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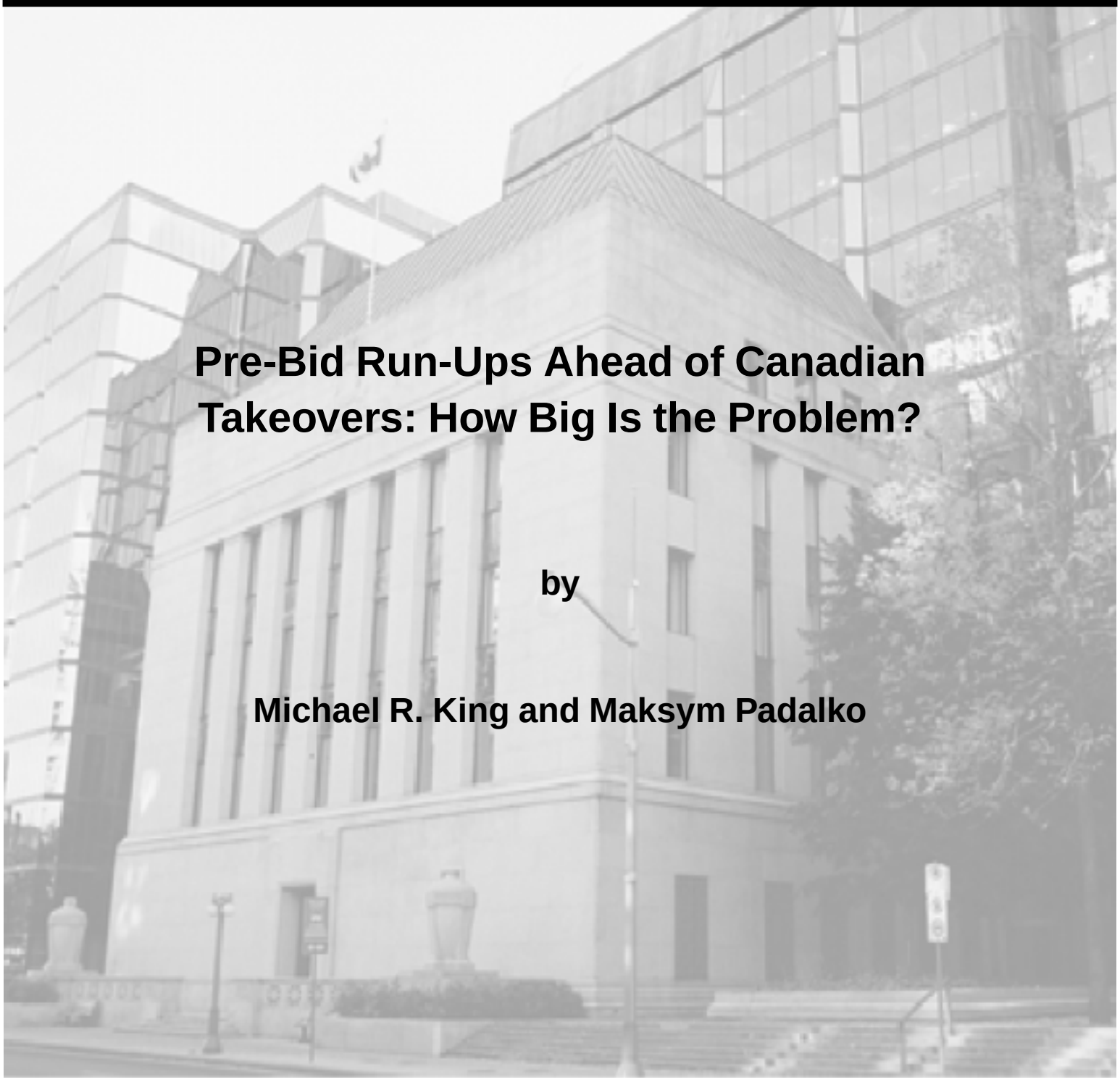

Pre-Bid Run-Ups Ahead of Canadian Takeovers: How Big Is the Problem?

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The views expressed in this paper are those of the authors.
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Contents

Acknowledgements iv
Abstract/Résumé v

1. Introduction 1
2. Explanations of Pre-Bid Price Run-Ups 3
   2.1 Illegal insider trading 5
   2.2 Market anticipation 8
   2.3 Summary of predictions 11
3. Institutional Background 11
4. Data and Methodology 13
   4.1 Data 13
   4.2 Methodology 15
5. Empirical Analysis 18
   5.1 Evidence of abnormal returns 18
   5.2 Evidence of abnormal volume 21
   5.3 Reaction of bid-ask spreads 22
   5.4 Regressions of abnormal returns and volume 23
6. Conclusion 24

References 26

Tables 31

Figures 39

Appendix 41

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Abstract

The authors study the price–volume dynamics ahead of the first public announcement of a takeover for 420 Canadian firms from 1985 to 2002. Pre-bid price run-ups in a target firm's shares may be caused by some combination of information leakage due to illegal insider trading or market anticipation based on rumours in the press. The authors review empirical studies of illegal insider trading and trading ahead of unscheduled announcements to generate predictions for abnormal returns and abnormal volume ahead of the takeover announcement. They observe serially correlated volume and a pattern of return reversals in their sample. Pre-bid run-ups occur shortly before the actual announcement, accompanied by significantly positive abnormal returns and share volume. The stock prices of the target firm react significantly to the actual announcement, with both positive and negative reactions. These price–volume dynamics are more consistent with the predictions of the market anticipation hypothesis than the hypothesis of illegal insider trading.

JEL classification: G14, G18, G34
Bank classification: Financial markets

Résumé

Les auteurs examinent la manière dont évoluent le cours des actions et le volume des transactions à l'approche d'une offre publique d'achat (OPA); leur échantillon englobe 420 entreprises canadiennes ayant été l'objet de telles opérations entre 1985 et 2002. Les hausses de cours qui précèdent une OPA peuvent être dues à une fuite d'information résultant d'opérations d'initié illicites et/ou à des anticipations du marché liées à des rumeurs véhiculées dans les médias. Prenant appui sur les résultats empiriques de chercheurs ayant analysé des délits d'initié et l'évolution du volume des transactions à l'approche d'annonces imprévues, les auteurs génèrent une prévision des rendements et des volumes anormaux susceptibles d'être observés avant la première annonce publique d'une OPA. Ils constatent une autocorrélation du volume des transactions et un renversement de tendance dans les rendements durant la période étudiée. Le cours de l'action grimpe peu avant l'annonce proprement dite, et tant les rendements anormaux que les volumes anormaux sont significativement supérieurs à zéro. Le prix de l'action de l'entreprise visée réagit de façon significative à l'OPA, aussi bien à la hausse qu'à la baisse. Cette évolution des cours et des volumes semble davantage tenir à des anticipations du marché qu'à des fuites d'information découlant de délits d'initié.

Classification JEL : G14, G18, G34
Classification de la Banque : Marchés financiers

1. Introduction

This paper examines the price–volume dynamics in a target firm's shares ahead of the first announcement of a takeover, to determine whether the patterns are consistent with the hypothesis of illegal insider trading or the market anticipation hypothesis. We study 420 takeovers of publicly listed Canadian firms from 1985 to 2002. Studies of takeovers in Canada and abroad consistently document a run-up in the target firm's shares before the takeover bid is made public, which suggests that some investors are more informed than others during this period. One explanation for the pre-bid price run-up is that corporate insiders with access to material, non-public information are trading illegally on this information at the expense of non-informed investors. Regulators view illegal insider trading as harmful to public welfare, despite arguments that suggest it is a victimless crime that promotes market efficiency (Bainbridge 2000). This activity may undermine investor confidence, increase the rate of return demanded by less-informed investors, reduce liquidity in secondary markets, and raise the cost of capital for firms, thereby reducing public welfare. Over the 1990s, following a series of high-profile prosecutions in the United States and abroad, regulators in 53 countries adopted securities laws that restrict when and how corporate insiders can trade in a firm's shares (Bhattacharya and Daouk 2002).[1]

We define illegal insider trading as trading by corporate insiders while they are in possession of material, non-public information about the firm.[2] Examples of corporate insiders are senior management, board members, controlling shareholders, or financial intermediaries who are fiduciaries of a firm, such as auditors, investment bankers, legal counsel, or credit rating agencies, among others. Corporate insiders may trade legally during certain periods, but are required to disclose these trades through regulatory filings.[3] Corporate insiders are prohibited from trading during periods when they are in possession of material, non-public information, such as ahead of an earnings announcement.

Insider trading investigations and prosecution have been most common in cases of corporate mergers and acquisitions (Meulbroek 1992). Change-of-control transactions provide an opportunity for corporate insiders with knowledge of an impending takeover to earn abnormal

1. Bhattacharya and Daouk (2002) find that it is only the enforcement of these laws that leads to a decline in the cost of capital.
2. The appendix provides details on Canadian insider trading regulations. See MacIntosh and Nicholls (2002) for a more comprehensive review.
3. Numerous authors have studied these legal insider trades to determine whether insiders earn superior returns by timing their purchases and sales. See Eckbo and Smith (1998), Finnerty (1976), Jaffe (1974), Jeng, Metrick, and Zeckhauser (2003), Lakonishok and Lee (2001), Lin and Howe (1990), Rozeff and Zaman (1988), and Seyhun (1986).

returns by buying stock in the target firm ahead of the first public announcement and selling after the bid has been announced. While regulators regularly scrutinize the trading in the target firm's shares after the fact, establishing illegal insider trading using solely econometric techniques is a difficult and often impossible task (Minenna 2003). The fact that the stock of a target company experienced abnormal returns and/or volume before the announcement of an acquisition does not necessarily imply illegal activity. For this reason, studies of corporate takeovers have not been able to discern whether pre-bid run-ups reflect illegal insider trading, the market's anticipation of an impending bid in response to legitimate sources such as media speculation, or some combination of both.

This study outlines the price–volume dynamics that we expect to be associated with each of the two hypotheses (illegal insider trading and market anticipation), based on a review of both theoretical models and empirical studies. We discuss two classes of models of informed trading—strategic trading models and competitive trading models—both of which consider the impact of asymmetric information on trading behaviour. These models are based on different assumptions about the nature of private information and the number of investors who have access to it, and therefore predict different behaviour and trading patterns. In light of these models, we discuss what might be expected to occur ahead of a takeover announcement to determine whether it is possible to distinguish between different types of informed trading. We then compare the price–volume dynamics ahead of takeovers with the stylized facts from empirical studies of known cases of illegal insider trading (Chakravarty and McConnell 1997, 1999; Cornell and Sirri 1992; Fishe and Robe 2004; Meulbroek 1992) and trading ahead of unscheduled announcements (Graham, Koski, and Lowenstein 2003; Chae 2005; Gao and Oler 2004). The insider trading studies consistently find that illegal insider trades are associated with abnormal returns and abnormal volume on the days when insiders trade, while the impact on market liquidity is mixed depending on the market structure. Provided that the Canadian and the U.S. markets have similar market microstructures and institutions, illegal insider trading may be expected to generate the same effects in Canada as in the United States. Studies of trading behaviour ahead of unscheduled announcements, such as earnings announcements or dividend changes, find that trading volume increases with mixed results on market liquidity. We analyze our sample in light of these previous findings.

Our sample consists of 420 takeover announcements of publicly listed Canadian firms from 1985 to 2002. The majority of studies of pre-bid price run-ups examine U.S. takeovers. While the United States has pursued a number of high-profile cases under insider trading laws that have generated large penalties and even jail terms, similar evidence of enforcement has been lacking in Canada (Canada 2003; McNally and Smith 2003). This lack of enforcement has contributed to the

impression among market participants that insider trading is a problem in Canadian capital markets (Canada 2003; Insider Trading Task Force 2003).[4] We examine whether Canadian regulatory initiatives and institutional changes over the past five years have affected the magnitude and frequency of pre-bid price run-ups.

Our main findings are as follows. The magnitude and timing of pre-bid price run-ups for the Canadian sample are very similar in magnitude to run-ups documented for U.S. takeovers, which suggests that price discovery occurs in the same manner in both countries. In the weeks ahead of the announcement, we observe serially correlated abnormal volume without abnormal returns, and a pattern of return reversals. We observe few days where abnormal returns coincide with abnormal volume. Pre-bid price run-ups occur shortly before the actual announcement, accompanied by significantly positive abnormal returns and share volume. Targets' stock prices react significantly to the actual announcement, with both positive and negative reactions. These price–volume dynamics are more consistent with our predictions for the market anticipation hypothesis than for the hypothesis of illegal insider trading. While we cannot dismiss the possibility of illegal insider trading in any takeover in our sample, the evidence suggests that this problem is not widespread for this type of corporate event.

