193,467	193,451	193,409	193,237		148,165	148,165	148,165	148,165
Uncensored/All Observations						0.3380%			
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.16: Insider sales OLS and Heckman comparison - More controls

	OLS					Heckman			
Variables	R(t+30)	R(t+60)	R(t+90)	R(t+180)	Selection	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Independent director	-0.09	-0.229	-0.421*	-0.253	-0.494***	0.936**	1.506**	3.519***	8.879***
	(0.118)	(0.187)	(0.241)	(0.378)	(0.017)	(0.387)	(0.616)	(0.772)	(1.222)
CEO	0.194	0.311	0.297	0.434	-0.009	0.281*	0.375	0.494	0.968*
	(0.132)	(0.206)	(0.281)	(0.443)	(0.020)	(0.152)	(0.234)	(0.323)	(0.499)
Return volatility					2.235***				
					(0.301)				
Recent trade					0.016***				
					(0.001)				
Prior return					0.286***				
					(0.012)				
Transaction size	-0.233**	-0.046	-0.065	-0.455*		-0.396***	-0.162	-0.306*	-0.597**
	(0.116)	(0.153)	(0.187)	(0.251)		(0.110)	(0.149)	(0.170)	(0.296)
Option related	0.325***	0.693***	0.708***	1.344***		0.419***	0.700***	0.776***	1.252***
	(0.092)	(0.141)	(0.182)	(0.276)		(0.108)	(0.165)	(0.216)	(0.318)
Female	-0.01	0.054	-0.177	-0.312	-0.116***	0.295*	0.647***	0.987***	2.254***
	(0.115)	(0.183)	(0.240)	(0.371)	(0.016)	(0.156)	(0.248)	(0.317)	(0.486)
Tenure	-0.007	-0.007	-0.013	-0.026	0.011***	-0.031***	-0.046***	-0.103***	-0.241***
	(0.006)	(0.009)	(0.012)	(0.018)	(0.001)	(0.010)	(0.016)	(0.020)	(0.032)
Age	0.001	-0.003	-0.001	-0.013	-0.002*	0.006	0.005	0.017	0.026
	(0.006)	(0.009)	(0.012)	(0.018)	(0.001)	(0.007)	(0.011)	(0.014)	(0.022)
Ownership	-0.028*	-0.042	-0.044	-0.05	0.021***	-0.054**	-0.092**	-0.199***	-0.388***
	(0.017)	(0.030)	(0.041)	(0.068)	(0.002)	(0.025)	(0.041)	(0.057)	(0.092)
Routine trader	-0.07	-0.364**	-0.525**	-0.998***	0.272***	-0.652***	-1.372***	-2.763***	-5.864***
	(0.129)	(0.182)	(0.229)	(0.355)	(0.019)	(0.251)	(0.377)	(0.473)	(0.716)
Routine month	-0.049	0.133	-0.19	-0.347	0.470***	-0.741*	-1.293**	-3.656***	-8.121***
	(0.217)	(0.273)	(0.380)	(0.561)	(0.030)	(0.429)	(0.606)	(0.810)	(1.345)
Size	-1.202***	-2.121***	-2.657***	-2.872***	-0.001	-1.021***	-1.996***	-2.497***	-2.441***
	(0.154)	(0.267)	(0.391)	(0.640)	(0.006)	(0.180)	(0.315)	(0.466)	(0.753)
MB ratio	-0.618***	-1.310***	-1.837***	-3.797***	0.035***	-0.723***	-1.511***	-2.271***	-4.933***
	(0.059)	(0.102)	(0.175)	(0.267)	(0.003)	(0.074)	(0.125)	(0.212)	(0.279)
R&D dummy	0.597	0.689	-0.605	-0.044	0.043***	0.592	0.487	-0.655	0.552
	(0.470)	(0.776)	(0.999)	(1.482)	(0.013)	(0.524)	(0.859)	(1.043)	(1.405)
Loss	0.131	0.594	0.89	2.528***	-0.153***	0.568*	1.359***	2.424***	6.010***
	(0.256)	(0.413)	(0.578)	(0.917)	(0.023)	(0.308)	(0.493)	(0.722)	(1.076)
Dispersion	0.001	0.012	0.004	0.016	0.000	0.004	0.013	0.004	0.009
	(0.010)	(0.014)	(0.014)	(0.021)	(0.000)	(0.010)	(0.014)	(0.014)	(0.022)
Institutional Ownership Ratio	-0.187	-0.479	-1.019	-0.512	0.368***	-0.428	-0.901	-3.278**	-6.994***
	(0.564)	(0.922)	(1.312)	(2.059)	(0.033)	(0.720)	(1.218)	(1.639)	(2.540)
Constant	17.160***	26.189***	35.351***	38.914***	-3.068***	23.108***	38.843***	62.928***	99.749***
	(2.357)	(4.188)	(3.069)	(7.077)	(0.092)	(3.432)	(5.713)	(6.221)	(11.083)
lambda						-1.992**	-3.687***	-8.752***	-19.470***
						(0.810)	(1.270)	(1.599)	(2.595)
Predicted trading profitability	-0.356	-0.939	-1.640	-3.891		5.093	9.169	22.339	49.606
Observations						25,383,850	25,383,850	25,383,850	25,383,850
Uncensored Observations	96,632	96,634	96,614	96,576		75,181	75,181	75,181	75,181
Firm FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.17: Presence of selection bias in insider sales

