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INFORMATIONAL CONTENT

OF

STOCK OPTIONS

by

KEH-YIING CHERN

A dissertation submitted to the Graduate Faculty in Business in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

2000

This manuscript has been read and accepted for the Graduate Faculty in Business in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

INFORMATIONAL CONTENT OF STOCK OPTIONS

by
Keh-Yiing Chern

Adviser: Professor Kishore Tandon

I provide empirical evidence on three areas of informational content of stock options listings and their subsequent trading. I test first whether increased and better quality information about a firm is introduced into the market by analyzing financial analysts' activities after options listings. I then test how momentum strategies work on both optioned and non-optioned stocks. Finally, I look into two corporate actions: stock splits and takeover (targets) and the resulting price reaction and financial analysts' activities.

My findings are consistent with the hypothesis that more analysts follow the same company after its options listing. In addition, I find a slight decline in the consensus estimate of the firm's future earnings and a wider dispersion of analysts' forecasts. However, analysts gradually become more accurate in their quarterly EPS estimates as measured by a smaller earnings surprise.

Earnings surprises and past analysts' forecast revisions of non-optioned stocks convey more informational content about the firms' future earnings ability. Momentum strategies can be implemented more successfully to exploit the earnings momentum by buying past non-optioned earnings winners and selling past non-optioned earnings losers.

I also find support for the hypothesis that the magnitude of the stock split announcement effect is larger for non-optioned stocks than for optioned stocks. The market adjusts more rapidly to the split announcement during the post-announcement period for optioned stocks than for non-optioned stocks. Besides, stock splits tend to precede strong revision of earnings estimates by analysts for both the optioned and the non-optioned stocks.

Takeover announcements of non-optioned targets seem to have more informational content than announcements of optioned target firms. Results on takeover announcements show that analysts revise estimates of the current fiscal-year EPS significantly for both optioned and non-optioned targets but they revise estimates of the next fiscal-year EPS significantly only for the non-optioned ones.

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CHAPTER 1. INTRODUCTION

In the finance literature, several studies have examined factors that drive stock returns. Most of these studies focus on macroeconomic trends, international competition, fundamental factors, corporate events, shifts in market expectation, and other similar factors. Robustness tests on these factors then follow.

The persistence of some seemingly irrational anomalies in the stock market can be attributed to information asymmetry that exists among investors. This paper extends the existing literature by attempting to isolate factors that may explain these anomalies. I divide stocks into two groups in this study: stocks with options listed on them and those without options. Availability of stock options is used as a proxy for the richness of informational environment. This is motivated by the hypothesis that stock options may affect the way investors assimilate new information about the underlying firms. I also hypothesize that the existence of stock options affects informational content from events and news that affect the underlying stock's price movements.

In this research, I explore and provide empirical evidence on three areas of informational content of stock options listings and their subsequent trading. I examine first whether increased and better quality information about a firm is introduced into the market by analyzing financial analysts' activities before and after options listings. I then test how momentum

strategies work on both optioned and non-optioned stocks. Finally, I look into two corporate actions: stock splits and takeover (targets) and the resulted price reaction and financial analysts' activities.

Overall, my findings are consistent with the hypothesis that more useful information is introduced to the market after an options introduction. More analysts, on average, start to follow the same company after options are listed upon its stocks. I find that the presence of additional analysts results in a slight decline in the (average) consensus estimate of the firm's future earnings and a wider dispersion of analysts' forecasts. However, analysts as a whole gradually become more accurate in their quarterly EPS estimates as measured by a smaller earnings surprise. In addition, reaction of investors to earnings surprise news shows a different pattern after options listings.

Optioned stocks tend to have a closer relationship between their past earnings or earnings forecasts and their past price performance. In the non-optioned case, negative standardized unexpected earnings (SUEs) or negative estimate revisions do not necessarily result in negative stock returns. However, the drift effect of earnings surprises is stronger in the case of non-optioned stocks; further, earnings momentum strategies continue to produce better return spreads after portfolio formation in the non-optioned group. This implies that earnings surprises of non-optioned stocks convey more informational content about the firms' future earnings ability and that momentum strategies can be implemented more successfully to exploit the

earnings momentum by buying past non-optioned earnings winners and selling past non-optioned earnings losers.

I also find support for the hypothesis that the magnitude of the stock split announcement effect is larger for non-optioned stocks than for optioned stocks. The market adjusts more rapidly to the split announcement during the post-announcement period for optioned stocks than for non-optioned stocks. Optioned stocks experience a clear reversion in returns three or four days after announcements, while the non-optioned stocks do not experience any reversion at all. Besides, stock splits tend to precede strong revision of earnings estimates by analysts. This tendency affects the split announcement for both the optioned and the non-optioned stocks.

I also analyze the impact of corporate takeovers on the two groups of stocks. Takeover announcements indicate that, on average, the current fiscal-year EPS forecasts increase significantly months following the takeover announcement for both optioned and non-optioned targets but the next fiscal-year EPS forecasts increase significantly only for the non-optioned ones. Takeover announcements of non-optioned targets seem to have more informational content than announcements of optioned target firms.

This research is organized as follows. Chapter 2 provides background discussion and a literature review of stock options listing, analyst forecast behavior, momentum strategies, and corporate events like stock splits and corporate takeovers. Chapter 3 describes the data and its sources and outlines the empirical methodology. Chapter 4 outlines the testable

hypotheses and empirical results of analyst behavior/forecast for optioned stocks compared to average S&P 500 stocks. Chapter 5 examines the informational content of stock options and momentum strategies. Chapter 6 examines corporate announcements like stock splits and takeovers. Chapter 7 concludes and summarizes my findings on the informational content of stock options.

CHAPTER 2. BACKGROUND AND LITERATURE REVIEW

2.1. Background

The popularity of organized stock options has inspired the investment community to examine the impact of options trading on stocks. What social functions do options markets perform? Does the existence of stock options markets improve the welfare of investors as a whole? Do stock options markets help improve the efficiency of existing stock markets?

Options markets may provide significant welfare benefits to investors with greater risk assessments. Through reduction in the actual risk of owning a certain common stock, stock options help change the preferences and opinions of different investors and help the economy reallocate scarce capital among competing firms. The prices of stock options, like prices of common stocks, contain the market's predictions and judgment about some corporate events. A better understanding of these social functions of the stock options markets can help us understand the benefits and drawbacks brought in by these markets and how the markets can be improved.

The classic Black-Scholes option-pricing model does not define clearly the role of stock options because arbitrageurs are assumed to be capable of duplicating all payoffs of a stock option with dynamic combinations of stocks and risk-free borrowing. Grossman (1988) raises the doubt that options and synthetic options are not identical instruments due to their

distinct informational content. It is practically cumbersome, if not impossible, to duplicate the payoffs of options by a dynamic stock-and-bond portfolio.

Stock options provide basically a means of hedging against unanticipated changes in stock price. Like insurance, stock options are very useful in dealing with catastrophic losses in stock markets. Both simple and complex strategies involving trading options in conjunction with stock and bond portfolios have been developed to control a portfolio's risk and even capture additional profits. While most traders can hedge the risk of underlying stocks by maintaining an opposite position in options, other traders may hold outright options positions to profit from their knowledge about the underlying stocks.

Ross (1976) pioneers the concept that options written on existing assets can improve the efficiency of incomplete asset markets by expanding the investment opportunity set facing investors and, as a result, provide additional risk-return tradeoffs. By helping stretch the state space covered by existing assets, derivatives can help market participants achieve better allocation of wealth.

Stock options also allow investors to circumvent some institutional restrictions on trading of underlying stocks, such as restrictions on short sale[1] and margin requirements on stock purchase. Restrictions like these could make an investment position costly or prohibitive. Investors who are

[1] Figlewski and Webb (1993) offer a detailed explanation on how trading in options actually reduce the effect of constraints on short sales.

reluctant to take positions due to high costs, can now take long or short position on a stock more freely and economically by trading options.

When stock prices are depressed in the market, traders are not allowed to sell short a stock according to the 'up-tick rule.' As a result of this asymmetric treatment of information, stock prices adjust much more slowly to negative information than to positive information. Now that put options are available in the market place, investors have an instrument to profit from negative information about a stock.

When the stock market experiences a long stretching downturn, traders using the market neutral strategy[2] realize that some of the short sale orders can not be executed completely without incurring extraordinary slippage. The final impact can be severe. If the trader midjudges the duration of the market downturn and decides to execute its buy orders first, the portfolio will expose itself to unnecessary market risk. If the market continues its free fall, the unrealized capital loss in the long portfolio may increase dramatically in a very short period of time without being compensated in the short portfolio. Even if the trader is able to execute the short orders eventually, the potential profit will, due to relatively low execution prices, diminish. Of course, the trader can choose to short alternate stocks instead, but that is not an optimal choice, either.

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[2] A market neutral strategy invests money in stocks believed more likely to go up in prices, while selling short an equivalent dollar amount of stocks believed more likely to go down in prices. By longing and shorting the same amount of capital, portfolio managers hope that the strategy can generate a net excess return without exposing the combined portfolio to huge market fluctuation.

Other restrictions, like margin requirements, also limit the investors' ability to profit from their information and judgment. Since an options contract costs only a fraction of the price of the underlying stock, it offers investors a cheaper way to participate in the movement of the stock market. Relatively cheap deep out-of-the-money call options on the stock can be used to test an investor's optimistic belief and out-of-the money put options can be employed to gain on negative information.

Investors barred from taking advantage of similar information earlier because of high transaction slippage or large initial investment requirement can now establish their positions more easily. As a result, stock options can help bring in some new information about the security to the market the first time.

Transactions in options markets may also be an important predictor of future stock price movements due to the nature of stock options. Rational traders and analysts can pick up the newly available information through observing the market actions and revise their expectations accordingly. As more investors are motivated to profit from trading upon their information, the market as a whole should be more homogeneous in judging a firm and should be able to reach a new equilibrium price faster, especially after certain dramatic news. Hence, options market may affect the manner in which stock prices adjust to the release of information relevant to firm valuation.

2.2. Stock Options Listing

Earlier empirical studies have examined stock prices around the announcement of the intention to list options contracts as well as their actual listing events. Distributive properties of stock prices before and after the event date are compared. Deviations in stock price behavior from pre-event "norms" generally are interpreted as the impact of options listings or other events.

Some studies take a different approach. They use a control portfolio methodology to compare the stock price behavior of optioned firms and non-optioned firms. Options exchanges do not randomly select firms for listing, and hence this technique is not flawless. Since optioned stocks tend to be more closely followed and are actively traded, finding a comparable non-optioned control portfolio seems almost impossible. This limitation also affects inevitably some of my tests here.

The investment community has been curious about the effect of options trading on the underlying stocks' price behavior. Conrad (1989) finds a persistent increase in the price of the underlying stock after options listing during the period between 1974 and 1980. One potential explanation for the positive price effect is the additional information hypothesis. Under this hypothesis, the introduction of options brings additional exposure and analysis of the underlying asset by financial analysts. This additional information provides more reliable estimates of future performance leading to an increase in the demand for the underlying stock.

Manaster and Rendleman (1982) argue that the options market may affect the manner in which stock prices adjust to the release of information relevant to firm valuation, since options markets may provide a preferred outlet for informed investors. The findings by Jennings and Starks (1986) are consistent with this hypothesis. Stock prices of non-optioned firms are found to take longer to adjust to earnings announcements than prices of optioned firms. This implies that the existence of the options market is useful in helping disseminate earnings news.

Damodaran and Lim (1991) attempt to explain the speedier stock price adjustment in the post-option-listing period. They report increases in both the number of analysts following the stock and the number of Wall Street Journal articles about the firm after the options listing. Skinner (1990) concludes that since stock options provide investors another tool for trading on information, the informational content of firms' accounting earnings releases is lower after options are listed on their stocks. This is consistent with the hypothesis that options listing improves the 'information efficiency' of the market and may reduce the 'informational content' of corporate announcements by the underlying firm.

Stock options volume and stock options premium have been used as indicators of movement in stock price in some trading strategies. The theory behind these strategies is that some corporate announcements may be signaled by heavy options trading volume in the days preceding the announcement. This phenomenon may be another direct result of the trading

activities of informed traders taking advantage of their information by using options instead of stocks.

Easley, O'Hara, and Srinivas (1998) focus on the linkage of price, volume, and information between the stock market and the options market. They argue that specific options volumes have informational content for future stock price movements. Both "positive news" options volumes and "negative news" options volumes have predictive power for stock price movements.

McGuire and Kudla (1991) suggest that information related to the over or under valuation of the stock's options is a useful indicator of future price performance of the stock, perhaps due to unusual trading as a result of well-informed anticipation or possibly due to insider trading. Detemple and Selden (1991) show that when the market is incomplete, the options market and the underlying securities market will interact and the valuation of options and the underlying security is a simultaneous pricing problem. However, Stephan and Whaley (1990) find that stock prices lead options prices, and not the other way around.

One concern, after the stock market crash of 1987, is that the listing of an options contract might be associated with a change in stock price volatility. The information released by new traders may have either a stabilizing or destabilizing effect on the stock market. If the new information is stabilizing, then, combined with the effects of increased liquidity, stock spreads should decline after options listing (Grossman (1988)). Alternatively,

if the information is destabilizing, its effect may be strong enough to offset the effects of increased liquidity, so that the stock spreads may increase after options listing (Stein (1987)).

Early studies, like Klemkosky and Maness (1980) and Whiteside, Dukes, and Dunne (1983), report random changes in the volatility and in the beta of the underlying security around options listing dates. Ma and Rao (1988) provide evidence that there is a differential market impact of options on underlying stocks. Volatile stocks become more stable after listing because of hedging behavior by uninformed traders and stable stocks become more volatile after listing because of increased speculation in the options markets by informed traders. The hedging behavior of uninformed traders tends to reduce noise, whereas the speculating behavior of informed traders tends to generate noise in the stock market.

Kumar, Sarin, and Shastri (1998) examine the impact of stock options listings on market quality of the underlying stocks. They test whether derivatives have a beneficial effect on the market for the underlying securities in terms of market microstructure characteristics. They hypothesize that options listings benefit the market quality of the underlying asset for three reasons. First, stock options expand the opportunity set facing investors and, therefore, reduce the volatility of underlying stock. Second, options listings may cause informed traders to migrate from stock market to options market and this may result in better liquidity in the underlying stock market due to lower adverse selection costs of market-

makers and narrower bid-ask spread. Third, since options provide a better speculative tool, options listings should encourage more information collection and usage, lower information asymmetry, and thus make the underlying stock market more efficient.

They show that the previously documented decrease in the bid-ask spread following options listings is accompanied by an increase in the number of contracts the specialist is willing to trade at the quoted prices. Lower spread and higher depth together provide evidence of higher liquidity, and suggest that larger trades can be executed at lower transaction costs after options listings. They also suggest that the level of information asymmetry and/or informed trading decreases for the underlying stocks following options listings.

In a recent study, Sorescu (2000) extends the studies by Conrad (1989) and Detemple and Jorion (1990). He examines all options listed on organized exchanges during 1973 to 1995 and finds positive abnormal returns for options listed during 1973 to 1980 and negative abnormal returns for options listed in 1981 and later. Three possible causes are pointed out in his paper: the introduction of index options in 1982, the implementation of regulatory changes in 1981, and the possibility that options expedite the dissemination of negative information.

2.3. Analyst Earnings Forecasts

Analysts' forecasts have become a unique source of information about a firm. Chen, Lin, and Sauer (1997) proxy a more active information environment by the increasing number of analysts following the stock.

Since financial analysts can access more data than simply the time series of past earnings, their forecasts are more current and informative than those generated from historical earnings information. In addition, even though management may have better information about the firm's current asset-in-place, operation, and any potential project, it is the analysts who have a broader knowledge about the competing environment and the whole industry's prospects. In addition, the management's forecast is usually affected by the corporate performance evaluation and compensation scheme. The consensus estimate of a firm's earnings by analysts provides a more objective estimate of a firm's earnings prospects.

Financial analysts compile their own earnings forecasts and buy-sell recommendations by relying on both privately collected information and research and publicly available information. Private information of analysts is gathered by constant inquiries to corporate officials, comparison of firms in the same industry, study of global competition, and acute response to new economic developments. As a result, financial analysts are seen both as providers of private information as well as information intermediaries.

Analysts' forecast of a company's quarterly (or annul) EPS has been acknowledged as a norm in evaluating a firm's performance. It is well

recognized that being able to beat the consensus estimate by a firm often presages future positive surprises plus superior stock performance, and vice versa. Bernard and Thomas (1989), among others, find that firms reporting unexpectedly high earnings outperform firms reporting unexpectedly poor earnings over a period of about 6 months after earnings announcement. In addition, upward revisions in earnings estimates by analysts often lead to positive price performance and downward revisions lead to future under-performance than its peers. Analysts' estimate revision or earnings surprise announcement by a certain firm in an industry is usually recognized as a key indicator for the entire industry.

Rajan and Servaes (1997) investigate analyst activities following initial public offerings. Analysts are found over-optimistic about the earnings potential and long-term growth prospects of recent IPOs. They find that, in the long run, IPOs have better stock performance when analysts ascribe low growth rather than high growth potential. These results suggest that IPOs' long-term under-performance anomalies may be partially driven by investors' over-optimism.

2.4. Momentum Strategies

Jegadeesh and Titman (1993) examine an immediate-term momentum strategy (over 3 to 12 months) by buying past winners and selling past losers and find evidence in support of the underreaction hypothesis. Many practitioners have adopted certain investment strategies aiming at exploiting

price momentum, by buying past winners and selling past losers. The popularity of this approach has grown to the extent that momentum investing constitutes a distinct, well-recognized style of investment in equity markets.

Chan, Jegadeesh, and Lakonishok (1996) document that the findings in Jegadeesh and Titman (1993) can be explained in part by underreaction to earnings information, but price momentum is not subsumed by earnings momentum. They indicate that past returns can be used in predicting future returns because the market and even financial analysts usually respond sluggishly to past earnings news. As a result, momentum strategies can be implemented to exploit the earnings momentum implied in the price momentum by buying past winners and selling past losers.

Rouwenhorst (1998) tries to address the price momentum issue by studying return patterns in an international context. He uses a sample of 2,190 stocks from 12 European countries in the period 1978 to 1995. He finds that between 1980 and 1995 after correcting for risk, an internationally diversified portfolio of past medium-term winners outperforms a portfolio of medium-term losers by more than 1 percent per month. The result holds for all 12 sample countries and lasts on average for about one year. Even though return continuation is negatively related to firm size, it is not limited to small firms.

Lee and Swaminathan (2000) rank all eligible stocks independently on the basis of both past returns and past trading volume and conclude that

price momentum is more pronounced among high volume stocks, but low volume stocks generally outperform high volume stocks after controlling for price momentum. In addition, they find that firms with high past turnover ratios tend to earn lower future returns and have more negative earnings surprises over the next eight quarters. They also show that price momentum effects reverse over the next five years and high volume winners experience faster reversals.