This paper is organized as follows. Section 2 describes competing hypotheses regarding the run-up in the price of the target firm's stock ahead of the first public announcement of a takeover. The strategic and competitive trading models are reviewed, and the stylized facts from empirical studies of known cases of illegal insider trading and trading ahead of unscheduled announcements are summarized. Section 3 provides institutional details on takeover legislation and the regulation of insider trading in Canada (more institutional detail is provided in the appendix). Section 4 describes the sample and the methodology used to calculate abnormal returns and trading volume. Section 5 analyzes pre-bid run-ups and examines the pattern of abnormal returns and volumes. We benchmark our results against existing U.S. studies, and provide panel regressions of abnormal return on abnormal volume for our sample. Section 6 concludes.

2. Explanations of Pre-Bid Price Run-Ups

Studies consistently find a price run-up (a "pre-bid run-up") in the target firm's stock that becomes statistically significant in the days or weeks before the takeover bid is first made

4. Market Regulation Services Inc., RS Notice, "Results of the RS Survey of Canadian Equity Trading Practices," 22 October 2004. Available at: <http://docs.rs.ca/ArticleFile.asp?Instance=100&ID=018F38AABEC148E9BE816D3B3ABC9A71>.

public.[5] This run-up is accompanied by higher-than-normal trading volume that may lead the price run-up by more than a week (Gao and Oler 2004).[6] Two hypotheses are generally offered to explain the pre-bid run-up and abnormal volume, with empirical results that support both.

The information leakage hypothesis argues that investors learn about an impending takeover bid through the trades of insiders who have access to material, non-public information (Keown and Pinkerton 1981). Corporate insiders may trade illegally using this private information, or they may tip this information to third parties such as family members, friends, or accomplices, who then trade on the basis of material, non-public information. Trading by insiders may be detected by market makers, who infer the presence of informed traders in a stock by observing the characteristics of order flow (O'Hara 1995; Madhavan 2002). Alternatively, investors may mimic insider trades disclosed in regulatory filings, in the belief that corporate insiders are trading on the basis of undisclosed, material information.[7] Concrete support for the information leakage hypothesis has been provided by studies that use actual data on illegal insider trades made public following prosecutions by U.S. regulators (Cornell and Sirri 1992; Meulbroek 1992; Chakravarty and McConnell 1997, 1999; Fishe and Robe 2004).

The market anticipation hypothesis argues that sophisticated investors are able to predict a takeover bid through legitimate sources, such as firm or industry analysis, analyst forecasts, technical analysis, or rumours in the financial media (Jensen and Ruback 1983). This hypothesis is closely related to the efficient market hypothesis, where prices always "fully reflect" available information (Fama 1970, 1991). Studies that support the market anticipation hypothesis include Asquith (1983), Jarrell and Poulsen (1989), Gupta and Misra (1989), Sanders and Zdanowicz (1992), and Pound and Zeckhauser (1990).

The principal difficulty in distinguishing empirically between the information leakage hypothesis and the market anticipation hypothesis is that both explanations are based on informed trading.

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5. Pre-bid run-ups have been documented in studies that employ U.S., Canadian, and U.K. data. For representative studies that use U.S. data, see Gao and Oler (2004), Jarrell and Poulsen (1989), Jensen and Ruback (1983), and Sanders and Zdanowicz (1992). For the United Kingdom, see Franks and Harris (1989). For Canada, see Eckbo (1986), Amoako-Adu and Yagil (1986), Eckbo and Thorburn (2000), and Jabbour, Jalilvand, and Switzer (2000).
6. Studies that find abnormal volume ahead of the takeover announcement include: Conrad and Niden (1993), Chae (2005), Eyssell and Arshadi (1993), Gao and Oler (2004), Graham, Koski, and Loewenstein (2003), and Jarrell and Poulsen (1989). The exception is Sanders and Zdanowicz (1992), although they use the log of raw volume, not share turnover.
7. Generally, investors cannot earn abnormal returns by duplicating the trades of insiders, particularly when transactions costs are taken into account (Rozeff and Zaman 1988). Seyhun (1986), Rozeff and Zaman (1988), and Lakonishok and Lee (2001) show that most of the abnormal returns are reduced when controlling for size, value effects, and transactions costs.

But the identities of the informed traders are not known ex ante and may not be known ex post. Without a model to distinguish between different types of informed trading—for example, when information is concentrated, as in illegal insider trading, or dispersed, as in market speculation by sophisticated institutional investors—patterns in stock behaviour cannot be used to distinguish between these two hypotheses (Minenna 2003). Despite this shortcoming, regulators such as the Securities and Exchange Commission (SEC) have developed detection algorithms that attempt to identify illegal insider trading based on patterns of price and volume ahead of major corporate events (Meulbroek 1992; Mitchell and Netter 1994).

We consider whether different patterns in abnormal returns and abnormal volume could be useful for distinguishing between the sources of informed trading. We review two classes of models of informed trading—strategic and competitive—that consider trading under conditions of information asymmetry. Each of these models makes predictions for price and volume dynamics based on different assumptions about the nature of the private information, the number of traders who have access to this information, and the time period during which informed traders can take advantage of this information. We then review empirical studies of known cases of illegal insider trading and trading ahead of unscheduled announcements. The key characteristics of these models and the stylized facts from the empirical studies suggest different patterns of price–volume dynamics that may be useful for distinguishing between the two hypotheses.

2.1 Illegal insider trading

The strategic trading models of Kyle (1985) and Admati and Pfleiderer (1988) describe how an insider will trade strategically to maximize the profits from their private information.[8] These models do not consider the identity of this insider but feature a representative insider, a risk-neutral market maker, and many uninformed liquidity traders. Liquidity traders are non-strategic and trade for motives that are exogenous, such as portfolio rebalancing or hedging.[9] Some have no discretion on the timing of their trades (“non-discretionary liquidity traders”), while others have limited discretion subject to the constraint of trading a particular number of shares within a given period (“discretionary liquidity traders”) (Admati and Pfleiderer 1988). A market maker updates quoted prices by observing order flow, which allows them to learn about the fundamental value of a stock. The insider will optimally trade when liquidity traders are active, so that the private information in their trade is not revealed immediately. The informed trader does not

8. The Kyle (1985) and Admati and Pfleiderer (1988) models are representative of strategic trading models, although many models developed in the market microstructure literature consider various settings and assumptions. Our discussion is necessarily limited and does not do justice to the complexity of these models.
9. A good example would be mutual funds that track a major equity index.

observe the current orders of liquidity traders, but infers their behaviour based on past patterns. Kyle (1985) notes that, despite their small trading volume, the insider ultimately determines what price is established at the end of trading because their trades, unlike the trades of liquidity traders, are positively correlated from period to period. The market maker observes this pattern in the order flow and adjusts their quotes, leading to price discovery. The insider's trades have a permanent impact on price, unlike trades by liquidity traders, which have a temporary impact due to inventory effects (O'Hara 1995; Madhavan 2002). Admati and Pfleiderer (1988) argue that abnormal volume occurs because the increased liquidity that occurs when the insider and the non-discretionary liquidity traders are active induces discretionary liquidity traders to transact, thereby leading to a concentration in trading volume in a limited period. As a result, the private information in insider trades moves the stock price and creates abnormal returns, whereas the extra trading generated by insiders and discretionary liquidity traders creates abnormal volume.

Cornell and Sirri (1992) and Chakravarty and McConnell (1997, 1999) were the first to test the predictions of strategic trading models using known cases of illegal insider trading, although they focus on the impact on bid-ask spreads. We focus instead on the price–volume dynamics that may be exhibited when illegal insider trading occurs. In the setting of a takeover, the insider may be a senior manager or board member of the acquirer (in the case of a hostile bid), the target (in the case of a friendly bid), or a financial intermediary involved in the takeover process. These corporate insiders have relatively precise knowledge about the value of the takeover bid and the timing of the announcement. This non-public, material information should be expected to influence the strategy of someone who trades illegally while in possession of it.[10] With a known time horizon and little competition from other informed traders, the corporate insider can execute a trading strategy designed to extract the maximum profits with the least probability of detection. In practice, a corporate insider may trade in the target or acquirer's stock, options on this stock, or even the stock of a similar company ("substitute trading").[11] We consider trading in the target firm's stock only. Given the existence in most countries of laws that prohibit insider trading, we expect corporate insiders to avoid trading close to the announcement date, when the scrutiny of regulators is greatest and the probability of detection is highest.

The stylized facts from actual cases of illegal insider trading are consistent with the predictions of strategic trading models. Illegal insider trades generate abnormal returns and are associated with greater than normal trading volume. In the case of Anheuser-Busch's 1982 acquisition of

10. Fishe and Robe (2004) consider the most extreme case: insiders had about one hour to benefit from the private information they received, leading to very specific trading strategies.
11. Chakravarty, Gulen, and Mayhew (2004), Easley, O'Hara, and Srinivas (1998), and Hyland, Sarkar, and Tripathy (2003) study informed trading using stock options or other derivative strategies.

Campbell Taggart, Cornell and Sirri (1992) find that abnormal returns occur only on days when corporate insiders trade, although they find that insiders receive better market execution because the illegal insider trades induce “falsely informed” (or noise) traders to transact, which leads to increased liquidity and inhibits a rise in the effective bid-ask spread. These falsely informed traders behave like the discretionary liquidity traders hypothesized by Admati and Pfleiderer (1988). Meulbroek (1992) studies illegal insider trading cases pursued by the SEC during the 1980s, of which takeovers represent 79 per cent of the sample. She finds that 43 per cent of the run-up in a target firm’s stock occurs on insider trading days, and this amount is greater than the run-up that occurs on days with public news announcements or no-news days. Although the volume of illegal insider trading is small relative to the total daily volume, Meulbroek (1992) finds that it constitutes much of the abnormal volume on insider trading days.

Chakravarty and McConnell (1997) find a positive and significant relationship between Ivan Boesky’s illegal trades and changes in the price of Carnation’s stock ahead of a takeover by Nestlé. In a subsequent study of the same case where the authors use signed, high-frequency order flow, Chakravarty and McConnell (1999) cannot distinguish between illegal insider trades and other buyer-initiated trades on Carnation’s stock: both have a significantly positive impact. This result is consistent with the prediction of strategic trading models that insiders are able to hide their trades in the order flow. Finally, Fishe and Robe (2004) study a 1999 case of illegal insider trading involving *Business Week’s* “Inside Wall Street” column. Consistent with theory, they find that increases in price and volume occur in response to illegal insider trades.

This review of the strategic trading model and studies of illegal insider trading suggests a number of testable predictions. Illegal trades by corporate insiders should generate abnormal returns, since their private information contributes to price discovery. Abnormal returns should occur on days with abnormal volume, because non-discretionary liquidity traders are induced to trade by the increased order flow when insiders are active. Illegal insider trades should therefore be identified by abnormal returns coinciding with abnormal volume on the same day. Abnormal returns that are not accompanied by abnormal volume (or vice versa) would constitute a rejection of this hypothesis. Given that the corporate insider should want to avoid revealing their private information by trading aggressively, these trades should be interspaced over the weeks prior to the announcement, leading to an irregular pattern of spikes in abnormal returns and abnormal volume. The illegal insider trades should generate price discovery, so that the reaction of the stock price to the takeover announcement should be limited. In the extreme case where price discovery is complete, the share price should not react. Formally, we hypothesize as follows:

H0: Pre-bid run-ups ahead of takeovers caused by illegal insider trading should be associated with abnormal returns coinciding with abnormal volume in the weeks ahead of the announcement, abnormal returns that follow a random walk on days when corporate insiders are not trading, and a limited price reaction in the takeover target's stock price following the announcement.

2.2 Market anticipation

The competitive trading models of Wang (1994), He and Wang (1995), and Llorente et al. (2002) model the behaviour of investors that are heterogeneous in their information about the state of the economy and their private investment opportunities. They do not formally consider market makers or corporate insiders per se, but address the trading of informed and uninformed investors outside a firm. To avoid confusion with the terminology of the strategic trading model, we refer to sophisticated and unsophisticated investors when discussing the predictions of this model. Sophisticated investors trade for two reasons: to rebalance portfolios for risk-sharing ("hedging"), or to take advantage of proprietary information about future payoffs for a stock ("speculating"). This proprietary information is the outcome of the sophisticated investors' analysis of public information, and is not the material, non-public information of a corporate insider.[12] Unsophisticated investors know they are trading with sophisticated investors, but are still willing to trade, because not all the trades are made against sophisticated investors' superior information. In these models, trading volume is always positively correlated with price changes, and the return–volume dynamics of a stock during intensive trading periods reflects the proportion of hedging vs. speculative trades. Llorente et al. (2002) argue that hedging trades due to portfolio rebalancing should generate negatively autocorrelated returns. Speculative trades based on proprietary information, however, should generate positively autocorrelated returns and serially correlated volume over a number of days following the initial trade, as the proprietary information about the stock becomes incorporated in the price.