	rho				$\chi^2(\rho = 0)$			
	R(t+30)	R(t+60)	R(t+90)	R(t+180)	R(t+30)	R(t+60)	R(t+90)	R(t+180)
Panel A: Managers + IDs								
Pre-SOX	0.96	0.976	0.977	0.988	109.86	149.4	163.97	786.11
Post-SOX	-0.225	-0.29	-0.442	-0.595	12.34	25.6	82.02	241.14
Post-Crisis	-0.405	-0.546	-0.601	-0.598	30.2	152.61	224.3	263.44
All	0.069	0.151	-0.025	-0.041	0.58	0.98	0.07	0.2
Panel B: Managers								
Pre-SOX	0.975	0.987	0.987	0.994	440.72	843.31	761.58	407.67
Post-SOX	-0.337	-0.296	-0.424	-0.552	20.04	23.94	60.88	125.59
Post-Crisis	-0.755	-0.585	-0.508	-0.551	28.58	37.43	30.88	64.23
All	0.112	0.13	0.039	-0.021	1.33	1.04	0.12	0.04
Panel C: IDs								
Pre-SOX	0.082	-0.004	0.995	0.445	0.02	0.00	46.38	3.43
Post-SOX	-0.631	-0.309	-0.543	-0.67	4.79	6.64	27.14	28.65
Post-Crisis	-0.682	-0.669	-0.677	-0.779	9.13	22.98	26.98	4.59
All	-0.103	0.068	-0.139	-0.107	0.93	0.14	1.8	0.99