2.5. Corporate Events

Financial economists have realized that understanding the limitations on the information possessed by investors, or information asymmetries, is crucial in understanding financial markets. Previous theoretical models and empirical literature suggest that managers have information that is not fully reflected in stock prices and these prices may react to certain actions taken by the managers. Especially in the situation where managers possess an informational advantage over outsiders, moral hazard may hinder the transfer of information from insiders to outsiders. Certain corporate announcements have proven to convey useful information and impact stock prices over a period far beyond the announcement date.

In a frequently cited paper, Myers and Majluf (1984) argue that management has better information about the value of the firm than outsiders do. Since existing shareholders have to share their fortune embedded in assets-in-place and potential projects with new shareholders,

management may rationally forgo any positive-NPV project and decide not to issue new equity. On the other hand, a decision to issue new equity indicates that the asset-in-place is currently overvalued by the market and, on average, conveys negative information about the firm. The situation is aggravated by the fact that management also controls the power to call off the decision.

It is natural to look at earnings to understand movements in stock prices before and after certain corporate announcements, so as to rationalize the existence of any price changes. For example, Brous (1992) finds that, on average, the current fiscal-year earnings forecasts are significantly increased in the months prior to seasoned equity offering announcements and significantly decreased following the announcements.

The positive stock-split announcement effects have also been associated with favorable earnings forecast revisions and significant post-announcement earnings growth in some papers. Klein and Peterson (1989) find that companies announcing splits experience greater earnings forecast revisions than similar non-splitting matched controlled companies. Pilotte and Manuel (1996) examine stocks that split their stock at least twice during their test period and find that market does use previous split experience in interpreting a recurring split decision. Lakonishok and Lev (1987) also find some support for the signaling-based hypothesis from stock split announcements. They find that firms with an unusual growth in earnings and

stock prices announce stock splits. The splitting firms exhibits a somewhat higher growth in earnings than control firms after the split announcement.

I also consider the impact of corporate takeover announcements on acquisition targets. Previous studies have shown that the value of a target firm's common stock increases when a takeover announcement is made. Bradley, Desai, and Kim (1983) argue that this positive reaction is consistent with both the information hypothesis and the synergy hypothesis. The information hypothesis focuses on the possibility of a mismanaged or undervalued target firm before the announcement, while the synergy theory hypothesizes the synergistic gain that can be realized after the takeover.

Focusing on the implication of takeover announcement on the bidding firm, Harford (1999) hypothesizes that cash-rich firms are more likely than other firms to attempt acquiring others and that acquisitions by cash-rich firms are value decreasing. He finds that cash-rich firms are more likely to make diversifying acquisitions and their targets are less likely to attract other bidders. Consistent with the stock return evidence, he also concludes that mergers in which the bidder is cash-rich are followed by abnormal declines in operating performance. Overall, his evidence supports the agency costs of free cash flow explanation for acquisitions by cash-rich firms. Managers of cash-rich firms may make investments that are not value increasing for the shareholders.

Brous and Kini (1993) attempt to explore the relationship between takeover announcements and analysts' earnings forecasts on target firms.

Since analysts continue to estimate the earnings prospect of target firms as stand-alone firms even months after any takeover announcement, any earnings estimate revision by analysts immediately following the announcement may be linked directly to the announcement itself. Any evidence of upward revision implies that analysts had previously underestimated the target firm's earnings prospects and can explain the abnormal returns on target firms after takeover announcements. They find that the announcement-month forecasts are systematically revised upward. This supports the notion that a takeover announcement conveys favorable information about the target firm.

CHAPTER 3. DATA SOURCES AND EMPIRICAL METHODOLOGY

3.1. Data Sources

A list of companies with options listed on their stocks and the listing dates is obtained from Chicago Board Options Exchange. It includes stocks with options listed on the following five exchanges: Chicago Board Options Exchange, American Stock Exchange, New York Stock Exchange, Pacific Stock Exchange, and Philadelphia Stock Exchange. Only the first of any multiple listings is included in my sample. Both active and research stocks are included to reduce survivorship bias. The list is then matched with the Zacks Investment Research's (Zacks) historical monthly database and the CRSP Daily Master File. Firms not found on Zacks or CRSP are deleted from the sample. The final sample includes 1,383 firms with options listed between January 1983 and December 1995.

I use monthly Zacks database for two reasons. First, its software assists users to deal more accurately with stock splits and irregular fiscal-year cycle problems. I can not over-emphasize the importance of dealing with these problems accurately, since only about 75% of S&P 500 firms have a fiscal year ending in December. In addition, a 2-for-1 stock split may make a firm look like experiencing a huge deterioration of its earnings potential if previous month's estimate is not adjusted properly. Second, the Zacks software allows users to manipulate a time series or cross-section data more efficiently.

3.2. Analyst Earnings Forecast

I use the distribution of analysts' earnings expectations complied in the Zacks database as a proxy for the market's earnings expectations. I intend to test different aspects of changes in analysts' activities around the time of options listing. In addition, I compare results from subsamples of stocks listed on NYSE/AMEX versus NASDAQ. This allows us to check if changes in analysts' forecast activities after options listings are uniform irrespective of whether the underlying securities are traded on a listed exchange or the OTC .

Estimates of EPS for different fiscal periods and their 3-to-5 year growth rate forecasts are analyzed. The number of analysts issuing these estimates is available from Zacks. Standard deviations of analysts' forecasts for both the current and next fiscal years are used in testing the variability of estimates. Four-week (monthly) estimate revisions defined by Zacks are also analyzed. Stock returns, market index returns, the size of the company, and trading volumes are obtained from the CRSP daily return tapes.

Similar to other studies, I use estimates for the current fiscal year's EPS in this research. To broaden the scope of my study, in addition to EPS estimates for current fiscal year, I also use other estimates: next fiscal year, the current fiscal quarter, next fiscal quarter, and the 3- to 5-year EPS growth rate estimates. This helps broaden the dimension of my research as

informational content of revisions on current fiscal year's EPS normally diminishes as it approaches the end of the fiscal year.

3.3. Number of Financial Analysts

I check alternative measures of the number of analysts following a stock. Number of analysts issuing forecasts for current fiscal year's EPS, next fiscal year's EPS, current fiscal quarter's EPS, next fiscal quarter's EPS, and long-term EPS growth rate in Zacks monthly database are examined in order. Like other investment service companies, Zacks did not start to collect forecasts of fiscal quarterly earnings until a few years after they started collecting forecasts of fiscal year earnings. Number of valid data also shrinks as I extend the comparison periods before and after the option-listing month. Corresponding change in the number of analysts following average S&P 500 stocks is used as a benchmark.

The Zacks database provides data on the number of analysts used to compile the consensus earnings forecasts for each firm in each month. For each firm, I collect the data on number of analysts covering the stock for two years before and two years after the options-listing month. The option-listing month is denoted as month 0. The number of analysts issuing earnings estimates for the firm in each month between month −24 and month + 23 are examined. For each firm, an average number is calculated for different comparison periods before and after options listing: (-6, -1), (-12, -1), (-24, -1), (0, 5), (0, 11), and (0, 23).

Since Zacks database aggregates and issues the consensus forecast at the end of each month in their monthly database, the options listing month can be either included in the "after" period or deleted from both "before" and "after" periods. I also analyze the data by excluding the listing month from the after-period but find similar results and hence I do not report them in this study.

3.4. Earnings Estimate Revision

A revision in the distribution of analyst earnings forecasts after options listing would be evidence of an informational effect of options listing. An estimate revision can be defined as the difference between two consecutive monthly estimates divided by either the corresponding stock price or the absolute value of previous month's estimate. Normalizing the estimate revision by stock price avoids the problem caused by observations of EPS of a penny or two; however, this may reduce the visibility of any small revision and make it easier to conclude that analysts are sluggish in responding to any event. For a firm with a stock price of $30, a forecast revision from $0.01 to $0.02 is 100% if expressed in terms of the previous forecast, but only 0.03% in terms of stock price.

Both approaches are analyzed in this study. I define monthly analysts' estimate revision as either

$$ER_{j,t} = (F_{j,t} - F_{j,t-1}) / P_{j,t-1} * 100$$

or

$$ER_{j,t} = (F_{j,t} - F_{j,t-1}) / | F_{j,t-1} | * 100$$

where $F_{j,t}$ is the consensus EPS forecast for firm *j* at month *t* as reported, $F_{j,t-1}$ is the consensus EPS forecast for firm *j* at month *t - 1*, and $P_{j,t-1}$ is the share price of firm *j*'s common stock at the end of the prior month.

Extreme care has to be taken to avoid data pitfalls. I have to ascertain that all related numbers are properly adjusted for stock splits before calculating the estimate revision. Since I am using historical time series, a 2-for-1 stock split may make a firm look like experiencing a 50% deterioration of its earnings potential if the previous month's estimate is not adjusted properly. In addition, I must ensure that those two estimates are referred to the same fiscal year. Once a new fiscal year starts, the original estimate for the next fiscal year's EPS immediately becomes an estimate for the new fiscal year's EPS. This twist occurs once a year for every firm and has to be treated correctly. Since my database is able to incorporate into the system the month indicator when a firm's fiscal year ends, I am able to match and compare the consensus estimate data correctly. In addition, since the forecast for the fiscal year following the next fiscal year is not reported in Zacks historical database (or I/B/E/S historical tapes), I can not calculate the estimate revision on the next fiscal-year's EPS without interpolating it from Zacks own estimate revision data.

Analysts' forecasts of current fiscal year's EPS (FY1), next fiscal year's EPS (FY2), and long-term EPS growth rate are analyzed. Any evidence of upward or downward revisions implies that analysts have previously

underestimated or overestimated the target firm's future earnings before options contracts are listed on its shares. I can calculate the change in growth rate forecasts by comparing current month's forecast with last month's forecast.

Cumulative three-, six-, and twelve-month revisions on estimates for the current fiscal year after options listings are calculated and compared to the corresponding revisions a year ago to avoid seasonality issues[3]. Abnormal forecast revisions are also calculated by deducting the average estimate revision of S&P 500 firms in the corresponding period.

3.5. Earnings Estimate Divergence

Variability of analysts' earnings estimates is used as a proxy for the diversity of investors' beliefs about future earnings. I test whether the variability increases or decreases after options listing as the information environment changes as a result of options.

Since each firm's EPS tends to grow over time, standard deviation alone is not suitable for comparing firms of different magnitudes of EPS. The coefficient of variation (CV) is adopted as the measure of analyst forecast dispersion. The coefficient of variation in any month is measured by dividing the standard deviation of analysts' earnings estimates by the absolute value

[3] Analysts generally are overly optimistic at the beginning of the fiscal year and systematically revise their forecasts downward as the year proceeds. Further, Brous (1992) shows that the monthly forecast revisions are serially correlated because not all analysts update their forecasts on a monthly basis.

of consensus forecast[4]. I then compare the CVs before and after options listing.

Since the dispersion of consensus analyst forecasts may decrease over the year, comparing the CV for the months just before and after the options listing may not be appropriate. Therefore, I compare the CVs for the 12 months after options listing to the CVs of the corresponding 12 months in the prior year.

In addition, I standardize each month's CV by the average CV for the S&P 500 firms to control for differences in the CV across years[5]. The standardized CV for firm *j*, denoted SCV_j, is computed as $SCV_j = CV_j / CV_{S\&P}$ for each month. I compare the SCVs for the 12 months after options listing to the SCVs of the corresponding 12 months in the previous year to avoid the bias that the dispersion of consensus analyst forecasts may decrease over the year[6].

3.6. Earnings Estimate Accuracy (Earnings Surprise)

It is the quality, not just the quantity, of information that determines the usefulness of analysts' earnings estimates. A more precise estimate

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[4] Taking absolute value will avoid canceling out variability measurement when trying to find the average value and median value among stocks. In addition, to avoid the small denominator problem, a firm is deleted if the absolute value of consensus forecast is less than ten cents.

[5] Kumar, Sarin, and Shastri (1998) also standardize daily trading volume on the stock around option listing date by the average trading volume on all stocks listed on the CRSP Daily Master File for the day.

[6] An earnings estimate for the current year is simply the sum of estimates of four consecutive quarters of this year. As it approaches the end of the year and more earnings information is available, analysts become less disperse in their earnings estimates for the current year.

results in a smaller earnings surprise, positive or negative, and provides support of a better information environment after the options listing.

Actual quarterly EPS is compared with the consensus estimates for the same fiscal quarter. Monthly EPS estimate for current fiscal quarter is obtained from Zacks database and is compared to actual quarterly earnings at the end of each quarter. Since there exist three monthly estimates before the actual earnings is reported, each monthly estimate's *ex-post* error is standardized by its own absolute value to reduce the size effect. Therefore, I derive the final forecast error (*FE*) by dividing the dollar amount error with the absolute value of each monthly EPS estimate:

$$FE_{j,t,n} = (AE_{j,t} - F_{j,t,n}) / | F_{j,t,n} |$$

where

n is either 1, 2, or 3 (first, second, and third month of each quarter),

$AE_{j,t}$ is actual quarterly earnings announced by firm j in quarter t, and

$F_{j,t,n}$ is the monthly consensus estimate for firm j 's fiscal quarter t.

As analysts improve their forecast accuracy throughout the year, comparing two consecutive monthly forecast errors (FEs) may not make sense. For each firm, I compute a series of 12 monthly FEs after options listing and compare each of them with the FE a year ago. In addition, I standardize each month's FE by the average FE for the S&P 500 firms to control for differences in the FE across years. The standardized FE for firm j, denoted SFE_j, is computed as $SFE_j = FE_j / FE_{S\&P}$ for each of the twelve particular months.

3.7. Reactions to Earnings Surprises

Constrained by the availability of earnings surprise data from Zacks, in this section I focus on firms with options listed on their stocks in the period of 1988-1995. For each firm, I include data for four quarters before and four quarters after the options listing date. Only samples with significant earnings surprises (greater than +5% or smaller than -5%) are included. I also analyze separately firms with positive-earnings-surprise and ones with negative-earnings-surprise in each period.

To test for differences in reaction to earnings surprises due to options listing or exchange location, cumulative abnormal returns in announcement period are cross-sectionally regressed on the magnitude of earnings surprise, a dummy variable coded zero for firm/quarters before options listing and one for firm/quarters after options listing, and a dummy variable for stock listing on the OTC.

$$CAR_{jt} = a + b_1\, ESURP_{jt} + b_2\, D_{option,\,j} + b_3\, D_{OTC,\,j} + e_{jt}$$

where

CAR_{jt} is the post earnings 3 day announcement (days 0 to +2) market-adjusted abnormal return for security *j*,

$ESURP_{jt}$ is the earnings surprise for firm *j*,

$D_{option,j}$ is a dummy variable equal to 1 if options exist on the firm j, and equal to 0 otherwise, and

$D_{OTC,j}$ is a dummy variable equal to 1 if the stock is traded on the

OTC, and 0 otherwise.

The regression slope coefficient measures the stock-price reaction to earnings releases, conditional on the size of unexpected earnings and the two dummy variables.

Several previous studies find that stock returns exhibit a post-earnings-announcement drift, such that abnormal returns still exist for several months after the earnings are announced. To provide further insight into this, I postulate that the speed of information assimilation and stock price adjustment depends on the quality of information that can be improved by attracting more analysts toward an optioned stock.

I test the earnings surprise drift effect in a different manner by analyzing a longer period. For each optioned stock, four quarters before and four quarters after options listing date are earmarked. Each quarter's earnings surprise is defined as positive if it is greater than 5 percent and as negative if less than –5 percent. Daily abnormal returns (beta adjusted) over the period 10 days before and 30 days after earnings announcement date are calculated and aggregated for each of the following four subgroups: negative surprises of non-optioned stocks, positive surprises of non-optioned stocks, negative surprises of optioned stocks, and positive surprises of optioned stocks. The cumulative excess return for each group is graphed for comparison.

3.8. Momentum Strategies

I adopt a methodology similar to Chan, Jegadeesh, and Lakonishok (1996) with some modifications to fit my additional tests on momentum strategies. At the beginning of every month from January 1983 to December 1995, I first group stocks into optioned and non-optioned samples. Since optioned stocks tend to have larger capitalization, it is difficult to find non-optioned stocks with matched capitalization. To maintain a comparable non-optioned stock sample, I select the same number of non-optioned stocks as optioned stocks by market capitalization. In other words, if 350 optioned stocks are available in June 1984, I select 350 non-optioned stocks with the highest market capitalization in the same month. I then rank stocks in both groups on the basis of either past returns or a measure of earnings news and assign them to one of ten portfolios. All stocks are equally-weighted within a given portfolio.

While I use a stock's past 6-month return as a ranking variable in the price momentum strategy, I use two other measures as ranking variables in the earnings momentum strategy. The first earnings momentum measure is the standardized unexpected earnings (SUE) variable as used in Chan et al. (1996). The SUE for stock *j* in month *t* is defined as

$$SUE_{j,t} = (QEPS_{j,q} - QEPS_{j,q-4}) / \sigma_{j,t}$$

where

$QEPS_{j,q}$ is quarterly earnings per share most recently announced as of

month t for stock j,

$QEPS_{j,q-4}$ is the earnings per share four quarters ago, and

$\sigma_{j,t}$ is the standard deviation of unexpected earnings, $QEPS_{j,q} - QEPS_{j,q-4}$, over the preceding eight quarters, as employed in Chan et al. (1996).

The second measure of earnings news is given by change in analysts' forecasts of earnings. Since analyst estimates are not necessarily revised every month, I define estimate revision REV6, a six-month moving average of past changes in earnings forecasts by analysts:

$$REV6_{j,t} = \Sigma_i (FY1_{j,t-i} - FY1_{j,t-i-1}) / P_{j,t-i-1}$$

where

i is equal to 0, 1, 2, 3, 4, and 5 in order.

$FY1_{j,t}$ is the consensus estimate in month t of firm j's earnings for the current fiscal year (FY1) and

$P_{j,t-i-1}$ is the stock price prior to month t-i.

For each of the three momentum strategies, I compute buy-and-hold returns in the period subsequent to portfolio formation. At the end of the period I rebalance all the remaining stocks in the original portfolio to equal weights in order to calculate returns in subsequent periods. I also track my two measures of earnings momentum at the time of portfolio formation and thereafter.

3.9. Corporate Event: Stock Splits

I identify all stock split events by searching the CRSP Daily Master Tape. The announcement date, day 0, is defined as the date of the published announcement of the offering. I examine only splits of factors at least five for four and exclude all reverse splits. Stocks not covered in Zacks database are excluded. I find, during the period January 1985 to December 1995, about 3,434 announcements of stock splits were made by 2,285 firms with valid pricing and analysts' consensus estimate data. Among them, 799 announcements are made by firms after stock options are listed upon their stocks.

