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Insider trading in takeover targets

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ABSTRACT

We examine open market stock trades by registered insiders in about 3700 targets of takeovers announced during 1988–2006 and in a control sample of non-targets, both during an 'informed' and a control period. Using difference-in-differences regressions of several insider trading measures, we find no evidence that insiders increase their purchases before takeover announcements; instead, they decrease them. But while insiders reduce their purchases below normal levels, they reduce their sales even more, thus increasing their *net* purchases. This 'passive' insider trading holds for each of the five insider groups we examine, for all three measures of net purchases, and is more pronounced in certain sub-samples with less uncertainty about takeover completion, such as friendly deals, and deals with a single bidder, domestic acquirer, or less regulated target. The magnitude of the increase in the dollar value of net purchases is quite substantial, about 50% relative to their usual levels, for targets' officers and directors in the six-month pre-announcement period. Our finding of widespread profitable passive trading by target insiders during takeover negotiations points to the limits of insider trading regulation. Finally, our finding that registered insiders of target firms largely refrain from profitable active trading before takeover announcements contrasts with prior findings that insiders engage in such trading before announcements of other important corporate events, and points to the effectiveness of private over public enforcement of insider trading regulations.

1. Introduction

Being acquired is one of the biggest events in the life of a company. Perhaps not surprisingly, takeovers are one of the most researched topics in finance.[1] One of the principal findings of this research is that target stock goes up dramatically, on average by about 30%, upon takeover announcement. This substantial and almost instantaneous increase in stock price provides a tempting trading opportunity to corporate insiders, who often have knowledge of takeover negotiations months in advance of its public announcement. Anecdotal evidence suggests that a great deal of insider trading takes place before takeover announcements. For example, in August 2006, the *New York Times* reported that securities of over 40% of the companies receiving buyout bids exhibited suspicious trading in the weeks before the deals became public (see Morgenson, 2006).

Consequently, takeovers have been a major focus of regulatory efforts against insider trading. For instance, of the two biggest insider trading cases ever prosecuted in the U.S., almost all of the charges in the Levine–Boesky–Milken case in the late 1980s and many of the charges in the Galleon hedge fund case in 2009, relate to insider trading in takeover targets (see, e.g., Bray, 2010; Frantz, 1987; Sharma and Pulliam, 2009; Strasburg and Bray, 2009). Furthermore, about 80% of the cases in Meulbroek's (1992,

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[1] Jensen and Ruback (1983), Jarrell et al. (1988), Andrade et al. (2001), Holmström and Kaplan (2001), and Betton et al. (2008) provide excellent reviews of this literature.

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p. 1669) sample of insider trading cases prosecuted by the U.S. Securities and Exchange Commission (SEC) during 1980–1989 are takeover-related.

This paper provides systematic evidence on the level, pattern and prevalence of open market stock trades by registered insiders (i.e., corporate officers, directors, and large blockholders) in takeover targets. This issue is important for at least three reasons. First, policy makers and regulators have a special interest in the trades of these 'ultimate' insiders who are likely to have detailed, ongoing knowledge of a firm's activities. Second, as discussed in Sections 5 and 7 below, an examination of this issue sheds some light on the efficacy of alternate mechanisms (public vs. private) used to enforce two different regulations against insider trading, SEC rule 10b-5 and Section 16b of the Securities Exchange Act of 1934. While pre-announcement trading by registered insiders before any major corporate event is subject to rule 10b-5, such trading in merger targets can also be subject to Section 16b because of the forced stock sale that occurs in mergers, as pointed out by Agrawal and Jaffe (1995) — see Section 3.1 below. While rule 10b-5 is enforced by the SEC, Section 16b is enforced by private attorneys. Finally, recent high-profile corporate scandals such as Enron, Worldcom and HealthSouth, and the consequent adoption of tough governance rules under the Sarbanes–Oxley Act and under listing requirements of the NYSE, Nasdaq and AMEX have focused investor, media and regulators' attention on the activities of these insiders. This raises the question of whether insiders change their trading behavior in response to greater scrutiny of their activities.

Surprisingly, despite the obvious importance of this issue and large waves of takeovers in recent decades, there is little systematic evidence on whether the level and pattern of profitable insider trading before takeover announcements (i.e., increase in purchases or reduction in sales) is abnormal for a broad cross-section of targets of takeovers during modern times (i.e., after 1961). This paper aims at filling this gap in the literature and provides large-sample evidence on this issue.

We examine the level and pattern of insider trading in about 3700 targets of takeovers announced during 1988–2006 and in a control sample of non-targets, both during an 'informed' and a control period. We analyze open-market stock transactions of five groups of corporate insiders, defined in Section 4.4 below: top management, top financial officers, all corporate officers, board members, and large blockholders. We separately examine their purchases, sales and net purchases in target and control firms during the one year period prior to takeover announcement (informed period) and the preceding one year (control) period, using a difference-in-differences (D-i-D) methodology. Using several measures of the level of insider trading, described in Section 5.1 below, we estimate cross-sectional regressions that control for other determinants of the level of insider trading.

We find an interesting pattern in the average trading behavior of target insiders over the one year period before takeover announcement. We find no evidence that insiders increase their purchases before takeover announcements. Instead, while they reduce their purchases below normal levels, they reduce their sales even more, thus increasing their *net* purchases. This pattern is confined to the six-month period before takeover announcement; it holds for each insider group, and for all three measures of net purchases that we examine. The economic magnitude of this effect is quite substantial. Over the six-month pre-announcement period, our D-i-D regression estimates indicate an increase of about 50% in the dollar value of net purchases of targets' officers and directors relative to their usual net purchase levels, after controlling for other factors. These effects are even stronger in certain sub-samples with less uncertainty about takeover completion, such as friendly deals, and deals with a single bidder, domestic acquirer, or less regulated target.

Our conclusions are tempered by two caveats that apply to most studies of trading by registered insiders.[2] First, we assume that insiders report their trades to the SEC as required by law. Second, insiders may trade via friends or extended family members (outside their immediate families), who are not required to report their trades.

While prior studies find that stocks sold by insiders underperform stocks bought by them (see, e.g., Cheng et al., 2007; Jaffe, 1974; Rozeff and Zaman, 1988; Seyhun, 1986), the literature on insider trading before major corporate events presents somewhat mixed findings. While insiders appear to trade profitably before many corporate events such as Chapter 11 bankruptcy filings, stock repurchases, seasoned equity offerings, earnings announcements, dividend initiations, and earnings restatements, insiders of acquiring firms appear to refrain from profitable trading before merger announcements (see, e.g., Seyhun and Bradley, 1997; Lee et al., 1992; Karpoff and Lee, 1991; Penman, 1985; John and Lang, 1991; Agrawal and Cooper, 2008; Seyhun, 1990, respectively).[3]

Meulbroek (1992, p.1663) argues that trades reported to the SEC by registered corporate insiders under Section 16a, such as the trades we study here, are legal insider trades that "are by definition not based on material, non-public information." She assumes that if these insiders make a trade based on material non-public information, prohibited by SEC Rule 10b-5, they will not report it to the SEC. There are several reasons to question the validity of this assumption. First, if insiders fail to report such trades, they are in violation of Section 16a. Second, the intense investor focus on trades reported by registered insiders (see, e.g., Seyhun, 1998, p. xx) suggests that investors believe such trades to be informed. Third, a large finance literature, cited above, that finds that registered insiders trade profitably before important corporate events suggests that reported insider trades are informed, on average. It is hard to argue that top executives and directors first learn about major events involving their companies from news reports in the media[4] and it is hardly surprising that their trades are profitable. Fourth, the recent law and economics literature on the efficacy of private securities litigation uses the existence of reported insider trades as an indicator of the merit of a securities lawsuit (see, e.g.,

[2] An exception is Meulbroek (1992), who examines insider trading uncovered by, rather than reported to, the SEC. Bhattacharya and Marshall (2012) find that top executives prosecuted by the SEC for insider trading tend to be wealthier and better-paid, implying that they do not violate the law only for the money.

[3] In addition, the early study by Elliott et al. (1984) finds that insiders trade in the profitable direction before most corporate news announcements (see their Table 5), although the effects are statistically significant only for some news (Table 4). And Givoly and Palmon (1985, Table 4) find that insider purchases or sales are followed by corporate news over the next one month only about one-third of the time, of which about one-half of the news is neutral, and the remaining is good or bad in roughly equal measure.

[4] In rare instances where that happens, the insiders in question are often about to become outsiders and become targets of news reports themselves!

Choi et al., 2009; Johnson et al., 2007). Finally, there have been high-profile cases of top corporate executives and directors charged with violating rule 10b-5, based on their trades reported to the SEC (see, e.g., Emshiller, 2006). In addition, Cohen et al. (2012, Section VI) find that some reported trades by registered insiders increase the likelihood of an SEC enforcement action for a 10b-5 violation. While the percentage of reported insider trades that are based on material, non-public information is surely less than 100% because insiders sometimes need to sell for liquidity reasons, the discussion above suggests that this percentage is likely to be substantial.

In related studies, Arshadi and Eyssell (1991) and Seyhun (1992) examine whether the level of insider trading in takeover targets declines in response to greater regulation or enforcement. These papers do not address the question of whether the level of insider trading in targets is *abnormal*. While Agrawal and Jaffe (1995) examine whether the level of trading by top managers in takeover targets is abnormal, they study a historical time period, 1941–1961, before modern insider trading laws started to be enforced against stock exchange transactions. Two other studies analyze insider trading in specialized groups of takeover targets: Harlow and Howe (1993) study leveraged buyouts (LBOs) and Madison et al. (2004) examine bank mergers. We provide a more detailed review of the related literature in Section 3 below.

Our finding that registered insiders of target firms forego large potential gains from increasing their purchases before news of a takeover is publicly disclosed contrasts with prior findings, discussed above, of profitable active trading by such insiders before many other important corporate events. What causes this difference in insider behavior? The answer may lie in the enforcement mechanism used for different insider trading laws. As Agrawal and Jaffe (1995) discuss, the reduction in pre-announcement purchases by registered insiders of targets in mergers may be an unintended consequence of the ban on short-swing trading (Section 16b), which is enforced by private attorneys, while the ban on trades based on material nonpublic information (rule 10b-5), is enforced by the SEC. The difference in the behavior of target insiders before takeovers (where both rules apply) and the behavior of insiders before other major corporate events (where only rule 10b-5 applies) suggests that private enforcement of insider trading laws is more potent than public enforcement.[5]

The rest of the paper is organized as follows. Section 2 briefly reviews insider trading regulations and analyzes insiders' trading decision. Section 3 reviews prior studies on informed trading before takeovers. Section 4 describes our sample, data and the stock price reaction to takeover announcements. Sections 5 and 6 present our results for the full sample and for a number of subsamples, respectively. Section 7 concludes.

2. Insider trading regulations and insiders' trading decision

We provide a brief overview of insider trading regulations in Section 2.1 and analyze insiders' trading decision in Section 2.2.

2.1. Insider trading regulations

In the U.S., insider trading is regulated under the Securities Exchange Act of 1934 and the SEC is responsible for enforcing this law. There are four main regulations governing insider trading.[6] First, Section 10(b) of the Act and SEC rule 10b-5 prohibit trades based on material, non-public information. This is the main, broad prohibition against insider trading; it applies to anyone who comes into possession of such information and owes a fiduciary duty, though the law is ambiguous about who has such duty. Second, registered corporate insiders (i.e., corporate officers, directors, and 10% or larger blockholders) are required to report their trades to the SEC under Section 16a. These trades become a matter of public record and comprise the data used in most studies of insider trading. Third, Section 16b, known as the short-swing rule, requires registered corporate insiders to hand over to the company any profits on round-trip trades (i.e., a purchase followed by a sale or vice-versa) made within a six-month period. This is a mechanical trading rule that applies to all such trades made by this well-defined group, regardless of whether they involve non-public information. This rule is expected to have little effect against insider trading before most corporate events; insiders can avoid it simply by holding the stock for six months and one day. A suit to enforce this rule can only be brought by a shareholder, not the SEC. Finally, rule 14e-3 prohibits anyone from trading based on material, non-public information about an upcoming tender-offer after the bidder has taken substantial steps toward making the offer. The rule also prohibits insiders of the bidder and target firms from divulging confidential information about an upcoming tender-offer to anyone who might trade on it.

Subsequent court rulings, such as U.S. Supreme Court (1969, 1980), have buttressed these rules. Insider trading rules have been strengthened by the Insider Trading Sanctions Act of 1984 (ITSA), which imposes monetary penalties of up to three times the illegal profits made or losses avoided by insiders. The sanctions have been further increased by the Insider Trading and Securities Fraud Enforcement Act of 1988 (ITSFEA). Besides the civil sanctions imposed by the SEC, the Justice Department can seek criminal penalties, involving fines and incarceration for willful violations of the law. In addition to penalties imposed by the law, offenders face penalties (such as firing) imposed by their employers and potential loss of reputational capital.

2.2. Insiders' trading decision

How can target insiders trade profitably during the period of takeover negotiations, before a takeover is publicly announced? There are two possibilities. First, insiders can increase their purchases to profit from the stock price increase upon the

[5] This story does not explain why insiders of acquiring firms refrain from profitable trading before merger announcements (see Seyhun, 1990).
[6] See Bainbridge (2007) and Seyhun (1992) for excellent and more detailed discussions of insider trading regulations and their enforcement.

announcement. We call this *active* insider trading. Second, insiders can increase their net stock purchases (= purchases − sales) by postponing their planned sales until after the announcement, even though their actual purchases may not increase. We call this *passive* insider trading. While active insider trading during private takeover talks is more profitable to target insiders than passive insider trading, the former is prohibited by insider trading laws. On the contrary, there is no rule against passive insider trading. We examine both types of trading by separately examining insiders' purchases, sales and net purchases.

What is the trade-off an insider faces when deciding whether to buy stock while in possession of non-public information about an upcoming takeover? An extensive literature in finance finds that takeover announcements typically result in large increases in target stock prices (see footnote 1 for references). So an insider's benefit from buying equals the potential profit to be made by selling his stockholdings after the takeover announcement. An insider's cost of buying stock before a takeover announcement consists of three components. First, he stands to lose his job or directorship with the company. Second, he risks damaging his reputation and faces a reduction in future career prospects. Third, he faces possible civil and criminal penalties under insider trading laws.

Given the costs and benefits that insiders face when trading on material, non-public information about an upcoming takeover, what do insiders typically do? While there are well-publicized episodes involving certain insiders who traded before takeover announcements, how widespread is such insider trading? This paper provides systematic, large-sample evidence on these questions. Our findings shed light on insiders' expected net benefits from buying before a takeover announcement.

We examine trades by several groups of insiders, namely, top management, top financial officers, all corporate officers, directors, and blockholders. Are all of these groups likely to be equally informed about an upcoming takeover? We do not believe so. One would expect the first four groups to have greater knowledge of the takeover. But given the size and under-diversification of their stockholdings (see Faccio et al., 2011), one would also expect blockholders to keep close tabs on the firm. We allow for the possibility of differential information of these groups by examining their trades separately.

3. Prior studies on informed trading before takeovers

Sections 3.1 and 3.2 briefly review prior studies on trading before takeovers by corporate insiders and by other potentially informed investors, respectively.