He and Wang (1995) model how sophisticated investors will trade ahead of an unscheduled announcement. They assume that the value of a stock has two components: a fundamental portion about which sophisticated investors have proprietary information and a residual portion about which they have no proprietary information. Whereas the true value of the fundamental portion is revealed over time through trading, the value of the residual portion is never revealed before the terminal date. Thus, residual uncertainty about the value of the stock remains until the terminal date. The weight of these two factors affects the aggressiveness of trading. On the one hand,

12. U.S. securities regulations make this distinction, because trades by sophisticated investors that might otherwise be considered illegal insider trading are viewed differently under the "mosaic" theory.

uncertainty about the stock's fundamental value decreases as the terminal date approaches and more proprietary information is revealed through trading, which tends to make sophisticated investors speculate more aggressively over time. On the other hand, as the terminal date approaches, there are fewer trading opportunities left and it becomes more difficult to unload any positions. Since no investor has information about the residual portion of the stock's value, it is optimal for sophisticated investors to reduce their speculative positions before the terminal date. This tends to make speculation less aggressive. The relative size of the two factors in the stock's value determines sophisticated investors' dynamic trading strategies. When sophisticated investors' private signals are low relative to the noise in the market and the uncertainty about the fundamental value of the stock is small (but greater than zero), both the aggressiveness of trading by sophisticated investors and their expected stock position increase until a few periods before the terminal date, and then decrease, resulting in high volume shortly before the announcement.

In the setting of a takeover, sophisticated investors are likely institutional investors that actively manage portfolios of stocks, or risk arbitrageurs that create long-short portfolios of targets and acquirers. These investors do not have access to the material, non-public information of corporate insiders. Instead, they extract signals about a potential takeover from public information through in-house analysis of industry trends, conversations with equity analysts, or monitoring of factors specific to a company, such as financial distress or the statements of managers and controlling shareholders. Unlike the private information of insiders, the proprietary information of sophisticated investors is noisy and generates probabilistic predictions on the likelihood of a takeover. When the likelihood is high, sophisticated investors do not know the true price offered by the bidder with any certainty, nor do they know the exact timing of the announcement. The public information that identifies a firm as a takeover candidate may be received by a wide group of sophisticated investors, who compete with each other to identify undervalued stocks. This dispersion of information affects the trading behaviour among these investors.

In the months preceding a takeover announcement, high uncertainty and investor heterogeneity will result in a low degree of speculative trading and a pattern of return reversals on high-volume days, reflecting the presence of both hedging and speculative trading. In other words, high volume should not generate price changes if information heterogeneity is high (Grundy and McNichols 1990; Harris and Raviv 1993; Kim and Verrecchia 1994). Closer to the date of the actual takeover announcement, the number of signals will increase and uncertainty should decline, leading sophisticated investors to speculate more aggressively. At this point, stock returns should exhibit positive autocorrelation with high volume as market speculation—whether accurate or not—becomes incorporated into prices, leading to a pre-bid run-up. Because residual risk remains until the announcement, the target's stock price should react significantly to the announcement.

Abnormal returns in response to the announcement may be either positive or negative, depending on the accuracy of the market's speculation.

A large empirical literature explores the relationship between informed trading and price–volume dynamics.[13] Of interest to our study are several recent papers that examine trading behaviour before unscheduled events.[14] Graham, Koski, and Loewenstein (2003) study surprise dividend announcements and find that abnormal volume increases before the announcement with no change in liquidity; they therefore conclude that informed trading before unanticipated events is not detected by market makers. Chae (2005) finds that trading volume increases before unscheduled announcements, such as a takeover bid or a credit rating change, and that market makers increase their price sensitivity as measured by price-impact coefficients. Both studies find increased trading volume but mixed results on liquidity, although neither study considers the impact on returns.

Both the theoretical models and the empirical studies predict an increase in trading volume ahead of an unscheduled event. The theoretical models further predict autocorrelated returns in response to speculative trades based on proprietary information, with research by Llorente et al. (2002) providing empirical support. Applying these predictions to the market anticipation hypothesis, we can expect trading behaviour ahead of a takeover to display these price–volume dynamics when the cause of the pre-bid run-up is speculation by sophisticated investors based on proprietary information, not illegal insider trading by corporate insiders. Formally, we hypothesize as follows:

H1: Pre-bid run-ups ahead of takeovers caused by market speculation should exhibit abnormal volume but no clear pattern in abnormal returns in the weeks ahead of the announcement, followed by intense trading and positively autocorrelated price and volume shortly before the announcement date. The announcement itself should generate a significant reaction in the target's stock price, either positive or negative.

13. Studies examine the impact of informed trading on, among other factors, returns (Admati and Pfleiderer 1988; Easley, Hvidkjaer, and O'Hara 2002; Kyle 1985; Llorente et al. 2002; O'Hara 2003; Wang 1994), volume (Admati and Pfleiderer 1988; Easley and O'Hara 1992; He and Wang 1995; Llorente et al. 2002; Wang 1994), market liquidity (Copeland and Galai 1983; Glosten and Milgrom 1985; Kyle 1985), and trade size (Easley and O'Hara 1987).
14. Brooks, Patel, and Su (2003) study the market reaction when firms experience events that are totally unanticipated, such as the death of a CEO, or a major disaster, such as the Exxon Valdez oil spill. Because no one has private information about these events, the market reaction occurs after the event.

2.3 Summary of predictions

Table 1 summarizes the price–volume dynamics ahead of a takeover consistent with the competing hypotheses for explaining pre-bid run-ups. These predictions find their theoretical support in the review of the strategic and competitive trading models. The key distinction between the illegal insider trading hypothesis and the market anticipation hypothesis relates to the relationship between abnormal returns and abnormal volume, the pattern and the timing of the run-up, and the reaction to the announcement. Because the existing hypotheses for explaining pre-bid run-ups do not make any specific predictions about market liquidity, the pattern of bid-ask spreads cannot be used to distinguish between informed trading by corporate insiders versus sophisticated investors. The analysis below therefore focuses on the price–volume dynamics.

3. Institutional Background

In contrast to studies of disclosed insider trading in the United States, Jabbour, Jalilvand, and Switzer (2000) find that Canadian insiders trade more frequently in the period shortly before a takeover bid is announced. McNally and Smith (2003) also find large-scale evidence of reporting violations, based on a study of stock buyback programs and insider trading around significant news announcements. This behaviour may be due to the weak enforcement of insider trading laws in Canada (Canada 2003; Insider Trading Task Force 2003).[15] McNally and Smith (2003) examine the enforcement record of insider trading prosecutions in Canada; they find that the number of cases is small, the average case takes four years to be settled, and the penalties are generally far below the profits earned. Given the findings of these studies, it is not surprising that Canadian market participants are concerned about insider trading. A recent survey of Canadian equity trading practices conducted by Market Regulation Services Inc. (RS Inc.), the independent regulator for Canadian equity markets, finds that market participants view manipulative and/or deceptive trading and insider trading as the top two risks facing Canadian markets.[16]

15. Concerned about the perceptions of market participants regarding the issue of insider trading, Canadian securities regulators and self-regulatory bodies formed a task force to study this issue. The report, issued in November 2003, highlights a number of key differences in the regulation of insider trading in Canada relative to the United States, such as a lack of specific requirements on containing insider information for lawyers, accountants, and banks in Canada (Insider Trading Task Force 2003). A second report commissioned by the Canadian government argues that the framework of securities regulation in Canada, with responsibility shared by 13 provincial regulators, may contribute to this poor enforcement record (Canada 2003).
16. RS Notice, "Results of the RS Survey on Canadian Equity Trading Practices," 22 October 2004. See footnote 4 for the web address.

Both provincial and federal authorities have responded to the perception of lax enforcement of insider trading regulations in Canada. The federal government's Bill C-13, passed in March 2004, increases the punitive and criminal penalties for insider trading, making it an offence under the Criminal Code punishable by up to 10 years in prison.[17] The legislation also establishes special police teams to pursue investigations in this area.[18] At the provincial level, Ontario introduced amendments to the legislation governing securities and commodity futures in April 2003. These amendments increase penalties and give the Ontario Securities Commission (OSC) more enforcement power for certain offences. These changes are expected to bolster investor confidence in Canadian capital markets, both domestically and internationally.

Although the impact of recent changes will be perceived only with time, we examine whether other regulatory and technological changes introduced over the past five years have had any impact on the size of pre-bid price run-ups. The regulations governing the reporting of insider trades have been enhanced to shorten the reporting period and make the trade date available electronically over the Internet.[19] The resources devoted to the detection and enforcement of securities regulation increased in late 1997 when the OSC, which has oversight responsibility for the Toronto Stock Exchange (TSX), converted to an independent, self-funded entity. As a result of this change, the budget devoted to enforcement increased, with staffing in this area rising by 75 per cent over the next year. A new self-regulatory body, RS Inc., was created in March 2002 to supervise Canada's stock markets. RS Inc.'s mandate is to protect investor confidence and enhance market integrity on the exchanges that it regulates.[20] The infrastructure covering trading has also changed, providing regulators with more powerful tools and algorithms to monitor trading. The TSX, Canada's major stock exchange, closed its trading floor in early 1997 when all remaining floor-traded stocks began to trade on its computer-assisted trading system (CATS).

The greater commitment of resources and regulatory changes from 1998 onwards may be expected to reduce the incidence of illegal insider trading in Canada, and potentially reduce price run-ups ahead of takeover announcements if they are caused by information leakage. We test these hypotheses using Canadian data.

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17. Bill C-13 is entitled "An Act to amend the Criminal Code (capital markets fraud and evidence-gathering)."
18. Integrated Market Enforcement Teams (IMETs) were established in 2003, jointly managed by the Royal Canadian Mounted Police, Justice Canada, and partner departments. These teams focus on white-collar crime, and work closely with securities regulators and other federal and provincial authorities.
19. In December 1999, the time frame for paper reporting of insider trading was reduced, with insiders required to report within 10 days of the trade date. The paper-based system was replaced with the introduction of the System for Electronic Disclosure by Insiders in October 2001.
20. One of the first initiatives taken by RS Inc. was to focus attention on the issue of illegal insider trading in Canada, which led to the report by the Insider Trading Task Force (2003).

4. Data and Methodology

4.1 Data

We purchased Canadian data on 1,125 takeover announcements of TSX-listed firms between January 1985 to December 2002 from Thomson Financial Securities Data Corporation (International Mergers Database) and Crosbie and Company. This sample includes both completed and withdrawn bids. Leveraged buyouts, spinoffs, recapitalizations, self-tenders, exchange offers, repurchases, minority stake purchases, acquisitions of remaining interest, and privatizations are excluded from the sample. We checked important details on these transactions against the original press release announcing the takeover. More details on the takeover process in Canada are provided in the appendix.

We collected market data on stock prices, returns, trading volume, and shares outstanding from the TSX-Canadian Financial Markets Research Centre (TSX-CFMRC) database. Trading data were available for only 844 deals. We excluded 136 subsequent bids that were made within two years from a previous bid for the same company's stock, because these firms were "in play" and it is reasonable to expect that the market anticipated a subsequent bid. We then excluded 288 takeovers of firms whose shares were infrequently traded prior to the takeover as an accurate measure of abnormal returns and volume could not be calculated for these firms. We identified these firms using the methodology described by Boehmer, Musumeci, and Poulsen (1991). To be included in our sample, the target firm's shares had to have at least 50 non-missing returns during the estimation window that lasted from 250 trading days to 61 trading days prior to the announcement, [-250,-61], and at least 75 per cent of non-missing returns from 60 days prior to 2 days following the announcement, [-60,2]. The final sample size is 420 transactions from 1985 to 2002.

Asquith (1983) and Jarrell and Poulsen (1989) discuss the importance of identifying the correct announcement date to measure pre-bid trading in a takeover target. We established the "news-adjusted" announcement date for the transactions in our sample by using Factiva to search major newspapers and newswires for stories on corporate control events during the six months prior to the formal takeover bid for each target company. The formal announcement date represents a press release by a target or acquirer that closely precedes the issuance of a takeover circular disclosing important transaction details. The "news-adjusted" announcement date is defined as any public news story prior to the formal announcement date that includes: an announcement by a target firm that it is negotiating a change in control, whether a buyer is named or not; an announcement by the target firm that it will look for the buyer or merger partner "to maximize

shareholders' value"; an announcement by the target's major shareholder of the intention to sell a controlling block of shares; an announcement by a target firm that it had been negotiating a merger or takeover that failed due to differences between the management of the two parties; or an announcement by the acquirer of a takeover intention. Out of 420 deals, 102 were determined to have a news-adjusted announcement date. The mean and median numbers of calendar days between the news-adjusted date and the formal announcement date were 60 and 56 days, respectively. We also identified media stories about rumoured takeover deals, where rumours are stories that name the target but do not provide any specific information about the acquirer or the terms of the transaction.