The first part of this study uses daily stock price returns to examine the valuation effect of stock split announcements. To isolate the market response to a split announcement, the event-time methodology is applied on the sample. Daily returns are then characterized according to when they occur in event time. Day 0 is the date of the first announcement of the firm's intention. Results from both subsamples, optioned stocks and non-optioned stocks, are then compared.

I adopt the mean adjusted return model used in Brown and Warner (1985). Under this method, the mean return for a comparison period is assumed to be the expected return for a given security. This expected return is compared to the actual return of the particular security for the event

period. The difference is the abnormal return. The comparison period[7] used in this study is similar to that used by Grinblatt et al. (1984), and includes days 4 to 43 relative to the announcement date of the stock split.

For each event day (-40, ..., 0, ..., +40), the cross-sectional mean daily return, R_t, is compared to a post-announcement benchmark return. The benchmark return is the grand daily mean return over the 40 trading day period from event day +4, ..., +43, inclusive. A *t*-test is used to test the null hypothesis that the difference between the mean daily return for the event day in question and the grand mean daily return during the 40 day post-announcement benchmark period is zero against the two-tailed alternative hypothesis that the difference is nonzero.

$$t = (R_t - \bar{R}) / \sqrt{\sum_{i=4}^{43} (R_i - \bar{R})^2 / 39}$$

where $\bar{R} = \sum_{i=4}^{43} R_i / 40$ and R_i = average return across securities on event day *i*.

I extend 40 days before and after announcements to compare the cumulative excess returns of both optioned and non-optioned samples. The result should help us visualize the impact of stock split announcements on different groups of firms.

[7] The average returns in the days subsequent to the announcement are appropriate benchmarks for the expected returns of these securities if mean returns are stationary and if the market is informationally efficient.

Next I analyze the analysts' estimate revisions for the splitting firms' earnings prospective. I adopt consensus earnings forecasts for individual stocks by financial analysts collected by Zacks. The observed monthly earnings forecast revision for firm *j* during month *t* is computed as follows:

$$ER_{j,t} = (F_{j,t} - F_{j,t-1}) / | F_{j,t-1} |$$

where $F_{j,t}$ is the consensus EPS forecast for firm *j* at month *t* and $F_{i,t-1}$ is the consensus EPS forecast for firm *j* at month $t - 1$. Any change in the analysts' forecasts of earnings following the corporate announcement is tested for statistical significance.

3.10. Corporate Event: Corporate Takeover (on Target Firms)

Next, I test analysts' estimate revisions made immediately after a corporate takeover attempt is made on both optioned as well as non-optioned firms. I use data from Thomson Financial Securities Data to identify takeover announcements and the announcement dates. Only domestic takeover announcements between January 1986 and December 1995 with amounts exceeding $50 million, are included in the sample. I delete takeover announcements, if the target firm is not covered in the Zacks database. Only 98 optioned and 332 non-optioned target firms are left in the final sample. I again code the announcement month as event month 0.

A month-by-month study of analysts' estimate revision of target firms' earnings perspective is conducted after takeover announcement. I use the forecast series for both the current-year earnings per share and the next-year

EPS to examine revisions in analysts' expectations for the firm's near-term earnings. All revisions are compared to the absolute values of previous month's estimate made on the corresponding fiscal-year EPS. Each revision is adjusted by the average estimate revision on the S&P 500 firms in the same period to include the impact of the movement of the overall market. Both Wilcoxon and sign tests are used for significance tests.

CHAPTER 4. INFORMATIONAL CONTENT OF OPTIONS AND ANALYST FORECASTS

4.1. Hypotheses

This section articulates the questions related to analysts' activities before and after options listings. Are more analysts and greater research interests directed to the underlying stock following an options listing? Do analysts revise their earnings estimates and recommendations favorably or unfavorably toward stocks with newly listed options? Are analysts less dispersed or more variant in their forecasts following an options listing? Are analysts' forecasts more accurate following options listings? Does the market react to earnings surprise announcement differently after options listing?

4.1.1. Number of Financial Analysts

Many brokerage houses generate a great portion of their total revenue from commissions and need to accommodate their clients' information needs to keep their business. While full-service brokers provide clients proprietary in-house financial research, discount and on-line brokers may provide clients information from some independent third-party financial services firms. Since the introduction of options on stocks changes the incentives for corporate information collection and attracts greater institutional and individual interest in the underlying stock, more financial analysts are expected to be hired to examine the underlying firm's earnings prospects.

Skinner (1990), using the IBES database, finds that the average number of analysts following a stock increases from 11.8 before options listing to 15.4 after options listing and interprets the increase as an indication of more private information being available to the market[8]. The major finding of the study is that the market as a whole becomes more precise in predicting earnings after options listing while the forecast accuracy of individual analysts does not change around the same time. Skinner conjectures that the contradiction is the result of more analysts following firms after options listing.

The number of analysts tracking a given stock measures essentially the quantity of available information about the firm. More analysts following the same stock broadens the total coverage of a firm's activity and performance. It also improves the deepness of analysts' research on a firm's earnings prospects. As a result, the amount of information available about the firm to the investors should improve in terms of both quantity and quality. In this research I try to determine whether the number of analysts following the stock changes significantly after options listing. The first hypothesis examined here is:

Hypothesis 1: The number of analysts tracking a stock increases significantly after options are listed on the underlying stock.

[8] Skinner (1990) uses forecast data issued by Value Line in his study. Similar to O'Brien and Bhushan (1990), he indicates that this increase is not totally due to an upward trend in analyst following. The

Non-parametric tests are used for examining statistical significance. I reject the null hypothesis if the median number of analysts following the stock after options listings is not greater than the median number prior to options listings. A change in the number of analysts following the stock in a 24-month period is considered significant only when the percentage change is actually greater than the percentage change in the average number of analysts following the S&P 500 firms during the same period.

4.1.2. Earnings Estimate Revision

By comparing earnings estimates at two points in time, I can analyze how market expectations about a firm's earnings prospects shift. As investors incorporate earnings estimates in the stock valuation, any estimate revision should impact the stock price. Any event or news, which may cause shift in market expectation, is worth a thorough analysis.

Financial analysts may revise their earnings forecasts when new information arrives or when their own proprietary research produces a different estimate. Of course, periodic earnings and other announcements by companies also offer analysts opportunities to revise their estimates accordingly.

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average (median) per year change in the number of analysts following stocks on IBES database tape over the 1981 to 1987 period is 0.7 (0.0).

Any event or announcement that conveys additional information, directly or indirectly, about a firm's earnings can result in an estimate revision. However, even though a firm's earnings prospects are considered in its decision to list its stock, they may not usually considered vital when an exchange decides to list options on the underlying stock. Options listing may convey any information (favorable or unfavorable) regarding the firm's short-term or its long-term earnings prospects. On the other hand, due to the possible change in the number of analysts following the same stock after options listing, I am curious about any impact that additional analysts and their estimates may have on the calculation of consensus earnings number.

I want to examine if new analysts, who start following the stock after options listing, are more optimistic or pessimistic than the other existing analysts regarding the firm's earnings prospects and if they bring any changes to the consensus estimates? Or, are they more willing to follow existing analysts and issue similar estimates when they just start? In addition, I test whether there is additional information available after options listing.

Hypothesis 2: Stock options listings do not cause any unusual revisions in the estimates of a firm's short-term and long-term earnings prospects.

The null hypothesis is that the percentage of positive revisions equals 50%. I test the hypothesis using the Wilcoxon matched-pairs signed-rank statistic. Any evidence of upward or downward revisions implies that analysts have previously under-estimated or overestimated the target firm's future earnings before options contracts are listed on its shares.

4.1.3. Earnings Estimate Divergence

As noted above, analyst coverage is likely to increase following stock options listings as a result of increased investor interest in the underlying stocks. To test whether there are improvements in analysts' ability to predict firms' performance after options listing, I examine analysts' earnings forecast divergence and forecast accuracy surrounding the options listing.

Investors do not accept all consensus earnings estimates without considering the variability of these estimates. Investors feel more confident about a consensus estimate if the estimates are all within a narrow range. Whether or not the variability of analysts' earnings estimates changes after a stock options listing is critical. If a new options listing does bring in more analysts to follow the stock, any significant change in the variability of analysts' estimates implies a change in the information environment, too.

Since new analysts may bring in additional information to the original information pool, analysts may become more disperse in their estimates. On the other hand, new analysts may tend to be less experienced in forecasting the EPS for the optioned firm, and may simply follow the flock and issue

similar estimates in the early stages. Information noise may increase as more analysts and investors follow the stock after options listing.

If more informed traders reveal their information through transactions in either stock market or stock options market, investors and analysts should revise their estimates toward a narrower range. However, Barry and Jennings (1992) examine the issue of information and diversity of analyst forecasts and document that dispersion of analyst earnings forecasts increases even though the amount of available information increases. They test the model empirically by using the number of analysts as a proxy for the amount of private information available.

Hypothesis 3: There is no significant change in the variability of analyst forecasts after a stock options listing.

A wider distribution of analysts' forecasts will reduce the usefulness of the consensus estimates. Any evidence of a significant change in SCVs signifies that analysts become either more or less dispersed in viewing a firm's earnings prospects.

4.1.4. Earnings Estimate Accuracy (Earnings Surprise)

Earnings surprises can be attributed to the quality of available information. Forecasting accuracy of analysts can be measured by comparing their consensus forecasts with the corresponding period's actual earnings. If

I use the mean analysts' forecast as a proxy for the market expectation of a firm's earnings, the unexpected component of the corporate earnings announcement is the difference between the actual earnings announced and the analysts' consensus estimate for the corresponding fiscal period.

The presence of more analysts following a stock does not warrant a more congruent and accurate earnings estimate, if the new analysts do not bring in better or additional information into the consensus estimates. The estimates issued by analysts may be colored by other incentives such as the desire to encourage investors to trade more and thus generate brokerage commissions. Analysts may be pressed by companies to steer clear of negative ratings. Herding effect is especially common in analysts' earnings forecasts. Even when one analyst has special or more accurate information, the analyst revises his or her estimate gradually. They recommend far more buys than sells and it is quite unlikely for an analyst to issue a strong sell signal about a stock. As a result, accuracy of analyst forecasts is still a doubt for many investors.

If information is costless, the information gathered by many analysts should be more valuable and complete than by only one analyst. Better information and thorough analyses about a firm's performance should result in better earnings forecast and, in turn, reflect in a smaller earnings surprise. Even if the number of analysts following a firm does not increase and as more potential investors reveal their information through increased transactions in the stock market or options market, analysts may use the

increased information flow to refine their earnings forecast. This notion motivates the following null hypothesis:

Hypothesis 4: Accuracy of analyst forecasts should improve after a stock options listing.

The sign test and the Wilcoxon signed rank test, which uses both the sign and magnitude of the differences, are used. I test if the percentage of firms experiencing decreasing SFEs is significantly greater than 50% or not.

4.1.5. Reactions to Quarterly Earnings Surprises

Academic research has documented that positive earnings surprises often presage future positive surprises plus superior stock performance, and vice versa. The explanation for this finding is that unexpected earnings provide new information about future cash flows. If earnings changes convey new information about expected cash flows, the stock market should respond to these changes. Prior studies postulate that the quality and quantity of information as well as the direction and magnitude of earnings surprises contribute to abnormal stock price changes.

Bernard and Thomas (1989), among others, find that firms reporting unexpectedly high earnings outperform firms reporting unexpectedly poor earnings. The superior performance persists over a period of about six months after earnings announcements. This effect is a well-documented

violation of the semi-strong form efficient market hypothesis. The post-earnings-announcement drift is a failure of prices to reflect the full implications of current earnings for future earnings.

Since the quantity and quality of information may improve after stock options are introduced, investors should adjust more quickly to the arrival of new information and the drift effect should subdue. More analysts can help the market reduce the time span it takes to disseminate and digest information implied in a new earnings announcement. As a result, it may reduce the informational content and price impact of the earnings announcement. However, it does not affect the fact that previous earnings do imply a firm's future earnings prospects and the impact on stock price is positively correlated to the surprise.

On the other hand, does a similar percentage of earnings surprise conveys a similar or a different message to investors of optioned stocks versus non-optioned stocks? The direct impact of an earnings surprise on stock prices should be different for the two subgroups. Take a negative announcement, for example. Since put options allow investors to use their pessimistic information about the stock more easily, a negative earnings surprise issued by an optioned stock may surprise the market more.

Hypothesis 5: Options listing reduces the post-earnings announcement drift effect.

4.2. Empirical Result

4.2.1. Number of Financial Analysts

Table 1 presents analyst activity around options listings. For each firm, an average number of analysts issuing estimates is calculated for different comparison periods before and after options listing. The average number of analysts 6 months after options listing (month 0 to month +5) is compared to the average number of analysts following the stock 6 months before options listing (month -6 to month -1). In addition to the 6-month comparison period, I also compare the average number of analysts before and after options listings on both a 12-month basis and a 24-month basis. My results are consistent with the hypothesis that the number of analysts following a certain stock increases around the time of options listing.

Panel A, Table 1, presents the sample statistics. I have data ranging from 400 firms to over 1100 firms, depending on the comparison period used and the variable analyzed. For example, among the 1,383 sample options-listed stocks, 1,117 of them have all 12 numbers of analysts issuing the current-fiscal-year EPS estimates six months before and after the options-listing month. The number of firms decreases when I extend the comparison period beyond six months. It is seen from Panel A that more analysts tend to issue estimates for yearly EPS than for quarterly EPS, as the number of firms decrease dramatically in the case of quarterly EPS estimates.

Table 1
Number of Analysts Following the Same Stock Before / After Stock Options Listings (between January 83 and December 95)

	FY1[†]	FY2	LTG	FQ1	FQ2
Panel A: Number of stocks with valid data					
6-month[‡]	1,117	1,004	1,019	780	677
12-month	986	881	906	651	565
24-month	806	715	748	460	403
Panel B: Average (Median) difference in number of analysts following the same stock around options listings					
6-month	0.7	0.3	0.5	0.4	0.3
	(0.5)	(0.3)	(0.3)	(0.4)	(0.2)
12-month	1.3	1.0	0.8	0.8	0.6
	(1.2)	(0.9)	(0.7)	(0.7)	(0.5)
24-month	2.3	1.7	1.5	1.3	0.9
	(2.1)	(1.5)	(1.3)	(1.2)	(0.8)
Panel C: Average (Median) percentage difference in number of analysts following the same stock around options listings					
6-month	16.9	18.9	21.0	21.4	20.3
	(8.3)	(7.1)	(8.3)	(13.0)	(9.1)
12-month	25.6	23.9	31.3	31.6	33.9
	(17.4)	(16.4)	(17.4)	(21.3)	(22.2)
24-month	44.5	38.7	50.3	55.2	50.7
	(32.1)	(27.0)	(33.0)	(38.6)	(40.0)
Panel D: Similar to Panel B, except that the difference of each stock is adjusted by the difference of average number of analysts following S&P 500 firms in corresponding period[§]					
6-month	0.5	0.3	0.3	0.2	0.2
	(0.4)	(0.3)	(0.3)	(0.2)	(0.2)
12-month	0.8	0.5	0.4	0.4	0.3
	(0.7)	(0.4)	(0.4)	(0.3)	(0.2)
24-month	1.2	0.7	0.6	0.5	0.3
	(1.1)	(0.5)	(0.5)	(0.4)	(0.3)

- Table 1 continued -

Panel E: Percentage of stocks with positive relative change in number of analysts (Individual stock's difference versus average S&P 500's in the same period) (Wilcoxon signed-rank statistic in parentheses)

6-month	61.3	53.9	59.8	55.4	56.6
	(8.2)*	(2.8)*	(7.6)*	(3.6)*	(3.8)*
12-month	63.6	60.4	59.6	59.1	57.7
	(11.4)*	(8.0)*	(6.8)*	(6.0)*	(4.9)*
24-month	67.4	62.0	61.2	59.3	58.8
	(11.4)*	(7.8)*	(7.9)*	(4.9)*	(4.8)*

† FY1: estimate for current fiscal year's EPS
FY2: estimate for next fiscal year's EPS
LTG: estimate for next 3-to-5 years' EPS growth rate
FQ1: estimate for current fiscal quarter's EPS
FQ2: estimate for next fiscal quarter's EPS

‡ Take the 6-month comparison period as example. Average number of analysts issuing estimates during the period, month -6 to month -1, is compared to the average number of analysts in the period, month 0 to month 5.

§ Take Microsoft (03/12/87) as an example. While the 6-month average number of analysts issuing the long-term EPS growth rate estimate for Microsoft increased from 6.2 (09/86~02/87) to 10.5 (03/87~08/87), the average number of analysts following one of the S&P 500 stocks for the same period increased only by 2.7. Therefore, Microsoft has experienced an increase in analysts following, more than the average S&P500 firm during the same period.

* Statistically significant at 1% level.

I document in Panel B the absolute change in the average number of analysts following a stock before and after options listing. I first identify the options-listing date for each stock. For example, options were first listed on Microsoft on March 12, 1987. The average number of analysts issuing current-fiscal-year EPS estimates for Microsoft increased from 13.00 six months before the options listing date (09/86 ~ 02/87) to 14.57 six months after the date (03/87 ~ 08/87), resulting in an increase of 1.57. Among the 1,117 firms with valid data over the 6-month comparison period, the average increase in the number of analysts is 0.7, while the median is 0.5. The average number of analysts issuing current fiscal-year's earnings estimates increases between 0.7 and 2.3 (and the median increases between 0.5 to 2.1), depending on the testing period (Panel B). The average number of analysts issuing other estimates also increases after options listing but by a smaller amount.

I also present the changes in the number of analysts on a percentage basis. In percentage terms, the change is even more drastic, as illustrated in Panel C of Table 1. The increase ranges between 17% (current fiscal year, 6 months) and 55% (current fiscal quarter, 24 months). Using the Microsoft case, I get an increase of 12% as the average number of analysts increased from 13 to 14.57 in the 6-month comparison period.

To test whether the increase in the number of analysts following optioned stocks is significant, I compare each firm's change to a benchmark. During the 6-month period, September 1986 to February 1987, a typical

S&P 500 firm was followed by, on average, 13.57 analysts. The number dropped to 13.3 during the 6-month period between March 1987 and August 1987. The change in the number of analysts following Microsoft during the same period of time is, therefore, larger than the change happening to an average S&P 500 firm. The S&P 500-adjusted change in the average number of analysts following Microsoft is 1.84 (=1.57-(-0.27)). I then present the S&P 500-adjusted results of analysts following the stocks before and after options listings in Panels D and E, Table 1.