3.1. Trading by corporate insiders

Several papers examine the level of insider trading in takeover targets to assess the effectiveness of insider trading regulations. Arshadi and Eyssell (1991) test the effectiveness of ITSA, adopted in 1984, by examining levels of insider trading in tender offer targets pre- and post-ITSA. In a sample of 330 tender offer targets during 1975–87, they find that over the 40-week pre-announcement period, insiders change from being net buyers pre-ITSA to being net sellers post-ITSA.

Seyhun (1992) provides a broad-ranging analysis of the effectiveness of tougher rules and greater enforcement of insider trading regulations by the SEC during the 1980s. He examines the profitability and volume of insider trading in general, and the level and pattern of insider trading before earnings announcements and insider trading in target firms before takeover announcements during three regulatory eras during 1975–1989. He finds that the level of target insiders' net purchases before takeover announcements reduces post-ITSA compared to prior periods. Given its coverage of a wide range of issues, the paper has only one table (Table 10) on insider trading before takeover announcements that analyzes net purchases by insiders. Since the purpose of both these papers is to compare the level of insider trading during different regulatory regimes, they have no control sample for takeover targets. So these papers do not address the question of whether the level of profitable insider trading in targets before takeover announcements (i.e., increase in purchases or reduction in sales) is abnormal.

Agrawal and Jaffe (1995) examine the deterrent effect of the 'short-swing' trading rule (Section 16b) on trading by top managers (i.e., officer–directors) in takeover targets during 1941–1961. Because merger completion forces the sale of all target stock, including stock held by insiders, Section 16b can deter target insiders from buying within six months before merger completion; given uncertainty about merger completion, it can even deter them from buying before merger announcement. Unlike rule 10 (b)-5, which is enforced by the SEC, Section 16b can only be enforced by a shareholder. In practice, Section 16b is enforced by private attorneys who search for its violation. Upon observing a violation, an attorney simply notifies the insider. If the insider does not comply, the attorney can purchase one share to become a shareholder and file a suit. Since the insider transaction is publicly reported, these suits are easy wins for attorneys, who receive attorney fees out of the insider trading profits returned to the company. Since this 'ambulance-chasing' (the legal term is 'champerty') serves a public purpose here, courts have been generous in awarding attorney fees. Agrawal and Jaffe's sample predates the Cady, Roberts decision in November 1961, which was the first time that the SEC enforced rule 10b-5 against stock exchange transactions.[7] Consistent with a deterrent effect of Section 16b, they find that managers significantly reduce their purchases before takeover announcements relative to both cross-sectional and time-series benchmarks. Surprisingly, even though Section 16b does not prevent managers from postponing their planned sales until after the announcement, they don't reduce their sales.

Two studies examine insider trading in specialized groups of takeover targets using time-series benchmarks. Harlow and Howe (1993) analyze a sample of 121 LBOs announced during 1980–1989. They find an increase in the aggregate number of net insiders buying (= number buying − number selling) over the year preceding the announcement for management-led

[7] See Columbia Law Review (1962), Hines (1963) and Manne (1966). Before this case, the SEC's view was that insider trading in stock exchange transactions is a 'victimless crime'.

buyouts, but not for other buyouts. Madison et al. (2004) examine a sample of 111 target firms in bank mergers during 1991–1997. They find that insiders reduce their purchases as well as sales in the two months prior to merger announcements. None of these studies examines whether the level and pattern of profitable insider trading before takeover announcements (i.e., increase in purchases or reduction in sales) is abnormal for a broad cross-section of targets of takeovers during modern times, a task that we tackle in this paper.

In addition, several papers examine insider trading in acquiring firms (see, e.g., Akbulut, 2005; Boehmer and Netter, 1997; Seyhun, 1990; Song, 2011). In contrast to most of the literature on insider trading that analyzes trades *reported* to the SEC by registered corporate insiders, Meulbroek (1992) analyzes a sample of insider trades *discovered* and prosecuted[8] by the SEC during 1980–1989, about 80% of which are takeover-related. She finds that almost one-half of the pre-announcement stock price run-up in takeover targets occurs on insider trading days. Other papers indirectly examine the prevalence of illegal insider trading by examining abnormal returns and trading volume prior to takeover announcements for stocks (see, e.g., Jarrell and Poulsen, 1989; Keown and Pinkerton, 1981; King, 2009; Sanders and Zdanowicz, 1992) or bonds (Kedia and Zhou, 2009).

3.2. Trading by other informed investors

Several recent studies examine the trading behavior of institutional investors before takeover announcements from various perspectives, using different datasets. Three papers use quarterly data on institutional holdings from SEC 13F filings. Ashraf and Jayaraman (2007) find that 'active' institutions (i.e., investment companies, money managers and independent investment advisors) increase their holdings of acquirer stock during the announcement quarter for takeovers with higher abnormal returns upon announcement. Bodnaruk et al. (2009) find that financial conglomerates to which bidders' M&A advisors belong take positions in targets before takeover announcement. Daouk and Li (2011) use Campbell et al.'s (2009) methodology to infer daily trades of institutional investors from 13F quarterly holdings and NYSE's daily trades and quotes (TAQ) database. They find that institutions are net buyers of target stock starting about 30 trading days before the announcement.

Two studies examine pre-announcement institutional trades in takeover targets using different sources of daily data. Jegadeesh and Tang (2010) analyze takeovers announced during 1998–2005. They find that while institutions as a group are not net buyers of target stock over the three-month pre-announcement period, institutions that trade via brokerage arms of target's M&A advisors are. Griffin et al. (in press) examine trading by different types of institutional and individual investors in Nasdaq-listed firms during 1997–2002 before takeover and earnings announcements. They find that wealthy individuals (i.e., those trading via full-service brokerages) buy target stock before takeover announcement. But they find no evidence of net buying either by institutional investors as a group, or in trading (either proprietary or for clients) done via brokerage houses that advise targets or bidders.

4. Sample and data

Section 4.1 details our sample selection procedure and describes the sample of takeover target firms. Section 4.2 deals with the selection of our cross-sectional control sample, and compares the target and control samples. Sections 4.3 and 4.4 describe our time-series control samples and insider trading data, respectively. Section 4.5 describes the stock-price reactions to the full sample of takeover announcements and a number of sub-samples.

4.1. Sample of takeover targets

We obtain our initial sample of target firms in completed or partially-completed takeovers[9] announced during 1988–2006 from the SDC database.[10] [11] We require each acquisition to have a deal value of at least $1 million, the target firm to be traded on the NYSE, AMEX, or NASDAQ before the acquisition, and exclude transactions that are spin-offs, recapitalizations, self-tenders, exchange offers, repurchases, minority stake purchases, acquisitions of remaining interest, or privatizations. These criteria yield an initial sample of 5792 takeover transactions.

We apply several screens to obtain the final sample of target firms. Table 1 outlines the sample selection process. We omit 103 repeat acquisitions of a target firm after the initial acquisition. These include a clean-up merger following a partial acquisition, and a resale of a company following its initial sale to another company, management or investor group. We also drop 126 observations consisting of tender offers that sought to buy less than 60% of the target's outstanding equity. Since we need insider trading data from TFN Insider database and control variables constructed using financial and stock price data from Compustat and CRSP, we eliminate firms that are not listed, or have incomplete coverage, in these databases. A total of 689 firms are not listed, and an additional 557 firms have incomplete coverage, on Compustat during the two-year period before the takeover announcement. An additional 232 firms are not listed on CRSP. We omit 165 firms with CRSP share code other than 10, 11, or 12; these are American Depository Receipts, units, exchange-traded funds, real estate investment trusts, or closed-end funds. We exclude an additional 161 firms with

[8] Few of the defendants in these cases are registered corporate insiders. See Meulbroek (1992, fn. 6).

[9] Partially completed takeovers are tender-offers where at least 60%, but less than 100%, of the target's equity is acquired.

[10] Our sample begins with takeovers announced in 1988 because insider trading data in TFN Insider database starts from 1986 and we need two years of insider trading data before a takeover announcement.

[11] The SDC database was accessed in November 2007.

Table 1
Sample selection. The table shows sample selection out of the 5792 target firms in takeover transactions with a deal value of $1 million or more, announced during 1988–2006. The sample is obtained from Securities Data Corporation (SDC).

Explanation	Dropped mergers	Number of mergers
Total number of merger observations obtained from SDC		5792
Repeat acquisitions of a firm[a]	103	
		5689
Tender offers with less than 60% shares tendered	126	
		5563
Firms not present in Compustat during two years prior to merger	689	
		4874
Firms with incomplete Compustat coverage	557	
		4317
Firms not on CRSP (NYSE, AMEX, or NASDAQ) before takeover	232	
		4085
ADRs, Units, ETFs, REITs, or Closed-end funds (firms with share codes other than 10, 11, or 12)	165	
		3920
Firms with incomplete CRSP coverage	161	
		3759
Firms not present in TFN	58	
Final sample		3701

[a] These include partial acquisitions, followed by a clean-up merger; sale to a company or management or investor group, followed by a resale, etc.

incomplete coverage on CRSP. Finally, we drop 58 firms that are not listed in the TFN Insider database. This yields our final sample of 3701 target firms.

Table 2 presents the distributions of the sample by the year of takeover announcement (in Panel A) and by industry (in Panel B), and shows the mean and median deal values for each group. The industry distribution is based on a firm's 2-digit primary SIC code reported in SDC, and uses the industry classification in Song and Walkling (1993). The deal values are obtained from SDC. All dollar values throughout the paper are in inflation-adjusted year 2000 dollars. Panel A shows that except during 1990–93, the sample includes over 100 takeovers in each year. After 1994, there are about 200 or more takeovers in each year except 2002. The mean (median) deal value is $1448 million ($227 million). Panel B shows that the sample is distributed over a wide range of industries. Industries with the largest number of takeovers are finance and services, and industries with the fewest takeovers are public administration and agriculture.

4.2. Cross-sectional control sample

We match each target firm with a control firm from its 2-digit Compustat primary SIC industry that has the smallest percentage difference in total assets at the end of fiscal year −2, where year 0 is the fiscal year in which the takeover announcement occurs. The pool of potential control firms excludes target firms, and is required to have CRSP share codes 10, 11 or 12 and complete Compustat and CRSP data needed for the study. A control firm matched with a given target firm in a takeover announced during fiscal year t is taken out of the pool of potential control firms for other target firms during fiscal years t−2 to t+2.

Table 3 shows descriptive statistics of our samples. Panel A reports mean and median values of financial and operating characteristics for our sample of 3701 matched-pairs of target and control firms. The table also reports p-values of two-tailed t-tests for differences in means and two-tailed Wilcoxon tests for differences in distributions. The typical target firm in the sample is relatively small, with a median market capitalization (total assets) of $136 million ($240 million), although the sample includes some very large firms, as indicated by substantially larger mean values. The median daily stock volatility in target (control) firm is about 3.1% (3.0%). Target and control firms have similar median operating performance (measured as operating income before depreciation to total assets) over the two years before the takeover announcement, although targets under-perform the control firms somewhat in year −3. Both target and control firms have moderate financial leverage, with median ratios of long-term debt to total assets of about 11% and 10%, respectively.

4.3. Time-series control sample

We compare the levels of insider trading in target and control firms during the pre-takeover period to their levels during the control period. The 'pre-takeover period' is the one-year period before a takeover announcement, and 'control period' is the year before that. Our method examines abnormal trades (or absence of normal trades) that abstract from insiders' normal trading patterns. In this sense, our approach is similar in spirit to that of Cohen et al. (2012). We choose a one-year period before the announcement to examine possibly informed trading because takeover talks typically appear to begin about three to five months before the first public announcement of a takeover, with substantial cross-sectional variation in the length of this interval (see, e.g., Anilowski et al., 2009; Sanders and Zdanowicz, 1992). We find that most of the abnormal insider trading is concentrated over the six months before takeover announcement.

We focus on insider trading *before* takeover announcements because insiders clearly have an information advantage over outsiders during this period, and they can mask their trades by timing them sufficiently before the public announcement. We do not examine insider trading *after* the takeover announcement because insiders' actions are under a spotlight during that period. So

Table 2
Time and industry distributions. Panels A and B show, respectively, the time and industry distributions of 3701 NYSE, AMEX, or NASDAQ-listed target firms in takeover transactions with a deal value of $1 million or more announced during 1988–2006. Industry distribution is based on a firm's 2-digit primary SIC code reported in SDC, and uses the industry classification in Song and Walkling (1993). Deal values are obtained from SDC. All dollar values are in inflation-adjusted 2000 dollars.

Panel A: Distribution by year of announcement					Panel B: Industry distribution				
Year	Merger count	% of total count	Deal value ($ mill.)		Industry (SIC2 code)	Merger count	% of total count	Deal value ($ mill.)	
			Mean	Median				Mean	Median
All	3701	100	1448	227	Agriculture (01–09)	14	0.38	1205	214
1988	159	4.30	740	119	Mining (10–14)	133	3.59	2816	398
1989	114	3.08	770	162	Construction (15–19)	26	0.70	446	308
1990	80	2.16	539	80	Food and tobacco (20–21)	58	1.57	2462	299
1991	56	1.51	504	154	Textile and apparel (22–23)	33	0.89	454	182
1992	50	1.35	504	218	Lumber, furniture, paper, and print (24–27)	103	2.78	1244	313
1993	66	1.78	865	143	Chemicals (28)	206	5.57	2297	425
1994	120	3.24	743	174	Petroleum, rubber, and plastic (29–30)	61	1.65	2412	206
1995	219	5.92	858	179	Leather, stone, and glass (31–32)	26	0.70	734	353
1996	231	6.24	1077	213	Primary and fabricated metals (33–34)	85	2.30	1179	186
1997	311	8.40	1087	357	Machinery (35–36)	450	12.16	954	188
1998	357	9.65	2441	256	Transport equipment (37)	49	1.32	2190	370
1999	402	10.86	1935	327	Instruments and miscellaneous manufacturing (38–39)	241	6.51	671	174
2000	325	8.78	1985	306	Transport, communications, and utilities (40–49)	284	7.67	3715	711
2001	251	6.78	1155	151	Wholesale trade (50–51)	97	2.62	546	154
2002	151	4.08	724	106	Retail trade (52–59)	201	5.43	923	172
2003	203	5.49	857	126	Finance, insurance, and real estate (60–69)	799	21.59	1520	209
2004	191	5.16	1721	268	Hotels and personal services (70–71)	46	1.24	1794	465
2005	196	5.30	2139	339	Services (72–89)	788	21.29	813	192
2006	219	5.92	2369	548	Public administration and others (90–99)	1	0.03	174	174

while insiders may still have an information advantage over outsiders as the details of the takeover are worked out between the target and acquiring firms, insiders are unlikely to trade on the basis of this information.

4.4. Insider trading data

We obtain data on insider trading from the Thomson Financial Insider Filing Data Files (hereafter, TFN). TFN reports ownership, insider transactions and changes in ownership that insiders report on Forms 3, 4, and 5 filed with the SEC.[12] For each target and control firm, we obtain data on insiders' open-market purchases and sales during the pre-takeover and control periods.[13]

Panel B of Table 3 shows the mean and median number of insiders in each of our five insider groups. These statistics are based on matched-pairs of target and control firms with non-zero number of insiders. Data on the number of insiders is based on all transactions or holdings reported by insiders during the two-year period prior to the takeover announcement date. The *top management* group consists of Chairman, Chief Executive Officer (CEO), Chief Operating Officer (COO), and President. *Top financial*

[12] Most insider transactions are reported on Form 4. Form 3 is the initial statement of beneficial ownership that insiders must file. Form 5 is an annual statement of changes in beneficial ownership and contains activity from small or exempt transactions that are not reported on Form 4.