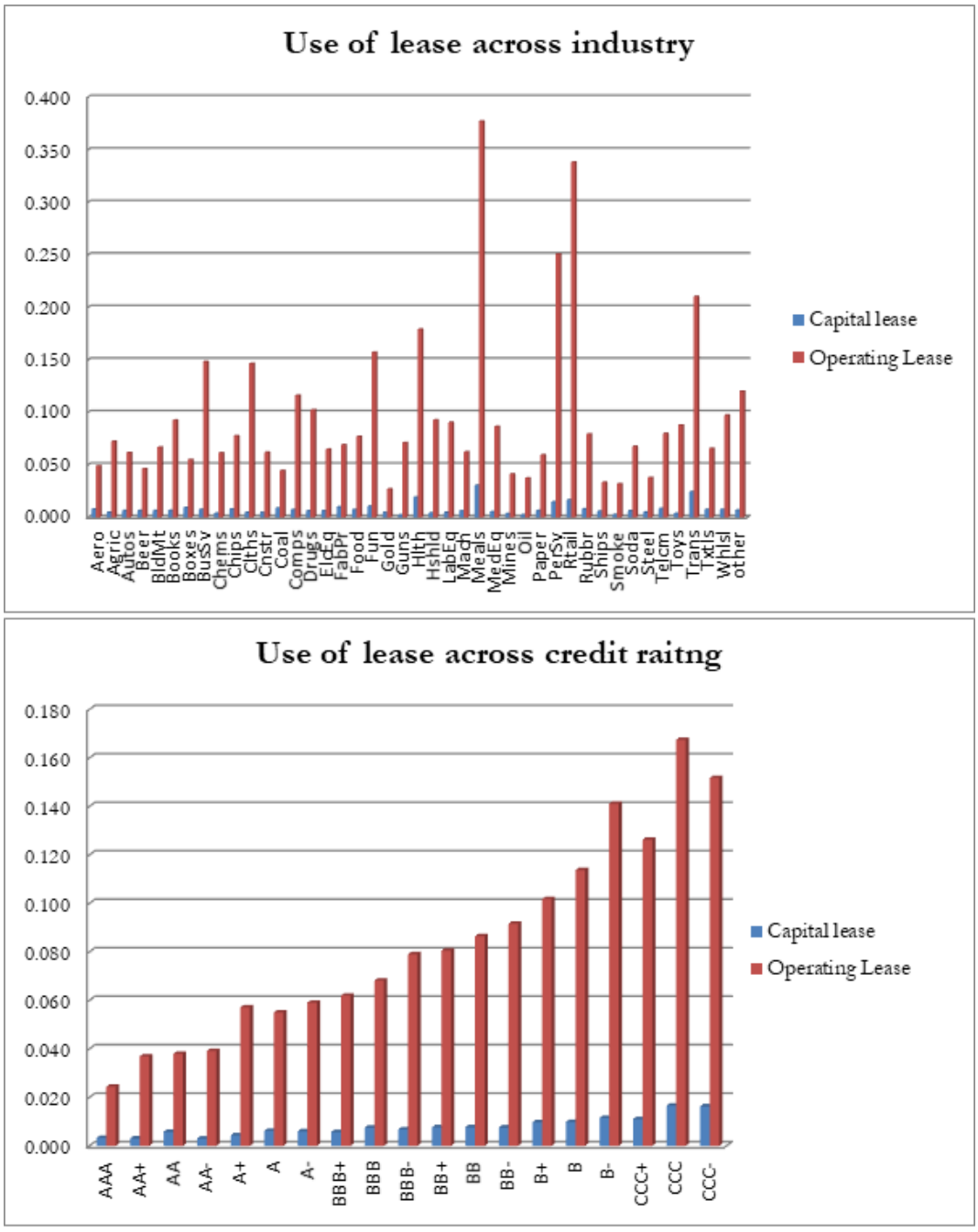

Figure 1.1: The use of lease across different industries and credit rating categories

Capital lease and operating lease are both scaled by the total asset. Firms in financial and utility industries and firms with credit rating lower than CCC- are excluded.

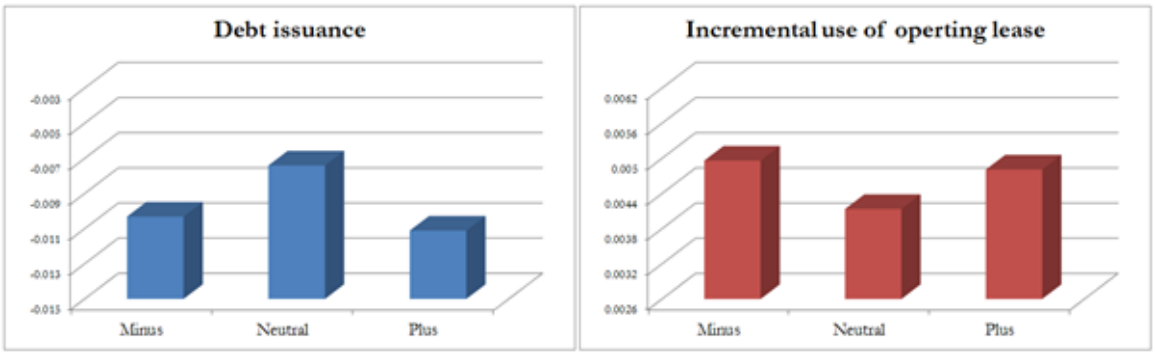

Figure 1.2: Debt issuance and incremental use of operating lease for different groups of firms

Debt issuance equals to the long-term debt issuance minus the long-term debt reduction plus the change in current debt. Incremental use of operating lease equals to the change of capitalized operating lease from last year. Debt issuance and change in capitalized operating lease are scaled by total assets. Minus group consists of all firms having a "-" in their S&P ratings. Plus group consists of all firms having a "+" in their S&P ratings. Neutral group consists of firms in the middle tier which contain neither "-" nor "+". Firms in the minus group are considered to have more downgrading concern. Firms belonging to the plus group are more likely to make upgrading attempts.