In both Panels D and E, I find that an increase in the number of analysts following the stock after options listings is not fully caused by an overall increase in analysts in the stock market. First, the change for each stock is compared to the change for the average S&P 500 firm during the same period. Panel D provides evidence that the increase in analysts issuing earnings estimates after any options listing can not be fully explained by an overall upward trend in the analysts following the average stock in the S&P 500.

Second, in Panel E, based on the S&P 500-adjusted changes in the number of analysts following, I compute the percentage of optioned stocks that experience a positive increase in the number of analysts following the stock. The Wilcoxon signed-rank statistics for all five earnings forecasts in Panel E indicate that I can not reject the null hypothesis that the number of analysts following a stock tend to increase after options introduction.

In Table 2 I extend the analysis by splitting the overall sample into two subsamples, one for exchange listed stocks (Part I) and the other for over-the-counter (NASADQ) traded stocks (Part II). As illustrated in Panel A of both Parts I and II, the number of stocks is evenly distributed across the two subgroups, irrespective of the comparison period and the statistic/variable analyzed. For example, 553 (or 49.5%) of the 1,117 optioned stocks with valid 6-month comparison data are traded on exchanges (NYSE/AMEX), while the remaining 50.5% are traded on NASDAQ. Furthermore, both panels show a pattern similar to Panel A of Table 1. The number of stocks decreases when I extend the comparison period and analysts tend to cover more stocks in their forecasts of annual EPS than in their forecasts of quarterly EPS.

Statistics in Panels B and C are complied in a manner similar to the corresponding panels in Table 1. Panel B shows the average difference in the number of analysts following the NYSE/AMEX stock around options listing. For example, as shown in the second row of Panel B in Part I (NYSE & AMEX listed stocks), the number of analysts issuing EPS forecasts for current fiscal year increases, on average, by 1.2 for a typical exchange-traded stock. This is based on a comparison period covering up to 12 months before and after options listings. The corresponding increase is 1.4 in the case of a NASDAQ listed stock, as shown in Panel B of Part II.

Table 2
Number of Analysts Before / After Stock Options Listings:
Exchange Listed Stocks versus NASDAQ (OTC) Listed Stocks
(between January 83 and December 95)

Part I: NYSE & AMEX Listed Stocks

	FY1	FY2	LTG	FQ1	FQ2
Panel A: Number of stocks with valid data					
6-month	553	494	542	364	307
12-month	499	451	492	316	270
24-month	433	389	427	236	212
Panel B: Average (Median) difference in number of analysts following the same stock around options listings					
6-month	0.7	0.1	0.5	0.3	0.1
	(0.5)	(0.0)	(0.3)	(0.3)	(0.1)
12-month	1.2	0.9	0.7	0.6	0.4
	(1.1)	(0.7)	(0.7)	(0.6)	(0.3)
24-month	2.2	1.6	1.4	1.2	0.8
	(2.2)	(1.5)	(1.3)	(1.1)	(0.7)
Panel C: Similar to Panel B, except that the difference of each stock is adjusted by the difference of average number of analysts following S&P 500 firms in corresponding period[5]					
6-month	0.4	0.4	0.2	0.2	0.0
	(0.2)	(0.4)	(0.3)	(0.2)	(0.1)
12-month	0.6	0.4	0.3	0.3	0.2
	(0.5)	(0.2)	(0.3)	(0.2)	(0.1)
24-month	0.9	0.5	0.4	0.4	0.3
	(0.8)	(0.4)	(0.5)	(0.4)	(0.2)

- Table 2 continued -

Part II: NASDAQ (OTC) Listed Stocks

	FY1	FY2	LTG	FQ1	FQ2
Panel A: Number of stocks with valid data					
6-month	564	510	477	416	370
12-month	487	430	414	335	295
24-month	373	326	321	224	191
Panel B: Average (Median) difference in number of analysts following the same stock around options listings					
6-month	0.8	0.6	0.6	0.6	0.4
	(0.6)	(0.5)	(0.4)	(0.5)	(0.3)
12-month	1.4	1.1	0.9	0.9	0.7
	(1.3)	(1.0)	(0.7)	(0.8)	(0.7)
24-month	2.4	1.8	1.6	1.5	1.1
	(1.9)	(1.6)	(1.3)	(1.2)	(1.0)
Panel C: Similar to Panel B, except that the difference of each stock is adjusted by the difference of average number of analysts following S&P 500 firms in corresponding period[§]					
6-month	0.6	0.1	0.4	0.2	0.3
	(0.5)	(0.2)	(0.4)	(0.1)	(0.3)
12-month	1.0	0.6	0.6	0.4	0.3
	(1.0)	(0.6)	(0.6)	(0.4)	(0.3)
24-month	1.6	1.0	0.9	0.5	0.4
	(1.4)	(0.7)	(0.7)	(0.3)	(0.3)

§ If an optioned firm has an increase of 1.3 in the average number of analysts over the 6-month comparison period and if the average number of analysts following S&P 500 firms increases by 0.8 during the same period, I conclude that the firm has an adjusted 0.5 increase in the average number of analysts around the options listing.

Similar to Table 1, Panel C presents the market-adjusted change in the number of analysts following an optioned stock during the same comparison period to remove any possible overall trend of analyst activities. This is calculated by deducting from each firm an average change in the number of analysts following a S&P 500 firm and presented for NYSE/AMEX in Panel C, Part I and for NASDAQ in Panel C, Part II. The NASDAQ stocks again seem to have a larger increase in the number of analysts following options listing for all five forecasts.

Results in Table 2 imply that options listings have more informational impact for OTC stocks than exchange-traded stocks. It coincides with the fact that exchange-listed stocks tend to have larger capitalization and are followed by more analysts even before options are listed on their stocks.

4.2.2. Earnings Estimate Revision

Earnings estimate revisions by analysts after options listings, standardized by previous estimates or last month's stock prices, are presented in Table 3. I first take the difference of estimates from two consecutive months and then divide the dollar difference by either the stock price of the first month or the estimate of the first month. Panels A and B exhibit estimate revisions during the 3-month, 6-month, and 12-month periods after options listings relative to stock prices, while Panels C and D show those revisions relative to earlier estimates.

Table 3
Median Earnings Estimate Revisions after Options Listings
(between January 83 and December 95)

Column†	2	3	4	5	6	7	8
Panel A: Estimate revision for current fiscal-year's EPS (standardized by previous stock price)							
3 months	0.00	45.8	-0.06	42.8	-0.23	34.5	-9.82 (0.01)
6 months	-0.08	42.2	-0.14	40.4	-0.42	33.9	-11.07 (0.01)
12 months	-0.37	38.4	-0.39	38.0	-0.88	31.7	-12.82 (0.01)
Panel B: Estimate revision for next fiscal-year's EPS (standardized by previous stock price)							
3 months	0.00	45.6	-0.04	45.8	-0.19	40.8	-5.52 (0.01)
6 months	-0.03	43.7	-0.14	43.6	-0.41	37.7	-7.65 (0.01)
12 months	-0.40	38.0	-0.52	37.1	-0.85	35.2	-11.72 (0.01)
Panel C: Estimate revision for current fiscal-year's EPS (standardized by previous estimate)							
3 months	0.00	47.2	-1.09	42.8	-3.48	41.8	-5.74 (0.01)
6 months	-1.11	43.2	-2.97	40.4	-7.70	38.1	-9.53 (0.01)
12 months	-4.46	40.6	-7.44	38.1	-20.00	35.9	-11.26 (0.01)
Panel D: Estimate revision for next fiscal-year's EPS (standardized by previous estimate)							
3 months	0.00	46.6	-0.49	46.5	-2.41	42.7	-4.30 (0.01)
6 months	-0.27	45.2	-2.21	43.6	-6.04	40.6	-6.97 (0.01)
12 months	-3.81	41.5	-6.91	37.6	-9.26	40.0	-8.99 (0.01)

- Table 3 continued -

† Column 2: Median estimate revision (%) of optioned stocks after options listings

Column 3: Percentage of optioned stocks with positive estimate revision after options listings

Column 4: Median of abnormal estimate revision (%) of optioned stocks after options listings (relative to estimate revision 1 year ago)

Column 5: Percentage of optioned stocks with abnormal positive estimate revision after options listings (relative to estimate revision 1 year ago)

Column 6: Median of abnormal estimate revision (%) of optioned stocks after options listings (relative to average S&P 500's estimate revision in the same test period)

Column 7: Percentage of optioned stocks with abnormal positive estimate revision after options listings (relative to average S&P 500's estimate revision in the same test period

Column 8: Wilcoxon signed rank statistic and *p*-value in parentheses

I first focus on Panels A and B of Table 3. All three periodic median estimate revisions after options listings are non-positive in all three panels (Panels A and B, column 2). The median estimate revision ranges from 0% three months after options listings to -0.4% in the case of forecasts for next fiscal year's EPS over the 12 months after options listings. Column 3 shows the percentage of optioned stocks with positive estimate revisions a few months after options listings. The percentage ranges from 38 to 46 in Panels A and B. Results in columns 1 and 2 are consistent with the notion that analysts tend to be optimistic in the beginning of the year and cut their estimates gradually through the year. Therefore, I need to distinguish further between estimate revisions caused by options listings and estimate revisions caused by observed pattern of analyst forecasts.

I proceed to compare each firm's estimate revision with its corresponding estimate revision a year ago to remove any calendar month impact. Take Cisco's options listing as an example. Options were listed on Cisco's stock on June 25, 1991. Analysts revised their forecasts for Cisco's current-fiscal-year EPS upward by about 3% between May 31, 1991 and August 31, 1991. However, in the year before options listing, analysts revised their forecasts for Cisco's EPS by a strong 18.7% between May 31, 1990 and August 31, 1990. When adjusted by the corresponding estimate revision a year ago, the median after-option-listing negative estimate revision becomes more pronounced, as illustrated in columns 4 and 5. The median of adjusted estimate revisions in column 4 is slightly more negative, and I even

record a negative 0.06% and a negative 0.04% in the 3-month period after options listings. I see from column 5 that if I adjust each revision by the corresponding revision one year ago for each optioned stock, there is a slightly smaller percentage of them receiving a positive estimate revision a few months after options listings. The percentage drops from 45.8% to 42.8% in the 3-month case in Panel A.

I derive columns 6 and 7 in a way similar to columns 4 and 5, except that each revision is adjusted by the average S&P 500 revision in the same period. Here I use the arithmetic average of the 500 estimate revisions of the S&P 500 firms as a benchmark. The results are similar to those in columns 4 and 5, if not stronger than. The median estimate revision after market adjustment now ranges from -0.19% to -0.88% and less than 41% of optioned stocks now show a positive estimate revision after adjusting for the average S&P 500 revision. I also record the Wilcoxon z-statistics (and *p*-value) in column 8 to demonstrate that analysts tend to give stocks with recent options listings more conservative earnings forecasts.

I extend the above analysis of estimate revisions in Panels C and D by standardizing the estimate revision by previous estimate instead of stock price. My results are similar to Panels A and B and further support my hypothesis that analysts tend to be more conservative with the earnings forecast after options are listed on them.

There are three plausible reasons behind these observations in Table 3. First, as new analysts are hired to follow a firm after options listing, they

tend to have more conservative estimates than current analysts do. Second, since I use previous month's stock price in the denominator and previous research has shown that options listing tend to have a permanent positive impact on stock price, I actually introduce a negative bias toward the estimate revision calculation. Third, new analysts choose to give estimates slightly lower than the average in the beginning and as they revise their estimates through time as other analysts do, they are not perceived to be as pessimistic in their views. To test the first argument I need detailed analyst estimates, which is beyond the scope of this research. However, since Panels C and D reveal a similar picture by standardizing estimate revisions with earlier estimates instead of stock prices, the second reason can be rejected.

This downward revision seems to affect all stocks, irrespective of whether they are listed on NYSE/AMEX or on NASDAQ, as reported in Table 4. Similar to Table 3, I find that more optioned stocks experience negative consensus estimate revisions than positive revisions after options listings. The medians are all negative in both Part I (NYSE/AMEX) and Part II (NASDAQ). New consensus estimates for optioned stocks are relatively lower after options listings, compared either to similar estimate revisions one year ago (column 4) or to the average estimate revision of S&P 500 firms in the same period (column 6).

Table 4
Median Earnings Estimate Revisions after Options Listings: Exchange Listed Stocks versus NASDAQ (OTC) Listed Stocks (between January 83 and December 95)

Part I: NYSE and AMEX Listed Stocks

Column†	2	3	4	5	6	7	Observations
Panel A: Estimate revision for current fiscal-year's EPS (standardized by previous stock price)							
3 months	-0.03	42.4	-0.07	44.3	-0.23	36.6	533
6 months	-0.12	39.5	-0.19	39.4	-0.38	36.5	553
12 months	-0.43	35.5	-0.30	40.3	-0.72	36.1	640
Panel B: Estimate revision for next fiscal-year's EPS (standardized by previous stock price)							
3 months	0.00	43.3	-0.06	44.6	-0.19	42.0	493
6 months	-0.11	39.3	-0.17	42.2	-0.44	38.5	522
12 months	-0.43	36.2	-0.47	38.5	-0.80	38.2	640

Part II: NASDAQ (OTC) Listed Stocks

Column†	2	3	4	5	6	7	Observations
Panel A: Estimate revision for current fiscal-year's EPS (standardized by previous stock price)							
3 months	0.00	49.2	-0.04	41.3	-0.24	32.4	516
6 months	-0.04	45.0	-0.12	41.4	-0.45	31.2	551
12 months	-0.24	41.4	-0.49	35.7	-1.07	27.4	636
Panel B: Estimate revision for next fiscal-year's EPS (standardized by previous stock price)							
3 months	0.00	47.9	-0.02	47.0	-0.18	39.6	472
6 months	0.00	48.1	-0.11	44.9	-0.38	36.9	534
12 months	-0.28	39.9	-0.54	35.7	-0.96	32.2	624

† See Table 3 for detailed description of columns.

However, the negative estimate revision impact is not similar for exchange-traded and OTC-traded stocks. Comparing column 5 to column 3, I see that optioned stocks traded on exchanges, which tend to be larger and established, exhibit a small increase in the percentage of firms with positive (abnormal) estimate revision. While only 42.4% of them experience positive estimate revisions three months after options listings, the percentage increases to 44.3% when I compare the revisions to similar revisions a year ago. OTC-listed stocks, on the other hand, have a larger percentage of them reporting positive estimate revisions (49.2%) three months after initial options listings, but the percentage drops to 41.3% once I compare all revisions to revisions a year ago. When I adjust these estimate revisions with the average revision of S&P 500 firms in the same period (columns 6 and 7), the adjustment causes the OTC-listed group to lose a larger percentage of firms with positive estimate revision than the exchange-listed group. It seems that exchange-listed stocks are more established and hence have more stable and accurate analyst coverage than OTC-listed stocks.

4.2.3. Earnings Estimate Divergence

Table 5 illustrates changes in analyst forecast variability before and after options listing on a monthly basis. Observations in a given month after options listings are compared to similar observations a year ago. Therefore, observations in month 0 are compared to those in month −12, observations

in month +1 are compared to those in month −11, etc. The number of observations in a given month after options listings is reported in column 1. Column 2 records the median standardized coefficient of variation (or SCV[9]) in a given month after options listings and column 3 reports the median SCV difference in a given month after options listings. A positive number in column 3 implies an increase in the forecast variability among analysts. Column 4 presents results from Wilcoxon signed rank test on the SCV movements around options listings.

As new analysts gradually join the pool, according to Table 5, their forecasts tend to diverge from the estimates of original analysts. The SCVs of analysts' earnings estimates start to increase a few months after options listings compared to the SCVs a year ago (Table 5, column 3). The SCV of long-term EPS growth estimates (Panel C, column 3) shows smaller increases after options listings. Both Wilcoxon signed rank test (column 4) and sign test (column 5) confirm that analysts, on average, become more divergent in their earnings forecasts for an optioned stock a few months after its options listing in terms of SCV of the consensus estimates.

[9] $SCV_j = CV_j / CV_{S\&P}$, where CV_j is measured by dividing the standard deviation of analysts' earnings estimates for firm j in a given month by the absolute value of consensus forecast and $CV_{S\&P}$ is the average CV for the S&P 500 firms.

Table 5
Significance Tests: Standardized Coefficient of Variation (SCV) of Analysts' Earnings Estimate after Options Listings (between January 83 and December 95)

Panel A: SCV of Current fiscal-year earnings estimates

Column†	1	2	3	4	5
Month 0	900	0.333	0.011	0.66 (0.509)	51.00 (0.529)
Month 1	912	0.313	0.013	0.94 (0.347)	51.75 (0.276)
Month 2	925	0.333	0.019	2.14 (0.032)*	52.97 (0.066)
Month 3	942	0.339	0.019	2.61 (0.009)*	52.23 (0.162)
Month 4	957	0.364	0.023	3.33 (0.001)*	53.61 (0.024)*
Month 5	974	0.378	0.034	3.78 (0.001)*	54.62 (0.004)*
Month 6	981	0.368	0.029	3.54 (0.001)*	53.31 (0.035)*
Month 7	1009	0.385	0.041	5.11 (0.001)*	56.79 (0.001)*
Month 8	1024	0.385	0.030	4.99 (0.001)*	54.49 (0.004)*
Month 9	1067	0.385	0.034	4.99 (0.001)*	56.23 (0.001)*
Month 10	1109	0.385	0.036	5.07 (0.001)*	55.00 (0.001)*
Month 11	1127	0.417	0.040	5.52 (0.001)*	55.72 (0.001)*

Panel B: SCV of Next fiscal-year earnings estimates

Column†	1	2	3	4	5
Month 0	764	0.471	0.009	2.17 (0.030)*	50.92 (0.589)
Month 1	764	0.444	0.022	1.24 (0.215)	51.96 (0.263)
Month 2	781	0.471	0.031	2.09 (0.037)*	52.37 (0.174)
Month 3	788	0.467	0.041	3.03 (0.002)*	54.82 (0.006)*
Month 4	819	0.467	0.055	4.46 (0.001)*	56.17 (0.001)*
Month 5	829	0.474	0.050	5.02 (0.001)*	56.82 (0.001)*
Month 6	823	0.500	0.036	4.51 (0.001)*	54.19 (0.015)*
Month 7	850	0.500	0.042	3.60 (0.001)*	55.18 (0.001)*
Month 8	888	0.500	0.028	3.97 (0.001)*	54.17 (0.012)*
Month 9	933	0.500	0.041	4.10 (0.001)*	54.45 (0.009)*
Month 10	972	0.500	0.077	6.54 (0.001)*	58.85 (0.001)*
Month 11	988	0.511	0.055	5.48 (0.001)*	56.98 (0.001)*

- Table 5 continued -

Panel C: SCV of long-term EPS growth estimates

Column†	1	2	3	4	5
Month 0	747	0.676	0.013	0.85 (0.395)	51.00 (0.555)
Month 1	771	0.647	0.008	0.79 (0.430)	50.58 (0.719)
Month 2	780	0.655	0.005	0.87 (0.384)	50.38 (0.803)
Month 3	791	0.656	0.018	1.79 (0.073)	51.83 (0.285)
Month 4	811	0.667	0.020	1.24 (0.215)	52.03 (0.234)
Month 5	822	0.667	0.030	1.84 (0.066)	53.28 (0.055)
Month 6	837	0.679	0.034	3.48 (0.001)*	54.36 (0.010)*
Month 7	854	0.667	0.027	2.21 (0.027)*	53.16 (0.060)
Month 8	872	0.688	0.025	1.35 (0.177)	52.06 (0.211)
Month 9	903	0.692	0.013	1.09 (0.276)	51.05 (0.503)
Month 10	931	0.700	0.031	2.54 (0.011)*	53.28 (0.042)*
Month 11	963	0.692	0.032	2.51 (0.012)*	53.69 (0.020)*

† Column 1: Number of observations in each month
Column 2: Median SCV after options listings
Column 3: Median SCV difference between post-option-listing SCV and SCV 1 year ago
Column 4: Wilcoxon signed rank statistics and *p*-value in parentheses
Column 5: (Sign test) Percentage of optioned firms with increases and *p*-value in parentheses

* Significant at 5% level of significance

Table 6 extends the results of the previous table by comparing changes in SCVs for stocks listed on the NYSE-AMEX versus those listed on NASDAQ. Only results related to the forecasts of current-fiscal-year EPS are included. NASDAQ stocks experience a relatively larger increase in SCVs after options listings than exchange-listed stocks, starting from month +4. This implies that these stocks originally have less information available before options listings and any new information brought in by new analysts after options listings has a more significant impact.