Table 2 provides descriptive statistics on the final sample. The average market capitalization of a takeover bid based on the average closing price times shares outstanding over the window [-250,-61] was $537 million, with a median of $92 million, and a standard deviation of $1,589 million.[21] In 77 out of the 420 takeover, the acquiring firm had purchased a toehold in the target firm's shares. In these cases, the mean (median) toehold in the target firm's shares was 22 per cent (15 per cent).

Mitchell and Mulherin (1996) and Andrade, Mitchell, and Stafford (2001) document how mergers happen in waves and cluster by industry, in response to industry-specific shocks such as deregulation or technology changes. These patterns may make it possible for analysts to predict likely takeover targets.[22] In our 18-year sample, there are more takeovers over the second half of the sample period, with the number of takeover bids increasing sharply from 1995 onwards. Almost 75 per cent of the transactions took place from 1995 to 2002, with 25 per cent occurring in the final three years of the sample. More than half of the takeover bids were for natural resource firms, defined as firms engaged in the exploration, production, and transportation of oil, gas, minerals, metals, and other commodity-related products. Two active periods for takeovers in this industry occurred from 1997 to 1998 and from 2000 to 2001. Similarly, takeovers of information technology firms were prominent from 1999 to 2001, but make up less than 10 per cent of the sample.

21. The average share price of a takeover target was $9.60, with a median price of $5.40. Only 12 per cent of the firms in our sample were "penny stocks," with an average closing share price over the window [-250,-61] of less than $1. Given the speculative nature of penny stocks discussed in Masse, Hanrahan, and Kushner (1998), we confirm that our results are robust to the exclusion of these firms.
22. Gao and Oler (2004) provide evidence that market makers monitor takeover firms and their competitors. They find that the bid-ask spreads of takeover targets rise prior to the announcement and drop sharply after it. The spreads for firms with the same characteristics rise and remain abnormally high after the announcement, which suggests that the risk of a takeover remains for these firms.

Hostile takeovers are relatively rare in this sample, and represent only 15 per cent of takeover bids, similar to the case in the United States (Andrade, Mitchell, and Stafford 2001). The high percentage of friendly takeovers makes it more likely that information about the takeover may have leaked out prior to the announcement. Given the high proportion of friendly takeovers, it is not surprising that two-thirds of the bids were completed. Fewer than 10 takeovers were only partially completed, where the acquirer purchased a controlling stake but did not make an offer for all outstanding shares in the target.

The number of rumoured takeover deals exhibits no discernible pattern. The number of rumours increases noticeably through the late 1990s, reaching a peak of 26 per cent of deals in 1999. The increased number of rumours in the latter half of our sample may be due to greater availability of information through sources such as the Internet or electronic media. In this case, it may be associated with greater market speculation and higher price run-ups for this period.

4.2 Methodology

We conduct a standard event study to examine abnormal returns and trading volume following the methodology in MacKinlay (1997). The "zero date" in our study, $t = 0$, is the date of the first public announcement of the takeover. Given that takeover announcements may be announced when the market is closed, or may be reported in the financial media the day following the announcement, we include the trading day after the announcement in our zero date, so our event date is [0,1]. Our event window begins 60 trading days prior to the first public announcement and ends 20 trading days after that date, [-60, 20]. Our estimation window begins 250 trading days before the first public announcement and ends 61 days before the zero date, [-250,-61]. We calculate daily abnormal returns (ARs) for target firm i and event date t in our sample according to the equation:

$$AR_{it} = R_{it} - E(R_{it}|X_t),$$

where AR_{it}, R_{it}, and $E(R_{it}|X_t)$ are the abnormal, actual, and normal returns, respectively, for the time period t. X_t is the conditioning information for the normal return model. We estimate normal returns over the estimation window [-250,-61] using two models: a standard market model and a 2-factor market model that includes an industry index.[23] For any security i, the market model is:

23. We also estimate a constant mean return model described in MacKinlay (1997), but find the results for statistical significance are the same. Results are available upon request.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it},$$

where R_{it} and R_{mt} are the period-t returns on security i and the market portfolio, respectively, and ε_{it} is the error term with zero mean and constant variance. We use the TSX-CFMRC equal-weighted index as the proxy for the market.[24] We use the equal-weighted index instead of the value-weighted index because of the large weighting of Nortel Networks in the value-weighted index over part of the sample. Our results are robust when we use the TSX-CFMRC market-weighted index.

We estimate a 2-factor market model that includes factors for both the overall market and the target firms' industry subindex (Halpern 1973). For any security i, the 2-factor market model is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \beta_k R_{nt} + \varepsilon_{it},$$

where R_{it}, R_{mt}, and R_{nt} are the period-t returns on security i, the market index, and the industry subindex, respectively, and ε_{it} is the error term with zero mean and constant variance. We identify ten subindexes based on Standard & Poor's Global Industry Classification Standard (GICS) industry codes, and assign each target firm to the relevant industry index.

We aggregate individual abnormal returns across securities to generate average abnormal returns (AARs). Given N events, the sample AARs for day t and its variance are

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N}(AR_{it}) \qquad \text{var}(AAR_t) = \frac{1}{N^2}\sum_{i=1}^{N} MSE_i,$$

where MSE_i is mean squared errors from the estimation regression for each firm i. The AARs are then aggregated over the event window to calculate the cumulative average abnormal return (CAAR) for each security i. For any interval (T_1, T_2) in the event window, the CAAR and its variance are calculated as

$$CAAR(T_1, T_2) = \sum_{t=T_1}^{T_2} AAR_t \qquad \text{var}(CAAR(T_1, T_2)) = \sum_{t=T_1}^{T_2} \text{var}(AAR_t).$$

24. The average daily return on the TSX-CFMRC equal-weighted index is the sum of all defined common equity returns divided by the number of valid equity returns (Canadian-based firms only). Returns used in this index are fully adjusted for distributions.

We conduct two tests of the null hypothesis that the AARs or CAARs are zero, using a parametric Z-test and a non-parametric, Wilcoxon signed-rank test. These tests are one-tailed, because we are testing for the presence of positive abnormal returns in all cases.

We examine the volume of shares traded around our event of interest to determine whether there is evidence of informed trading. Because raw trading volume is highly non-normal, Lo and Wang (2000) recommend measuring volume using the log of daily turnover, where daily turnover is daily trading volume divided by the number of shares outstanding.[25] We calculate two measures of abnormal volume. First, we follow Chae (2005) and calculate abnormal volume for any security *i* at event time *t* as:

$$AV_{it} = V_{it} - \frac{1}{n} \sum_{n=-250}^{-61} V_{in},$$

where V_{it} is log of turnover for firm i on day t. The estimation period for de-meaning the individual firm's log of turnover is [-250, -61]. A positive and statistically significant value for a given day suggests that, on average, a target firm experienced higher turnover on day t than it did on the average day over the window [-250, -61]. Second, we check the robustness of our measure of abnormal volume by calculating abnormal volume using a market model similar to the one used for returns. For any security i, the market model is:

$$V_{it} = \alpha_i + \beta_i V_{mt} + \varepsilon_{it},$$

where V_{it} is the individual firm's log of turnover calculated as the log of (trading volume divided by the number of shares outstanding) for firm i on day t, V_{mt} is the mean log of turnover for all stocks captured in the TSX-CFMRC database on day t, and ε_{it} is the error term with zero mean and constant variance. The average abnormal volume (AAV), the cumulative average abnormal volume (CAAV), and their statistical significance are computed in a fashion similar to that for AARs and CAARs.

25. Sanders and Zdanowicz (1992) perform their volume event study on the log of raw volume, controlling for first-order serial correlation and day-of-the-week patterns in share trading. Lo and Wang (2000) do not find any day-of-the-week effect in volume or turnover.

5. Empirical Analysis

5.1 Evidence of abnormal returns

Table 3 reports the AARs and CAARs for the whole sample over the window [-30,1] although the CAARs are based on [-60,20]. The results are shown for both models used to estimate abnormal returns: namely, the single-factor market model and the 2-factor market model with an industry subindex. We denote the statistical significance of the AARs and CAARs based on the parametric Z-test with asterisks, where three asterisks represent statistical significance at the 1 per cent level and one asterisk represents significance at the 5 per cent level. The non-parametric Wilcoxon test leads to similar results.[26]

The results in Table 3 are very similar for the different models, so we discuss only the results estimated using the market model. AARs begin to show weak and episodic statistical significance over the window [-12,-5] that represents the two weeks prior to the first public announcement of the takeover bid. Up to this point, the percentage of AARs that are positive on any given day across the 420 takeovers fluctuates around 50 per cent, with a number of reversals consistent with the predictions of the market anticipation hypothesis. The AARs become positive and significant only at the 99 per cent level shortly before the takeover announcement. There is a significant reaction on date 0 to the announcement itself, with an AAR of 9.8 per cent. The announcement day AAR is 9.7 per cent using the 2-factor market model, and 9.8 per cent using the constant mean return model (not shown). While three-quarters of the sample have a positive abnormal return on day 0, fully one-quarter of the stocks have negative abnormal returns on the announcement date. The AARs then become mostly negative but not statistically significant over the window [2,20].

The CAARs in Table 3 show a similar story. The CAARs are positive and statistically significant from day -2, very close to the announcement date. This pattern is repeated when using the 2-factor market model, and starts sooner when using the constant mean return model. Using the market model, the CAARs peak at 17.5 per cent on day 1, and then decline steadily to 15.9 per cent by day 20 while remaining statistically significant at the 99 per cent level. These results show that the pre-bid run-up begins only in the days prior to the first public announcement. The timing of this run-up is more consistent with the market anticipation hypothesis, because speculative trading becomes more intense shortly before the announcement, when uncertainty is reduced.

26. Any results discussed in this paper that are not shown are available upon request.

CAARs are sensitive to the choice of window used for cumulating AARs. For this reason, Table 4 checks the robustness of our results by showing the CAARs calculated for different accumulation periods and subsamples.[27] We divide the sample into various subsamples to highlight the impact of clustering by year and industry (Mitchell and Mulherin 1996), and the time period when the takeover bid occurred due to the changing institutional setting. Column 1 in Table 4 shows the results for all 420 takeover bids in our sample. The first row shows that the CAAR for the period [-60, 20] is 15.9 per cent. This CAAR is statistically significant and economically important, and is slightly larger than the 13.9 per cent reported by Jabbour, Jalilvand, and Switzer (2000). Figure 1 shows that the AARs become positive and statistically significant shortly before the announcement date. The CAAR around the event date [0,1] is 11.9 per cent in Table 4, with the AARs over the three days shown in the rows below. The announcement date has the highest AAR (9.8 per cent), which suggests that the date of the first announcement has been correctly identified in our data. The announcement day AAR is almost double the 5.9 per cent reported by Jabbour, Jalilvand, and Switzer (2000). The final row of Table 4 shows the ratio of the pre-bid run-up [-60,-1] to the total run-up up to, and including the day after, the announcement [-60,1], which Meulbroek (1992) terms the run-up index. The price run-up over the window [-60,-1] is 32.3 per cent of the CAAR over the window [-60,1], significantly smaller than the 59.8 per cent reported in Jabbour, Jalilvand, and Switzer (2000).

The high number of takeovers in the oil and gas sector, and the clustering of bids over a few key periods, may be expected to generate higher CAARs for takeovers of natural resource firms than for non-resource firms. Columns 2 and 3 of Table 4 report the CAARs for takeovers of natural resource and non-natural resource firms, respectively. The CAARs of natural resource takeovers are significant and of similar magnitude to the overall sample, with the run-up occurring closer to the announcement date. Contrary to our expectations, the CAAR of 5.9 per cent for the period [-30,-1] is considerably smaller than the comparable CAAR for non-resource firms of 10.1 per cent. Likewise, the jump for natural resource takeovers over the event date [0,1] and on day zero of the announcement is about two-thirds the size of the jump for non-natural resource takeovers. The AARs for natural resource firms are very small and fluctuate around zero, with the run-up occurring only in the days before the announcement. By contrast, the CAARs for the non-resource takeovers in this sample are larger and become statistically significant around two weeks prior to the announcement. Column 3 of Table 4 shows that the run-up index for non-resource firms is close to 40.0 per cent.

27. Although we accumulate AARs estimated using the market model, similar results are found using the 2-factor market model or the constant mean return model, and are available upon request.