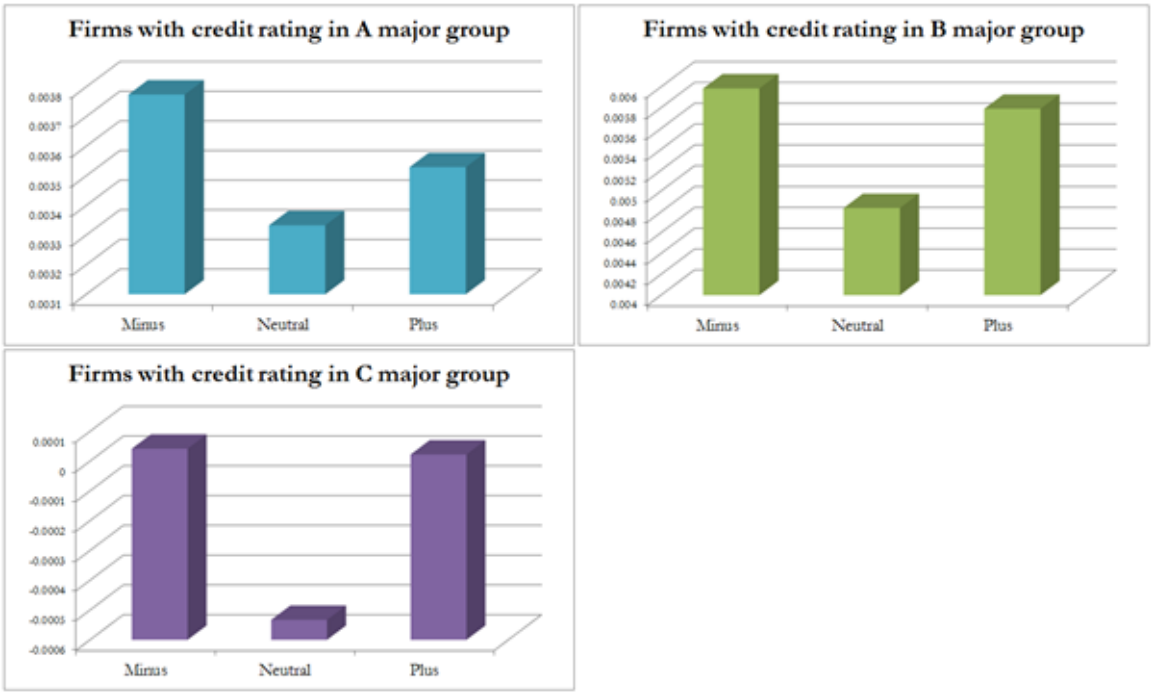

Figure 1.3: Incremental use of operating lease among different groups of firms

Incremental use of operating lease equals to the change of capitalized operating lease from last year. Change in capitalized operating lease is scaled by total assets. A major group includes all firms with S&P credit rating belong to "AAA", "AA" or "A" broad categories. B major group includes all firms with S&P credit rating belong to "BBB", "BB" or "B" broad categories. C major group only includes firms with S&P credit rating belong to "CCC" broad categories because we exclude the firms with credit rating lower than CCC-. Then for each major group, the firms are further separated into minus, plus and neutral groups. Minus group consists of all firms having a "-" in their S&P ratings. Plus group consists of all firms having a "+" in their S&P ratings. Neutral group consists of firms in the middle tier which contain neither "-" nor "+". Firms in the minus group are considered to have more downgrading concern. Firms belonging to the plus group are more likely to make upgrading attempts.