[13] We review the TFN database for obvious coding and transposition errors and make corrections where appropriate. We delete filings marked as inaccurate or incomplete by TFN (labeled via cleanse indicators 'S' or 'A'). We also remove transactions that are amended by subsequent filings, and transactions involving shares indirectly owned by insiders via a partnership, corporation, trust or other entity.

Table 3
Descriptive statistics of target and control samples. Panel A shows characteristics of target and control samples. The samples consists of 3701 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. Each target firm is matched to a control firm in its 2-digit primary SIC code industry on Compustat that has the smallest percentage difference in total assets at the end of fiscal year −2, where fiscal year 0 is the year in which the takeover announcement occurs. Measures of firm size, financial leverage and the first two growth measures shown are for (or the end of) fiscal year −1. Sales growth is computed as $[(\text{Sales}_{t-1}/\text{Sales}_{t-5})^{(1/4)}-1]$. OPA(t) is Operating performance to total assets for year t. Operating performance is operating income before depreciation. OPA equals $[(\text{OPA}(-1)+\text{OPA}(-2)+\text{OPA}(-3))/3]$. Firm value equals (Total assets − Book value of equity + market value of equity). All publicly traded common shares of a firm are used to compute market value of equity. PRET(t) is the market-adjusted average daily prior stock return for a firm for quarter t relative to the beginning of one year prior to the merger announcement date, where market return is the equal-weighted CRSP market index return. Stock return volatility (σ) is the standard deviation of stock returns for the period of (−250, −126) days before one year prior to the announcement date. The change in stock return volatility (Δσ) is computed as $[\sigma_{(-250,\,-126)}-\sigma_{(-125,\,-1)}]$. Stock returns and market value of equity are obtained from CRSP, and all other financial data are from Compustat. Panel B shows descriptive statistics of the number of insiders for matched target and control firm pairs with non-zero number of insiders, for each of five insider groups. The panel also shows the numbers of target, control, and matched pairs of firms with non-zero number of insiders. The number of insiders is obtained from TFN Insider database based on all transactions or holdings reported by insiders during the two-year period prior to the takeover announcement date. The 'top management' group consists of Chairman, Chief Executive Officer (CEO), Chief Operating Officer (COO), and President. 'Top financial officers' are Chief Financial Officer (CFO), Controller and Treasurer. 'All officers' are all corporate officers defined by the SEC under Section 16a of the Securities Exchange Act of 1934. 'All directors' are all members of the board of directors. 'Blockholders' are beneficial owners of 10% or more of any class of equity securities of a firm. Panel C shows descriptive statistics of four different measures of the latest shareholdings reported by insiders of matched target and control firm pairs during the one year period prior to takeover announcement, for each of the five insider groups. Shareholding data is obtained from TFN Insider. We define *# insiders* as the number of individuals within the insider group that reported shareholdings, and *# shares* (*$ shares*) [*% equity*] as total insider shareholdings expressed in thousands of shares (in thousands of dollars) [as a percentage of shares outstanding]. The table reports p-values of two-tailed t-tests for differences in means and two-tailed Wilcoxon tests for differences in distributions. All dollar values are in inflation-adjusted 2000 dollars.

Panel A: Firm characteristics

Measure	N	Mean			Median		
		Target	Control	p-value	Target	Control	p-value
Firm size							
Market value of equity ($ mill.)	3701	912	1079	0.015	136	145	0.000
Firm value ($ mill.)	3546	2833	2888	0.487	345	361	0.000
Total assets ($ mill.)	3563	2245	2148	0.039	240	243	0.098
Sales ($ mill.)	3566	832	836	0.890	145	144	0.975
Employees ('000s)	3156	4.110	4.672	0.005	0.824	0.846	0.538
Stock volatility and prior returns							
σ (%)	3700	3.669	3.683	0.781	3.108	3.004	0.332
Δσ (%)	3700	0.005	−0.032	0.558	−0.042	0.023	0.527
PRET(−1) (%)	3701	0.019	−0.004	0.130	−0.029	−0.032	0.434
PRET(−2) (%)	3699	−0.022	−0.007	0.098	−0.037	−0.034	0.111
PRET(−3) (%)	3699	−0.006	−0.003	0.737	−0.023	−0.029	0.877
PRET(−4) (%)	3610	0.000	0.009	0.403	−0.024	−0.016	0.518
Growth							
B/M	3546	0.651	0.622	0.559	0.579	0.554	0.000
Firm value/total assets	3546	1.660	1.806	0.000	1.208	1.225	0.000
Sales growth rate (%)	2066	19.552	20.004	0.753	11.164	12.849	0.010
Operating performance							
OPA(−1) (%)	3492	5.466	6.244	0.080	8.795	8.421	0.154
OPA(−2) (%)	3641	6.578	7.070	0.188	9.346	8.788	0.144
OPA(−3) (%)	3516	5.806	6.740	0.079	9.380	9.588	0.027
OPA (%)	3338	5.919	6.803	0.027	9.298	8.961	0.074
Financial leverage							
Long-term debt/total assets	3538	0.169	0.173	0.406	0.109	0.102	0.962
Long-term debt/firm value	3524	0.124	0.124	0.777	0.074	0.066	0.440

Panel B: Number of insiders

Insider group	Number of firms with non-zero number of insiders			Mean			Median		
	Target	Control	Pair	Target	Control	p-value	Target	Control	p-value
Top management	3248	3060	2753	2.748	2.834	0.035	2.000	3.000	0.020
Top financial officers	2242	2118	1584	1.712	1.744	0.349	1.000	1.000	0.342
All officers	3415	3204	2970	6.448	6.557	0.284	5.000	5.000	0.225
All directors	3537	3324	3184	6.760	7.192	0.000	6.000	6.000	0.000
Blockholders	1668	1493	739	2.892	2.578	0.072	2.000	2.000	0.022

Table 3 (*continued*)

Panel C: Shareholdings							
Measure	N	Mean			Median		
		Target	Control	p-value	Target	Control	p-value
Top management							
# insiders	3701	1.469	1.516	0.116	1	1	0.077
# shares	3701	634	959	0.243	43	55	0.000
$ shares	3701	15,604	23,936	0.390	545	602	0.000
% equity	3701	3.653	4.311	0.403	0.267	0.305	0.000
Top financial officers							
# insiders	3701	0.615	0.610	0.758	0	0	0.974
# shares	3701	103	187	0.586	0	0	0.197
$ shares	3701	4059	1529	0.323	0	0	0.102
% equity	3701	0.379	0.275	0.517	0	0	0.187
All officers							
# insiders	3701	3.324	3.431	0.136	2	2	0.138
# shares	3701	867	787	0.729	54	65	0.000
$ shares	3701	22,463	19,360	0.717	643	722	0.001
% equity	3701	3.892	3.655	0.708	0.327	0.377	0.000
All directors							
# insiders	3701	3.828	4.148	0.000	3	3	0.000
# shares	3701	1066	1388	0.407	132	152	0.000
$ shares	3701	30,493	34,796	0.767	1621	1760	0.000
% equity	3701	5.041	6.261	0.178	0.868	0.987	0.000
Blockholders							
# insiders	3701	0.376	0.357	0.433	0	0	0.587
# shares	3701	881	1031	0.249	0	0	0.742
$ shares	3701	16,089	22,262	0.120	0	0	0.428
% equity	3701	4.327	4.087	0.526	0	0	0.958

officers are Chief Financial Officer (CFO), Controller and Treasurer. *All officers* are all corporate officers defined by the SEC under Section 16a of the Securities Exchange Act of 1934.[14] *All directors* are all members of the board of directors. *Blockholders* are beneficial owners of 10% or more of any class of equity securities of a firm. The panel also shows the numbers of target, control, and matched pairs of firms with non-zero number of insiders. The median number of individuals in the top management group in target (control) firms is 2 (3); the corresponding number is 1 (1) for top financial officers, 5 (5) for all officers, 6 (6) for all directors, and 2 (2) for 10% blockholders. The small numbers of officers and directors and the large numbers of blockholders are consistent with the relatively small size of the typical firm in both samples.

Panel C shows mean and median values of four different measures of the latest shareholdings reported by insiders of matched target and control firm pairs during the one year period prior to takeover announcement, for each of the five insider groups. We define *# insiders* as the number of individuals within the insider group that reported shareholdings, and *# shares* (*$ shares*) [*% equity*] as total insider shareholdings expressed in thousands of shares (in thousands of dollars) [as a percentage of shares outstanding]. The median shareholding by top management is $545 ($602) thousand in target (control) firms. The corresponding shareholding is $643 ($722) thousand for all officers, and $1621 ($1760) thousand for all directors. Mean values of shareholdings are substantially higher (by orders of magnitude) than median values, indicating that the distribution of ownership data is highly skewed, with some insider groups having extremely large holdings. While mean insider stockholdings are generally insignificantly different between the target and control samples, their median values are significantly lower for several groups of target insiders, as indicated by the Wilcoxon test.

4.5. Stock price reaction

We next examine the stock-price reaction to takeover announcements for our full-sample of target firms, as well as a number of sub-samples. For comparison, as well as to examine potential contagion effects, we also present corresponding reactions for the control sample of non-targets. We compute the abnormal return for stock i on day t as:

$$e_{it} = r_{it} - r_{mt}, \tag{1}$$

where r_i and r_m are the stock returns for firm i and the market, respectively. The market return is defined as the return on the equal-weighted CRSP (i.e., NYSE, AMEX and Nasdaq) stock index.[15] We start by defining the average abnormal return over day t as:

$$AAR_t = \sum_{i=1}^{n} e_{it}/n. \tag{2}$$

[14] This group includes top management, principal financial officer, principal accounting officer, vice presidents in charge of principal business units, divisions or functions, and any other person who performs a policy-making function for the company.

[15] The results are very similar if we use the value-weighted index instead.

We then define the cumulative average abnormal return over days (t_1, t_2) as:

$$CAAR_{t_1,t_2} = \sum_{t=t_1}^{t_2} AAR_t \tag{3}$$

We compute t-statistics for CAARs after adjusting for cross-sectional dependence, as in Brown and Warner (1985). In addition, we measure the cumulative abnormal return for firm i over days (t_1, t_2) as:

$$CAR^i_{t_1,t_2} = \sum_{t=t_1}^{t_2} e_{it}. \tag{4}$$

The first two rows of Table 4 show CAARs for our full samples of target and control firms over eight windows around the takeover announcement day (day 0). The first three windows show the stock price run-up from days −40 to −6, the fourth and eighth windows show the price reaction over short windows around the announcement, and the remaining three windows show the total price effect of the announcement including the run-up. Consistent with prior research (see footnote 1 for references), takeover announcements result in large increases in stock prices of target firms. Over the shorter window, (−5, +1), target firms

Table 4
CAARs for target and control samples and for target sub-samples. The table shows cumulative average abnormal returns (CAARs) for eight windows around the takeover announcement date (day 0) for target and control samples, and for various sub-samples of target firms. For each firm, the abnormal return for trading day t is computed by subtracting the return on the equal-weighted CRSP (i.e., NYSE, Nasdaq and AMEX) index from the return on a stock on day t. The samples consist of 3701 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. The table presents nine sub-samples of takeover targets. Firms with market value of equity (as of the latest fiscal year-end before day 0) in the bottom (top) 30% of the NYSE are classified as small (large) firms, and the remaining as medium-size firms. Three different sub-samples are constructed based on takeover announcements during the periods 1988–1995, 1996–2001 and 2002–2006. The NYSE, AMEX and NASDAQ sub-samples correspond to target firms listed on each exchange. The 'Hostile' sub-sample consists of target firms whose initial reaction to the merger is hostile; the remaining targets are 'Friendly'. Tender-offers consist of takeovers where 60% or more of the target's outstanding equity is acquired via a tender-offer; LBOs are leverage buyouts; the remaining takeovers are classified as mergers. The sub-samples 'Stock deal' and 'Cash deal' consist of takeovers via 100% stock and 100% cash, respectively; the remaining takeovers are classified as 'Other deals'. Target firms in railroad, public utility, banking, finance, or insurance industries (i.e. 2-digit primary SIC codes 40, 49, 60, 61, or 63) are classified as 'More regulated'; all other firms are called 'Less regulated.' A target firm is classified into small, mid-size or large target group if it is in the bottom, middle or top tercile, respectively, of all the firms on CRSP by market capitalization at the end of its fiscal year −1.

Category	Observations		Days around announcement							
	Count	%	(−40, −21)	(−20, −11)	(−10, −6)	(−5,+1)	(−40,+5)	(−20,+5)	(−10,+1)	(−1,+5)
Target	3701	100	1.49***	2.25***	1.52***	24.16***	29.24***	27.75***	25.68***	21.35***
Control	3701	100	0.14	0.13	0.34**	0.43**	1.21**	1.07***	0.77***	0.34*
Sub-samples of targets										
Mergers	2673	72.22	1.10***	2.02***	1.37***	21.18***	25.39***	24.29***	22.55***	18.59***
Tender-offers[a]	836	22.59	2.86***	3.51***	2.23***	34.40***	43.18***	40.31***	36.63***	30.91***
LBOs[a]	243	6.57	0.85	0.79	0.55	21.71***	23.61***	22.76***	22.26***	18.99***
Hostile	128	3.46	1.99*	1.87*	1.46**	27.51***	33.74***	31.75***	28.97***	26.66***
Friendly	3573	96.54	1.46***	2.27***	1.52***	24.04***	29.08***	27.61***	25.56***	21.16***
Single bidder	3469	93.73	1.36***	2.12***	1.52***	24.47***	29.27***	27.91***	25.99***	21.67***
Multiple bidder	232	6.27	3.43***	4.33***	1.44**	19.57***	28.73***	25.30***	21.00***	16.62***
Stock deals	1128	31.13	1.25**	2.36***	1.72***	19.74***	24.70***	23.45***	21.46***	16.92***
Cash deals	1421	38.40	1.83***	2.45***	1.67***	29.20***	35.21***	33.39***	30.87***	26.44***
Other deals	1152	30.48	1.31***	1.91***	1.14***	22.27***	26.32***	25.00***	23.41***	19.41***
Cross border acquirer	595	16.08	2.07***	3.11***	1.90***	28.97***	36.39***	34.31***	30.87***	25.31***
Domestic acquirer	3106	83.92	1.38***	2.09***	1.44***	23.24***	27.87***	26.49***	24.69***	20.59***
More regulated	859	23.21	0.19	1.11***	0.98***	19.87***	22.06***	21.87***	20.85***	17.87***
Less regulated	2842	76.79	1.88***	2.60***	1.68***	25.46***	31.41***	29.53***	27.14***	22.40***
1988–1995	864	23.35	0.96	2.57***	1.54***	24.11***	29.28***	28.32***	25.65***	21.54***
1996–2001	1877	50.72	1.57***	2.88***	1.74***	24.89***	30.86***	29.27***	26.63***	21.37***
2002–2006	960	25.94	1.76***	0.75**	1.07***	22.78***	26.02***	24.28***	23.85***	21.15***
Small target	2027	54.77	2.21***	3.03***	1.61***	26.16***	32.80***	30.59***	27.77***	32.21***
Mid-size target	780	21.08	0.46	1.21***	1.45***	23.29***	26.37***	25.91***	24.74***	20.36***
Large target	894	24.16	0.75	1.41***	1.37***	20.39***	23.67***	22.92***	21.76***	18.00***
NYSE target	937	25.32	1.28***	1.57***	0.92***	21.95***	25.26***	23.98***	22.87***	18.99***
AMEX target	299	8.08	2.20**	2.18***	1.32**	24.33***	30.02***	27.82***	25.65***	21.97***
NASDAQ target	2465	66.60	1.48***	2.52***	1.77***	24.98***	30.65***	29.17***	26.75***	22.17***

[a] Tender-offers and LBOs are not mutually exclusive. There are 51 LBOs that are also tender-offers.
*** Denote significantly different from zero at the 1% level, using two-tailed Brown and Warner (1985) t-tests.
** Denote significantly different from zero at the 5%, level, using two-tailed Brown and Warner (1985) t-tests.
* Denote significantly different from zero at the 10% level, using two-tailed Brown and Warner (1985) t-tests.

experience a CAAR of about 24.2%; over the longer (−40, +5) window, the CAAR is about 29.2%. The corresponding CAARs for control firms are 0.4% and 1.2%, consistent with a contagion effect in industries of takeover targets found by prior studies (e.g., Song and Walkling, 2000). All these CAARs are statistically significant at the 5% level or better.