The resources devoted to enforcement of insider trading increased in 1998 after the OSC became self-funded, at the same time that the TSX closed its trading floor and moved all stocks to the electronic trading system. Greater enforcement budgets should be associated with less insider trading, because the probability of getting caught increases. The move to electronic trading may have reduced the leakage of information from brokers to market makers, as suggested by Garfinkel and Nimalendran (2003), who find that anonymity is greater on electronic trading systems than on trading floors. Both changes lead us to expect that pre-bid price run-ups should be smaller post-1997 than during the earlier period.

Columns 4 and 5 of Table 4 compare the results for 227 takeovers announced from 1985 to 1997 with the results for 217 deals announced from 1998 to 2002. Contrary to our expectations, both the pre-bid price run-ups and the jump over the event window [0,1] were larger for takeovers announced after 1997. The CAAR of 10.5 per cent over the window [-30, -1] for deals announced from 1998 to 2002 is more than twice as large as the CAAR of 4.9 per cent for takeovers announced from 1985 to 1997. The CAARs for other subperiods are similarly larger. Pre-bid price run-ups from [-60,-1] for takeovers from 1998 to 2002 were the largest, and have the largest run-up index of 42 per cent. The price run-up begins at day -20 but accelerates from day -10. The CAARs for takeovers from 1985 to 1997 are smaller and become statistically significant only on the announcement date. The larger run-ups from 1998 to 2002, in combination with the higher number of rumours in the financial media, suggest that the market's ability to anticipate the timing and target of a takeover bid has improved.

Table 5 compares the pre-bid run-ups and the run-up index for our sample with the results of earlier studies. Columns 1 to 5 report the results for studies of U.S. takeovers from 1975 to 1995.[28] Despite focusing on different samples, as detailed in the footnotes to Table 5, the total CAAR over the window [-20,1] between 20 and 30 per cent is remarkably consistent across the U.S. studies. The other variables show greater variation. The pre-event CAAR over the window [-20,-1] ranges from 8.1 to 14.2 per cent, while the jump around the announcement date [0,1] ranges from 6.4 to 21.4 per cent. The run-up index ranges from 27.5 to 68.9 per cent. By contrast, the studies of Canadian takeovers have consistently lower CAARs, although the run-up index is of similar magnitude around 40 per cent. This comparison suggests that pre-bid run-ups for Canadian takeovers are no worse than for U.S. takeovers.

28. We are not aware of any international studies that use daily data; as most studies of foreign takeovers, such as that by Franks and Harris (1989), rely on monthly data.

5.2 Evidence of abnormal volume

Table 3 also reports the AAVs and CAAVs over the window [-30,1], with CAAVs based on the window [-60,20]. The results are shown for both models used to estimate abnormal volume: namely, the firm-detrended model used by Chae (2005) and the market model. The results are very similar using both models, so we focus on the firm-detrended model. We notice sporadic days with significantly positive AAV during the weeks ahead of the announcement, on days when the percentage of firms with positive AAV was noticeably greater than 50 per cent. AAV becomes consistently and significantly positive at the 1 per cent level beginning from day -25, one month prior to the takeover announcement, when the percentage of firms with positive AV rises close to or above 60 per cent. High abnormal volume is not associated with high abnormal returns until close to the announcement date, consistent with the predictions of the market anticipation hypothesis. Gao and Oler (2004) find a similar pattern of abnormal volume leading abnormal returns for a sample of U.S. takeovers, which they ascribe to selling by risk arbitrageurs. Chae (2005) also documents higher-than-normal volume prior to the announcement for takeovers.

There is a large increase in AAV on day zero, with AAV that is 8 to 10 times larger than that over the previous weeks, demonstrating the importance of the announcement. This jump in volume on the announcement day is consistent with Grundy and McNichols (1990), Harris and Raviv (1993), and Kim and Verrecchia (1994), who argue that information announcements can affect volume when investors have heterogeneous information, leading them to correct their previous forecasts with different intensity. High positive AAV continues until the end of the post-event window, which suggests that investors continue to trade on the new information after the uncertainty is reduced. This finding is consistent with the results reported by Chae (2005).

In contrast to abnormal returns, CAAVs become statistically significant from day -60, which suggests that the target firm experiences higher-than-normal turnover far ahead of the announcement date, whether measured against itself or the overall market. An investigation over different time horizons (not shown) finds that CAAVs are not statistically significant earlier than day -60. Figure 2 shows this steady run-up in abnormal volume that accelerates around the announcement date. This pattern is consistent with the predictions in competitive trading models, where sophisticated investors take a position in a potential target early but speculate more aggressively as the takeover announcement approaches, and then reduce their positions shortly before the announcement. At the same time, the absence of statistically significant abnormal returns—whether AAR or CAAR—over much of this period suggests that this trading has little information value, because it does not lead to a run-up in price.

Table 6 provides the CAAVs for different windows and across different subsamples based on the firm-detrended measure of abnormal volume. It is striking that the CAAVs for all accumulation periods exhibit statistically higher abnormal volume relative to the window [-250,-61]. The increase in CAAV for natural resource firms is close to the levels for firms in other industries: both experience similar increases in turnover on the day of the announcement, with the run-up in CAAV during the pre-event window [-60,-1] representing over 70 per cent of the abnormal volume over the period, including the announcement date [-60,1]. The comparison between deals announced from 1985 to 1997 and deals announced after 1997 indicates that the latter period experienced higher CAAVs, with a larger reaction to the takeover announcement. An examination of average turnover for the stocks covered in the TSX-CFMRC dataset (not shown) shows a sharp increase in this measure beginning in 1997.[29] The greater turnover on the TSX following 1997 may be due to the closing of the trading floor, the merging of regional exchanges under the TSX in 1999, or other factors that are not considered in the analysis.[30] We leave this question for future research.

5.3 Reaction of bid-ask spreads

While it does not allow us to distinguish between the two hypotheses, we examine whether there is any reaction in bid-ask spreads ahead of takeover announcements in our sample. Strategic trading models predict that the adverse selection component in the bid-ask spread should widen during the presence of informed trading, although the effect may be offset if the inventory or the order processing component declines. Empirically, insider trading studies report mixed results. Cornell and Sirri (1992) and Chakravarty and McConnell (1997) find that illegal insider trades had no impact on bid-ask spreads or quoted depth. Fishe and Robe (2004) find that insider trades are associated with a decrease in depth and an increase in bid-ask spreads for stocks traded on the NYSE and the AMEX, but not for stocks traded on the NASDAQ. They suggest the ability to detect informed trading depends on market structure. Specialist markets are better able to detect informed trading, while the diffuse nature of a dealer market makes it more difficult for a given dealer to determine the information content of the order flow. Takeover studies also find mixed evidence: Chae (2005) and Gao and Oler (2004) report a widening of bid-ask spreads and a

29. Foerster and Keim (2000) document how the turnover on U.S. exchanges increased over this period, with fewer days without trades for stocks listed on the NYSE and the AMEX.

30. In 1999, Canada's markets were consolidated. The TSX assumed the role of the exchange for senior equities. The former Alberta and Vancouver exchanges formed the Canadian Venture Exchange (CDNX) and assumed control of junior equities, and the Montréal Exchange became the centre for derivatives trading in Canada. The Winnipeg Stock Exchange and the equities portion of the Montréal Exchange later merged with the CDNX.

decline in quoted depth ahead of takeover announcements, but Conrad and Niden (1993) and Jennings (1994) do not.

Table 7 reports the reaction to takeover announcements in our sample for two measures of the bid-ask spread: the effective spread and the proportional effective spread. The effective spread is equal to 2 times the absolute value of the difference between the closing price and the closing mid-quote. The proportional effective spread is the effective spread divided by the closing mid-quote. Average spreads are calculated for four time windows: an estimation window [-250,-61], a pre-announcement window [-60,-1], an announcement window [0,1], and a post-announcement window [2,20]. We conduct a simple t-test of equality of means for the pre-announcement, announcement, and post-announcement windows against the estimation window. We find that the bid-ask spread is narrower, not wider, during the pre-announcement window [-60,-1], measured by the average effective spread, although it is not statistically different based on the average proportional effective spread. For both measures, the bid-ask spread is lower following the announcement relative to the estimation window [-250,-61], consistent with the drop in uncertainty once the information event has passed. These mixed results do not provide any clear outcome, although the market microstructure of the TSX—which lies between the specialist model of the NYSE and the AMEX, and the dealer model of the NASDAQ—may explain these results. The appendix provides more details on the market microstructure of the TSX.

5.4 Regressions of abnormal returns and volume

A naïve comparison of the abnormal returns and abnormal volume in Table 3 suggests that there are almost no cases, on average, when both were observed on the same day. This relationship can be easily confirmed by viewing the scatter plot in Figure 3 for the pre-event window [-30,-1]. The scatter plot reveals a cloud of points centred on the origin, with a few outliers that have either positive or negative abnormal returns. Note that there are also a number of observations of abnormally low volume with no abnormal returns towards the bottom of the figure, which suggests that, for some of the sample, there are days with lower-than-average trading. Table 8 shows the simple correlation of abnormal returns to abnormal volume over the period [-30,-1] is 0.1235, or 12 per cent. By contrast, the correlation over the announcement window [0,1] is 0.3472, or 35 per cent.

A more formal test of the relationship between abnormal returns and abnormal volume is provided by running panel regressions. Panel methods capture both the time-series dimension of the data and the cross-sectional dimension, and assume a particular structural form for the residuals (Wooldridge 2002). The panel variable is an identifier for each takeover, i, and the time

variable is the day in event time, t. These regressions are estimated using random effects, which assumes that part of the residual is takeover-specific but random, although it remains unidentified. This assumption is less restrictive than the fixed-effects approach that assumes the takeover-specific residual is constant over time. We include dummy variables for the year in which the takeover occurred, with 2002 as the base case, and dummy variables for the ten Standard & Poor's GICS industries in our sample, with oil and gas firms as the base case. More details on this estimation model are provided by Wooldridge (2002, chapter 10). The standard errors are adjusted using a heteroscedasticity-consistent covariance matrix estimator to generate t-statistics that are robust to heteroscedasticity and possible autocorrelation up to some lag (White 1980).

Table 8 reports the results of this estimation over two separate windows. In all three cases, abnormal returns are statistically associated with abnormal volume at the 1 per cent level, although the small size of the coefficient estimated for abnormal volume and the poor fit of the regression suggest that the relationship is not economically important. Column 1 shows the estimation over the pre-event window [-30,-1], and finds that an increase of one standard deviation in abnormal volume leads to an increase in abnormal returns of 1.4202 x 0.0047 = 67 basis points, or 0.67 per cent. The fit of the regression over this window is very low, at 1.7 per cent. Column 2 shows the relationship over the event window [0,1] where the overall R-squared is 14.4 per cent. An increase of one standard deviation in abnormal volume over the announcement window [0,1] is associated with an increase in abnormal returns of 1.7657 x 0.0260 = 4.59 per cent.

From these panel regressions, we conclude that abnormal returns during our pre-event window are not importantly associated with abnormal volumes. This pattern is not consistent with the pattern found in prior studies of illegal insider trading, but is consistent with the predictions for the market anticipation hypothesis. We conclude that pre-bid run-ups are caused by market anticipation, and not by information leakage due to insider trading.

6. Conclusion

We have studied 420 takeover announcements of Canadian-listed firms from 1985 to 2002 to examine the price and volume dynamics in the target firm's shares ahead of the first public announcement. Pre-bid run-ups in the target firm's shares occurred shortly before the announcement and were of comparable magnitude to the run-ups documented for U.S. takeovers, which suggests a similar amount of price discovery in both countries. Contrary to our expectations, run-ups were lower for firms in the natural resource sector, including oil and gas, despite the high level of takeover activity and the clustering of deals in this sector. The size of

price run-ups has increased since 1997, during a period when regulators devoted greater resources to the monitoring of markets and the number of rumours about potential takeovers increased.

Pre-bid run-ups may be caused by information leakage due to illegal insider trading, market anticipation by investors who correctly identify a potential takeover target prior to the announcement, or some combination of both. We have reviewed two classes of models of informed trading—namely, strategic and competitive trading models—that suggest different price–volume dynamics based on the nature of informed trading. We have reviewed empirical studies of known cases of illegal insider trading in the United States and trading ahead of unscheduled announcements, and described the price–volume dynamics that we expected to be associated with each hypothesis for explaining pre-bid run-ups.

We have found that the takeover targets experience significantly positive and rising abnormal volume beginning as early as 60 trading days prior to the first announcement or disclosure of a takeover bid. Abnormal volume is not accompanied by abnormal returns, which suggests that there is information heterogeneity among investors. We find a pattern of return reversals with abnormal returns that fluctuate around zero, consistent with a random walk. Positive and statistically significant abnormal returns occur only shortly before the announcement, accompanied by significantly positive abnormal volume. The targets' stock price reacts significantly to the actual announcement, exhibiting both positive and negative abnormal returns, accompanied by very high abnormal volume. These price–volume dynamics are more consistent with the predictions of the market anticipation hypothesis than with the information leakage hypothesis, which leads us to conclude that pre-bid run-ups are likely due to speculation by sophisticated investors, rather than illegal insider trading by corporate insiders.