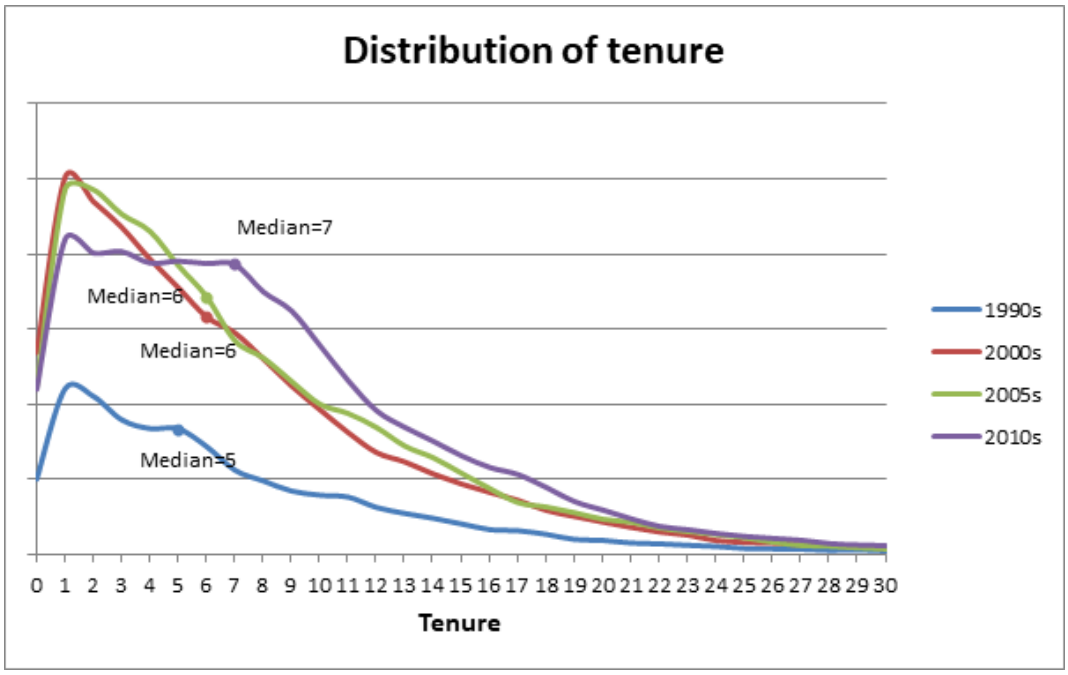

Figure 2.1: Distribution of tenure for different time periods

This figure plots the distribution of tenure for all independent directors of the sample firms for four different time periods. The 1990s include year 1998 and 1999. During this period, the median tenure of all independent directors is 5 years. The 2000s include the year 2000 to 2004. The 2005s include the year 2005 to 2009. During these two periods, the median tenure of all independent directors are both 6 years. The 2010s include the year 2010 to 2014. During this period, the median tenure of all independent directors becomes 7 years.