Table 6
Significance Tests: Standardized Coefficient of Variation (SCV) of Analysts' Earnings Estimate after Options Listings: Exchange Listed Stocks versus NASDAQ (OTC) Listed Stocks (between January 83 and December 95)

Panel A: SCV of Current fiscal-year earnings estimates (NYSE-AMEX listed stocks)

Column†	1	2	3	4	5
Month 0	490	0.333	0.024	1.25 (0.211)	52.24 (0.298)
Month 1	493	0.313	0.013	0.76 (0.447)	51.72 (0.418)
Month 2	497	0.333	0.033	2.67 (0.008)*	56.34 (0.004)*
Month 3	500	0.357	0.017	2.32 (0.020)*	52.00 0.347)
Month 4	507	0.357	0.020	2.20 (0.028)*	53.45 (0.028)*
Month 5	516	0.375	0.028	2.52 (0.012)*	55.04 (0.020)*
Month 6	509	0.353	0.022	1.47 (0.142)	51.87 (0.373)
Month 7	517	0.357	0.033	2.88 (0.004)*	56.67 (0.001)*
Month 8	525	0.364	0.025	2.64 (0.009)*	53.90 (0.067)
Month 9	547	0.348	0.012	1.70 (0.089)	52.47 (0.230)
Month 10	572	0.313	0.013	1.51 (0.131)	51.92 (0.337)
Month 11	582	0.375	0.025	2.33 (0.020)*	53.61 (0.075)

Panel B: SCV of Current fiscal-year earnings estimates (NASDAQ (OTC) listed stocks)

Month 0	410	0.333	0.000	0.32 (0.749)	49.51 (0.881)
Month 1	419	0.313	0.018	0.54 (0.589)	51.79 (0.435)
Month 2	428	0.333	0.000	0.28 (0.779)	49.07 (0.810)
Month 3	442	0.333	0.019	1.33 (0.184)	52.49 (0.276)
Month 4	450	0.364	0.025	2.53 (0.011)*	53.78 (0.099)
Month 5	458	0.400	0.040	2.75 (0.006)*	54.15 (0.069)
Month 6	472	0.375	0.048	3.50 (0.001)*	54.87 (0.031)*
Month 7	492	0.438	0.057	4.44 (0.001)*	56.91 (0.001)*
Month 8	499	0.444	0.044	4.48 (0.001)*	55.11 (0.020)*
Month 9	520	0.429	0.065	5.15 (0.001)*	60.19 (0.001)*
Month 10	537	0.444	0.067	5.60 (0.001)*	58.29 (0.001)*
Month 11	545	0.462	0.067	5.50 (0.001)*	57.98 (0.001)*

† See Table 5 for detailed description of columns.

* Significant at 5% level of significance

4.2.4. Earnings Estimate Accuracy (Earnings Surprise)

It is the analysts' consensus forecast of the quarterly EPS, not the yearly EPS, that is used in measuring the forecast error since there are four quarterly earnings reports in a given year. The forecast error information from quarterly estimates is timelier. Since Zacks database reports the analyst consensus forecasts of a firm's EPS of a given quarter on a monthly basis, I can compare actual quarterly EPS to at least three monthly consensus forecasts, including the last month of the quarter. This is due to the fact that the actual quarterly EPS is reported only weeks after the quarter ends.

Analysts become slightly more accurate in their forecasts of quarterly EPS a few months after stock options listings, as reported in Table 7. Column 3 compares monthly *ex-post* standardized forecast errors (SFEs) after options listings to SFEs 12 months ago. A negative median difference in column 3 indicates a smaller forecast error after options introductions. Forecast errors start to decrease in the fourth month after options listings (Panel A) and the improvement in analyst forecast accuracy is statistically significant at 5% level in months +6, +7, and +8.

Table 7
Significance Tests: Standardized Forecast Error of Analysts' Earnings Estimate after Option Listings: Exchange Listed Stocks versus NASDAQ (OTC) Listed Stocks (between January 88 and December 95)

Panel A: SFE of Current fiscal-year earnings estimates (Whole sample)

Column†	1	2	3	4	5
Month 0	454	0.297	0.004	0.32 (0.749)	49.34 (0.741)
Month 1	468	0.344	0.010	0.93 (0.352)	48.93 (0.610)
Month 2	469	0.352	0.024	0.37 (0.711)	48.40 (0.459)
Month 3	505	0.375	0.009	0.81 (0.418)	49.50 (0.787)
Month 4	526	0.360	-0.007	0.17 (0.865)	51.33 (0.569)
Month 5	528	0.408	-0.026	1.45 (0.147)	52.65 (0.238)
Month 6	540	0.394	-0.049	2.66 (0.008)*	55.00 (0.029)*
Month 7	573	0.392	-0.041	2.60 (0.009)*	54.10 (0.055)
Month 8	591	0.367	-0.030	2.13 (0.033)*	52.79 (0.162)
Month 9	637	0.377	0.000	0.98 (0.327)	49.92 (0.936)
Month 10	675	0.347	0.013	0.32 (0.749)	48.30 (0.358)
Month 11	697	0.344	-0.001	1.14 (0.254)	50.22 (0.881)

Panel B: SFE of Current fiscal-year earnings estimates (NYSE-AMEX listed stocks)

Column†	1	2	3	4	5
Month 0	258	0.351	-0.017	0.75 (0.453)	52.33 (0.497)
Month 1	261	0.372	0.013	0.74 (0.459)	49.43 (0.803)
Month 2	257	0.376	0.029	0.03 (0.976)	47.47 (0.384)
Month 3	277	0.375	0.007	0.40 (0.689)	49.82 (0.904)
Month 4	281	0.351	-0.013	0.37 (0.711)	52.67 (0.342)
Month 5	284	0.407	-0.010	0.74 (0.459)	51.41 (0.596)
Month 6	290	0.368	-0.067	2.47 (0.014)*	57.24 (0.011)*
Month 7	311	0.353	-0.045	1.61 (0.107)	54.66 (0.118)
Month 8	325	0.342	-0.030	1.58 (0.114)	53.23 (0.222)
Month 9	352	0.323	-0.003	0.72 (0.472)	50.57 (0.873)
Month 10	368	0.305	0.020	0.73 (0.465)	46.47 (0.159)
Month 11	374	0.301	0.015	0.55 (0.589)	47.86 (0.379)

- Table 7 continued -

Panel C: SFE of Current fiscal-year earnings estimates (NASDAQ (OTC) listed stocks)

Column†	1	2	3	4	5
Month 0	196	0.260	0.021	0.39 (0.697)	45.41 (0.174)
Month 1	207	0.293	0.007	0.56 (0.575)	48.31 (0.575)
Month 2	212	0.319	0.014	0.51 (0.610)	49.53 (0.834)
Month 3	228	0.375	0.009	0.77 (0.441)	49.12 (0.741)
Month 4	245	0.363	0.001	0.12 (0.904)	49.80 (0.897)
Month 5	244	0.410	-0.067	1.34 (0.180)	54.10 (0.222)
Month 6	250	0.432	-0.026	1.30 (0.194)	52.40 (0.569)
Month 7	262	0.453	-0.032	2.04 (0.041)*	53.44 (0.242)
Month 8	266	0.392	-0.027	1.48 (0.139)	52.26 (0.424)
Month 9	285	0.443	0.005	0.67 (0.503)	49.12 (0.719)
Month 10	307	0.404	-0.009	0.33 (0.741)	50.49 (0.818)
Month 11	323	0.415	-0.022	2.24 (0.025)*	52.94 (0.267)

† Column 1: Number of observations in each month
Column 2: Median SFE after options listings
Column 3: Median SFE difference between post-option-listing SFE and SFE 1 year ago
Column 4: Wilcoxon signed rank statistics and *p*-value in parentheses
Column 5: (Sign test) Percentage of optioned firms with increases and *p*-value in parentheses

* Significant at 5% level

Changes in forecast error after options listings are similar between exchange-listed stocks (Panel B) and NASDAQ stocks (Panel C). Both groups of stocks experience some reduction of forecast error as early as four months after options listings, as illustrated in Panels B and C of Table 7. This implies that quality of information about a firm barely improves after options listing, irrespective of whether the stock is listed on NYSE/AMEX or NASDAQ. Since some useful information might be revealed the first time in the market after options listings, analysts as a group are probably able to reduce their forecast errors.

4.2.5. Reactions to Quarterly Earnings Surprises

In this section I test whether the market reaction to firms' quarterly earnings announcements changes after options listings. Up to eight quarterly earnings announcements of each optioned stock are used in this study: four quarterly announcements before and four quarterly announcements after options listing date. I regress the following model:

$$CAR_{jt} = a + b_1\, ESURP_{jt} + b_2\, D_{option,\,j} + b_3\, D_{OTC,\,j} + e_{jt}$$

where

CAR_{jt} is the post earnings 3 day announcement (days 0 to +2) market-adjusted abnormal return for security *j*,

$ESURP_{jt}$ is the earnings surprise for firm *j*,

$D_{option,j}$ is a dummy variable equal to 1 if options exist on the firm j,

and equal to 0 otherwise, and

$D_{OTC,i}$ is a dummy variable equal to 1 if the stock is traded on the OTC, and 0 otherwise.

Table 8 reports the results of the regression model of the two-day cumulative excess returns against quarterly earnings surprises. To test for differences in reaction to earnings surprises due to options listing or exchange location, cumulative abnormal returns in announcement period are cross-sectionally regressed on the magnitude of earnings surprise, a dummy variable coded zero for firm/quarters before options listing and one for firm/quarters after options listing, and a dummy variable for stock listing on the OTC, where D = 1 if OTC, zero otherwise. This regression framework is estimated for the entire sample pooled before and after options listings (Panel A), as well as for positive (earnings surprises > = 5%, Panel B) and negative surprises (earnings surprises < = -5%, Panel C).

Generally, firms are rewarded or punished according to their actual quarterly earnings, compared to analysts' forecasts in the two-day period after earnings are reported. The constant term of the regression equation is positive (+0.012248) in Panel B (Positive Earnings Surprises) and negative (-0.00804) in Panel C (Negative Earnings Surprises). Both constant terms are statistically significant at 1% level. In addition, firms with more than 5% positive earnings surprises are further rewarded depending on the amount of earnings surprises. The positive coefficient (0.000025) in Panel B is also significant at 1% level.

Table 8
Regression Analysis of Excess Returns and Earnings Surprises
(before/after Options Listings, OTC/Exchange Listed Stocks)

$$CAR_t = a + b_1 * ESURP_t + b_2 * D_{option} + b_3 * D_{otc} + e_t$$

Panel A: Whole Sample

	Constant	Earnings Surprise	D_{option}	D_{otc}
Coefficient	0.003116	0.000016	-0.002260	-0.001670
(t-statistic)	(2.32)**	(5.93)*	(-1.53)	(-1.14)
(p-value)	(0.020)	(0.001)	(0.125)	(0.253)

Panel B: Positive Earnings Surprises (more than +5%)

Coefficient	0.012248	0.000025	-0.001100	0.003155
(t-statistic)	(5.64)*	(3.19)*	(-1.47)	(1.35)
(p-value)	(0.001)	(0.001)	(0.636)	(0.177)

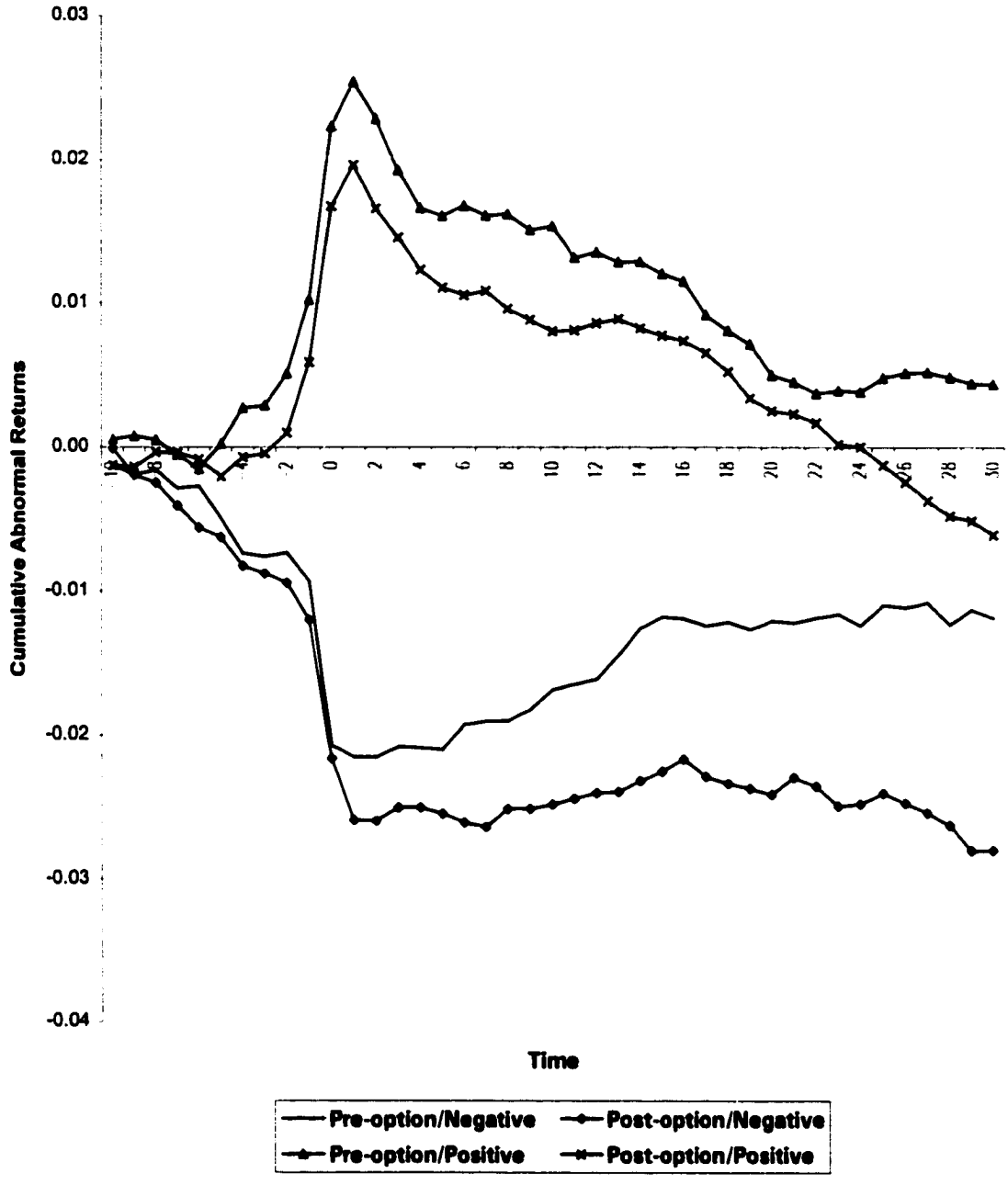
Panel C: Negative Earnings Surprises (less than -5%)

Coefficient	-0.008040	0.000004	-0.001430	-0.008220
(t-statistic)	(-2.94)*	(1.17)	(-0.47)	(-2.74)*
(p-value)	(0.003)	(0.243)	(0.638)	(0.006)

Note: Panel A includes all four quarters before and after options listing for each stock. Panel B and Panel C include only any earnings surprises more than +5% or less than -5%.

* significant at 1% level
** significant at 5% level

Figure 1
Cumulative Abnormal Returns around Earnngs Announcement Date



The coefficients on the options dummy variable are negative in all three panels. The negative coefficient, -0.0011, in Panel B (Positive Earnings Surprises) implies that options listings reduce the reward to firms with positive earnings surprises and the cumulative abnormal returns do not rise as much as when they report positive surprises before options listings. On the other hand, the negative coefficient, -0.00143, in Panel C (Negative Earnings Surprises) implies that options listings may augment the punishment to firms with negative earnings surprises. However, none of these three coefficients is statistically significant based on the *t*-statistics.

The market tends to reward OTC stocks slightly more than exchange-listed stocks when firms report positive earnings surprises (0.003155 in Panel B), but punishes them significantly more than exchange-listed stocks when they report negative earnings surprises (-0.00822 in Panel C). This negative OTC coefficient is statistically significant at 1% level.

Figure 1 portraits the cumulative abnormal returns 10 days before and 30 days after the quarterly earnings announcement dates. I use up to eight quarterly earnings announcements from each stock: four quarterly announcements right before its options listing and four quarterly announcements right after its options listing. By further distinguishing between positive and negative quarterly earnings surprises, I derive four subgroups: pre-option stocks with negative surprises, pre-options stocks

with positive surprises, post-options stocks with negative surprises, and post-options stocks with positive surprises.

In the case of positive earnings surprises, market seems to reward stocks less when they have options listed on them. The post-option/positive line falls almost completely below the pre-option/positive line in Figure 1. This positive cumulative abnormal return also evaporates three weeks after the quarterly earnings announcement day for stocks with newly listed options, but the line remains above zero longer when options are not listed on these stocks (pre-option/positive).