While this conclusion applies to the average takeover in our sample of 420 firms, we cannot dismiss the possibility of illegal insider trading in any of the individual takeovers in our sample. We note from our scatter plot (Figure 3) that there are a number of outliers that exhibit both abnormal returns and abnormal volume prior to the announcement. Likewise, we have not examined insider trading ahead of other important corporate events, such as earnings announcements, dividend changes, and bankruptcy announcements. We leave these topics for future research.

References

Admati, A.R. and P. Pfleiderer. 1988. “A Theory of Intraday Trading Patterns: Volume and Price Variability.” *Review of Financial Studies* 1(1): 3–40.

Amoako-Adu, B. and J. Yagil. 1986. “Stock Price Behaviour Between the Base, Announcement, and Consummation Dates of the Merger.” *Journal of Economics and Business* 38: 105–11.

Andrade, G., M. Mitchell, and E. Stafford. 2001. “New Evidence and Perspectives on Mergers.” *Journal of Economic Perspectives* 15(2): 103–20.

Ascioglu, N.A., T. McInish, and R. Wood. 2002. “Merger Announcements and Trading.” *Journal of Financial Research* 25(2): 263–78.

Asquith, P. 1983. “Merger Bids, Uncertainty, and Stockholder Returns.” *Journal of Financial Economics* 11(1-4): 51–83.

Bainbridge, S. 2000. “Insider Trading: An Overview.” In *Encyclopaedia of Law and Economics*. Boston: NBER.

Bhattacharya, U. and H. Daouk. 2002. “The World Price of Insider Trading.” *Journal of Finance* 57(1): 75–108.

Boehmer, E., J. Musumeci, and A. Poulsen. 1991. “Event-Study Methodology Under Conditions of Event-Induced Variance.” *Journal of Financial Economics* 30: 253–72.

Brooks, R.M., A. Patel, and T. Su. 2003. “How the Equity Market Responds to Unanticipated Events.” *Journal of Business* 76(1): 109–33.

Canada. Wise Persons’ Committee to Review the Structure of Securities Regulation in Canada. 2003. *It’s Time*. Ottawa: Department of Finance.

Chae, J. 2005. “Trading Volume, Information Asymmetry, and Timing Information.” *Journal of Finance* 60(1): 413–42.

Chakravarty, S. and J.J. McConnell. 1997. “An Analysis of Prices, Bid/Ask Spreads, and Bid and Ask Depths Surrounding Ivan Boesky’s Illegal Trading in Carnation Stock.” *Financial Management* 26(2): 18–34.

———. 1999. “Does Insider Trading Really Move Stock Prices?” *Journal of Financial and Quantitative Analysis* 34(2): 191–209.

Chakravarty, S., H. Gulen, and S. Mayhew. 2004. “Informed Trading in Stock and Option Markets.” *Journal of Finance* 59(3): 1235–57.

Conrad, J. and C.M. Niden. 1993. “Order Flow, Trading Costs and Corporate Acquisition Announcements.” *Financial Management* 21(4): 22–31.

Copeland, T.E. and D. Galai. 1983. “Information Effects on the Bid-Ask Spread.” *Journal of Finance* 38(5): 1457–69.

Cornell, B. and E.R. Sirri. 1992. “The Reaction of Investors and Stock Prices to Insider Trading.” *Journal of Finance* 47(3): 1031–59.

Easley, D. and M. O’Hara. 1987. “Price, Trade Size, and Information in Securities Markets.” *Journal of Financial Economics* 19(1): 69–90.

———. 1992. “Time and the Process of Security Price Adjustment.” *Journal of Finance* 47(2): 576–605.

Easley, D., S. Hvidkjaer, and M. O’Hara. 2002. “Is Information Risk a Determinant of Asset Returns?” *Journal of Finance* 57(5): 2185–2221.

Easley, D., M. O’Hara, and P. Srinivas. 1998. “Option Volume and Stock Prices: Evidence on Where Informed Traders Trade.” *Journal of Finance* 53(2): 431–65.

Eckbo, E.B. 1986. “Mergers and the Market for Corporate Control: The Canadian Evidence.” *Canadian Journal of Economics* 19(2): 236–60.

Eckbo, E.B. and D.C. Smith. 1998. “The Conditional Performance of Insider Trades.” *Journal of Finance* 53(2): 467–98.

Eckbo, B.E. and K.S. Thorburn. 2000. “Gains to Bidder Firms Revisited: Domestic and Foreign Acquisitions in Canada.” *Journal of Financial and Quantitative Analysis* 35(1): 1–25.

Eyssell, T.H. and N. Arshadi. 1993. “Insiders, Outsiders, or Trend Chasers? An Investigation of Pre-Takeover Transactions in the Shares of Target Firms.” *Journal of Financial Research* 16(1): 49–59.

Fama, E. 1970. “Efficient Capital Markets: A Review of Theory and Empirical Work.” *Journal of Finance* 25(2): 383–417.

———. 1991. “Efficient Capital Markets: II.” *Journal of Finance* 46(5): 1575–1617.

Finnerty, J.E. 1976. “Insiders and Market Efficiency.” *Journal of Financ*e 31(4): 1141–48.

Fishe, R.P. and M.A. Robe. 2004. “The Impact of Illegal Insider Trading in Dealer and Specialist Markets: Evidence from a Natural Experiment.” *Journal of Financial Economics* 71(3): 461–88.

Foerster, S.R. and D.B. Keim. 2000. “Direct Evidence of Non-Trading of NYSE and AMEX Stocks.” In *Security Market Imperfections in Worldwide Equity Markets*, edited by D.B. Keim and W.T. Ziemba. Cambridge: Cambridge University Press.

Franks, J.R. and R.S. Harris. 1989. “Shareholder Wealth Effects of Corporate Takeovers: The U.K. Experience 1955–1985.” *Journal of Financial Economics* 23(2): 225–49.

Gao, Y. and D. Oler. 2004. “Takeover Announcement and Price Discovery.” Cornell University. Photocopy.

Garfinkel, J.A. and M. Nimalendran. 2003. “Market Structure and Trader Anonymity: An Analysis of Insider Trading.” *Journal of Financial and Quantitative Analysis* 38(3): 591–610.

Glosten, L.R. and P.R. Milgrom. 1985. “Bid, Ask, and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders.” *Journal of Financial Economics* 14(1): 71–100.

Graham, J.R., J. Lynch Koski, and U. Loewenstein. 2003. “Information Flow and Liquidity Around Anticipated and Unanticipated Dividend Announcements.” Duke University. Available at: <http://ssrn.com/abstract=411720>.

Griffiths, M.D., B.F. Smith, D.A.S. Turnbull, and R.W. White. 2000. “The Costs and Determinants of Order Aggressiveness.” *Journal of Financial Economics* 56: 65–88.

Grundy, B.D. and N. McNichols. 1990. “Trade and the Revelation of Information through Prices and Direct Disclosure.” *Review of Financial Studies* 2(4): 495–592.

Gupta, A. and L. Misra. 1989. “Public Information and Pre-Announcement Trading in Takeover Stocks.” *Journal of Economics and Business* 41(3): 225–33.

Halpern, P.J. 1973. “Empirical Estimates of the Amount and Distribution of Gains to Companies in Mergers.” *Journal of Business* 46(4): 554–75.

Harris, M. and A. Raviv. 1993. “Differences of Opinion Make a Horse Race.” *Review of Financial Studies* 6(3): 473–506.

He, H. and J. Wang. 1995. “Differential Information and Dynamic Behavior of Stock Trading Volume.” *Review of Financial Studies* 8(4): 919–72.

Hyland, D.C., S.K. Sarkar, and M. Tripathy. 2003. “Insider Trading When an Underlying Option is Present.” *Financial Analyst’s Journal* 59(3): 69–77.

Insider Trading Task Force. 2003. *Illegal Insider Trading in Canada: Recommendations on Prevention, Detection, and Deterrence*. Ottawa. Available at: <http://www.csa-acvm.ca/pdfs/ITTF_report.pdf>.

Jabbour, A.R., A. Jalilvand, and J.A. Switzer. 2000. “Pre-Bid Price Run-Ups and Insider Trading Activity: Evidence from Canadian Acquisitions.” *International Review of Financial Analysis* 9(1): 21–43.

Jaffe, J.F. 1974. “Special Information and Insider Trading.” *Journal of Business* 47(3): 410–28.

Jarrell, G. and A. Poulsen. 1989. “Stock Trading before the Announcement of Tender Offers: Insider Trading or Market Anticipation?” *Journal of Law, Economics, and Organization* 5(2): 225–48.

Jeng, L., A. Metrick, and R. Zeckhauser. 2003. “Estimating the Returns to Insider Trading: A Performance-Evaluation Perspective.” *Review of Economics and Statistics* 85(2): 453–71.

Jennings, R. 1994. “Intraday Changes in Target Firms’ Share Price and Bid-Ask Quotes Around Takeover Announcements.” *Journal of Financial Research* 17(2): 255–70.

Jensen, M.C. and R.S. Ruback. 1983. “The Market for Corporate Control: The Scientific Evidence.” *Journal of Financial Economics* 11(1): 5–50.

Keown, A.J. and J.M. Pinkerton. 1981. “Merger Announcements and Insider Trading Activity: An Empirical Investigation.” *Journal of Finance* 36(4): 855–69.

Kim, O. and R.E. Verrecchia. 1994. “Market Liquidity and Volume around Earnings Announcements.” *Journal of Accounting and Economics* 17(1-2): 41–67.

Kyle, A.S. 1985. “Continuous Auctions and Insider Trading.” *Econometrica* 53(6): 1315–35.

Lakonishok, J. and I. Lee. 2001. “Are Insider Trades Informative?” *Review of Financial Studies* 14: 79–111.

Lin, J.-C. and J.S. Howe. 1990. “Insider Trading in the OTC Market.” *Journal of Finance* XLV(4): 1273–84.

Llorente, G., R. Michaely, G. Saar, and J. Wang. 2002. “Dynamic Volume-Return Relation of Individual Stocks.” *Review of Financial Studies* 15(4): 1005–47.

Lo, A.W. and J. Wang. 2000. “Trading Volume: Definitions, Data Analysis, and Implications of Portfolio Theory.” *Review of Financial Studies* 13(2): 257–300.

MacIntosh, J.G. and C.C. Nicholls. 2002. *Securities Law.* Toronto: Irwin Law Inc.

MacKinlay, G.A. 1997. “Event Studies in Economics and Finance.” *Journal of Economic Literature* 35(1): 13–39.

Madhavan, A. 2002. “Market Microstructure: A Practitioner’s Guide.” *Financial Analysts Journal* 58(5): 28–42.

Masse, I., R. Hanrahan, and J. Kushner. 1998. “Are Stock Market Event Studies Affected by the Price Range of Shares? The Canadian Experience.” *Applied Economic Letters* (5): 313–15.

McNally, W.J. and B.F. Smith. 2003. “Do Insiders Play by the Rules?” *Canadian Public Policy* 29(2): 125–44.

Meulbroek, L.K. 1992. “An Empirical Analysis of Illegal Insider Trading.” *Journal of Finance* 47(5): 1661–99.

Minenna, M. 2003. “Insider Trading, Abnormal Return, and Preferential Information: Supervising Through a Probabilistic Model.” *Journal of Banking and Finance* 27: 59–86.

Mitchell, M.L. and J.H. Mulherin. 1996. “The Impact of Industry Shocks on Takeover and Restructuring Activity.” *Journal of Financial Economics* 41: 193–229.

Mitchell, M.L. and J.M. Netter. 1994. “The Role of Financial Economics in Securities Fraud Cases: Applications at the Securities and Exchange Commission.” *Business Lawyer* 49: 545–90.

O’Hara, M. 1995. *Market Microstructure Theory.* Oxford: Blackwell Publishing.

———. 2003. “Presidential Address: Liquidity and Price Discovery.” *Journal of Finance* 58(4): 1335–54.

Pound, J. and R.J. Zeckhauser. 1990. “Clearly Heard on the Street: The Effect of Takeover Rumours on Stock Prices.” *Journal of Business* 63(3): 291–308.

Rozeff, M.S. and M.A. Zaman. 1988. “Market Efficiency and Insider Trading: New Evidence.” *Journal of Business* 61(1): 25–44.

Sanders, R.W. and J.S. Zdanowicz. 1992. “Target Firm Abnormal Returns and Trading Volume Around the Initiation of Change in Control Transactions.” *Journal of Financial and Quantitative Analysis* 27(1): 109–29.