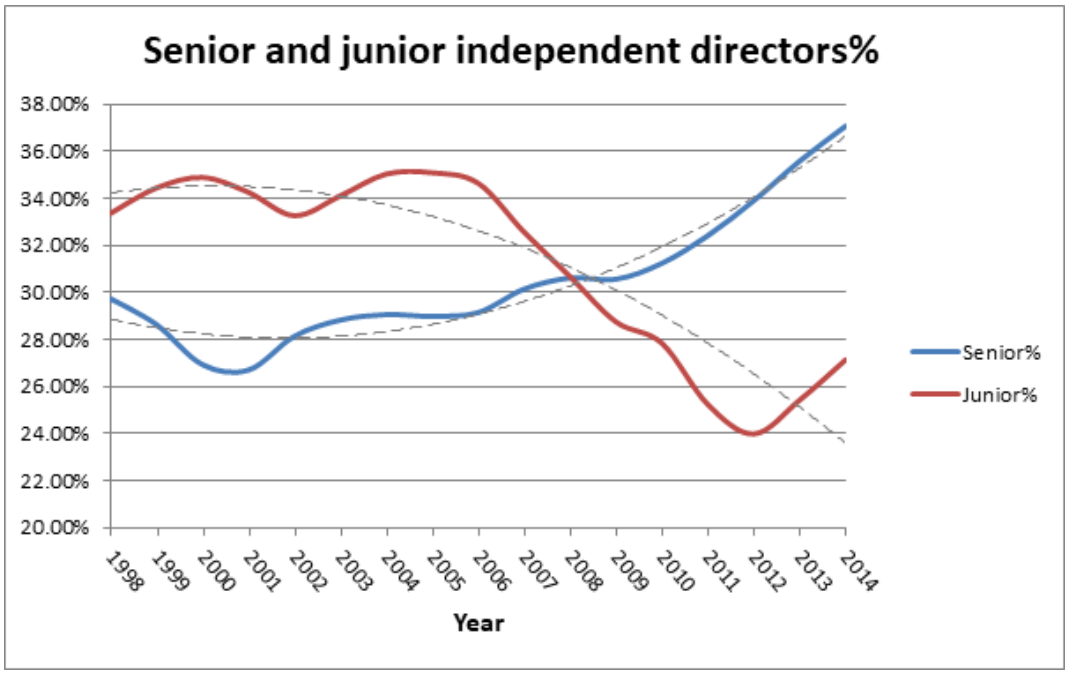

Figure 2.2: Percentage of senior and junior independent directors over time

Among all independent directors in all sample firms during the whole sample period, the top 30 percentile of the tenure is 10 years and bottom 30 percentile equals to 3 years. Senior independent director is defined as those whose tenure is longer than 10 years. And junior independent director is defined as those whose tenure is shorter than 3 years. This figure shows how the percentages of senior and junior independent directors change over time respectively.

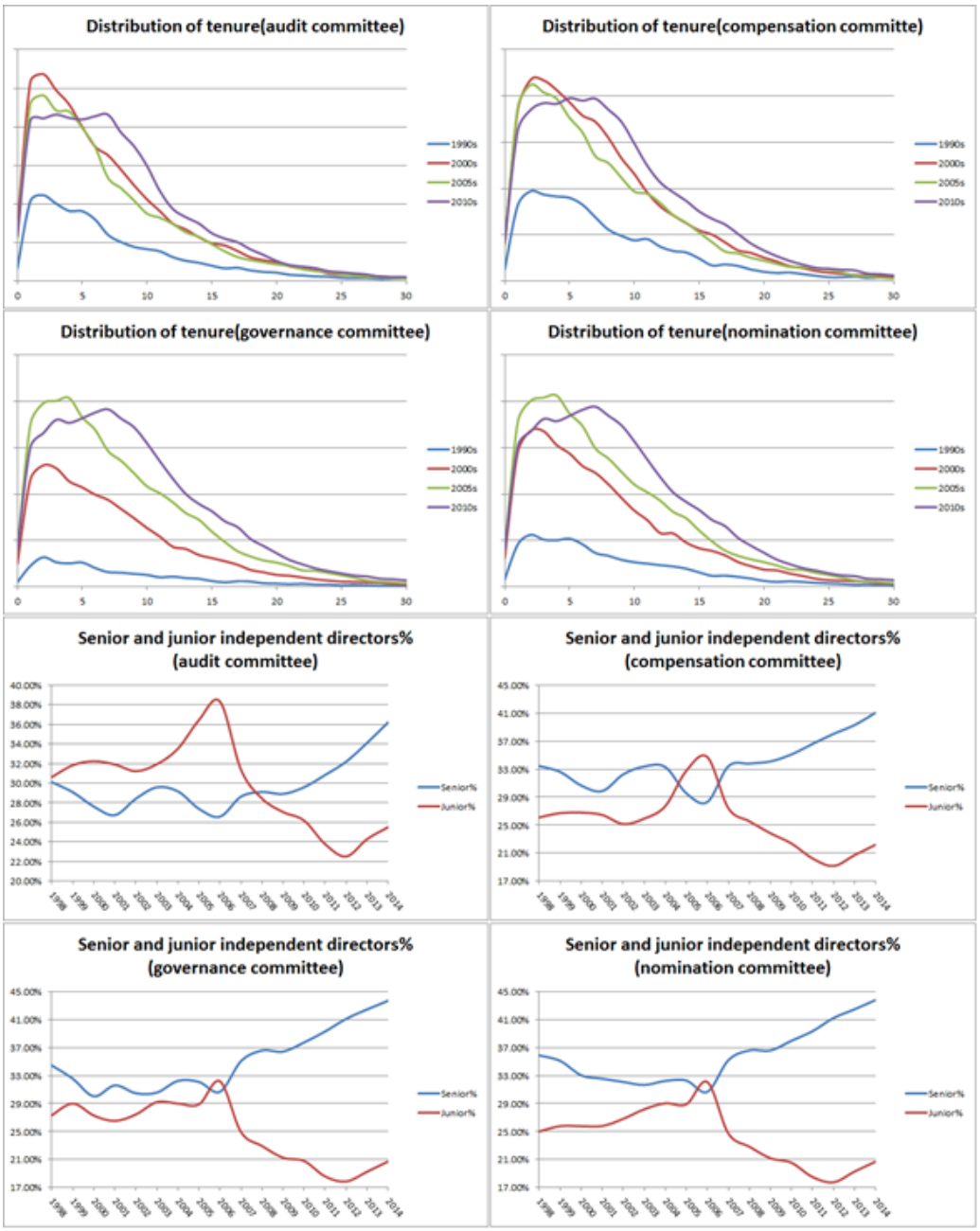

Figure 2.3: Distribution of tenure and Percentage of senior or junior independent directors for different board committees