In the case of negative earnings surprises, market reacts more negatively when these quarterly announcements are made after options listings (post-option/negative). While the pre-option/negative line reverts first and remains stable 14 days after earnings announcement dates, the post-option/negative line never recovers up to 30 days after the announcement dates. I do not know exactly what factor causes the post-option/negative line to continue to fall. However, firms are found to release earnings warnings at the same time when they report a poor quarterly earnings and analysts are reported to revise their forecasts immediately following the quarterly announcements. Both are consistent with the post-option/negative line.

CHAPTER 5. INFORMATIONAL CONTENT OF OPTIONS AND MOMENTUM STRATEGIES

5.1. Hypotheses

The evidence of return predictability constitutes a controversial aspect of the debate on market efficiency. Jegadeesh and Titman (1993) add a new twist to the literature by documenting that over an intermediate horizon of three to twelve months, past winners on average continue to outperform past losers, so that there is "momentum" in stock prices. Investment strategies that exploit such momentum, by buying past winners and selling past losers, predate the scientific evidence and have been implemented by many professional investors. The popularity of this approach has grown to the extent that momentum investing constitutes a distinct well-recognized style of investment in the equity markets.

Can publicly available information, such as a stock's prior six-month return, the most recent earnings surprise, and the recent analysts' earnings estimate revision, help to predict future returns? What role would stock options play in helping to predict future returns? Does sorting stocks into optioned or non-optioned sub-samples by prior six-month return yield similar spreads over the subsequent six, twelve, or twenty four months? Are analysts of optioned stocks more active in revising their earnings estimates?

One explanation for the success of momentum strategies is that the market responds only gradually to new information and that previous information provides an ongoing source of information about a firm's

prospects. Since optioned stocks tend to attract more attention from both analysts and investors, I expect that momentum strategies using earnings surprises and analysts' estimate revisions work differently in the two separate sample of stocks: optioned and non-optioned. I hypothesize that the market reacts more confidently to earnings surprises and analysts' earnings estimate revisions in the sample of optioned stocks rather than in the sample of non-optioned stocks. In other words, past earnings surprise news or past analysts' earnings forecasts for optioned stocks should have a higher correlation with stocks' past price performances than for non-optioned stocks.

Financial analysts tend to revise their earnings forecasts gradually after quarterly earnings announcements by firms. This inertia in revising forecasts does not help the market assimilate new information in a timely fashion. In particular, analysts are found slow in revising their estimates in the case of companies with negative earnings performance. They try not to be the first one to cause the stock price to plunge and, as a result, hurt the working relationship with firms' management.

Chan, Jegadeesh, and Lakonishok (1996) also examine momentum strategies on a subsample of larger firms and find similar evidence of price and earnings momentum. The market adjusts only gradually to the information in past returns or past earnings news. Since optioned firms tend to be relatively large, I do not expect the existence of stock options to

dramatically alter the conclusions of momentum strategies documented in Chan, Jegadeesh, and Lakonishok (1996).

I expect optioned stocks to have less informational content in their earnings surprises or estimate revision. Applying earnings momentum strategies on non-optioned stock sample is expected to be more profitable than on optioned stock sample.

5.2. Empirical Results

5.2.1. Price Momentum

Tables 9A and 9B document the results of momentum strategies for portfolios formed on the basis of prior six-month returns, where portfolio 1 constitutes past "losers" and portfolio 10 constitutes past "winners." Return spread in the formation period is relatively bigger in the optioned sample than in the non-optioned sample. Optioned portfolio 10 outperforms portfolio 1 by 100 percent, similar to Chan et al. (1990), while the corresponding spread is 97.1 in non-optioned case. The spread between portfolio 9 and portfolio 2 presents a picture similar to Chan et al. (1990).

Past returns of optioned stocks exhibit a slightly better predicting power of future returns than those of non-optioned stocks. Optioned portfolios (Table 9A, Panel A) continue to command a slightly larger spread than non-optioned portfolios (Table 9B, Panel A) up to 1 year after formation period. However, as pointed out in Chan et al. (1996), past return momentum stops working in the second year after portfolio formation in both

groups. Looking at Panel A of Table 9A, I see that total return spread between portfolio 10 and portfolio 1 of optioned sample is 12% (= 21.42% - 9.42%) one year after portfolio formation, while the spread drops slightly to 11.15% (= 41.09% - 29.94%) two years after portfolio formation. The corresponding one-year spread in the non-optioned sample (Panel, Table 9B) is 8.98% (= 18.83% - 9.85%) and the two-year spread is 10.82% (= 37.34% - 26.52%).

Panel B of Tables 9A and 9B reports price-to-book ratios in the portfolio formation period. The portfolio of past extreme winners tends to include stocks with high price-to-book ratios. The portfolio of past extreme losers tends to include stocks with low price-to-book ratios. Interestingly, both past winners and losers of non-optioned stocks (Table 9B) have higher price-to-book ratios than corresponding optioned stocks (Table 9A).

The next two panels provide clue as to what may be driving this price momentum. Panel C of Tables 9A and 9B reports each portfolio's most recent past and subsequent values of quarterly standardized unexpected earnings (SUEs). Not surprisingly, the past price performance is closely aligned with past SUE performance in both optioned and non-optioned groups. Past returns can also shed some light on the firms' prospective earnings. Past winners are more capable of showing a larger positive SUE in the next earnings report. In addition, optioned past losers are more distinctively caused by their negative SUEs than non-optioned losers. Portfolio 1 of optioned stocks has an average SUE of -0.4 in both the most

recent quarter and the following quarter after formation period, compared to nearly zero for portfolio 1 of non-optioned stocks. Past earnings can, therefore, be conjectured to have a more determining role in deciding stock returns of optioned stocks than non-optioned stocks. Even though I find that the market continues to be caught by surprise at the next quarterly earnings announcement, I do not find a wider spread between the SUEs of the winner and loser portfolios in the following quarter, as reported in Chan et al. (1996).

In Panel D (Tables 9A and 9B), analysts' average revisions in earnings forecasts are reported. Stocks that experience high (low) past returns are associated with large upward (downward) past revisions in analysts' estimates. Similar to the results in Panel C, optioned stocks' past return spread can be more distinctively explained by the revision spread between portfolios. For optioned stocks, there is a large downward monthly revision averaging 8.8 percent in the first six months after portfolio formation for the losing portfolio. The negative average monthly revision for months from seven to twelve afterwards is still as high as 7.7 percent (relative to the stock price at the beginning of the month). This compares to a much lower decline of negative 2 percent for non-optioned stocks (Table 9B, Panel D). It is still consistent with the conjecture by Chan et al. (1996) that it may not be in an analyst's best interest to be the first messenger with bad news. Instead analysts may wait for additional confirming evidence of poor earnings before they modify their estimates.

Table 9A
Mean Returns and Characteristics for Portfolios Classified by Prior Six-Month Return (Optioned Stocks)

At the beginning of every month from January 1983 to December 1995, all optioned stocks are ranked by their compound return over the prior six months into ten portfolios. All stocks are equally-weighted in a portfolio.

Portfolios	(low) 1	2	3	4	5	6	7	8	9	(high) 10
Panel A: Returns (%)										
Past 6-month return	-36.2	-16.1	-7.4	-1.1	4.2	9.3	14.8	21.4	31.4	64.0
Return 6 months after portfolio formation	4.3	6.4	7.9	8.2	8.5	8.2	8.0	8.1	8.0	10.1
Return one year after portfolio formation	9.4	12.2	14.7	15.2	16.2	16.3	16.7	17.2	17.5	21.4
Return two years after portfolio formation	29.9	30.7	33.4	33.0	34.1	35.3	35.0	37.3	36.7	41.1
Panel B: Price-to-Book										
Price-to-Book	3.3	4.1	3.1	3.1	4.6	4.3	3.7	3.7	4.7	6.0
Panel C: Standardized Unexpected Earnings										
Most recent past quarter's SUE	-0.4	0.1	0.4	0.6	0.8	1.0	1.2	1.3	1.4	1.3
Next quarter's SUE	-0.5	0.0	0.3	0.6	0.8	1.0	1.2	1.3	1.4	1.4
Panel D: Revision in Analyst Forecasts (%)										
Most recent 6-month revision	-8.3	-2.2	-1.4	-1.0	-0.8	-0.5	-0.7	-0.4	-0.2	0.1
Average over next 6 months' revision	-8.8	-2.4	-1.5	-1.0	-0.8	-0.6	-0.4	-0.4	-0.2	-0.0
Average revision from months 7 to 12	-7.6	-2.1	-1.4	-1.0	-0.8	-0.7	-0.6	-0.6	-0.7	-0.8

Table 9B
Mean Returns and Characteristics for Portfolios Classified by Prior Six-Month Return (Non-optioned Stocks)

At the beginning of every month from January 1983 to December 1995, selected non-optioned stocks are ranked by their compound return over the prior six months into ten portfolios. All stocks are equally-weighted in a portfolio.

	(low)									(high)
Portfolios	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Panel A: Returns (%)										
Past 6-month return	-22.0	-7.3	-1.0	3.8	8.1	12.6	17.8	24.5	35.5	75.1
Return 6 months after portfolio formation	5.0	7.8	8.6	8.5	8.8	8.5	8.6	8.6	8.7	9.7
Return one year after portfolio formation	9.9	14.3	16.4	16.6	17.2	17.1	17.8	18.3	18.5	18.8
Return two years after portfolio formation	26.5	32.3	35.2	35.6	36.3	35.8	37.1	37.3	38.1	37.3
Panel B: Price-to-Book										
Price-to-Book	4.2	3.4	3.5	3.1	3.1	3.2	3.3	4.4	5.5	8.0
Panel C: Standardized Unexpected Earnings										
Most recent past quarter's SUE	-0.0	0.4	0.6	0.8	0.8	1.0	1.1	1.2	1.3	1.4
Next quarter's SUE	-0.1	0.4	0.6	0.7	0.8	1.7	1.3	1.2	1.5	1.4
Panel D: Revision in Analyst Forecasts (%)										
Most recent 6-month revision	-1.8	-0.8	-0.5	-0.4	-0.3	-0.2	-0.1	-0.0	0.1	0.3
Average over next 6 months' revision	-2.3	-1.0	-0.8	-0.8	-0.5	-0.4	-0.5	-0.4	-0.3	-0.4
Average revision from months 7 to 12	-2.3	-1.0	-0.8	-0.7	-0.7	-0.7	-0.8	-0.6	-0.4	-0.6

5.2.2. Earnings Momentum – Earnings Surprises

Tables 10A and 10B evaluate earnings momentum by forming portfolios based on a strategy of standardized unexpected earnings (SUEs). Optioned stocks (Table 10A) seem to have a closer correlation between their past earnings (SUEs) and past returns. Extremely negative SUEs result in relatively lower stock returns for optioned samples in Table 10A, Panel A. In the non-optioned case (Table 10B) , negative SUEs does not result in negative stock returns (in fact, it is a positive 2.74 for portfolio 1 and 6.50 for portfolio 2). This is consistent with my previous findings: earnings information can explain the past returns of optioned stocks better than those of non-optioned stocks.

On the other hand, earnings-surprise-drift effect is stronger in the case of non-optioned stocks and earnings momentum strategies continue to produce better return spread after portfolio formation, even up to two years (Panel A, Tables 10A and 10B). While the return spread in the optioned sample edges up slightly from 9.47% (= 20.36% - 10.89%) one year after formation to 13% (= 42.29% - 29.30%) two years after formation, the spread in the non-optioned sample moves up from 12.28% (= 21.95% - 9.67%) to 16.35% (= 42.37% - 26.02%).

Panel B of Tables 10A and 10B reports price-to-book ratios in the portfolio formation period. Optioned stocks (Table 10A) with higher SUEs tend to include stocks with higher price-to-book ratios (5.16 for portfolio 10)

than optioned stocks with lower SUEs (2.67 for portfolio 1). On the other hand, there is no clear pattern of price-to-book ratios in the non-optioned sample (Panel B, Table 10B).

Past earnings information (SUEs) in both groups can be used to predict next quarterly SUEs and analysts estimate revisions equally well after portfolio formation (Panel C). Portfolio 1 tends to have worse earnings performance and estimate revisions than portfolio 10 in both optioned sample (Panels C and D, Table 10A) and non-optioned sample (Panels C and D, Table 10B). It implies that past earnings information can be used to predict the future earnings prospective equally well in both subsamples.

Table 10A
Mean Returns and Characteristics for Portfolios Classified by Prior Standardized Unexpected Earnings (Optioned Stocks)

At the beginning of every month from January 1983 to December 1995, all optioned stocks are ranked by their past quarter's SUEs into ten portfolios. All stocks are equally-weighted in a portfolio.

Portfolios	(low) 1	2	3	4	5	6	7	8	9	(high) 10
Panel A: Returns (%)										
Past 6-month return	-7.6	-1.4	1.8	6.1	9.0	11.5	13.7	14.9	17.7	16.5
Return 6 months after portfolio formation	4.7	6.0	6.3	7.2	8.6	9.4	9.6	9.9	10.3	10.3
Return one year after portfolio formation	10.9	13.8	15.0	16.0	17.6	18.3	18.3	19.7	19.4	20.4
Return two years after portfolio formation	29.3	33.0	34.5	35.6	37.0	39.5	37.1	39.4	38.5	42.3
Panel B: Price-to-Book										
Price-to-Book	2.7	3.3	3.0	3.0	3.5	4.5	3.4	5.4	5.0	5.2
Panel C: Standardized Unexpected Earnings										
Most recent past quarter's SUE	-2.1	-1.0	-0.4	-0.0	0.3	0.7	1.1	1.6	2.4	5.0
Next quarter's SUE	-0.9	-0.5	-0.2	0.1	0.3	0.6	0.9	1.1	1.9	4.3
Panel D: Revision in Analyst Forecasts (%)										
Most recent 6-month revision	-4.7	-3.2	-2.3	-1.7	-1.0	-0.4	-0.9	-1.1	0.0	0.2
Average over next 6 months' revision	-5.3	-2.6	-2.4	-1.7	-1.9	-0.7	-0.6	-0.3	-0.1	-0.1
Average revision from months 7 to 12	-5.0	-1.8	-2.6	-1.6	-1.2	-1.1	-1.0	-0.9	-0.5	-0.3

Table 10B
Mean Returns and Characteristics for Portfolios Classified by Prior Standardized Unexpected Earnings (Non-optioned Stocks)

At the beginning of every month from January 1983 to December 1995, selected optioned stocks are ranked by their past quarter's SUEs into ten portfolios. All stocks are equally-weighted in a portfolio.

Portfolios	(low) 1	2	3	4	5	6	7	8	9	(high) 10
Panel A: Returns (%)										
Past 6-month return	2.7	6.5	7.7	10.9	13.2	14.3	15.9	18.1	21.2	20.2
Return 6 months after portfolio formation	3.5	6.1	6.4	7.8	8.1	8.4	9.6	10.2	11.3	12.3
Return one year after portfolio formation	9.7	14.1	14.0	17.1	17.4	16.8	18.4	18.8	20.5	21.9
Return two years after portfolio formation	26.0	30.4	30.4	35.0	36.5	35.3	36.3	37.9	41.0	42.4
Panel B: Price-to-Book										
Price-to-Book	4.1	3.6	3.7	3.8	3.2	2.8	2.9	3.2	4.2	4.3
Panel C: Standardized Unexpected Earnings										
Most recent past quarter's SUE	-1.8	-0.7	-0.2	0.1	0.4	0.7	1.1	1.7	2.4	4.4
Next quarter's SUE	-0.6	-0.2	0.0	0.2	0.4	0.6	0.9	1.2	1.7	3.7
Panel D: Revision in Analyst Forecasts (%)										
Most recent 6-month revision	-1.8	-1.0	-0.8	-0.6	-0.2	-0.2	0.0	0.1	0.3	0.2
Average over next 6 months' revision	-1.9	-1.3	-0.9	-0.7	-0.6	-0.4	-0.4	-0.3	-0.2	-0.1
Average revision from months 7 to 12	-2.4	-1.0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.5	-0.4	-0.2

5.2.3. Earnings Momentum – Estimate Revisions

Tables 11A and 11B evaluate the earnings momentum strategies for portfolios based on analysts' earnings estimate revisions. Optioned stocks again seem to have a closer correlation between past analysts' estimate revisions and past returns (Panel A). Downward revisions tend to result in relatively lower stock returns in the optioned sample (-11.46% for portfolio 1), while in the non-optioned case, downward revision does not result in a negative stock return (+0.41% for portfolio 1) in Panel A. Estimate revision information can explain past returns of optioned stocks better than that of non-optioned stocks. Past estimate revision information in both groups can be used to predict next quarterly SUEs equally well (Panel C), analysts' estimate revisions (Panel D), and even portfolio return spread up to one year after portfolio formation (Panel A). Similar to results in Panel B of Tables 10A and 10B, optioned stocks (Table 11A) with higher estimate revisions tend to be stocks with higher price-to-book ratios (4.00 for portfolio 10) than optioned stocks with lower estimate revisions (2.85 for portfolio 1). On the other hand, there is no clear pattern of price-to-book ratios in the non-optioned sample (Panel B, Table 11B).

Chan et al. (1996) showed that investors may not be able to capture the return spreads across different portfolios, as documented here. It may be difficult to establish short positions in stocks with lower momentum. In addition, since stocks with high momentum also tend to be smaller issues,

their trading costs tend to be relatively high. These implementation issues may reduce the benefits from pursuing momentum strategies.

To summarize, momentum strategies involving optioned stocks show a much closer relationship among past returns, past SUEs, and past analysts' estimate revisions. The success of momentum strategies involving non-optioned stocks is controlled by factors other than past earnings information.

Table 11A
Mean Returns and Characteristics for Portfolios Classified by Prior Revision in Analyst Forecasts (Optioned Stocks)

At the beginning of every month from January 1983 to December 1995, all optioned stocks are ranked by their last 6 months' revision on estimates for current fiscal year's EPS and assigned to one of ten portfolios. All stocks are equally-weighted in a portfolio.