Seyhun, H.N. 1986. “Insiders’ Profits, Costs of Trading, and Market Efficiency.” *Journal of Financial Economics* 16: 189–212.

Smith, B.F., D.A.S. Turnbull, and R.W. White. 2001. “Upstairs Market for Principal and Agency Trades: Analysis of Adverse Selection and Price Effects.” *Journal of Finance* 56(5): 1723–46.

Wang, J. 1994. “A Model of Competitive Stock Trading Volume.” *Journal of Political Economy* 102(1): 127–68.

White, H. 1980. “A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity.” *Econometrica* 48: 817–38.

Wooldridge, J.M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Table 1: Predicted Price–Volume Dynamics under Competing Hypotheses

This table outlines the predicted price–volume dynamics under the competing hypotheses for explaining pre-bid run-ups ahead of a takeover announcement. The predictions for the insider trading hypothesis are based on the stylized facts from U.S. studies of known cases of illegal insider trading, as well as a review of strategic trading models. The predictions of the market anticipation hypothesis are based on empirical studies of trading behaviour ahead of unscheduled announcements, as well as a review of competitive trading models.

Variable	Insider trading hypothesis	Market anticipation hypothesis
Abnormal returns	Coinciding with abnormal volume	Close to announcement date
Pattern of abnormal returns	Abnormal returns on days when insiders are active	Return reversals in early period; positive autocorrelation close to announcement date
Share price reaction to announcement	Limited reaction to announcement due to price discovery ahead of announcement	Significant reaction to announcement, with both positive and negative abnormal returns depending on accuracy of proprietary information
Abnormal volume	Coinciding with abnormal returns	Leading abnormal returns
Pattern of abnormal volume	No pattern	Serially correlated and rising close to announcement date

Table 2: Summary Statistics for the Main Sample of 420 Takeovers, 1985–2002

Panel A: Market capitalization of target firms

	Mean	Median	Standard deviation	1st quartile	3rd quartile	Max	Min
Size (mm)	$537.3	$92.0	$1,589.4	$37.5	$338.5	$13,947.0	$2.8
Average closing share price [-250,-60]	$9.60	$5.40	$12.70	$1.80	$13.30	$234.00	$0.03

Panel B: Annual breakdown of takeover bids with details on the number of completed (fully or partially) deals, the number of hostile bids, the number of takeovers rumoured in the press, the number of targets engaged in natural resources, and the number of takeovers where the bidder held a toehold.

Year	Total number of bids	Completed takeovers (%)	Hostile bids (%)	Natural resource targets (%)	Rumoured prior to bid (%)	Takeovers with toeholds (%)
1985	7	29	14	71	0	14
1986	8	50	13	63	0	13
1987	7	57	14	71	14	57
1988	11	73	27	45	9	36
1989	18	67	6	39	17	22
1990	10	40	0	60	0	40
1991	5	80	0	80	20	20
1992	11	73	18	64	0	0
1993	14	57	7	64	14	7
1994	17	47	29	71	6	6
1995	29	69	21	69	21	17
1996	32	53	9	72	9	13
1997	39	67	31	56	18	28
1998	37	65	22	59	16	14
1999	34	68	9	26	26	21
2000	59	76	17	46	15	15
2001	56	82	7	61	18	14
2002	26	65	15	50	19	27
Total	420	67	15	56	15	18

Table 3: Average and Cumulative Abnormal Returns and Volume for 420 Takeovers, 1985–2002

Average and cumulative abnormal returns were estimated using two models: a market model with the CFMRC equal-weighted index, and a 2-factor market model with S&P/TSX sector indexes. Average and cumulative abnormal volumes were estimated using two models: a firm-detrended model and a market model. CAARs (CAAVs) are accumulated over the window [-60,20]. The column % positive AR (AV) shows the percentage of deals where the abnormal returns (volume) was positive for a given day. A one-tailed Z-test is used to test for positive abnormal returns and volume.

	Abnormal returns – market model (420 takeovers)			Abnormal returns – 2-factor model (387 takeovers)			Abnormal volume – firm detrended (420 takeovers)			Abnormal volume – market model (420 takeovers)		
Trading day	AAR %	% positive ARs	CAAR %	AAR %	% positive ARs	CAAR %	AAV %	% positive AV	CAAV %	AAV %	% positive AV	CAAV %
-30	-0.08	46	-2.16	-0.03	45	-2.32	5.3	52	316.3***	2.5	51	224.9***
-29	-0.24	44	-2.40	-0.20	47	-2.52	4.0	48	320.4***	0.8	48	225.8***
-28	-0.06	46	-2.46	-0.06	47	-2.58	6.4	55	326.8***	2.0	55	227.8***
-27	-0.27	48	-2.72	-0.38	49	-2.96	11.2*	55	338.1***	6.6	53	234.4***
-26	0.06	45	-2.66	0.11	46	-2.85	11.2*	53	349.3***	6.9	52	241.3***
-25	0.20	50	-2.46	0.24	51	-2.61	19.2***	55	368.6***	16.5***	55	257.9***
-24	0.20	46	-2.25	0.24	47	-2.37	28.9***	58	397.6***	28.5***	61	286.4***
-23	0.41	52	-1.84	0.37	52	-1.99	24.6***	60	422.3***	22.1***	59	308.6***
-22	0.50*	51	-1.35	0.58***	53	-1.41	33.4***	61	455.7***	31.0***	61	339.6***
-21	0.05	50	-1.29	0.05	50	-1.36	26.7***	59	482.5***	24.7***	59	364.3***
-20	0.08	46	-1.21	0.04	42	-1.32	20.3***	56	502.8***	19.1***	54	383.4***
-19	-0.11	46	-1.32	-0.19	47	-1.51	21.2***	57	524.0***	18.2***	57	401.6***
-18	-0.08	49	-1.40	-0.08	50	-1.60	30.3***	57	554.4***	27.7***	57	429.4***
-17	-0.07	41	-1.47	-0.11	40	-1.70	27.8***	60	582.2***	23.1***	57	452.5***
-16	0.14	50	-1.34	0.17	48	-1.54	27.0***	58	609.3***	25.9***	58	478.4***
-15	0.19	48	-1.14	0.24	50	-1.29	31.9***	60	641.2***	28.0***	60	506.5***
-14	0.41*	46	-0.73	0.42*	46	-0.88	25.4***	59	666.7***	22.3***	59	528.9***
-13	-0.02	50	-0.75	-0.07	51	-0.94	29.9***	57	696.6***	26.0***	56	554.9***
-12	0.41*	51	-0.34	0.30	49	-0.65	26.0***	55	722.7***	23.9***	54	578.9***
-11	0.38	51	0.03	0.48*	51	-0.16	43.3***	64	766.0***	38.9***	62	617.9***
-10	-0.35	46	-0.32	-0.49*	45	-0.65	25.8***	54	791.9***	23.5***	55	641.4***
-9	0.43*	51	0.11	0.40*	51	-0.24	28.1***	59	820.0***	24.6***	59	666.0***
-8	0.66***	53	0.77	0.72***	55	0.48	43.6***	62	863.7***	39.4***	61	705.5***
-7	0.40*	52	1.17	0.44*	50	0.92	43.2***	63	906.9***	40.4***	62	746.0***
-6	0.34	50	1.51	0.41*	52	1.33	32.8***	62	939.8***	30.2***	60	776.3***
-5	0.35	46	1.86	0.40	46	1.73	43.3***	65	983.2***	41.1***	63	817.4***
-4	0.77***	52	2.63	0.82***	54	2.55	42.9***	62	1026.1***	38.3***	61	855.8***
-3	0.02	52	2.66	0.02	54	2.57	54.0***	64	1080.1***	51.1***	63	906.9***
-2	1.45***	60	4.11***	1.35***	60	3.92*	66.6***	68	1146.8***	62.7***	67	969.6***
-1	1.55***	59	5.66***	1.48***	59	5.40***	84.7***	74	1231.6***	81.0***	72	1050.6***
0	9.76***	75	15.41***	9.71***	76	15.11***	228.5***	90	1460.1***	223.0***	90	1273.7***
1	2.11***	56	17.52***	2.40***	58	17.51***	249.3***	94	1709.5***	242.2***	93	1515.9***

*** indicates significance at 1% and * at 5% from a one-tailed Z-test.

Table 4: Cumulative average Abnormal Returns by Subsample, 1985–2002

Average and cumulative abnormal returns are estimated using a market model where the CFMRC equal-weighted index is the proxy for the market. "Natural resources" consists of target firms engaged in exploration, production, and transportation of oil, gas, minerals, metals, and other commodity-related products.

	(1)	(2)	(3)	(4)	(5)
Period	Main sample	Natural resource firms	Non-natural resource firms	Deals announced 1985-1997	Deals announced 1998-2002
CAARs (%):					
[-60,20]	15.90***	12.78***	19.86***	10.07***	21.41***
[-60,-1]	5.66***	3.13	8.83***	1.66	9.45***
[-30,-1]	7.74***	5.89***	10.08***	4.91***	10.46***
[-20,-1]	6.95***	5.80***	8.39***	4.77***	9.05***
[-10,-1]	5.62***	4.79***	6.68***	5.24***	6.00***
[0,1]	11.87***	10.42***	13.71***	10.65***	13.00***
[-60,1]	17.52***	13.57***	22.54***	12.31***	22.44***
[2,20]	-1.62	-0.8	-2.68*	-2.24*	-1.03
AARs (%):					
-1	1.55***	1.13***	2.09***	1.43***	1.66***
0	9.76***	8.48***	11.42***	8.40***	11.03***
1	2.11***	1.96***	2.29***	2.25***	1.97***
Run-up index:					
CAAR[-60,-1] / CAAR[-60,1]	32.31	23.07	39.18	13.49	42.11

*** indicates significance at 1% and * at 5% from a one-tailed Z-test.

Table 5: Comparison of Cumulative Average Abnormal Returns from Different Studies

CAAR [-*i*,-*j*] is the cumulative average abnormal return from day -*i* through day -*j* relative to the announcement day (day 0). "Total CAAR" is calculated over the window [-20,1]. "Pre-event CAAR" is over the window [-20,-1]. "Announcement CAAR" is over the window [0,1]. "Run-up index" is the percentage of the total run-up that occurred before the announcement day, equal to CAAR [-20,-1] / CAAR [-20,1].

	1	2	3	4	5	6	7
	Keown and Pinkerton (1981)[1]	Jarrell and Poulsen (1989)[1,2]	Sanders and Zdanowicz (1992)[3]	Meulbroek (1992)[4]	Ascioglu et al. (2002)[5]	Jabbour et al. (2000)	This study
Sample period	1975-1978	1981-1985	1978-1986	1980-1989	1995	1985-1995	1985-2002
Sample size	194	172	30	145	50	128	420
Country	U.S.	U.S.	U.S.	U.S.	U.S.	Canada	Canada
Total CAAR	25.7	28.3	29.5	30.6	20.6	12.7	18.9
Pre-event CAAR	12.2	11.0	8.1	13.0	14.2	5.5	7.0
Announcement CAAR	13.5	17.3	21.4	17.6	6.4	7.1	11.9
Run-up index	47.6	38.9	27.5	42.5	68.9	43.8	37.0

1. Successful takeovers only.
2. Cash offers only.
3. Deals with identifiable takeover initiation date. The total CAAR is calculated from the takeover initiation date to the announcement date (day 0), the pre-event CAAR is from the takeover initiation date to day -2, and the announcement CAAR is [-1,0].
4. Alleged cases of insider trading only. The total CAAR is calculated over the window [-20,0], the pre-event CAAR is [-20,-1], and the announcement CAAR is [-1,0].
5. Takeovers of firms cross-listed on NYSE and another U.S. exchange only.

Table 6: Cumulative Average Abnormal Volume for 420 Takeovers, 1985–2002

Each target's abnormal volume in the event window [-60,20] is calculated as the log of daily turnover minus the log of average daily turnover over the window [-250,-61] for the same target. Daily turnover is calculated as daily volume divided by the number of shares outstanding. Average abnormal volume (AAV) for day t=-60,…,20 is a cross-sectional mean of abnormal volumes across all 420 targets. Cumulative average abnormal volume (CAAV) is a sum of average abnormal volumes over a specific time period.