The remaining rows of Table 4 present CAARs for sub-samples resulting from nine partitions of the target sample. These partitions are based on the method of acquisition, target management's response to the bid, number of bidders, method of payment, bidder domicile, level of regulation of the target firm, time period, target size, and target's exchange listing. Consistent with prior research (see the references cited above), target firms experience greater abnormal returns in tender-offers, hostile bids, cash deals, and cross-border acquisitions. In addition, targets in less regulated industries, targets during 1996–2001, smaller targets and targets listed on Nasdaq or AMEX experience greater abnormal returns. Surprisingly, target abnormal returns are somewhat lower in takeovers with multiple bidders (cf. Bradley et al., 1988).

5. Results for the full sample

We start by comparing the level of insider trading in target firms during the one-year pre-takeover period to two sets of controls: contemporaneous trades by insiders of control firms (the cross-sectional control) and trades by target firm insiders during the preceding one-year control period (the time-series control). By examining trades by insiders of both target and control firms at the same time, the cross-sectional control provides a perfect control for the effect of the time period, but it provides an imperfect control for firm attributes that may affect the level of insider trading. The time-series control emphasizes the opposite trade-off. It provides a perfect control for firm characteristics by using the target firm as its own control, but by comparing insider trades over different periods, it does not control for possible changes in the trading behavior of insiders over time. While each control has its merits and limitations, our main interest is in the dual-control, which equals the abnormal purchases of target firm insiders (i.e., their purchases during the pre-takeover period minus their purchases during the control period) minus the abnormal purchases of control firm insiders (i.e., their purchases during the pre-takeover period minus their purchases during the control period). This difference-in-differences (D-i-D) approach controls for both the effects of firm characteristics and the time period.

We examine insider purchases separately from insider sales because, as discussed in Section 2.2 above, the incentives and penalties faced by insiders differ for the two types of transactions. While stock purchases before takeover announcements are governed by insider trading regulations, reductions in planned sales are not. Of course, what insiders really care about is the net effect of their trading, reflected in their net purchases, which we examine last.

For brevity, we present the univariate results on insider trading in our full sample of takeover targets in Appendix A. As discussed there, while insiders reduce both their purchases and sales below normal levels, they increase their net purchases by reducing sales more than they reduce purchases. These results are inconsistent with profitable active insider trading based on private negotiations on the takeover, but are consistent with profitable passive insider trading.

5.1. Regression specification

We next estimate cross-sectional regressions of the level of insider trading. Each regression includes four observations corresponding to each target firm: two observations for the target firm (for the pre-takeover and control periods) and two for the control firm. The main explanatory variables are Pre-takeover, Target and Pre-takeover Target. Pre-takeover is a dummy variable equal to 1 (0) if the insider trading activity occurs during the pre-takeover (control) period. Target is a dummy variable equal to 1 (0) for a target (control) firm. The marginal effects of the first two variables measure the abnormal level of insider trading relative to our time-series and cross-sectional controls, respectively. The marginal effect of the interaction term measures abnormal insider trading relative to our dual control, i.e., it represents the D-i-D estimate.

The regressions control for other determinants of the level of insider trading found by prior studies, including firm size, the level and change in stock volatility, prior stock returns, stock liquidity, firm valuation, innovation, and insider holdings. Seyhun (1986) finds that insiders at small (large) firms tend to be net buyers (sellers) of their firms' stock. We measure firm size as the natural logarithm of market capitalization, denoted Ln (Market cap), defined as the market value of equity as of the second last fiscal year ending prior to a takeover announcement. Meulbroek (2000) finds that managers in more risky companies tend to sell equity more aggressively. We measure risk, σ, as the standard deviation of stock returns over trading days (−250, −126) relative to the beginning of the pre-takeover or control period.[16]

Demsetz and Lehn (1985), Aggarwal and Samwick (1999, 2003), and Jin (2002) show theoretically and empirically that managers' equity holdings are determined by optimal contracting considerations. Their findings imply that changes in equity risk should induce changes in managers' holdings via stock purchases or sales. We measure the change in equity risk, $\Delta\sigma$, as the standard deviation of a firm's daily stock returns computed over trading days (−125, −1) relative to the takeover or control period minus σ. Lakonishok and Lee (2001) find that insiders are contrarian investors who buy (sell) stock with poor (good) past performance. We control for prior stock returns using $PRET_t$ for quarter t, t = −4 to −1. $PRET_t$ is the market-adjusted average daily prior stock return for a firm for quarter t (of either the pre-takeover or the control period), where the market return is the equal-weighted CRSP market index return.

Ofek and Yermack (2000) find that executives with large shareholdings sell stock after receiving new equity incentives to diversify their portfolios. We control for the direct shareholdings last reported by insiders during the relevant period. Jenter (2005)

[16] We require that at least two thirds of the daily stock returns over this period be available on CRSP. We impose the same requirement when calculating the average daily stock returns for a period.

finds that insiders tend to be contrarian investors who buy a stock when it is selling at a low valuation, and sell it when it has a high valuation. Book-to-market (B/M) decile is our measure of a firm's valuation ratio relative to other firms. B/M deciles equal 1 through 10 depending on a firm's B/M ratio. NYSE B/M decile breakpoints during the year are used to ascertain a firm's B/M decile in a given year.[17]

Aboody and Lev (2000) argue that research and development (R&D) activities increase the information asymmetry between insiders and outsiders, thereby allowing insiders to reap greater profits on their trades. Their finding implies that insiders will trade more in firms with greater R&D expenses. We divide R&D expense by sales revenue for the fiscal year. R&D/Sales equals zero for firms whose R&D expenses are not reported by Compustat. Data for B/M and R&D/Sales are for (or at the end of) the fiscal year t − 2, where the takeover announcement occurs during fiscal year t.

The market microstructure models of Grossman and Stiglitz (1980), Kyle (1985) and Holmstrom and Tirole (1993) imply that informed traders are more likely to trade when stock liquidity is higher due to more trading by uninformed traders. Our regressions control for stock liquidity, measured as the daily average over the prior year of the ratio of share trading volume to shares outstanding.

Finally, an insider's incentive to trade before the announcement increases with the potential effect of a takeover announcement on the target's stock price. We measure this stock price effect as the cumulative abnormal stock return over days −40 to +10 around the takeover announcement (denoted $CAR_{-40,+10}$), as defined in Eq. (4) in Section 4.5 above. The beginning date of the window for measuring the stock price effect of the takeover announcement follows the findings of a stock price run-up before a takeover announcement (see, e.g., Jarrell and Poulsen, 1989). The ending date allows for incorporation of more bid-related information that typically follows the initial announcement.[18]

We construct the explanatory variables using stock-price data from CRSP and financial statement data from Compustat. Financial statement data are for the last fiscal year ending prior to the relevant pre-takeover or control period. To be included in the regressions, we require that two observations (one for the pre-takeover period, the other for the control period) be available for all explanatory variables for both the target firm and the control firm. Accordingly, the regression includes observations pooled from these four matched samples. We estimate the following equation:

$$\begin{aligned} IT_i = {} & \beta_o + \beta_1 \mathrm{Ln}(Market\,cap)_i + \beta_2 \sigma_{si} + \beta_3 \Delta\sigma_{si} + \beta_4 PRET_{-1i} + \beta_5 PRET_{-2i} + \beta_6 PRET_{-3i} + \beta_7 PRET_{-4i} + \beta_8 Holdings_i \\ & + \beta_9 B/M\ \ decile_i + \beta_{10} R\&D/Sales_i + \beta_{11} \mathrm{Liquidity}_i + \beta_{12} CAR_{-40,+10,i} + \beta_{13} Pre\text{-}Takeover_i + \beta_{14} Target_i \\ & + \beta_{15} Pre\text{-}Takeover_i * Target_i + \varepsilon_i, \quad i = 1, 2, \ldots, \end{aligned} \tag{5}$$

where IT is one of the five measures of insider trading: number of insiders buying during a year (denoted '# insiders' in the table), number of shares bought in thousands ('# shares'), dollar value of shares bought in millions ('$ shares'), percentage of outstanding equity bought ('% equity'), and number of pure buy months, i.e., months with some insider purchases and no insider sales ('# buy months').[19] The dollar value of shares traded is computed by multiplying the number of shares traded by the transaction price reported on TFN. Missing transaction prices are replaced by the closing price or the bid-ask average from CRSP on the transaction date. The percentage of equity traded equals the number of shares traded divided by the number of shares outstanding on the transaction date. The error term is denoted by ε. All other variables are defined above.

The first and fifth dependent variables used in the regressions are the number of insiders (# insiders) buying or selling shares during the period of interest and the number of pure buy months (# buy months). Both variables take integer values from 0 to 5 in most cases. For example, the number of top managers of target firms who buy during the pre-takeover period is zero for about 80% of the sample, one for 10.8% of the sample, and two or more for the remaining 9.4% of the sample (shown in the last two rows in Panel A of Appendix Table A.1). Given that the observations of these two dependent variables represent count data, we estimate equation (5) using the Poisson or Negative Binomial regression here. We use the Poisson model if the equi-dispersion restriction holds; otherwise we use the Negative Binomial model.

The remaining three dependent variables (# shares, $ shares, and % equity) are censored from below at zero. We use the single-censored Tobit model to estimate these regressions (see Greene, 2003, for an exposition of these models). Since these variables contain some influential outliers, we Winsorize the top and bottom 1% of the dependent-variable observations in each regression. Finally, we calculate test statistics using robust standard errors where appropriate.

5.2. Insider purchases

Table 5 shows estimates of the regressions of insider purchases. From here on, the sample consists of 2763 target firms and 2763 control firms for which data for all the variables in the regressions is not missing. Panel A of Table 5 shows the coefficient estimates and p-values of the regressions for top management purchases for the full year. Panel B shows the coefficient estimates of Pre-takeover∗Target in similar regressions, where the pre-takeover and control periods are partitioned into two half-year periods; these regressions are estimated separately for each half-year pre-takeover sub-periods, using months (−18, −13) as the control period in both cases.

Panel C presents the marginal effect (ME) of Pre-takeover∗Target and the %ME from regressions for each of the five insider groups for the full year and the two half-year periods. The marginal effect of Pre-takeover∗Target is computed as [{E(IT| Pre-

[17] The NYSE decile breakpoints were obtained from Professor Kenneth French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french.
[18] Our subsequent results are essentially unchanged if we replace $CAR_{-40,+10}$ by $CAR_{-5,+1}$ or if we omit this variable from the regression.
[19] Measures of insider sales are defined analogously.

takeover = 1,Target = 1, $\bar{X}$) − E(IT| Pre-takeover = 1,Target = 0, $\bar{X}$)} − {E(IT| Pre-takeover = 0, Target = 1, $\bar{X}$) − E(IT| Pre-takeover = 0, Target = 0, $\bar{X}$)}], where $\bar{X}$ represents all other covariates at their mean values. The% marginal effect (%ME) of Target∗Pre-takeover is computed as 100 (Marginal Effect/Mean value of the dependent variable), if the mean of the dependent variable is >0, and as −100∗(Marginal Effect/Mean of the dependent variable), if the mean of the dependent variable is <0.

In Panel A, top management purchases are positively related to stock volatility, change in stock volatility, insider holdings, firm valuation and (for the % equity measure of insider purchases) stock liquidity; they are negatively related to firm size and stock returns over the three previous quarters. While their purchases are not abnormal using either the time-series or the cross-sectional benchmark, they are significantly lower using the dual (i.e., D-i-D) control, as indicated by the coefficient of the interaction term, Pre-takeover∗Target. That is, during the one-year pre-takeover announcement period, top managers of target firms reduce their purchases relative to their normal levels significantly more than do top managers of control firms. Panel B shows that this reduction is confined to the six month period before takeover announcement.

To give an idea of the magnitudes of these effects, Panel C of Table 5 shows the marginal effect of the interaction term for each of the five insider groups for each of the five measures of insider trading, for the full year before takeover announcement and for its two equal sub-periods. Each set of three values (ME, p-value, %ME) in Panel C shows the result of one regression. The first five rows in the panel show that for the full year before takeover announcement, each of the first four insider groups (i.e., all except blockholders) significantly reduce their purchases. The magnitude of this reduction is quite substantial regardless of the measure of insider purchase we use. For example, the number of top managers purchasing goes down by 0.158. Relative to the usual number of top managers buying, this represents a 52% reduction. The dollar value of their purchases drops by about 124% and the number of pure buy months drops by 44%. The magnitudes of the effects are particularly striking for top financial officers, who reduce the dollar value of their purchases by about 247%. Even for the group of all directors, the drop is almost 60% in dollar terms. The remaining of Panel C shows that these effects are confined to, and much stronger for, the six month period immediately preceding the takeover announcement. This finding is consistent with our expectation that most takeovers talks begin within six months before the public announcement of a deal.

As discussed in Section 3.1 above, Agrawal and Jaffe (1995) find that top managers of target firms reduce their stock purchases before merger announcements in the pre-1961 period, before the SEC began enforcing rule 10b-5, apparently because they were afraid of being caught by Section 16b. We next examine whether this pattern extends to our later (1988–2006) sample period, other types of takeovers besides mergers, and other insider groups besides top managers. In un-tabulated results, we find that while target insiders reduce their pre-announcement stock purchases before all types of takeovers, the reduction is statistically significant only for mergers; it is insignificant for tender-offers and LBOs. For mergers, there is a significant reduction in purchases by top management, top financial officers, all officers and all directors based on all five trading measures that we examine; for blockholders, the change in purchases is statistically insignificant for all measures.

5.3. Insider sales

Table 6 shows estimates of the regressions of insider sales in a format similar to Table 5. In Panel A, the significant determinants of top management's sales for the full year before takeover announcement are largely the same as the determinants of their purchases found in Table 5, except that their sales are also negatively related to their firms' R&D intensity. Top management's sales increase with their holdings; as one would expect, the signs of the other determinants of their sales are the opposite of the signs for purchases. Once again, relative to either time-series or cross-sectional benchmarks, the levels of their sales show no evidence of being abnormal. But importantly, relative to the dual benchmark, their sales are significantly lower for each of the five sales measures. Panel B shows that, as in Table 5, the decrease in top managers' sales is also confined to the six month period immediately preceding the takeover announcement.