The definitions are the same as in figure 1 and figure 2. The lines are plotted for the independent directors sitting on four different board committees respectively. The SOX and associated exchange rule changes have slightly different policies among these four committees.

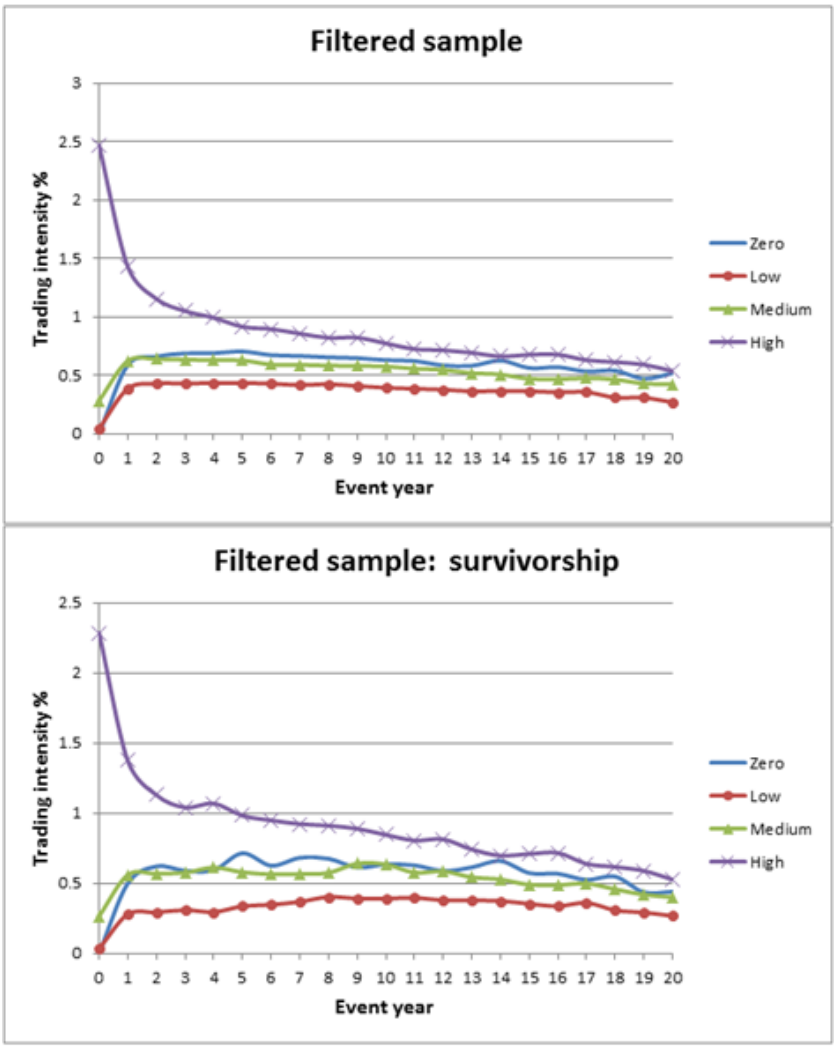

Figure 3.1: Firm's trading intensity do not seem to persistent over time

This figure presents the average trading intensity of four portfolios in event time, where year zero is the portfolio formation period. Each year, we take firms with zero trading intensity as portfolio zero, and sort the rest of the firms into three trisections according to their trading intensity, which we denote: Low, Medium, and High. The portfolio formation year is denoted event year 0. Holding the portfolios fixed for the next 20 years, we compute the average trading intensity for each portfolio. For example, in 1986 we separate firms into these four groups, and for each year from 1987 to 1996, we compute the average trading intensity for each of these four portfolios. We repeat these two steps of sorting and averaging for every year in the sample period. This process generates 31 sets of event-time averages, one for each year in our sample. We then compute the average trading intensity of each portfolio across the 31 sets within each event year. The lower panel presents similar results, but for a subsample of firms required to exist for at least next 20 years (similarly, we can only perform the portfolio formation till 1996 for our sample).