	(1)	(2)	(3)	(4)	(5)
Period	Main sample	Natural resource firms	Non-natural resource firms	Deals announced 1985-1997	Deals announced 1998-2002
CAAVs (%):					
[-60,20]	3878.52***	3707.79***	4092.98***	3268.95***	4471.44***
[-60,-1]	1231.61***	1198.77***	1272.72***	866.79***	1583.62***
[-30,-1]	920.54***	908.60***	935.38***	704.64***	1127.98***
[-20,-1]	749.05***	746.72***	751.83***	575.25***	915.92***
[-10,-1]	465.54***	428.46***	512.65***	366.53***	560.57***
[0,1]	477.95***	458.36***	503.13***	419.12***	534.38***
[-60,1]	1709.55***	1657.14***	1775.84***	1285.90***	2118.01***
[2,20]	2168.97***	2050.65***	2317.14***	198.31***	2353.43***
AAVs (%):					
-1	84.74***	63.32***	112.21***	70.91***	98.04***
0	228.58***	220.20***	239.41***	187.87***	267.33***
1	249.37***	238.16***	263.72***	231.25***	267.05***
Run-up index:					
CAAV[-60,-1] / CAAV[-60,1]	72.04	72.34	71.69	67.41	74.77

*** indicates significance at 1% from a one-tailed Z-test.

Table 7: Average Spreads for 420 Takeovers, 1985–2002

Two types of spreads are calculated for each takeover target: the effective spread and the proportional effective spread. The effective spread is equal to 2 times the absolute value of the difference between the closing price and closing mid-quote. The proportional effective spread is the effective spread divided by the closing mid-quote. Average spreads are calculated for four time windows: an estimation window [-250,-61], a pre-announcement window [-60,-1], an announcement window [0,1], and a post-announcement window [2,20]. We conduct a simple *t*-test of equality of means for the pre-announcement, announcement, and post-announcement windows against the estimation window.

	Estimation window [-250,-61]	Pre-announcement window [-60,-1]	Announcement window [0,1]	Post-announcement window [2,20]
Average effective spread	\$0.1368	\$0.1257***	\$0.1088***	\$0.0955***
Average proportional effective spread	2.77%	2.75%	2.04%***	1.99%***

*** indicates statistical significance at 1% from a two-tailed *t*-test.

Table 8: Panel Regressions of Abnormal Returns and Abnormal Volume for 420 Takeovers, 1985–2002

The panel regressions are estimated using random effects, with robust standard errors shown in parentheses. The dependent variable is the abnormal return for each takeover *i* at time *t*, where abnormal returns are estimated using a market model. The independent variables are abnormal volume for each takeover *i* at time *t*, and dummy variables for the year of the takeover and the 10 GICS industries in our sample. The base case represents natural resource takeovers in 2002.

Panel A: Panel regressions over different windows (standard errors in parentheses)

	(1) [-30,-1)	(2) [0,1]	(3) [-30,1]
Abnormal volume	0.0047***	0.0260***	0.0090***
	(<0.001)	(0.002)	(<0.001)
Constant	0.0036	-0.0167	0.0046
	(0.091)	(0.394)	(0.053)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Observations	12014	797	12811
Number of takeovers	420	406	420
R-squared (overall)	0.017	0.144	0.048
Wald chi-squared	206.8***	129.2***	645.2***
P-value	<0.001	<0.001	<0.001

*** indicates significance at 1%.

Panel B: Summary statistics over different windows

	N	Mean	Std. dev.	Min	Max
		Window [-30,-1]			
Abnormal return	12,014	0.0026	0.0537	-0.6764	1.4859
Abnormal volume	12,283	0.3064	1.4202	-9.5620	6.3964
		Window [0,1]			
Abnormal return	797	0.0588	0.1301	-0.2959	0.8940
Abnormal volume	821	2.3908	1.7657	-4.9240	6.9542

Panel C: Correlations of abnormal returns and abnormal volume over different windows

Window	Correlation
[-30,-1]	0.1235
[0,1]	0.3472

Figure 1: Average and Cumulative Average Abnormal Returns for 420 Takeover Bids, 1985–2002

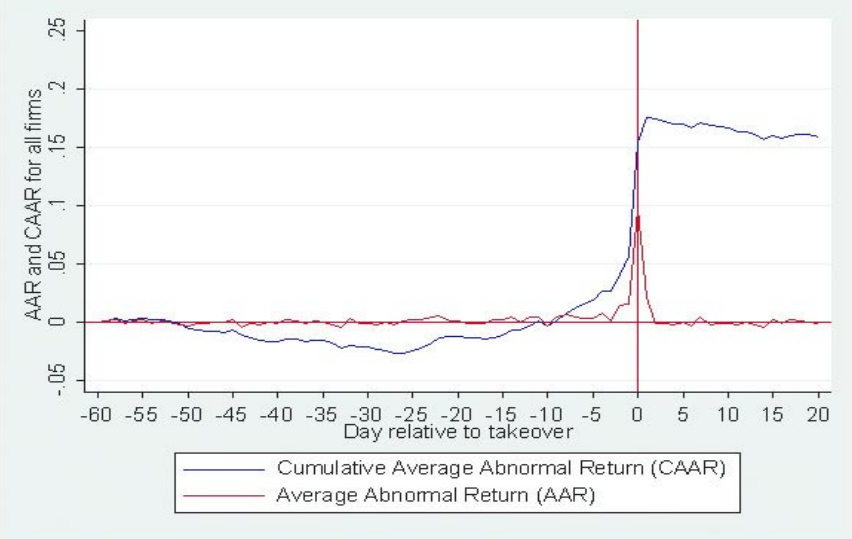


Figure 2: Average and Cumulative Average Abnormal Volume for 420 Takeover Bids, 1985–2002

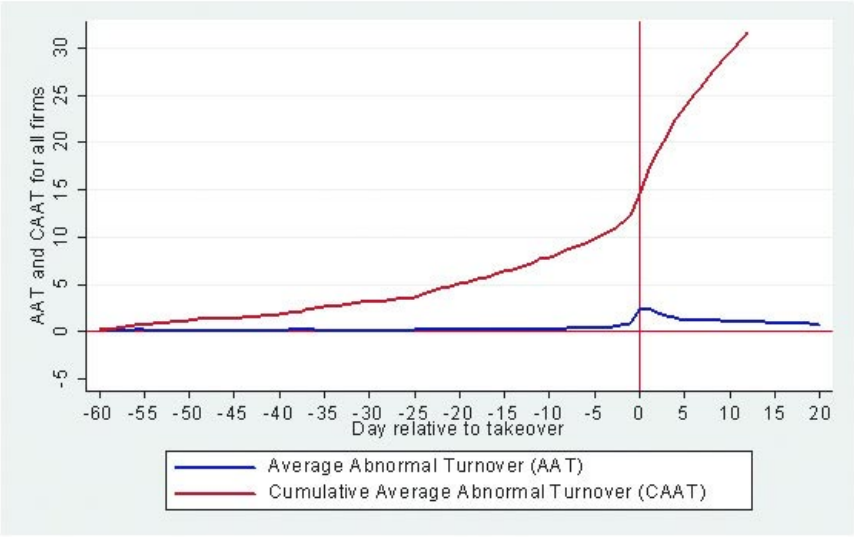
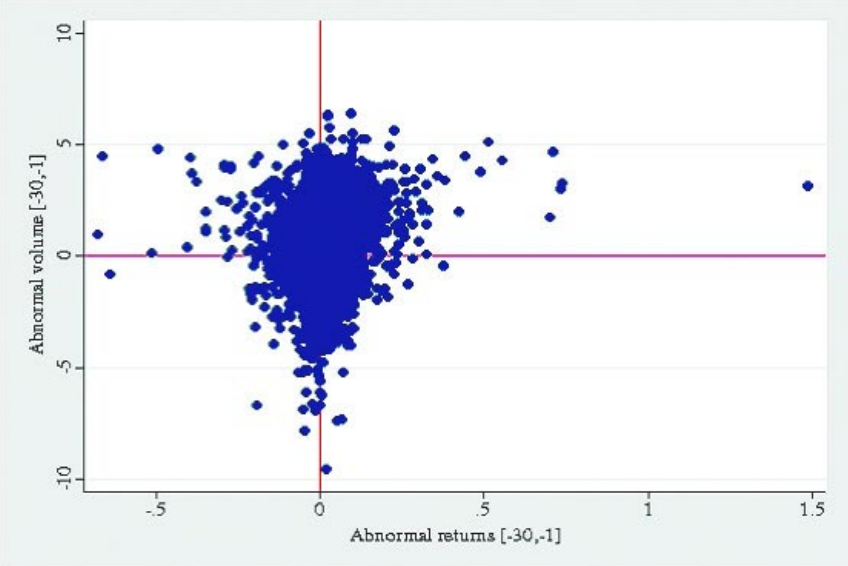


Figure 3: Scatter Plot of Abnormal Returns vs. Abnormal Volume for 420 Takeover Bids, 1985–2002



Appendix

A.1 Regulation of insider trading in Canada

Insider trading in Canada is governed by both provincial securities laws and corporate law statutes (MacIntosh and Nicholls 2002). Insider trading requirements apply only to companies that have issued securities through a prospectus or takeover bid, or that are listed on a stock exchange. Individuals and entities are considered corporate insiders if they are directors or senior officers of a reporting issuer or its subsidiary, or control more than 10 per cent of the voting shares. Corporate insiders are permitted to buy or sell shares in their companies provided they report their trades to securities regulators and do not trade when they have confidential insider information. These trading restrictions apply to a wider class of persons that have a "special relationship" with a reporting issuer, such as members of the Board of Directors, the five highest-paid employees, family members, and insiders of companies proposing to make a takeover bid, reorganization, or similar business arrangement. Tippees are included in the definition of "special relationship"; a tippee is a person who acquires material information from another person who is in the special relationship.

A.2 Takeover process in Canada

The process of launching a takeover bid in Canada is similar to that in the United States, although the responsibility for oversight and the regulatory requirements are different. Takeovers fall under the jurisdiction of the provincial securities commission, because Canada does not have a single, national securities regulator. This section describes the regulations in the Province of Ontario, which are representative of the practice in the rest of Canada (MacIntosh and Nicholls 2002).

A takeover bid is defined under the Ontario Securities Act as an offer to acquire a target firm's voting or equity securities, where the bidder seeks to acquire 20 per cent or more of an outstanding class of voting securities. To launch a takeover bid, a bidder must either deliver a formal bid document to all of the target security holders, or publish a detailed announcement in a major daily newspaper and deliver a copy of the bid to the target's head office.[1] Under continuous disclosure rules, bidders would typically be required to issue a press release indicating their intent in advance of their bid. A bidder would then have to send a bid circular to all target shareholders. The takeover bid circular discloses important transaction details such as the terms of the bid, method of payment, acquirer's current holdings of the target's securities ("toeholds"), any plans for material changes in the operation of the target's business, and any arrangements between the acquirer and the directors or officers of the target.

1. Prior to 31 March 2001, formal takeover bids in Ontario could be commenced only by delivering a bid document.

Current Ontario legislation limits the acquirer's ability to gain control by making anonymous purchases in the market. Any person acquiring control of 10 per cent or more of an issuer's securities must file a report with the OSC. This report must disclose the buyer's intention for purchasing the securities (i.e., investment or gain of control). Every subsequent increase in the securities under control by 2 per cent above this 10 per cent threshold must be accompanied by a press release and an "early warning" report filed with the commission.

A.3 The Toronto Stock Exchange (TSX)

Electronic trading was first introduced in 1977 when the computer-assisted trading system (CATS) was introduced to cover inactive stocks. More stocks were added over the 1990s, with all remaining stocks brought online in early 1997. At that time, the TSX closed its trading floor, although the upstairs market continues to operate (Smith, Turnbull, and White 2001). The engine running the CATS system was further improved in 2001.

The TSX uses a centralized electronic order-matching system similar to the Paris Bourse and the Tokyo Stock Exchange.[2] Similar to the New York Stock Exchange (NYSE), the TSX opens as a call market, and functions as a continuous auction market after the open. While both the NYSE and the TSX have a market-making structure, market makers on the TSX—termed Registered Traders (RTs)—have less ability to disrupt and take precedence over the public limit orders than do NYSE specialists. An RT cannot halt trading at their own discretion, and their main focus is providing liquidity for small orders. Given the limited role of the RT, Smith, Turnbull, and White (2001) argue that the TSX operates more like a pure limit-order market—similar to the Paris Bourse and the Tokyo Stock Exchange—than like the NYSE.

All TSX orders go initially to an upstairs market, which consists of the trading desks of member firms. The market maker who receives the order has up to 15 minutes to decide whether (i) to try and fill the order as either a principal or to cross the order with another client as agent, or (ii) to send the order downstairs to the consolidated limit-order book. These market makers see all order flow on a non-anonymous basis and can selectively participate in handling these orders. Orders that are matched or "crossed" in the upstairs market are recorded as "put-throughs" in the consolidated electronic order book that comprises the downstairs market. Orders that are not filled upstairs are transmitted to the downstairs market and are entered in the consolidated electronic order book as limit orders, with market orders entered as limits at the price on the opposite side of the book.

2. The material in this section is based on Griffiths et al. (2000) and Smith, Turnbull, and White (2001).

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