In Panel C of Table 6, the reduction in sales is seen for all five sales measures for the first four insider groups, and for the second through fourth measures, also by blockholders. The magnitudes of the reduction are quite substantial. For example, top managers reduce the dollar value of their sales by about 133% relative to the D-i-D benchmark. The magnitude of the reduction in sales is particularly striking for blockholders and top financial officers. As with purchases, the reduction in insider sales is confined to the six month pre-bid period.

Agrawal and Jaffe (1995) find the puzzling result that top managers of merger targets do not reduce their pre-announcement stock sales in the pre-1961 period, even though there is no regulation against postponement of planned insider sales. We revisit this issue with our later sample of three types of takeovers. In un-tabulated results, we find that contrary to Agrawal and Jaffe's results for the earlier time period, top management, top financial officers, all officers, and all directors significantly reduce their pre-announcement stock sales below normal levels before each type of takeover (merger, tender-offer and LBO), except that the reduction is statistically insignificant for top financial officers before tender-offers. For blockholders, the change in sales is statistically insignificant before each type of takeover.

5.4. Net insider purchases

We next examine the net effect of the reduction in insiders' purchases and sales. Since the definition of net purchases is not clear for our first and fifth measures of insider trading (number of insiders and percentage of pure buy months), Table 7 shows the results for the remaining three measures of net purchases in the same format as Tables 5 and 6. Panel A shows that for the

Table 5

Regressions of insider purchases. Panel A of the table shows coefficient estimates from regressions of measures of stock purchases by top management (Chairman, CEO, COO, and President) on several explanatory variables. The sample consists of 2763 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample, with non-missing data for all the variables in the regressions. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. There are two observations for each firm: one measures insider purchases during the one-year period immediately before a takeover announcement (pre-takeover period), and the other measures it during the year before that (control period). '# insiders' is the number of insiders buying during a year, '# shares' is the number of shares (in '000) bought during the year, '$ shares' is the dollar value of shares (in millions) bought, '% equity' is the percentage of outstanding equity bought, and '# buy months' is the number of pure buy months, i.e., months with some insider purchases and no insider sales. All dollar values are in inflation-adjusted 2000 dollars. The top and bottom 1% of the observations of three of the dependent variables ('# shares', '$ shares' and '% equity') in each regression are winsorized. Market cap equals the market value of equity as of the second last fiscal year ending prior to a takeover announcement. The standard deviation of daily stock returns (σ) is computed over trading days (-250, -126) relative to the beginning of the pre-takeover or control period. The change in standard deviation ($\Delta\sigma$) equals the standard deviation of the firm's daily stock returns computed over trading days (-125, -1) relative to the pre-takeover or control period minus σ. PRET(t) is the market-adjusted average daily stock return for a firm for quarter t prior to either the pre-takeover or the control period, where the market return is the equal-weighted CRSP market index return. Book-to-market (B/M) deciles equal 1 through 10 depending on a firm's B/M ratio. NYSE B/M decile breakpoints during the year are used to assign B/M deciles. R&D/Sales is R&D expense to sales revenue. Data for B/M and R&D/Sales are for (or at the end of) the fiscal year $t-2$ and $t-3$ for pre-takeover and control period, respectively, where the takeover announcement occurs during fiscal year t. Liquidity equals the average daily trading volume scaled by shares outstanding during the pre-takeover (control) period, provided that data is available for at least 160 trading days. $CAR_{-40,+10}$ is the cumulative abnormal return on the stock from 40 days before to 10 days after the takeover announcement date. Pre-takeover is a dummy variable equal to 1 (0) if the insider trading activity occurs during the pre-takeover (control) period. Using TFN Insider data, insider holdings are measured as the number of insiders (when dependent variable is # insiders or # buy months), log of 1 plus total shares held (when dependent variable is # shares), log of 1 plus total shareholdings in dollar value (when dependent variable is $ shares), and total number of shares held as a percentage of shares outstanding (when dependent variable is% equity), based on the latest holdings reported by insiders during either the pre-takeover or the control period. Target is a dummy variable equal to 1 (0) for a target (control) firm. Regressions of '# insiders' and '# buy months' use the Poisson model if the equi-dispersion restriction holds; otherwise they use the Negative Binomial model. Regressions of '# shares', '$ shares', and '% equity' use the single-censored Tobit model. Test statistics are calculated using robust standard errors where appropriate. Panel A shows coefficient estimates for the full sample period. Panel B shows the coefficient estimates of Pre-takeover*Target in similar regressions, where the pre-takeover and control periods are partitioned into two half-year periods; these regressions are estimated separately for each half-year pre-takeover sub-periods, using the first half-year control period (i.e. half-year -3 relative to the takeover announcement date) as the control in both cases. Half-year -1 consists of months -1 to -6 relative to the takeover announcement date. Panel C presents the marginal effect (ME) of Pre-takeover$*$Target and the %ME from regressions for each of the five insider groups for the full year and the two half-year periods. The marginal effect of Pre-takeover$*$Target is computed as $[(E(IT|\text{ Pre-takeover}=1,\text{Target}=1,\bar{X})-(E(IT|\text{ Pre-takeover}=1,\text{Target}=0,\bar{X}))-((E(IT|\text{ Pre-takeover}=0,\text{Target}=1,\bar{X})-(E(IT|\text{ Pre-takeover}=0,\text{Target}=0,\bar{X}))]$, where $\bar{X}$ represents all other covariates at their mean values. The % marginal effect (%ME) of Target$*$Pre-takeover is computed as $100*$(Marginal Effect/Mean of the dependent variable), if the mean of the dependent variable is >0, and as $-100*$(Marginal Effect/Mean of the dependent variable), if the mean of the dependent variable is <0.

Panel A: Top management purchases (Full year)

Independent variables	Dependent variables									
	# insiders[a]		# shares		$ shares		% equity		# buy months[b]	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Ln (market cap)	−0.241	0.000	−5.536	0.000	−0.044	0.000	−0.041	0.000	−0.253	0.000
σ	1.592	0.124	221.332	0.000	1.334	0.000	1.367	0.000	1.285	0.325
$\Delta\sigma$	0.235	0.841	134.827	0.004	0.666	0.062	0.978	0.018	−0.073	0.963
PRET1	−21.660	0.000	−969.070	0.000	−6.316	0.000	−7.601	0.000	−19.278	0.000
PRET 2	−16.535	0.001	−505.850	0.005	−3.800	0.007	−4.125	0.010	−21.050	0.000
PRET 3	−8.322	0.097	−544.734	0.004	−4.499	0.006	−4.085	0.009	−14.654	0.011
PRET 4	−4.353	0.322	−299.694	0.051	−1.999	0.114	−1.034	0.447	−1.989	0.683
Insider holdings	0.391	0.000	5.809	0.000	0.043	0.000	0.001	0.033	0.565	0.000
B/M decile	0.019	0.016	1.288	0.000	0.010	0.000	0.011	0.000	0.029	0.001
R&D/Sales	−0.005	0.544	−0.384	0.169	−0.003	0.271	−0.003	0.198	−0.009	0.356
Liquidity	0.004	0.271	0.167	0.284	0.000	0.670	0.002	0.032	−0.015	0.002
$CAR_{-40,+10}$	0.023	0.669	−1.833	0.369	0.000	0.986	0.007	0.670	−0.023	0.708
Pre-takeover	−0.031	0.597	−0.235	0.896	−0.011	0.481	−0.001	0.930	−0.079	0.213

Target	0.069	0.223	1.276	0.491	0.009	0.610	0.022	0.194	0.063	0.324
Pre-takeover∗Target	−0.278	0.001	−7.695	0.002	−0.069	0.002	−0.094	0.000	−0.257	0.005
Constant	−0.882	0.000	−82.461	0.000	−0.737	0.000	−0.277	0.000	−0.893	0.000
N	11,052		11,052		11,052		11,052		11,052	
Chi-square p-value	0.000		0.000		0.000		0.000		0.000	
Pseudo R-squared	0.1095		0.058		0.166		0.044			
Mean of dependent variable	0.303		4.548		0.039		0.040		0.371	
Panel B: Top management purchases (half-year periods)										
First half (months −1 to −6)	−0.638[a]	0.000	−11.782	0.000	−0.099	0.000	−0.104	0.000	−0.612[a]	0.000
Second half (months −7 to −12)	0.012[a]	0.910	−1.290	0.513	−0.012	0.458	−0.021	0.210	−0.045[a]	0.681

Panel C: Marginal effect of Pre-takeover∗Target

Insider category	Dependent variables														
	# insiders			# shares			$ shares			% equity			# buy months		
	ME	p-value	%ME	ME	p-value	%ME	ME	p-value	%ME	ME	p-value	%ME	ME	p-value	%ME
Full year (months −1 to −12)															
Top management	−0.158[a]	0.005	−52.193	−7.695	0.002	−169.201	−0.047	0.003	−123.511	−0.082	0.000	−208.199	−0.164[b]	0.024	−44.299
Top financial officers	−0.505[a]	0.015	−481.502	−1.080	0.024	−307.799	−0.09	0.040	−246.683	−0.016	0.002	−518.970	−0.488[a]	0.024	−372.091
All officers	−0.163[b]	0.013	−34.071	−6.497	0.001	−155.946	−0.041	0.002	−110.222	−0.057	0.000	−172.916	−0.149[b]	0.009	−35.981
All directors	−0.181[b]	0.003	−20.328	−10.192	0.000	−102.263	−0.064	0.002	−59.446	−0.093	0.000	−107.537	−0.191[b]	0.001	−23.613
Blockholders	0.026[a]	0.665	30.824	−51.620	0.162	−389.553	−0.349	0.178	−284.981	−0.296	0.293	−293.678	−0.021[a]	0.639	−17.560
First half year (months −1 to −6)															
Top management	−0.260[a]	0.001	−153.050	−11.782	0.000	−643.768	−0.079	0.000	−523.366	0.098	0.000	−650.112	−0.240[a]	0.002	−133.663
Top financial officers	−0.768[a]	0.012	−1360.471	−1.124	0.033	−815.281	−0.013	0.002	−988.071	−0.017	0.000	−1608.248	−0.602[a]	0.022	−945.877
All officers	−0.376[a]	0.001	−141.608	−10.083	0.000	−593.239	−0.074	0.000	−481.397	−0.087	0.000	−635.382	−0.314[a]	0.000	−154.408
All directors	−0.338[b]	0.000	−66.318	−12.751	0.000	−296.059	−0.091	0.000	−200.367	−0.111	0.000	−299.713	−0.279[b]	0.000	−70.766
Blockholders	−0.014[a]	0.801	−28.614	−21.959	0.311	−545.810	−0.209	0.160	−655.252	−0.328	0.139	−826.077	−0.022[a]	0.622	−36.899
Second half year (months −7 to −12)															
Top management	0.004[a]	0.951	1.981	−1.290	0.513	−61.135	−0.008	0.461	−50.912	−0.018	0.214	−103.786	−0.026[a]	0.668	−13.472
Top financial officers	−0.087[a]	0.612	−141.117	0.063	0.905	36.698	0.002	0.583	112.937	−0.001	0.719	−107.809	−0.156[a]	0.384	−227.061
All officers	−0.029[a]	0.701	−10.123	−1.210	0.441	−60.828	−0.011	0.287	−63.842	−0.016	0.154	−104.274	−0.034[a]	0.540	−15.927
All directors	0.048[b]	0.441	8.927	−1.510	0.435	−32.021	−0.005	0.749	−10.244	−0.020	0.207	−50.186	0.010[b]	0.863	2.263
Blockholders	0.023[a]	0.759	44.666	−9.459	0.665	−215.162	−0.091	0.518	−267.363	−0.107	0.565	−278.952	0.007[a]	0.924	11.207

[a] Poisson regression.
[b] Negative binomial regression.

Table 6
Regressions of insider sales. Panel A of the table shows coefficient estimates from regressions of measures of stock sales by top management (Chairman, CEO, COO, and President) on several explanatory variables. The sample consists of 2763 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample, with non-missing data for all the variables in the regressions. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. There are two observations for each firm: one measures insider sales during the one-year period immediately before a takeover announcement (pre-takeover period), and the other measures it during the year before that (control period). '# insiders' is the number of insiders selling during a year, '# shares' is the number of shares (in '000) sold during the year, '$ shares' is the dollar value of shares (in millions) sold, '% equity' is the percentage of outstanding equity sold, and '# sell months' is the number of pure sales months, i.e., months with some insider sales and no insider purchases. All dollar values are in inflation-adjusted 2000 dollars. The top and bottom 1% of the observations of three of the dependent variables ('# shares', '$ shares' and '% equity') in each regression are winsorized. The independent variables, the regression models used, and computations of test statistics and marginal effect are as described in Table 5. Panel A shows coefficient estimates for the full sample period. Panel B shows the coefficient estimates of Pre-takeover∗Target in similar regressions, where the pre-takeover and control periods are partitioned into two half-year periods; these regressions are estimated separately for each half-year pre-takeover sub-periods, using the first half-year control period (i.e. half-year −3 relative to the takeover announcement date) as the control in both cases. Half-year −1 consists of months −1 to −6 relative to the takeover announcement date. Panel C presents the marginal effect (ME) of Pre-takeover∗Target and the %ME (computed as described in Table 5) from regressions for each of the five insider groups for the full year and the two half-year periods.