	(low)									(high)
Portfolios	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Panel A: Returns (%)										
Past 6-month return	-11.5	-3.1	0.7	4.1	6.8	9.4	12.8	15.9	20.9	28.5
Return 6 months after portfolio formation	4.4	6.4	6.8	6.8	7.3	7.7	8.6	9.7	10.6	11.4
Return one year after portfolio formation	12.1	13.7	14.2	14.2	14.8	15.3	17.3	19.4	20.6	21.9
Return two years after portfolio formation	32.2	32.7	32.5	33.5	33.2	34.7	36.4	38.2	40.8	43.9
Panel B: Price-to-Book										
Price-to-Book	2.9	2.9	3.0	3.1	4.8	4.6	4.0	4.3	4.6	4.0
Panel C: Standardized Unexpected Earnings										
Most recent past quarter's SUE	-0.8	-0.6	-0.3	0.2	0.7	1.7	2.1	2.1	1.6	1.3
Next quarter's SUE	-0.6	-0.5	-0.2	0.2	0.7	1.6	2.1	2.1	1.5	1.2
Panel D: Revision in Analyst Forecasts (%)										
Most recent 6-month revision	-13.9	-2.4	-1.2	-0.6	-0.3	-0.1	0.0	0.2	0.4	2.7
Average over next 6 months' revision	-9.6	-2.1	-1.3	-0.9	-0.6	-0.4	-0.2	-0.2	-0.2	-0.3
Average revision from months 7 to 12	-8.4	-1.8	-1.2	-1.0	-0.7	-0.5	-0.4	-0.4	-0.5	-1.2

Table 11B
Mean Returns and Characteristics for Portfolios Classified by Prior Revision in Analyst Forecasts (Non-optioned Stocks)

At the beginning of every month from January 1983 to December 1995, selected optioned stocks are ranked by their last 6 months' revision on estimates for current fiscal year's EPS and assigned to one of ten portfolios. All stocks are equally-weighted in a portfolio.

	(low)									(high)
Portfolios	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Panel A: Returns (%)										
Past 6-month return	0.4	5.3	7.1	9.1	11.4	13.5	16.2	19.9	24.9	34.5
Return 6 months after portfolio formation	4.8	6.8	7.0	7.5	7.7	8.1	9.6	9.7	10.9	11.6
Return one year after portfolio formation	12.2	14.4	14.8	15.3	15.8	16.0	18.2	19.4	20.5	20.5
Return two years after portfolio formation	31.1	32.5	33.7	32.6	34.8	34.1	36.7	40.6	41.4	40.3
Panel B: Price-to-Book										
Price-to-Book	2.6	2.8	3.0	3.0	3.0	4.6	3.8	3.6	4.9	3.7
Panel C: Standardized Unexpected Earnings										
Most recent past quarter's SUE	-0.7	-0.2	0.3	0.8	1.2	1.5	1.6	1.5	1.4	1.3
Next quarter's SUE	-0.4	0.0	0.3	0.8	1.1	1.4	1.6	1.5	1.3	1.2
Panel D: Revision in Analyst Forecasts (%)										
Most recent 6-month revision	-4.4	-1.1	-0.5	-0.3	-0.1	0.0	0.1	0.2	0.5	1.9
Average over next 6 months' revision	-3.0	-1.1	-0.8	-0.5	-0.4	-0.3	-0.2	-0.2	-0.2	-0.4
Average revision from months 7 to 12	-3.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.3	-0.3	-0.4	-0.7

CHAPTER 6. INFORMATIONAL CONTENT OF OPTIONS AND CORPORATE ANNOUNCEMENTS

To a large extent, investors anticipate the information contained in any corporate announcement, such as accounting earnings releases, takeover announcements, share repurchases, or stock splits. A large percentage of the stock-price adjustment associated with corporate announcements may occur before the announcement. If options trading creates additional incentives to collect private information about firms, then the extent to which investors anticipate the information contained in news releases is likely to increase after options listing. This should result in a smaller stock-price adjustment at the time of the release. Optioned stocks should exhibit a less noticeable upward price movement than non-optioned stocks in response to a positive news event.

Financial analysts and institutional investors can actually help disseminate information to the public by either recommending the stock, upgrading the earnings estimates, or including that stock in their own portfolios. The credibility of any signal can be enhanced by other information. I hypothesize that an announcement by a firm with options on its stocks should be considered more credible.

Since optioned firms are scrutinized more closely by analysts and institutional investors and the options listing decision is not controlled by the management, investors should be more confident about accepting

management's true intention behind any corporate announcement. This should, in turn, reduce the consequence of information asymmetry between the management and outside investors.

In addition, investors' reaction does not depend solely on a single announcement. They tend to interpret a series or a set of signals altogether. It is quite possible that prior news emanating from the firm contradicts the current news, causing uncertainty on the part of investors. In some cases investors might have misinterpreted signals from the same management and need additional signals to clarify their own interpretation over time. Options listings may offer some confirmation of management's intentions. Managers' incentive to release a false signal is further reduced when more analysts are monitoring their activities closely.

I hypothesize that the two-day or three-day price effect at the time of the announcement should be greater for non-optioned stocks than for optioned stocks. In addition, the market should adjust more rapidly and completely to the announcement for optioned stocks than for non-optioned stocks. As a result, any drift effect should last longer for non-optioned stocks.

Analysts' estimate revisions have been used to confirm the signaling hypothesis of corporate announcements. For example, Ofer and Siegel (1987) find that security analysts revise their earnings forecasts in response to unexpected dividend changes. The greater the unexpected dividend change, the more drastic the forecast revision. Consistent with investor

rationality, this is evidence that earnings revisions are positively associated with abnormal stock price effects upon the announcement of dividend changes.

Brous (1992) examines the revisions of analysts' forecasts of future earnings around announcements of common stock offerings. The forecasts of the current year earnings, on average, are reduced when firms announce plans to issue additional common stock. The size of the decrease is significantly related to announcement period abnormal stock returns. He interprets these results as being consistent with the claim that equity offering announcements convey unfavorable information regarding the firm's short-term earnings prospects.

I focus on whether optioned firms, under closer scrutiny, experience a smaller change in the consensus analysts' earnings forecasts after certain corporate announcements. In this study, I analyze stock split and corporate takeover announcements. I examine market reactions in terms of both stock price movements and financial analysts' activities around these announcements.

6.1. Stock Splits

A stock split occurs when a firm replaces its outstanding shares with a certain number of new shares without changing its market value. It does not involve a huge amount of cash spending. Firms use stock splits to affect claims of existing stakeholders and remain highly popular among investors. In

1998, of the 500 S&P firms, 93 split their shares by a split factor of 1.5 or more. Of these 93 firms, 14 of them had split their shares in 1997 as well.

Grinblatt, Masulis, and Titman (1984) find that stocks react positively to stock split announcements. They hypothesize that firms signal information about their future earnings or equity values through their split decisions. Arbel and Swanson (1993) use the number of analysts as the proxy for informational richness of a firm. They suggest that market anticipation of split announcement is related directly to the stock's information richness. The magnitude of the split announcement is greater for information-poor stocks. However, the post-announcement market price adjustment process is more rapid and complete for information-rich stocks than for information-poor stocks.

Stock split announcement is suitable for analyzing the impact of stock options and analyst behavior around corporate announcements for the following reasons. First, since seasoned equity offerings and share repurchase announcements both involve a change in number of shares outstanding of the stock, it is not obvious whether all analysts take that into consideration in revising their EPS estimates. This distorts the analysis of estimate revisions caused by these events. Furthermore, firms may later reverse their decisions to issue additional equity and at times may only partially execute their share repurchase programs. Stock split announcements are rarely cancelled after being approved by the board and shareholders. As long as the split factor is entered correctly into the

database, earnings estimates from different periods can be compared appropriately. Second, equity issuance and share repurchase decisions usually affect directly or indirectly other corporate financing and investment decisions and, hence, may affect the firms' earning capabilities. This complicates the process of filtering the pure effect of these two announcements. Since tremendous cash outlays or inflows are involved in these two decisions, they affect firms' capital investment plans and, as a result may distort the accuracy of analysts' estimates accuracy. On the other hand, except for a small direct operating costs, stock split decisions do not affect the firms' investment opportunities directly. If a stock split decision causes analysts to revise their earnings estimates, it is reasonable for investors to conclude that the split announcement may carry some extra information with it.

In this paper, I use the availability of stock options to distinguish between information-rich and information-poor stocks. The price impact around the split announcements should be different between non-optioned stocks and optioned stocks. It is hypothesized that the market adjusts more rapidly to the split announcement for optioned stocks than for non-optioned stocks. I expect optioned splitting stocks' cumulative mean daily return to be flatter than a similar estimate for non-optioned splitting stocks. I also hypothesize that post-announcement earnings forecast revisions are greater for non-optioned stocks than for optioned stocks.

First, I report the descriptive statistics of my stock split samples in Table 12. Panel A is designated to stock split announcements made by optioned firms and Panel B for non-optioned firms. As options are listed on more and more stocks, the number of stock splits made by optioned firms increases over the years (62 in 1986 compared to 140 in 1995), while the number of stock splits made by non-optioned firms shows a downward trend (519 in 1986 compared to 258 in 1995). Both the mean and median market capitalizations confirm the fact that optioned firms are usually larger than non-optioned firms. While the mean market capitalization remains stable over the years in both subgroups, the median market capitalization is declining in the optioned group but increasing in the non-optioned group. This is due to the fact that options are now listed on stocks with medium capitalization.

Table 13 illustrates the adjusted price movements around stock split announcements. The average daily adjusted stock returns and *t*-statistics are reported for all three samples: the whole sample, the optioned sample, and the non-optioned sample. Adjusted daily returns over twenty-one trading days are reported, including ten days before and ten days after the split announcement day, which is event day 0.

Table 12
Descriptive Statistics of Stock Split Firms

Panel A: Stock Split Announcements by Optioned Firms

Year	Number of stock splits	Market Capitalization (in Million Dollars) Mean	Median
1986	62	4,479	2,863
1987	75	4,418	3,285
1988	16	4,078	2,088
1989	49	6,558	3,051
1990	45	6,205	3,081
1991	77	3,144	2,158
1992	110	4,508	1,874
1993	124	3,784	1,589
1994	101	5,069	1,681
1995	140	4,006	1,554
Total	799*		

Panel B: Stock Split Announcements by Non-optioned Firms

Year	Number of stock splits	Market Capitalization (in Million Dollars) Mean	Median
1986	519	413	179
1987	379	390	169
1988	168	319	131
1989	242	367	186
1990	122	509	172
1991	167	338	184
1992	280	453	190
1993	302	428	245
1994	198	344	204
1995	258	478	242
Total	2,635**		

* made by 552 firms
** made by 1,733 firms

Table 13
Adjusted Daily Returns and t-statistics around Stock Split Announcement Dates

Event Day	Aggregate Sample		Optioned Sub-sample		Non-optioned Sub-sample	
	Mean	t-statistic	Mean	t-statistic	Mean	t-statistic
-10	0.2163	2.92**	-0.0064	-0.06	0.2840	3.26**
-9	0.2440	3.29**	0.2414	2.17*	0.2447	2.81**
-8	0.2497	3.37**	0.1609	1.44	0.2766	3.17**
-7	0.1033	1.39	-0.0195	-0.18	0.1406	1.61
-6	0.2014	2.72**	0.0857	0.77	0.2365	2.71**
-5	0.2074	2.80**	0.1739	1.56	0.2175	2.50*
-4	0.1915	2.58**	0.1882	1.69	0.1925	2.21*
-3	0.1366	1.84	0.0294	0.26	0.1691	1.94
-2	0.2362	3.19**	0.0652	0.58	0.2881	3.31**
-1	0.1804	2.43*	0.1907	1.71	0.1772	2.03*
0	1.2909	17.41**	1.0294	9.24**	1.3706	15.73**
1	0.7925	10.69**	0.3329	2.99**	0.9322	10.70**
2	0.3156	4.26**	0.0869	0.78	0.3852	4.42**
3	0.0432	0.58	-0.1731	-1.55	0.1088	1.25
4	0.0179	0.24	-0.1335	-1.20	0.0638	0.73
5	-0.2533	-0.29	-0.0813	-0.73	-0.0034	-0.04
6	0.0343	0.46	-0.0871	-0.78	0.0711	0.82
7	-0.2204	-0.73	-0.1591	-1.43	-0.0227	-0.26
8	-0.1870	-1.18	-0.1432	-1.28	-0.0711	-0.82
9	-0.2562	-0.25	0.1438	1.29	-0.0680	-0.78
10	-0.2548	-0.27	-0.1247	-1.12	0.0117	0.13

Notes:
Grand standard deviation and mean daily return during the 40 day post-announcement benchmark

std dev %	0.0741	0.1115	0.0872
average %	0.1374	0.1176	0.1435

The t-statistics test the null hypothesis that the difference between the mean daily return for the event day in question and the grand mean daily return during the 40 day post-announcement (+4, ..., +43) benchmark period is zero against the two-tailed alternative hypothesis that the difference is non-zero.

I examine the overall sample first. It seems that most firms experience a sharp price increase before they announce stock splits, which is consistent with the finding in Grinblatt et al. (1984). Eight out of ten days before split announcement demonstrate significant abnormal returns (*t*-statistic). These positive and significant abnormal returns are then followed by another three positive and large excess returns, beginning on the day the firm announces the split decision.

The compounded three-day abnormal return following the stock split announcement is 2.42% (= 1.29% + 0.79% + 0.32%) and statistically significant. Abnormal returns gradually decline after this three-day-event-window period and eventually start to revert five days after the announcement day. However, the reversion is not significant statistically, with an absolute value of *t*-statistic no greater than 1.18.

Since non-optioned sample constitutes almost 77% of the overall sample, the results on the non-optioned sample basically mirror the results of the overall sample. Positive abnormal returns tend to precede split announcements in the non-optioned sample and are statistically significant. The cumulative three-day excess return is 2.71% (= 1.37% + 0.93% + 0.39%), and exceeds the return for the overall sample as well as the optioned sample. It is clear that a strong stock split announcement effect exists for the non-optioned sample. Similar to overall sample, stock returns

revert five days after the announcement day but the returns are not significant.

The results for the optioned sample differ from the previous two samples. Even though optioned firms also experience some positive abnormal returns before they announce stock splits, they are mostly insignificant at the 5% level. Following the announcement, significant abnormal returns last for only two instead three days. The three-day excess return (days 0 to +2) is only 1.45% (= 1.03% + 0.33% + 0.09%), which is far less than the non-optioned sample. I thus find support for my hypothesis that the magnitude of the split announcement effect is greater for information-poor stocks (non-optioned stocks) than for information-rich stocks (optioned stocks). It implies that informational content of stock split announcements in the optioned sample is smaller than that in the non-optioned sample.

Reversion in returns, though insignificant, kicks in earlier for optioned stocks. They tend to experience negative abnormal returns as early as three days after the split announcement.

Figure 2 presents a longer period's cumulative average excess returns of the three samples. The chart covers 40 days before and 40 days after the announcement day. The difference starts to appear 20 days before the announcement, widens around the announcement, and never converges after that (Figure 2). The line of optioned sample shows a slight reversion in returns three days after the announcement, while the non-optioned line does not show any such reversion at all. In addition, the cumulative excess return

line of the non-optioned sample shows an upward drift effect 20 days into the post announcement period, whereas the optioned line shows a more or less random walk. It provides support for the hypothesis that the market adjusts rapidly to the stock split announcement during the post-announcement period for optioned stocks but not for non-optioned stocks.

Tables 14A (optioned firms) and 14B (non-optioned firms) illustrate how analysts revise their estimates after the stock split announcement. Each month's revision on estimates for current fiscal-year's EPS, next fiscal-year's EPS, and 3-to-5 years' EPS growth rate are compared to the corresponding revision on estimates for the average S&P 500 firm (see Section 3.4. for detailed discussion). I calculate the excess estimate revision for each of the 3-month, 6-month, and 12-month periods after the split decisions. The results are reported in Panels A, B, and C in both Tables 14A and 14B.

Column 1 shows the number of observations used in the analysis. Optioned stocks tend to have a higher percentage of firms with valid data due to their being followed by more analysts. For example, 780 of the 799 stock splits by optioned firms have valid estimate revision data and only 2,015 of the 2,635 splits by non-optioned firms have similar data available. The second column calculates the median excess estimate revision for each test period. Columns 3 and 4 present test results for the Wilcoxon and sign tests.

Figure 2
Cumulative Mean Daily Adjusted Percentage Return
on Three Subsamples of Stock Split Firms

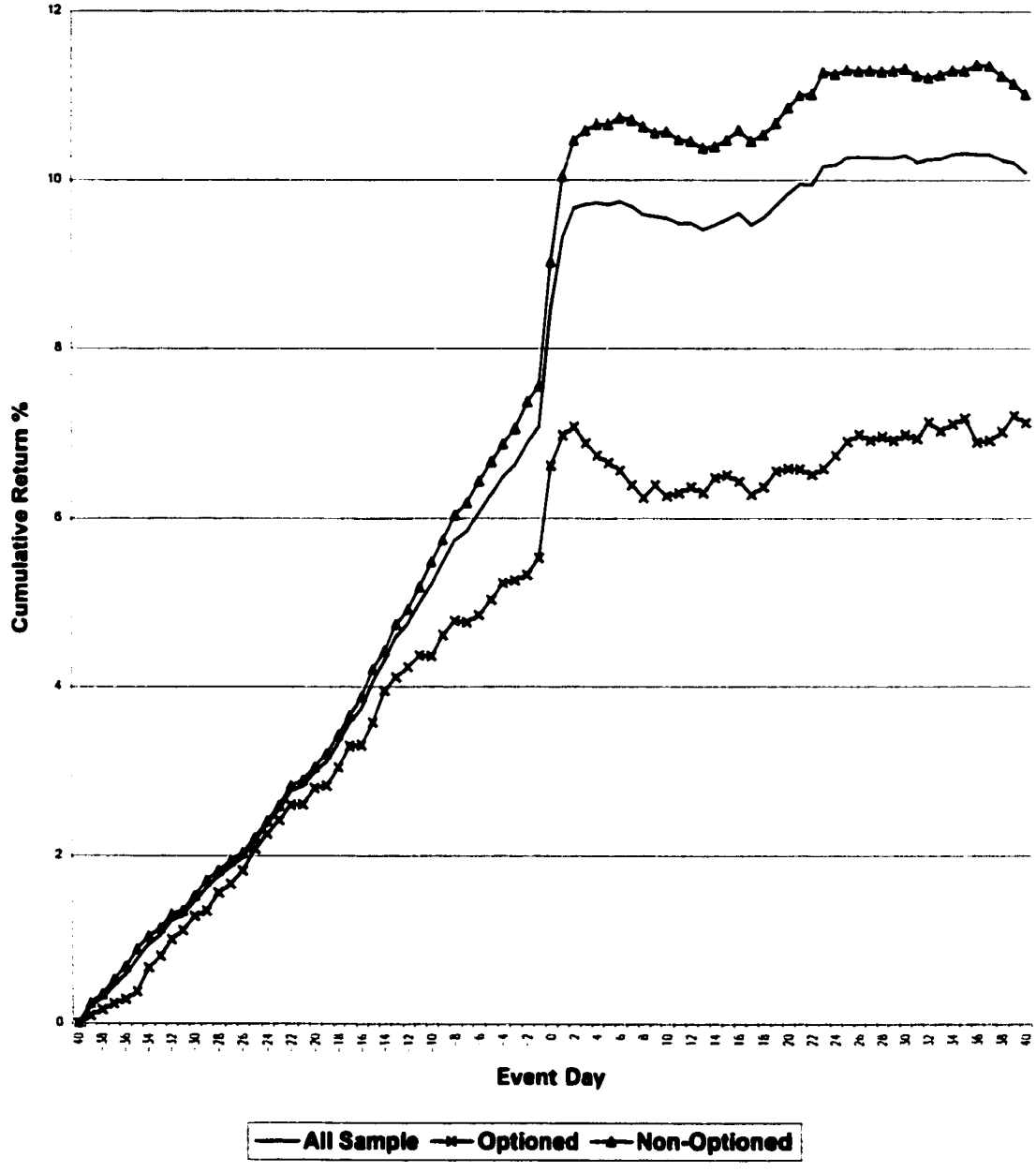


Table 14A
Estimate Revisions after Stock Split Announcements by Optioned Firms (between January 86 and December 95)

Column†	1	2	3	4
Panel A: Estimate revision on current fiscal year's EPS				
3 Months	780	16.0	23.0 (0.001)*	96.8 (0.001)*
6 Months	780	29.6	23.4 (0.001)*	96.4 (0.001)*
12 Months	775	47.4	23.4 (0.001)*	95.5 (0.001)*
Panel B: Estimate revision on next fiscal year's EPS				
3 Months	721	5.8	17.7 (0.001)*	79.5 (0.001)*
6 Months	680	11.1	19.0 (0.001)*	87.4 (0.001)*
12 Months	584	19.1	17.0 (0.001)*	86.5 (0.001)*
Panel C: Estimate revision on 3-to-5 years' EPS Growth				
3 Months	783	0.09	5.4 (0.001)*	58.4 (0.001)*
6 Months	781	0.28	6.2 (0.001)*	59.4 (0.001)*
12 Months	778	0.36	4.3 (0.001)*	57.8 (0.001)*

† Column 1: Number of observations
Column 2: Median abnormal estimate revision (%) (relative to the average S&P 500 firm's estimate revision)
Column 3: Wilcoxon signed rank statistics and *p*-value in parentheses
Column 4: (Sign test) Percentage of firms with increases (*p*-value)

* Statistically significant at 1% level

Note:
First, we compare estimate revision 3 months before stock split announcement, month -3 to month -1, to estimate revision 3 months after announcement, month 0 to month +2, for each announcing firm. We then compare this change to the average change of S&P 500 firms during the same period of time (as a difference).