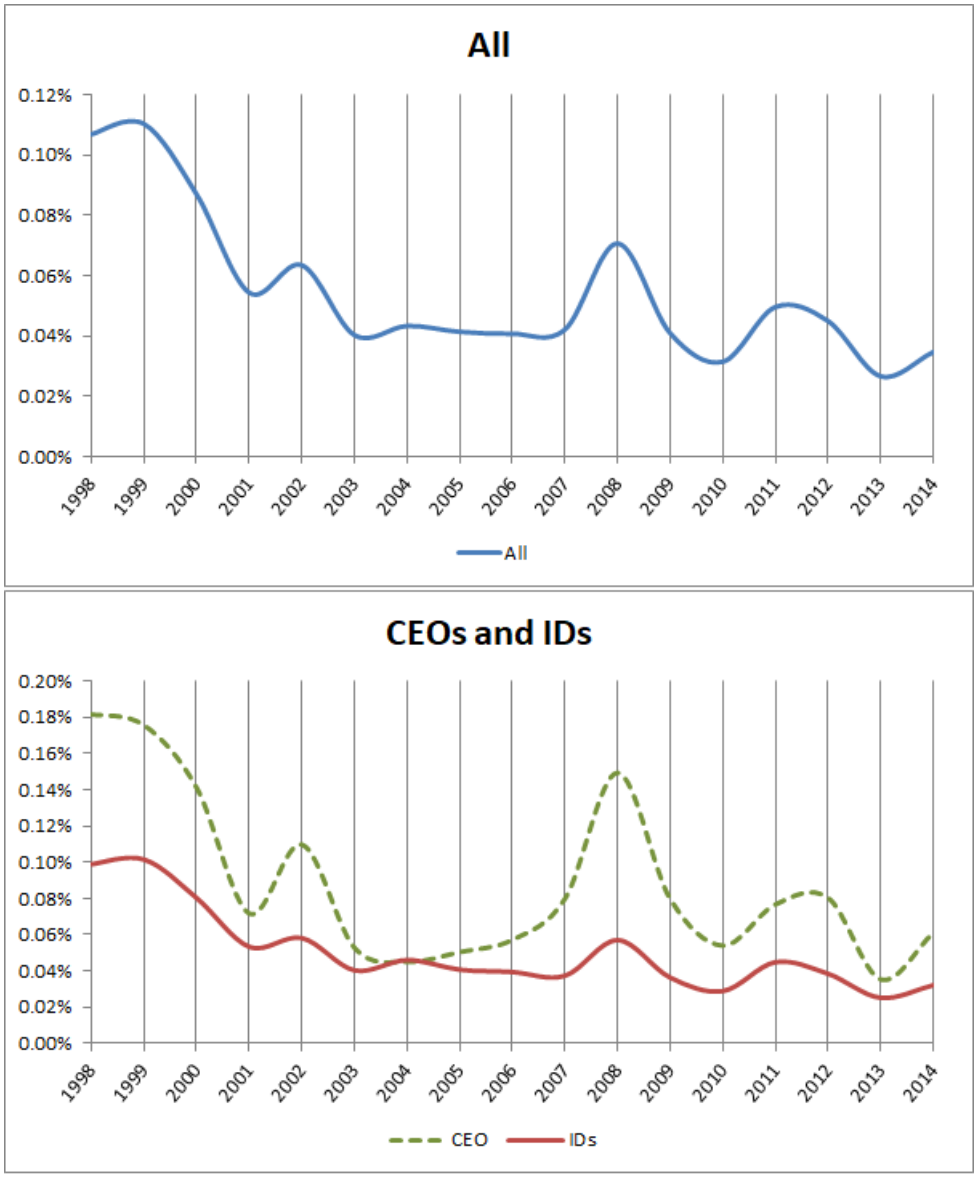

Figure 3.2: Censoring rate over years

This figure plots the percentage of uncensored observations divided by all observations. It can be considered as a daily-level participate rate.