Panel A: Top management sales (Full year)

Independent variables	Dependent variables									
	# insiders[a]		# shares		$ shares		% equity		# sell months[b]	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Ln (market cap)	0.102	0.000	27.438	0.000	0.937	0.000	0.059	0.000	0.074	0.000
σ	−3.498	0.002	−243.296	0.181	−5.625	0.252	−3.870	0.000	−5.946	0.000
Δσ	−4.635	0.000	−358.150	0.102	−9.679	0.100	−2.555	0.015	−6.544	0.000
PRET1	25.153	0.000	4147.908	0.000	121.583	0.000	17.934	0.000	18.345	0.000
PRET 2	13.027	0.001	2547.720	0.002	81.827	0.000	11.246	0.001	10.735	0.028
PRET 3	9.781	0.018	2528.858	0.001	80.319	0.000	16.616	0.000	19.915	0.000
PRET 4	−0.388	0.914	312.176	0.665	1.257	0.948	5.276	0.094	0.686	0.886
Insider holdings	0.281	0.000	26.262	0.000	0.642	0.000	0.002	0.025	0.438	0.000
B/M decile	−0.088	0.000	−12.172	0.000	−0.353	0.000	−0.053	0.000	−0.103	0.000
R&D/Sales	−0.016	0.198	−3.699	0.014	−0.102	0.014	−0.014	0.047	−0.004	0.641
Liquidity	0.024	0.000	6.443	0.000	0.192	0.000	0.031	0.000	0.046	0.000
$CAR_{-40,+10}$	−0.021	0.692	−12.143	0.226	−0.175	0.550	0.007	0.863	−0.043	0.516
Pre-takeover	0.020	0.676	11.896	0.125	0.433	0.055	0.052	0.126	0.035	0.529
Target	0.013	0.783	4.917	0.559	0.071	0.768	0.036	0.323	−0.048	0.411
Pre-takeover∗Target	−0.208	0.002	−42.444	0.000	−1.303	0.000	−0.220	0.000	−0.254	0.001
Constant	−1.438	0.000	−499.890	0.000	−15.766	0.000	−0.662	0.000	−1.293	0.000
N	11,052		11,052		11,052		11,052		11,052	
Chi-square p-value	0.000		0.000		0.000		0.000		0.000	
Pseudo R-squared	0.191		0.067		0.131		0.069			
Mean of dependent variable	0.481		35.800		0.981		0.146		0.622	

Panel B: Top management sales (half-year periods)										
First half (months −1 to −6)	−0.490[a]	0.000	−58.879	0.000	−1.647	0.000	−0.293	0.000	−0.507[a]	0.000
Second half (months −7 to −12)	−0.097[a]	0.246	−13.667	0.120	−0.381	0.116	−0.092	0.020	−0.075[a]	0.408

Panel C: Marginal effect of Pre-takeover∗Target

Insider category	Dependent variables														
	# insiders			# shares			$ shares			% equity			# sell months		
	ME	p-value	%ME	ME	p-value	%ME	ME	p-value	%ME	ME	p-value	%ME	ME	p-value	%ME
Full year (months −1 to −12)															
Top management	−0.300[a]	0.006	−62.391	−42.444	0.000	−118.559	−1.303	0.000	−132.861	−0.248	0.000	−169.691	−0.357[b]	0.008	−57.334
Top financial officers	−0.413[a]	0.048	−199.045	−7.361	0.009	−158.718	−0.225	0.004	−163.735	−0.046	0.002	−266.118	−0.406[a]	0.048	−143.940
All officers	−0.459[b]	0.005	−37.732	−41.131	0.001	−72.334	−1.339	0.000	−90.649	−0.192	0.000	−109.241	−0.308[b]	0.011	−29.256
All directors	−0.315[b]	0.000	−35.729	−35.191	0.002	−58.625	−1.352	0.000	−90.452	−0.202	0.000	−83.937	−0.223[b]	0.021	−23.644
Blockholders	−0.035[a]	0.718	−28.463	−199.228	0.009	−590.774	−2.987[c]	0.007[c]		−1.306	0.042	−598.871	−0.027[a]	0.669	−20.009
First half year (months −1 to −6)															
Top management	−0.658[a]	0.000	−230.987	−58.879	0.000	−371.883	−1.647[c]	0.000[c]		−0.343	0.000	−523.117	−0.594[a]	0.000	−194.966
Top financial officers	−0.846[a]	0.015	−705.912	−8.400	0.001	−406.255	−0.260	0.000	−416.393	−0.051	0.000	−657.834	−0.721[a]	0.022	−520.855
All officers	−1.090[b]	0.000	−152.008	−51.680	0.000	−216.188	−1.524	0.000	−226.672	−0.240	0.000	−295.751	−0.642[b]	0.000	−123.380
All directors	−0.672[b]	0.000	−131.665	−56.782	0.000	−225.792	−1.693	0.000	−255.985	−0.294	0.000	−275.689	−0.524[b]	0.000	−112.863
Blockholders	−0.022[a]	0.861	−31.224	−118.972	0.011	−1143.917	−1.529	0.019	−1083.358	−0.789	0.014	−1169.673	−0.080[a]	0.347	−121.059
Second half year (months −7 to −12)															
Top management	−0.124[a]	0.263	−40.849	−13.667	0.120	−79.982	−0.381	0.116	−83.363	−0.105	0.020	−147.700	−0.078[a]	0.424	−23.909
Top financial officers	−0.166[a]	0.471	−130.895	−0.041	0.987	−1.826	−0.006	0.935	−8.853	−0.009	0.516	−104.593	−0.196[a]	0.380	−134.133
All officers	−0.024[b]	0.877	−3.181	−3.888	0.624	−15.421	−0.113	0.627	−16.057	−0.033	0.318	−38.390	0.005[b]	0.966	0.897
All directors	0.000[b]	1.000	−0.007	−3.602	0.670	−13.367	−0.077	0.743	−10.996	−0.036	0.404	−31.428	0.029[b]	0.735	5.817
Blockholders	0.057[a]	0.520	76.886	−26.850	0.507	−273.434	−0.349	0.454	−232.434	−0.221	0.476	−337.144	0.050[a]	0.428	74.315

[a] Poisson regression.
[b] Negative binomial regression.
[c] Reports the regression coefficient and its p-value instead of ME and its p-value, as the ME estimation is non-convergent.

Table 7
Regressions of insiders' net purchases. Panel A of the table shows coefficient estimates from OLS regressions of measures of net purchases of top management (Chairman, CEO, COO, and President) on several explanatory variables. The sample consists of 2763 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample, with non-missing data for all the variables in the regressions. There are two observations for each firm: one measures insiders' net purchases during the one-year period immediately before a takeover announcement (pre-takeover period), and the other measures it during the year before that (control period). '# shares' is the net number of shares (in '000) bought by insiders during a year, '$ shares' is the net dollar value of shares (in millions) bought during the year, and '% equity' is the net percentage of outstanding equity bought. All dollar values are in inflation-adjusted 2000 dollars. The top and bottom 1% of the observations of dependent variables in each regression have been winsorized. The independent variables are as in Table 5. Panel A shows coefficient estimates for the full sample period. Panel B shows coefficient estimates of Pre-takeover∗Target in similar regressions, where the pre-takeover and control periods are partitioned into two half-year periods; these regressions are estimated separately for each half-year pre-takeover sub-periods, using the first half-year control period (i.e. half-year −3 relative to the takeover announcement date) as the control in both cases. Half-year −1 consists of months −1 to −6 relative to the takeover announcement date. Panel C presents the marginal effect (ME) of Pre-takeover∗Target and the %ME (computed as described in Table 5) from regressions for each of the five insider groups for the full year and the two half-year periods.

Panel A: Top management's net purchase (full year)

Independent variables	Dependent variables					
	# shares		$ shares		% equity	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Ln (market cap)	−11.291	0.000	−0.460	0.000	0.003	0.276
σ	−96.560	0.100	−2.396	0.100	1.872	0.000
Δσ	4.266	0.953	−0.182	0.916	1.229	0.002
PRET1	−1522.833	0.000	−41.525	0.000	−8.534	0.000
PRET 2	−1057.997	0.002	−36.527	0.000	−5.473	0.000
PRET 3	−890.727	0.002	−26.075	0.001	−7.170	0.000
PRET 4	−24.625	0.935	2.635	0.726	−2.165	0.094
Insider holdings	−2.983	0.000	−0.068	0.000	−0.001	0.068
B/M deciles	3.125	0.000	0.076	0.000	0.016	0.000
R&D/Sales	0.760	0.001	0.022	0.003	0.002	0.003
Liquidity	−2.758	0.000	−0.086	0.000	−0.013	0.000
$CAR_{-40,+10}$	5.428	0.073	0.068	0.419	0.002	0.889
Pre-takeover	−1.478	0.637	−0.111	0.234	−0.008	0.532
Target	0.704	0.829	0.058	0.532	0.002	0.881
Pre-takeover∗Target	8.754	0.037	0.304	0.014	0.036	0.044
Constant	48.685	0.000	2.160	0.000	−0.228	0.000
N	11,052		11,052		11,052	
F-statistic p-value	0.000		0.000		0.000	
Adjusted R-squared	0.138		0.169		0.062	
Mean value of dependent variable	−31.314		−0.942		−0.107	
Panel B: Half-year periods						
First half	6.634	0.002	0.200	0.001	0.033	0.000
Second Half	2.999	0.193	0.084	0.196	0.017	0.098

Panel C: Marginal effect of Pre-takeover∗Target

Insider category	Dependent variables								
	# shares			$ shares			% equity		
	ME	p-value	%ME	ME	p-value	%ME	ME	p-value	%ME
Full year									
Top management	8.754	0.037	27.96	0.304	0.014	32.27	0.036	0.044	33.78
Top financial officers	1.178	0.060	27.52	0.045	0.021	33.84	0.007	0.008	46.52
All officers	15.194	0.004	32.62	0.465	0.008	32.50	0.054	0.003	38.22
All directors	10.744	0.086	23.02	0.484	0.006	35.14	0.024	0.386	15.82
Blockholders	14.760	0.056	77.32	0.251	0.026	74.19	0.091	0.074	83.26
First half (months −1 to −6)									
Top management	6.634	0.002	47.62	0.200	0.001	48.14	0.033	0.000	66.02
Top financial officers	0.796	0.017	41.54	0.031	0.004	50.79	0.004	0.008	53.86
All officers	10.384	0.000	46.95	0.316	0.000	48.18	0.083	0.000	56.66
All directors	8.789	0.006	42.38	0.331	0.000	53.92	0.030	0.036	43.02
Blockholders	4.126	0.118	71.76	0.046	0.187	49.06	0.022	0.224	91.52
Second half (months −7 to −12)									
Top management	2.999	0.193	20.01	0.084	0.196	19.18	0.017	0.098	31.23
Top financial officers	0.071	0.842	3.46	0.003	0.757	5.41	0.002	0.275	22.17
All officers	2.947	0.333	12.76	0.084	0.358	12.31	0.009	0.378	13.26
All directors	0.484	0.884	2.18	0.015	0.871	2.33	−0.002	0.903	2.54
Blockholders	1.584	0.538	28.79	0.023	0.566	20.66	0.009	0.619	32.47

full pre-bid year, top managers significantly increase their net purchases. This conclusion holds for each of the three net purchase measures. Panel B shows that the effect is largely confined to the six month pre-bid period.

Panel C shows the magnitude of the increase in net purchases for each of the five insider groups. For the full year before takeover announcements, the marginal effect of 0.304 for $ shares for top management implies an increase in their net purchases of $304,000. The increase in net purchases is not confined to top managers. It is also displayed by each of the other four insider groups. The magnitude of the effect on the dollar value of net purchases, relative to their usual levels, is about 33% for each of the first four insider groups; at 74%, it is substantially larger for blockholders. For the first four insider groups, the effect is confined to the six month pre-bid period; the magnitude of the increase in the dollar value of their net purchases is quite substantial, about 50%. For blockholders, while the signs of the effects are positive for each the two 6-month periods before the bid, they are statistically insignificant in both sub-periods.

6. Sub-sample results

In Section 5, we find an interesting and subtle pattern of insider trading in takeover targets. While insiders reduce both their purchases and sales before takeover announcement, they reduce their sales much more than their purchases, thus effectively increasing their (net) purchases. We next examine whether this pattern of insider trading is more pronounced in certain sub-samples of takeovers. In particular, one might expect insiders to increase their effective (i.e., net) stock purchases more in sub-samples where there is less uncertainty about the completion of the takeover, such as mergers, friendly bids, single bidder deals, cash deals, bids with a domestic acquirer, and deals with smaller or less regulated targets.

Table 8 shows the percentage marginal effects (%ME) of the interaction term for the dollar value of net purchases for each of the five insider groups;%ME that are statistically significant at the 5% level or better are shown in bold. Consistent with the results for the full sample in Table 7, insiders increase their net purchases in most of the sub-samples. The table shows a consistent pattern of statistically significant increases in insiders' net purchases relative to the dual control in certain sub-samples with less uncertainty about takeover completion, such as friendly deals, deals with a single bidder, domestic acquirer, and less regulated target. These results are generally similar for the other two measures of net purchases, and are not tabulated for brevity.

The pattern of significant increases in insiders' net purchases is also more evident in deals involving large targets. In untabulated results, the increase in top managers' net purchases in large targets is driven by a significant reduction in their pre-bid sales,

Table 8
Sub-sample regressions of dollar value of insiders' net purchases. The table shows percentage marginal effects (%ME) of the interaction term, Pre-takeover∗Target, from regressions of dollar value of insiders' net purchases, similar to those shown in Panel C of Table 7, for nine partitions of the target sample. Values of %ME that are significantly different from zero at the 5% level are indicated in bold. Columns 2 through 6 show the results for each of the five insider groups. The sample consists of 2763 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample, with non-missing data for all the variables in the regressions. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. There are two observations for each firm: one measures insider trading activity during the one-year period immediately before takeover announcements (pre-takeover period), and the other measures it during the year before that (control period). Pre-takeover is a dummy variable that equals 1 (0) for the pre-takeover (control) period. Target is a dummy variable that equals 1 (0) for the target (control) firm. The sample partitions are as described in Table 4.

Sub-samples	N	% marginal effect (%ME)				
		Top management	Top financial officers	All officers	All directors	Blockholders
Merger	8180	20	23	17	27	**78**
Tender offer	2248	**65**	57	**87**	51	151
LBO	784	65	64	**85**	78	−110
Hostile	432	**117**	57	85	81	−5
Friendly	10,620	26	**33**	**29**	**32**	**75**
Single bidder	10,324	**31**	**38**	**31**	**33**	**77**
Multiple bidder	728	47	−32	50	69	−13
Stock deals	3344	20	15	11	37	77
Cash deals	4112	38	35	**40**	36	43
Other deals	3596	39	49	**45**	35	97
Cross border acquirer	1748	21	43	52	33	127
Domestic acquirer	9304	**30**	**32**	**28**	**35**	65
More regulated	2840	27	26	20	53	260
Less regulated	8212	**33**	**35**	**35**	**32**	59
1988–1995	2592	9	75	27	30	39
1996–2001	5260	30	32	35	**44**	**103**
2002–2006	3200	**43**	34	**34**	26	52
Small target	5784	20	41	45	40	−1
Mid-size target	2300	11	20	26	33	113
Large target	2968	**48**	**43**	**37**	**40**	97
NYSE target	3164	**39**	38	28	**45**	72
AMEX target	924	−70	−34	−62	6	156
NASDAQ target	6964	**35**	37	**45**	33	67

but not in their purchases. Given the larger trading volume in these stocks and greater media coverage of these firms, their insiders may find it easier to hide this subtle, unregulated pattern of their trading.

Finally, one might expect profitable insider trading before announcements of major corporate events to reduce after the adoption of Sarbanes–Oxley Act (SOX) in 2002. SOX may have enhanced investors' focus on insider trading by requiring insiders to report their trades within two business days instead of the tenth day of the following month. Surprisingly, Table 8 shows that of the three sub-periods of our sample, the increase in top corporate officers' pre-announcement net purchases is most pronounced post-SOX.

7. Summary and conclusions

This paper provides systematic evidence on the level, pattern and prevalence of trading by registered insiders before takeovers during modern times. We examine the level and pattern of insider trading in about 3700 targets of takeovers announced during 1988–2006 and in a control sample of non-targets, both during an 'informed' and a control period. We analyze open-market stock transactions of five groups of corporate insiders: top management, top financial officers, all corporate officers, board members, and large blockholders. We separately examine their purchases, sales and net purchases in target and control firms during the one year period prior to takeover announcement (informed period) and the preceding one year (control) period, using a D-i-D approach. Using several measures of the level of insider trading, we estimate cross-sectional regressions that control for other determinants of the level of insider trading.