Table 14B
Estimate Revisions after Stock-split Announcements by Non-optioned Firms (between January 86 and December 95)

Column	1	2	3	4
Panel A: Estimate revision on current fiscal year's EPS				
3 Months	2,016	15.8	34.8 (0.001)*	92.9 (0.001)*
6 Months	1,976	29.4	36.0 (0.001)*	93.2 (0.001)*
12 Months	1,871	46.6	35.3 (0.001)*	93.2 (0.001)*
Panel B: Estimate revision on next fiscal year's EPS				
3 Months	1,439	5.8	23.1 (0.001)*	78.2 (0.001)*
6 Months	1,126	10.3	22.6 (0.001)*	84.3 (0.001)*
12 Months	587	19.4	16.4 (0.001)*	84.3 (0.001)*
Panel C: Estimate revision on 3-to-5 years' EPS Growth				
3 Months	1,708	0.06	11.1 (0.001)*	59.6 (0.001)*
6 Months	1,648	0.13	8.0 (0.001)*	58.0 (0.001)*
12 Months	1,562	0.11	3.4 (0.001)*	53.5 (0.005)*

† Column 1: Number of observations
Column 2: Median abnormal estimate revision (%) (relative to the average S&P 500 firm's estimate revision)
Column 3: Wilcoxon signed rank statistics and *p*-value in parentheses
Column 4: (Sign test) Percentage of firms with increases (*p*-value)

* Statistically significant at 1% level

Note:
First, we compare estimate revision 3 months before stock split announcement, month -3 to month -1, to estimate revision 3 months after announcement, month 0 to month +2, for each announcing firm. We then compare this change to the average change of S&P 500 firms during the same period of time (as a difference).

Comparing Table 14A to Table 14B, I find that stock split announcements are dominant events and persuade analysts to upgrade their estimates equally even months after the split announcement for both groups, optioned and non-optioned. Estimates for current fiscal-year's estimates (Panel A) experience a 16% revision in 3 months following the announcement, a 29% relative upgrade in 6 months, and a hefty 47% in a year for both groups. Both Wilcoxon and sign tests confirm that more firms experience positive estimate revisions after stock split announcements.

Estimates for next fiscal-year's EPS of stock-split firms (Panel B) also experience a positive excess revision after split announcements. The revision on next fiscal-year's EPS ranges, on average, between 5.8% and 19.4% for both groups. This implies that stock split announcements are treated as a positive signal about firms' short-term earnings prospects. Managers announce stock splits only when they are confident about the firms' future prospects in the short run. Revisions for 3 to 5 years' EPS growth rate estimates (Panel C) are not as strong as revisions for current or next fiscal-year's estimates. All three median estimate revisions are very similar for both optioned as well as non-optioned firms.

As a whole, stock splits tend to precede estimate revisions by analysts. The signal is strong enough that analysts revise their estimates upwards, irrespective of whether the firm's stocks have options written on them or not. Another possible implication is that analysts are slow in revising

their estimates and use stock split announcements as a confirmation about the firm's return prospects and revise their estimates accordingly.

6.2. Corporate Takeovers (on Target Firms)

Previous research has shown that the price of a target firm's common stock increases when a takeover bid is announced. This market reaction is consistent with two alternative hypotheses. The information hypothesis implies that the announcement of a takeover conveys favorable information about the target firm, either by prompting inefficient managers to implement a better operating strategy, or by signaling that the target firm's shares are undervalued. The synergy hypothesis suggests that the target firm's shareholders are expected to benefit from synergistic gains that will be realized after the takeover is completed.

Analysts' forecasts of future earnings after a takeover announcement represent their expectations about the stand-alone prospects of the target firm. I hypothesize that analysts continue to forecast stand-alone values in order to enable investors to evaluate the fairness of the takeover offers and make appropriate tendering decisions. In a study of the informational content of takeover announcements, Brous and Kini (1993) document a systematic upward revision in analysts' forecasts for a sample of takeover targets. This is consistent with the excess abnormal return on the target's stock after the takeover announcement.

In this paper, I examine two takeover target groups separately, the optioned and non-optioned firms. I hypothesize that post-announcement earnings forecast revisions are greater for non-optioned target firms than for optioned targets since any news about a non-optioned firm tends to have more informational content than news about an optioned firm.

Table 15 describes the takeover announcement samples examined. All announcements are made between January 1986 and December 1995. I use 98 takeover announcements made for optioned firms and 331 takeover announcements made for non-optioned firms in my test, based on data availability. Optioned targets (Panel A) tend to have a larger market capitalization than non-optioned targets (Panel B).

Tables 16A and 16B compare the analysts' estimate revisions after takeover attempts on either optioned stocks or non-optioned stocks are announced. I look at the estimate revision at the end of the month of announcement and the following six months. I report the number of observations in each sub-sample, the median percentage revision on both current fiscal-year's (Panel A) and next fiscal-year's EPS estimates (Panel B) versus the average S&P 500 firm's revision, and the results of both Wilcoxon and sign tests in Tables 16A and 16B.

Table 16A presents results for takeover targets with options listed on their stocks when the announcement is made. Analysts tend to upgrade their estimates on current fiscal- year's EPS immediately after any takeover is announced on an optioned stock. Both Wilcoxon and sign tests indicate that

more optioned targets receive positive than negative adjusted estimate revisions. The results on estimate revisions made on the next fiscal-year's EPS are not significant for five out of seven months' results (Panel B).

Table 16B reports results for takeover targets without options listed on their stocks when the announcement is made. Similar to the results for optioned targets, analysts upgrade their estimates on current fiscal- year's EPS immediately after any takeover is announced on a non-optioned stock. Both Wilcoxon and sign tests indicate that these estimate revisions tend to be higher than estimate revisions made on the average S&P 500 firm's EPS. In addition, all statistics of non-optioned sub-sample are significant and more compelling than those of optioned sub-sample. The results on estimate revisions made on the next fiscal-year's EPS are all significant at the 1% level.

The results are consistent with two arguments. First, takeover announcements are positive signals about the takeover target's short-term earnings prospective. Analysts revise their estimates on both optioned and non-optioned targets' current fiscal-year's and next fiscal-year's EPS. Second, takeover announcements made on non-optioned targets have more informational content than on optioned targets. Non-optioned targets receives higher and more significant positive estimate revisions than optioned targets, especially on estimates made on next fiscal-year's EPS.

Table 15
Descriptive Statistics of Takeover Targets

Panel A: Optioned Takeover Target Firms

Year	Number of Takeovers	Market Capitalization (in Million Dollars) Mean	Median
1986	11	983	557
1987	6	537	385
1988	4	1,365	1,130
1989	7	1,490	344
1990	4	1,336	553
1991	10	430	244
1992	5	1,402	992
1993	5	2,071	1,608
1994	19	914	300
1995	27	902	445
Total	98		

Panel B: Non-optioned Takeover Target Firms

Year	Number of Takeovers	Market Capitalization (in Million Dollars) Mean	Median
1986	36	197	124
1987	39	383	223
1988	41	273	143
1989	26	194	111
1990	12	208	96
1991	15	260	116
1992	23	184	110
1993	27	198	117
1994	43	226	112
1995	69	260	128
Total	331		

Table 16A
Estimate Revisions after Takeover Announcements
on Optioned Firms
(between January 86 and December 95)

Panel A: Estimate revision on current fiscal year's EPS

Event Month	Column† 1	2	3	4
0	65	2.2	2.96 (0.001)*	67.7 (0.001)*
1	64	2.6	4.42 (0.001)*	81.3 (0.001)*
2	64	1.7	2.39 (0.017)**	65.6 (0.008)*
3	64	1.9	3.54 (0.001)*	75.0 (0.001)*
4	61	2.0	3.21 (0.001)*	78.7 (0.001)*
5	51	2.1	2.71 (0.007)*	78.4 (0.001)*
6	38	1.8	2.91 (0.004)*	76.3 (0.001)*

Panel B: Estimate revision on next fiscal year's EPS

0	64	0.4	1.35 (0.177)	60.9 (0.060)
1	62	0.5	2.16 (0.031)**	66.1 (0.008)*
2	58	0.3	0.29 (0.772)	58.6 (0.267)
3	51	0.9	2.60 (0.010)*	68.6 (0.005)*
4	45	0.6	1.87 (0.061)	57.8 (0.234)
5	34	0.7	0.13 (0.797)	64.7 (0.059)
6	29	0.4	0.93 (0.353)	58.6 (0.267)

† Column 1: Number of observations
Column 2: Median abnormal estimate revision (%) (relative to the average S&P 500 firm's estimate revision)
Column 3: Wilcoxon signed rank statistics and *p*-value in parentheses
Column 4: (Sign test) Percentage of firms with increases (*p*-value)

* Statistically significant at 1% level
** Statistically significant at 5% level

Note:
We compare estimate revision in certain event month and then compare this revision to the average change of S&P 500 firms during the same month (as a difference).

Table 16B
Estimate Revisions after Takeover Announcements
on Non-optioned Firms
(between January 86 and December 95)

Panel A: Estimate revision on current fiscal year's EPS

Event Month	Column† 1	2	3	4
0	165	2.6	5.03 (0.001)*	71.5 (0.001)*
1	166	2.6	6.53 (0.001)*	83.1 (0.001)*
2	156	3.1	8.13 (0.001)*	85.9 (0.001)*
3	146	2.9	5.98 (0.001)*	82.9 (0.001)*
4	129	2.6	7.36 (0.001)*	87.6 (0.001)*
5	113	3.1	7.51 (0.001)*	86.7 (0.001)*
6	92	2.4	5.53 (0.001)*	84.8 (0.001)*

Panel B: Estimate revision on next fiscal year's EPS

0	128	0.5	4.15 (0.001)*	66.4 (0.001)*
1	120	1.1	6.11 (0.001)*	80.0 (0.001)*
2	107	0.9	5.24 (0.001)*	76.6 (0.001)*
3	95	1.0	4.01 (0.001)*	74.7 (0.001)*
4	69	0.9	3.06 (0.001)*	73.9 (0.001)*
5	55	1.1	4.23 (0.001)*	83.6 (0.001)*
6	42	1.2	2.84 (0.005)*	76.2 (0.001)*

† Column 1: Number of observations
Column 2: Median abnormal estimate revision (%) (relative to the average S&P 500 firm's estimate revision)
Column 3: Wilcoxon signed rank statistics and *p*-value in parentheses
Column 4: (Sign test) Percentage of firms with increases (*p*-value)

* Statistically significant at 1% level
** Statistically significant at 5% level

Note:
We compare estimate revision in certain event month and then compare this revision to the average change of S&P 500 firms during the same month (as a difference).

CHAPTER 7. CONCLUSION AND SUMMARY

I provide empirical evidence on three areas of informational content of stock option listings and their subsequent stock trading. I examine first whether increased and better quality information about a firm is introduced into the market through analyst forecasts after options are introduced on their stock. I then test how momentum strategies work on both optioned and non-optioned stocks. Finally, I look into two corporate events: stock splits and takeover (targets) and the resultant price reaction and analysts' earnings forecasts.

A list of 1,383 firms with options listed between January 1983 and December 1995 is obtained from CBOE. The list is then matched with the Zacks Investment Research's (Zacks) historical monthly database and the CRSP Daily Master File. I use the distribution of analysts' earnings expectations complied in the Zacks database as a proxy for the market's earnings expectations.

Overall, my findings are consistent with the hypothesis that more useful information about the firm is introduced to the market after options listing. More analysts, on average, are recorded to follow a stock around the time of options listing. The consensus estimate declines slightly after options listings for reasons to be discovered. Financial analysts also become more

disperse in their earnings estimates about a firm a few months after options are introduced on their common stock.

Further, financial analysts become slightly more accurate in their quarterly EPS estimates a few months after options listings. Standardized forecast errors decrease beginning four months after options listings. In case of positive earnings surprises, as illustrated in Figure 1, market seems to reward stocks less when they just have options listed on them. This positive cumulative abnormal return disappears three weeks after the earnings announcement day for stocks with newly listed options, but remains positive longer for stocks without options. In the case of negative earnings surprises, market reacts more negatively when firms report the earnings news after options listings. This negative cumulative return drags for weeks after earnings announcement. This may be due to the fact that analysts revise their estimates right after the earnings announcement.

I adopt a methodology similar to Chan, Jegadeesh, and Lakonishok (1996) to examine the relationship between stock options and momentum strategies. I rank stocks in both optioned and non-optioned groups independently on the basis of past returns as well as a measure of earnings news and assign them to one of ten portfolios. Past returns of optioned stocks exhibit a slightly better predicting power of future returns than those of non-optioned stocks.

Past earnings information and estimates can be conjectured to have more a determining role in deciding stock returns of optioned stocks than

non-optioned stocks. Optioned stocks seem to have a closer correlation between their past earnings and their past returns. In the non-optioned case, negative SUEs may not necessarily result in negative stock returns. On the other hand, earnings-surprise-drift effect is stronger in the case of non-optioned stocks and earnings momentum strategies using earnings surprise news continue to produce better return spread (measured as portfolio 10 minus portfolio 1) after portfolio formation in this subgroup, even up to two years.

In the corporate event section, I test price reaction and analysts' earnings estimate revisions after stock split and impact on target firms immediately after corporate takeover announcements.

To isolate the market response to a split announcement or a takeover decision, the event-time methodology is incorporated on the sample. Results from both subsamples, optioned stocks and non-optioned stocks, are then compared. The picture on optioned stock splits is obviously different from that on non-optioned stock splits. The significant abnormal returns after announcement day last for only two days on optioned stocks instead of three days on non-optioned stocks. In addition, the three-day excess return is far less for optioned stocks than non-optioned stocks. I find support for the hypothesis that the magnitude of the split announcement effect is greater for information-poor stocks (non-optioned stocks) than for information-rich stocks (optioned stocks).

A longer period's cumulative average excess return of these three samples are presented in Figure 2. The chart covers 40 days before and 40 days after the announcement day. The line of optioned sample shows a clear reversion in returns four days after announcements, while the non-optioned line does not show any clear reversion at all. In addition, the cumulative excess return line of the non-optioned sample reveals a drift effect 20 days into the post period, whereas the optioned line shows a more or less random walk. It adds some support for the hypothesis that the market adjusts rapidly to the stock split announcements during the post-announcement period for optioned stocks but not for non-optioned stocks.

Stock splits also tend to precede estimate revisions by analysts. The signal is so favorable that analysts tend to revise their estimates upward no matter whether the firm's stocks have options written on them or not. Another possible implication is that analysts are slow in revising their estimates and use stock split announcement as a confirmation about the future return prospects of the firm and revise their estimates accordingly.

I examine revisions of analysts' earnings forecasts for 430 takeover targets announced between January 1986 and December 1995 by separating them into optioned targets and non-optioned targets. I find that, on average, the current fiscal-year EPS forecasts are significantly increased months following the announcement for both the subsamples and that the next fiscal-year EPS forecasts are significantly increased only for the non-optioned sample. Overall, the favorable information conveyed by takeover

announcements appears to affect forecasts of short-term earnings of both optioned and non-optioned targets. However, takeover announcements on non-optioned targets have more informational content than announcements on optioned firms.

Overall, the results suggest that the options market makes a significant contribution to the efficiency of financial markets by improving the adjustment of prices to new information. Corporate events of optioned stocks tend to have less informational content than do those of non-optioned stocks and the drift effect following a corporate event is found to be stronger for non-optioned stocks.

I leave a few questions unanswered about analysts' activities after options listings. If detailed (individual) analysts' forecasts data are available, I could have answered several more questions. Do new analysts bring in better information and improve the forecast accuracy? Do existing analysts improve their forecasts after options listings by incorporating more and better information assembled from observing both stock and options markets? Detailed forecast data can also help us find whether analysts of an optioned stock revise their forecasts more frequently than those who follow a non-optioned stock.

This study does not clearly define the possibility that informed traders may substitute trading in stocks with trading in options after options listings. If informed traders do so, it will reduce the new information assimilated through the stock market. It may further impact momentum strategies, as

stock prices may no longer reflect all available information due to lower liquidity in the stock market.

When a takeover financed by stock is announced, arbitrageurs tend to buy stock of the target and short the stock of the acquirer. When the deal is complete, a small profit is usually made. However, a failed takeover attempt may cause huge losses to these arbitrageurs. What role do stock options play in risk arbitrage involving mergers and acquisitions? Would it affect the success rate of a takeover attempt? Can stock options help risk arbitrageurs reduce the risk caused by a failed takeover attempt? I leave these questions for future research.

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