We find an interesting and subtle pattern in the average trading behavior of target insiders over the one year period before takeover announcement. We find no evidence that insiders increase their purchases before takeover announcements; instead, they decrease them. But while insiders reduce their purchases below normal levels, they reduce their sales even more, thus increasing their *net* purchases. This pattern of passive insider trading is confined to the six-month period before takeover announcement, when insiders are more likely to be informed about an upcoming takeover; it holds for each insider group, and for all three measures of net purchases that we examine. The economic magnitude of this effect is quite substantial. Over the six-month pre-announcement period, our D-i-D estimates indicate an increase of about 50% in the dollar value of net purchases of targets' officers and directors, relative to their usual net purchase levels. These effects are even stronger in certain sub-samples with less uncertainty about takeover completion, such as friendly deals, and deals with a single bidder, domestic acquirer, or less regulated target. As with all prior studies analyzing trades of registered insiders, we assume that insiders comply with the law to report all their trades to the SEC and do not trade via third parties.

Our findings suggest that target insiders engage in profitable passive insider trading before takeover announcement. This trading pattern appears to reflect insiders' attempts at capitalizing on their information advantage during takeover negotiations, while avoiding running afoul of SEC rules on insider trading. As such, this finding suggests the limits of insider trading regulation, an issue that has been extensively debated by law and economics scholars (see, e.g., Fried, 2003; Manne, 1985; Salbu, 1993).

We find that registered insiders of target firms forego large potential gains from increasing their purchases before news of a takeover is publicly disclosed. While insiders reduce their pre-announcement purchases before all three types of takeovers that we examine (mergers, tender-offers and LBOs), the reduction is statistically significant only in mergers. These findings suggest that insider trading regulations are somewhat effective at deterring registered insiders from trading actively before takeovers, especially mergers. This finding contrasts with prior findings, discussed in the introduction, of profitable active trading by registered insiders before many other corporate events such as bankruptcies, stock repurchases, earnings announcements, and earnings restatements.

Why do registered insiders shy away from active, profitable trading before mergers, but not before other major corporate events? The answer may lie in the enforcement mechanism used for different insider trading laws. As Agrawal and Jaffe (1995) discuss, the reduction in pre-announcement purchases by target insiders in mergers appears to be an unintended consequence of the ban on short-swing trading (Section 16b), which is enforced by private attorneys, rather than by the SEC.[20] The main regulation against insider trading, rule 10b-5, which can only be enforced by the SEC, appears to be largely ineffective against the type of insider trades for which it might be the easiest to enforce, namely trades reported to the SEC by registered corporate insiders. Whether this apparent non-enforcement (or under-enforcement) of rule 10b-5 against registered corporate insiders is by choice (e.g., optimal non-enforcement, as argued by Carlton and Fischel, 1983) or due to the difficulty of proving a violation under rule 10b-5, remains an open question for future research.

More broadly, how do our findings that registered insiders engage in profitable passive, but not active, trading tie up with other indications (e.g., stock price run-ups and SEC actions) of widespread insider trading in takeover targets in general? Well, a takeover deal directly involves at least two firms, involves several intermediaries (such as investment bankers, lawyers and auditors), and affects most of the stakeholders (employees, investors, customers, suppliers, …) in the firms. So information can leak from a variety of sources. Our findings suggest that the overall level of insider trading in target firms might be even higher absent the deterrent effects of insider trading laws and their enforcement. The international evidence in Bhattacharya and Daouk (2002) is consistent with this conjecture.

[20] Ironically, section 16b is not even considered a 'real' insider trading law.

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Appendix A. Univariate results

We present univariate results for insider purchases in Section A.1, their sales in Section A.2, and net purchases in Section A.3.

A.1. Insider purchases

Table A.1 shows mean and median values of five parametric measures and values of two non-parametric measures of insider purchases for the target and control samples for the pre-takeover and control periods. The 'pre-takeover period' is the one year period before the takeover announcement date, and 'control period' is the one year period before that. Each panel shows measures of purchases for one of the five groups of insiders defined in Section 4.4 in the paper. The parametric measures of insider purchases are: number of insiders buying during a year (denoted '# insiders' in the table), number of shares bought in thousands ('# shares'), dollar value of shares bought in millions ('$ shares'), percentage of outstanding equity bought ('% equity'), and number of pure buy months, i.e., months with some insider purchases and no insider sales ('# buy months'). The dollar value of shares traded is computed by multiplying the number of shares traded by the transaction price reported on TFN. Missing transaction prices are replaced by the closing price or the bid-ask average from CRSP on the transaction date. The percentage of equity traded equals the number of shares traded divided by the number of shares outstanding on the transaction date.

The table reports p-values of the two-tailed t-test for the difference in means and Wilcoxon test for the difference in distributions (shown in rows for medians). The last two rows in each panel show the percentages of firms with at least one or at least two insiders buying shares in a year and p-values of two-tailed z-tests for differences in proportions. Signs of the test statistics are shown in parentheses after p-values. Column 5 (labeled '1 − 2') shows p-values of test statistics for the change in the level of purchases of target firm insiders between the pre-takeover and control periods (i.e., the time-series control); column 6 ('1 − 3') is for differences in the level of insider purchases during the pre-takeover period between target and control firms (i.e., the cross-sectional control); column 7 ('3 − 4') is for the change in the level of purchases of control firm insiders between the pre-takeover and control periods; and column 8 ['(1 − 2) − (3 − 4)'] is for the difference between (1) the change in the level of purchases of target firm insiders between the pre-takeover and control periods and (2) the change in the level of purchases of control firm insiders between the pre-takeover and control periods. While the tests in columns 5 and 6 are certainly pertinent, our focus is on the test in column 8, which uses the dual control or the D-i-D approach.

In Panel A of Table A.1, the top management group in target firms significantly reduces their purchases during the pre-takeover period. This conclusion holds whether we use the time-series control, the cross-sectional control, or the dual control, and is based on all seven measures of insider purchases. Of the 12 p-values for the dual control shown in column 8, nine are less than 0.001, one is between 0.001 and 0.05, and the remaining two are between 0.05 and 0.10. The results are generally similar for the group of all financial officers (in Panel B), all officers (in Panel C), and all directors (in Panel D). While blockholders (in Panel E) also reduce their pre-takeover purchases, only two of the p-values for the dual control are below 0.05 and another two are below 0.10. These results are inconsistent with active insider trading based on private negotiations on the takeover. The fact that insiders not only avoid increasing their pre-announcement purchases above their normal levels, but actually decrease it suggests that they are concerned about being caught by either insider trading laws or company rules against insider trading.

A.2. Insider sales

Table A.2 examines insider sales in a format similar to Table A.1. Column 8 shows that target insiders reduce their pre-takeover sales significantly compared to their normal levels. This conclusion holds for all five insider groups in Panels A through E, and for all seven measures of the level of insider sales. These results are consistent with passive insider trading. While securities laws and company rules against insider trading can deter insiders from purchasing shares based on inside information about the upcoming takeover, they cannot prevent them from postponing their planned sales.

A.3. Net insider purchases

Table A.3 examines the net effect of insiders' purchases and sales. Four of the measures of insider trading (namely # insiders, # buy or sell months, and% of firms with at least one or at least two insiders buying or selling) that we examine in Tables A.1 and A.2 are no longer well-defined for measuring the level of net purchases. So we examine the remaining three measures (# shares, $ shares, and% equity). Table A.3 provides some evidence that insiders increase their net purchases before the takeover

Table A.1
Insider purchases at target and control firms during pre-takeover and control periods. The table shows mean and median values of five parametric measures and values of two non-parametric measures of insider purchases for target and control samples during the pre-takeover and control periods. The pre-takeover period is the one-year period before the takeover announcement date and control period is the one-year period before that. Each panel shows measures of purchases for one of the five groups of insiders defined in Table 3. Insider trading data is from TFN Insider database. The samples consists of 3701 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. The parametric measures of insider trading are: number of insiders buying during a year (# insiders), number of shares bought in '000 (# shares), dollar value of shares bought in millions ($ shares), percentage of outstanding equity bought (% equity), and number of pure buy months, i.e., months with some insider purchases and no insider sales (# buy months). The table reports p-values of two-tailed t-tests for differences in means and Wilcoxon tests for differences in distributions (shown in rows for medians). The last two rows in each Panel show the percentages of firms with at least one or at least two insiders buying shares in a year and p-values of two-tailed z-tests for differences in proportions. Signs of the test statistics are shown in parentheses after p-values. All dollar values are in inflation-adjusted 2000 dollars.

Panel A: Top management

Statistic	Target firms		Control firm		p-values			
Insider buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) - (3 − 4)
Mean								
# insiders	0.269	0.354	0.335	0.329	0.000 (−)	0.000 (−)	0.683 (+)	0.000 (−)
# shares	6.639	9.533	13.231	8.846	0.212 (−)	0.024 (−)	0.082 (+)	0.034 (−)
$ shares	0.050	0.107	0.101	0.096	0.020 (−)	0.022 (−)	0.838 (+)	0.072 (−)
% equity	0.057	0.084	0.131	0.092	0.220 (−)	0.021 (−)	0.220 (+)	0.089 (−)
# buy months	0.303	0.412	0.405	0.409	0.000 (−)	0.000 (−)	0.801 (−)	0.000 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.000 (−)	0.679 (+)	0.000 (−)
# shares	0	0	0	0	0.000 (−)	0.000 (−)	0.165 (+)	0.000 (−)
$ shares	0	0	0	0	0.000 (−)	0.000 (−)	0.686 (−)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.000 (−)	0.198 (+)	0.000 (−)
# buy months	0	0	0	0	0.000 (−)	0.000 (−)	0.797 (−)	0.000 (−)
% of firms with								
≥1 insiders buying	20.08	24.97	23.99	24.10	0.000 (−)	0.000 (−)	0.913 (−)	0.001 (−)
≥2 insiders buying	9.38	13.37	12.97	12.16	0.000 (−)	0.000 (−)	0.293 (+)	0.000 (−)

Panel B: Top financial officers

Statistic	Target		Control		p-values			
Insider buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
Mean								
# insiders	0.098	0.126	0.110	0.113	0.000 (−)	0.117 (−)	0.675 (−)	0.013 (−)
# shares	0.471	1.341	1.216	1.298	0.182 (−)	0.189 (−)	0.919 (−)	0.448 (−)
$ shares	0.004	0.018	0.011	0.009	0.162 (−)	0.106 (−)	0.645 (+)	0.147 (−)
% equity	0.004	0.010	0.008	0.013	0.074 (−)	0.226 (−)	0.465 (−)	0.978 (−)
# buy months	0.119	0.154	0.141	0.135	0.000 (−)	0.054 (−)	0.484 (+)	0.001 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.117 (−)	0.760 (−)	0.007 (−)
# shares	0	0	0	0	0.000 (−)	0.087 (−)	0.679 (+)	0.010 (−)
$ shares	0	0	0	0	0.000 (−)	0.302 (−)	0.482 (−)	0.040 (−)
% equity	0	0	0	0	0.001 (−)	0.163 (−)	0.729 (+)	0.018 (−)
# buy months	0	0	0	0	0.000 (−)	0.042 (−)	0.451 (+)	0.001 (−)
% of firms with								
≥1 insiders buying	9.05	11.45	10.11	10.13	0.001 (−)	0.123 (−)	0.969 (+)	0.017 (−)
≥2 insiders buying	2.51	3.35	3.22	3.13	0.033 (−)	0.070 (−)	0.842 (+)	0.104 (−)

Panel C: All officers

Statistic	Target		Control		p-values			
Insider buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
Mean								
# insiders	0.426	0.509	0.531	0.477	0.000 (−)	0.000 (−)	0.008 (+)	0.000 (−)
# shares	5.882	8.670	13.151	7.391	0.170 (−)	0.008 (−)	0.023 (+)	0.009 (−)
$ shares	0.049	0.100	0.135	0.082	0.040 (−)	0.036 (−)	0.209 (+)	0.035 (−)
% equity	0.054	0.067	0.104	0.061	0.512 (−)	0.036 (−)	0.014 (+)	0.032 (−)

Table A.1 (*continued*)

Panel C: All officers

Statistic	Target firms		Control firm		p-values			
Insider buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) - (3 − 4)
# buy months	0.341	0.427	0.469	0.422	0.000 (−)	0.000 (−)	0.005 (+)	0.000 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.000 (−)	0.002 (+)	0.000 (−)
# shares	0	0	0	0	0.000 (−)	0.000 (−)	0.001 (+)	0.000 (−)
$ shares	0	0	0	0	0.000 (−)	0.000 (−)	0.020 (+)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.000 (−)	0.001 (+)	0.000 (−)
# buy months	0	0	0	0	0.000 (−)	0.000 (−)	0.006 (+)	0.000 (−)
% of firms with								
≥1 insiders buying	23.21	28.07	27.99	26.18	0.000 (−)	0.000 (−)	0.080 (+)	0.000 (−)
≥2 insiders buying	11.21	14.10	16.59	13.94	0.000 (−)	0.000 (−)	0.002 (+)	0.000 (−)

Panel D: All directors

Statistic	Target		Control		p-values			
Insider buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-Takeover period	(4)Control period	1 − 2	1 − 3	3 − 4	(1 − 2)– (3 − 4)
Mean								
# insiders	0.672	0.907	0.939	0.952	0.000 (−)	0.000 (−)	0.608 (−)	0.000 (−)
# shares	11.348	22.970	25.499	17.002	0.001 (−)	0.014 (−)	0.156 (+)	0.004 (−)
$ shares	0.127	0.258	0.238	0.188	0.001 (−)	0.031 (−)	0.307 (+)	0.004 (−)
% equity	0.104	0.171	0.164	0.147	0.019 (−)	0.022 (−)	0.515 (+)	0.030 (−)
# buy months	0.608	0.828	0.869	0.851	0.000 (−)	0.000 (−)	0.441 (+)	0.000 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.000 (−)	0.938 (−)	0.000 (−)
# shares	0	0	0	0	0.000 (−)	0.000 (−)	0.159 (+)	0.000 (−)
$ shares	0	0	0	0	0.000 (−)	0.000 (−)	0.542 (−)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.000 (−)	0.368 (+)	0.000 (−)
# buy months	0	0	0	0	0.000 (−)	0.000 (−)	0.411 (+)	0.000 (−)
% of firms with								
≥1 insiders buying	35.86	44.07	44.31	43.83	0.000 (−)	0.000 (−)	0.673 (+)	0.000 (−)
≥2 insiders buying	19.35	26.88	28.12	27.45	0.000 (−)	0.000 (−)	0.517 (+)	0.000 (−)

Panel E: Blockholders

Statistic	Target		Control		p-values			
Insider buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) - (3 − 4)
Mean								
# insiders	0.076	0.106	0.088	0.098	0.001 (−)	0.140 (−)	0.206 (−)	0.071 (−)
# shares	82.230	42.027	62.103	51.246	0.421 (+)	0.702 (+)	0.392 (+)	0.569 (+)
$ shares	0.917	0.528	0.705	0.505	0.352 (+)	0.632 (+)	0.267 (+)	0.678 (+)
% equity	0.243	0.243	0.287	0.191	0.998 (+)	0.620 (−)	0.115 (+)	0.333 (−)
# buy months	0.105	0.119	0.121	0.129	0.162 (−)	0.215 (−)	0.461 (−)	0.700 (−)
Median								
# insiders	0	0	0	0	0.001 (−)	0.140 (−)	0.325 (−)	0.125 (−)
# shares	0	0	0	0	0.001 (−)	0.644 (−)	0.792 (+)	0.018 (−)
$ shares	0	0	0	0	0.009 (−)	0.541 (−)	0.725 (−)	0.053 (−)
% equity	0	0	0	0	0.010 (−)	0.837 (−)	0.563 (+)	0.034 (−)
# buy months	0	0	0	0	0.044 (−)	0.255 (−)	0.610 (−)	0.329 (−)
% of firms with								
≥1 insiders buying	6.19	7.19	7.05	7.00	0.085 (−)	0.135 (−)	0.928 (+)	0.205 (−)
≥2 insiders buying	3.05	4.08	3.35	3.86	0.019 (−)	0.468 (−)	0.216 (−)	0.401 (−)

Table A.2
Insider sales at target and control firms during pre-takeover and control periods. The table shows mean and median values of five parametric measures and values of two non-parametric measures of insider sales for target and control samples during the pre-takeover and control periods. The pre-takeover period is the one-year period before the takeover announcement date and control period is the one-year period before that. Each panel shows measures of sales for one of the five groups of insiders defined in Table 3. Insider trading data is from TFN Insider database. The samples consists of 3701 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. The parametric measures of insider trading are: number of insiders selling during a year (# insiders), number of shares sold '000 (# shares), dollar value of shares sold in millions ($ shares), percentage of outstanding equity sold (% equity), and number of pure selling months, i.e., months with some insider sales and no insider purchases (# sell months). The table reports p-values of two-tailed t-tests for differences in means and Wilcoxon tests for differences in distributions (shown in rows for medians). The last two rows in each Panel show the percentages of firms with at least one or at least two insiders selling shares in a year and p-values of two-tailed z-tests for differences in proportions. Signs of the test statistics are shown in parentheses after p-values. All dollar values are in inflation-adjusted 2000 dollars.

Panel A: Top management

Statistic	Target		Control		p-values			
Insider sales measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
Mean								
# insiders	0.419	0.507	0.516	0.497	0.000 (−)	0.000 (−)	0.177 (+)	0.000 (−)
# shares	41.517	48.812	55.169	49.228	0.238 (−)	0.045 (−)	0.175 (+)	0.078 (−)
$ shares	1.172	1.256	1.746	1.347	0.615 (−)	0.012 (−)	0.030 (+)	0.049 (−)
% equity	0.163	0.212	0.224	0.221	0.020 (−)	0.014 (−)	0.874 (+)	0.090 (−)
# sell months	0.521	0.627	0.701	0.640	0.000 (−)	0.000 (−)	0.006 (+)	0.000 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.000 (−)	0.099 (+)	0.000 (−)
# shares	0	0	0	0	0.000 (−)	0.000 (−)	0.019 (+)	0.000 (−)
$ shares	0	0	0	0	0.000 (−)	0.000 (−)	0.009 (+)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.000 (−)	0.042 (+)	0.000 (−)
# sell months	0	0	0	0	0.000 (−)	0.000 (−)	0.029 (+)	0.000 (−)
% of firms with								
≥1 insiders selling	26.72	31.53	31.69	29.94	0.000 (−)	0.000 (−)	0.102 (+)	0.000 (−)
≥2 insiders selling	15.86	19.05	19.56	19.13	0.000 (−)	0.000 (−)	0.638 (+)	0.004 (−)

Panel B: Top financial officers

Statistic	Target		Control		p-values			
Insider sales measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2)– (3 − 4)
Mean								
# insiders	0.178	0.206	0.215	0.208	0.001 (−)	0.001 (−)	0.427 (+)	0.004 (−)
# shares	4.649	8.971	7.261	6.826	0.178 (−)	0.002 (−)	0.726 (+)	0.167 (−)
$ shares	0.145	0.454	0.239	0.192	0.264 (−)	0.002 (−)	0.155 (+)	0.202 (−)
% equity	0.017	0.027	0.033	0.024	0.001 (−)	0.049 (−)	0.268 (+)	0.030 (−)
# sell months	0.243	0.283	0.313	0.281	0.005 (−)	0.000 (−)	0.024 (+)	0.000 (−)
Median								
# insiders	0	0	0	0	0.001 (−)	0.001 (−)	0.352 (+)	0.002 (−)
# shares	0	0	0	0	0.001 (−)	0.001 (−)	0.028 (+)	0.000 (−)
$ shares	0	0	0	0	0.001 (−)	0.001 (−)	0.009 (+)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.000 (−)	0.019 (+)	0.000 (−)
# sell months	0	0	0	0	0.000 (−)	0.000 (−)	0.066 (+)	0.001 (−)
% of firms with								
≥1 insiders selling	14.97	17.66	17.86	17.21	0.002 (−)	0.001 (−)	0.463 (+)	0.007 (−)
≥2 insiders selling	6.40	8.05	8.35	7.65	0.006 (−)	0.001 (−)	0.265 (+)	0.007(−)

Panel C: All officers

Statistic	Target		Control		p-values			
Insider sales measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
Mean								
# insiders	1.056	1.206	1.262	1.148	0.000 (−)	0.000 (−)	0.000 (+)	0.000 (−)
# shares	59.630	98.471	70.950	65.708	0.226 (−)	0.178 (−)	0.328 (+)	0.175 (−)
$ shares	1.702	2.100	3.212	4.734	0.274 (−)	0.133 (−)	0.602 (−)	0.702(+)
% equity	0.295	0.618	0.256	0.251	0.408 (−)	0.678 (+)	0.847 (+)	0.403 (−)
# sell months	0.912	1.009	1.110	1.007	0.000 (−)	0.000 (−)	0.000 (+)	0.000 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.000 (−)	0.000 (+)	0.000 (−)
# shares	0	0	0	0	0.000 (−)	0.000 (−)	0.001 (+)	0.000 (−)

Table A.2 (*continued*)

Panel C: All officers

Statistic	Target		Control		p-values			
Insider sales measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
$ shares	0	0	0	0	0.000 (−)	0.000 (−)	0.000 (+)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.000 (−)	0.001 (+)	0.000 (−)
# sell months	0	0	0	0	0.000 (−)	0.000 (−)	0.001 (+)	0.000 (−)
% of firms with								
≥1 insiders selling	38.31	42.77	42.61	40.45	0.000 (−)	0.000 (−)	0.059 (+)	0.000 (−)
≥2 insiders selling	26.34	30.05	29.56	27.86	0.000 (−)	0.002 (−)	0.105 (+)	0.000 (−)

Panel D: All directors

Statistic	Target		Control		p-values			
Insider sales measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
Mean								
# insiders	0.752	0.889	0.942	0.910	0.000 (−)	0.000 (−)	0.151 (+)	0.000 (−)
# shares	78.666	84.010	77.758	76.632	0.661 (−)	0.933 (+)	0.884 (+)	0.654 (−)
$ shares	2.037	2.019	2.449	2.276	0.951 (+)	0.304 (−)	0.624 (+)	0.740 (−)
% equity	0.346	0.366	0.341	0.357	0.642 (−)	0.905 (+)	0.655 (−)	0.954 (−)
# sell months	0.812	0.921	1.007	0.959	0.000 (−)	0.000 (−)	0.072 (+)	0.000 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.000 (−)	0.092 (+)	0.000 (−)
# shares	0	0	0	0	0.000 (−)	0.000 (−)	0.295 (+)	0.000 (−)
$ shares	0	0	0	0	0.000 (−)	0.000 (−)	0.201 (+)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.000 (−)	0.631 (+)	0.000 (−)
# sell months	0	0	0	0	0.000 (−)	0.000 (−)	0.096 (+)	0.000 (−)
% of firms with								
≥1 insiders selling	39.58	44.64	44.31	43.31	0.000 (−)	0.000 (−)	0.386 (+)	0.000 (−)
≥2 insiders selling	24.56	29.02	29.91	28.83	0.000 (−)	0.000 (−)	0.307 (+)	0.000 (−)

Panel E: Blockholders

Statistic	Target		Control		p-values			
Insider sales measure	(1) Pre-takeover Period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
Mean								
# insiders	0.124	0.187	0.132	0.152	0.000 (−)	0.529 (−)	0.171 (−)	0.033 (−)
# shares	102.739	136.806	129.591	88.094	0.277 (−)	0.647 (−)	0.484 (+)	0.272 (−)
$ shares	2.405	3.413	1.663	2.084	0.333 (−)	0.307 (+)	0.605 (−)	0.663 (−)
% equity	0.477	0.484	0.486	0.366	0.940 (−)	0.955(−)	0.392 (+)	0.448 (−)
# sell months	0.132	0.184	0.155	0.163	0.000 (−)	0.115 (−)	0.497 (−)	0.011 (−)
Median								
# insiders	0	0	0	0	0.000 (−)	0.471 (−)	0.296 (−)	0.001 (−)
# shares	0	0	0	0	0.000 (−)	0.249 (−)	0.788 (+)	0.000 (−)
$ shares	0	0	0	0	0.000 (−)	0.183 (−)	0.973 (−)	0.000 (−)
% equity	0	0	0	0	0.000 (−)	0.263 (−)	0.819 (+)	0.000 (−)
# sell months	0	0	0	0	0.000 (−)	0.068 (−)	0.399 (−)	0.003 (−)
% of firms with								
≥1 insiders selling	7.75	10.75	8.97	9.21	0.000 (−)	0.058 (−)	0.716 (−)	0.004 (−)
≥2 insiders selling	4.35	5.92	4.62	4.89	0.002 (−)	0.574 (−)	0.585 (−)	0.069 (−)

announcement. This conclusion holds for top management, top financial officers and all officers (Panels A through C), and is based on the Wilcoxon test for the dual control in column 8. For the group of all directors and blockholders in Panels D and E, while the signs of the dual control in column 8 are positive for the Wilcoxon test, only one of the three p-values is low (0.011) for directors and two of the p-values are low (0.046 and 0.058) for blockholders. While these results provide both a time-series and a cross-sectional control for the level of insider trading, they do not control for other determinants of the level of insider trading, a task that we tackle in Section 5 in the paper.

Table A.3
Insiders' net purchases at target and control firms during pre-takeover and control periods. The table shows means and medians of three different measures of insiders' net purchases for target and control samples during the pre-takeover and control periods. The pre-takeover period is the one-year period before the takeover announcement date and control period is the one-year period before that. Each panel shows net purchase measures for one of the five groups of insiders defined in Table 3. Insider trading data is from TFN Insider database. The samples consists of 3701 target firms in takeover transactions announced during 1988–2006 with a deal value of $1 million or more, and an industry-size matched control sample. Both target and control firms are listed on the NYSE, AMEX, or NASDAQ. The measures of insiders' net purchases are: net number of shares bought during a year in '000 (# shares), net dollar value of shares bought during a year in millions ($ shares), and net percentage of outstanding equity bought during a year (% equity). The table reports p-values of two-tailed t-tests for differences in means and Wilcoxon tests for differences in distributions (shown in rows for medians). Signs of the test statistics are shown in parentheses after p-values. All dollar values are in inflation-adjusted 2000 dollars.

Panel A: Top management

Statistic	Target		Control		p-values			
Insider net buy measure	(1) `Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1−2	1−3	3−4	(1−2)−(3−4)
Mean								
# shares	−34.878	−39.280	−41.938	−40.381	0.506 (+)	0.319 (+)	0.735 (−)	0.457 (+)
$ shares	−1.123	−1.150	−1.615	−1.250	0.873 (+)	0.030 (+)	0.034 (−)	0.089 (+)
% equity	−0.106	−0.128	−0.093	−0.129	0.497 (+)	0.727 (−)	0.342 (+)	0.769 (−)
Median								
# shares	0	0	0	0	0.009 (+)	0.119 (+)	0.127 (−)	0.008 (+)
$ shares	0	0	0	0	0.003 (+)	0.006 (+)	0.003 (−)	0.000 (+)
% equity	0	0	0	0	0.016 (+)	0.354 (+)	0.229 (−)	0.034 (+)

Panel B: Top financial officers

Statistic	Target		Control		p-values			
Insider net buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1−2	1−3	3−4	(1−2)−(3−4)
Mean								
# shares	−4.178	−7.630	−6.045	−5.528	0292 (+)	0.063 (+)	0.727 (−)	0.270 (+)
$ shares	−0.141	−0.437	−0.228	−0.183	0.287 (+)	0.005 (+)	0.183 (−)	0.223 (+)
% equity	−0.013	−0.017	−0.025	−0.011	0.405 (+)	0.171 (+)	0.192 (−)	0.130 (+)
Median								
# shares	0	0	0	0	0.108 (+)	0.023 (+)	0.057 (−)	0.005 (+)
$ shares	0	0	0	0	0.075 (+)	0.003 (+)	0.008 (−)	0.000 (+)
% equity	0	0	0	0	0.111 (+)	0.009 (+)	0.040 (−)	0.005 (+)

Panel C: All officers

Statistic	Target		Control		p-values			
Insider net buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1−2	1−3	3−4	(1−2)−(3−4)
Mean								
# shares	−53.478	−89.801	−57.799	−58.317	0.262 (+)	0.635 (+)	0.925 (+)	0.276 (+)
$ shares	−1.653	−2.001	−3.077	−4.653	0.343 (+)	0.157 (+)	0.589 (+)	0.676 (−)
% equity	−0.241	−0.551	−0.152	−0.190	0.428 (+)	0.357 (−)	0.159 (+)	0.488 (+)
Median								
# shares	0	0	0	0	0.001 (+)	0.157 (+)	0.112 (−)	0.006 (+)
$ shares	0	0	0	0	0.000 (+)	0.015 (+)	0.008 (+)	0.000 (+)
% equity	0	0	0	0	0.003 (+)	0.395 (+)	0.242 (−)	0.019 (+)

Panel D: All directors

Statistic	Target		Control		p-values			
Insider net buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1−2	1−3	3−4	(1−2)−(3−4)
Mean								
# shares	−67.318	−61.040	−52.259	−59.630	0.620 (−)	0.210 (−)	0.446 (+)	0.392 (−)
$ shares	−1.910	−1.761	−2.211	−2.088	0.621 (−)	0.455 (+)	0.731 (−)	0.955 (−)
% equity	−0.243	−0.195	−0.176	−0.210	0.343 (−)	0.216(−)	0.432 (+)	0.217 (−)
Median								
# shares	0	0	0	0	0.032 (+)	0.561 (+)	0.707 (−)	0.211 (+)
$ shares	0	0	0	0	0.006 (+)	0.081 (+)	0.088 (−)	0.011 (+)
% equity	0	0	0	0	0.138 (+)	0.857 (−)	0.960 (−)	0.279 (+)

Table A.3 (*continued*)

Panel E: Blockholders								
Statistic	Target		Control		p-values			
Insider net buy measure	(1) Pre-takeover period	(2) Control period	(3) Pre-takeover period	(4) Control period	1 − 2	1 − 3	3 − 4	(1 − 2) − (3 − 4)
Mean								
# shares	−20.510	−94.780	−67.488	−36.848	0.202 (+)	0.542 (+)	0.614 (−)	0.220 (+)
$ shares	−1.487	−2.885	−0.958	−1.579	0.204 (+)	0.504 (−)	0.438 (+)	0.576 (+)
% equity	−0.234	−0.241	−0.199	−0.175	0.952 (+)	0.834 (−)	0.873 (−)	0.869 (+)
Median								
# shares	0	0	0	0	0.008 (+)	0.440 (+)	0.696 (+)	0.100 (+)
$ shares	0	0	0	0	0.002 (+)	0.375 (+)	0.652 (+)	0.046 (+)
% equity	0	0	0	0	0.004 (+)	0.353 (+)	0.579 (+)	0.058 (+)

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