Short Interest, Insider Trading, and Stock Returns [d]

T. Y. Leung,[b] Oliver Meng Rui,[a] and Steven Shuye Wang [c*]

This version: September 2, 2007

Abstract

We examine the effects of short selling and the combined effects of two forms of informed trading – short selling and insider trading – on stock price movements in the Hong Kong stock market. Short selling in Hong Kong is characterized by a high frequency of transactions. We provide empirical evidence that short-selling transactions carry information that signals a future decrease in the share price, and also find that insider purchasing helps to mitigate the negative impact of short-selling transactions. Our regression results show that the magnitude of abnormal losses is related to the value of the short-selling transaction, the presence of insider purchasing, and whether the security being sold is also an optioned stock. Finally, we find that when a tick rule is imposed, the short sale signal is more informative.

[a*]Corresponding author: Faculty of Business Administration, Chinese University of Hong Kong, Shatin, Hong Kong. Tel.: +852-2609-7594; E-mail: oliver@baf.msmail.cuhk.edu.hk. **Dr. Oliver M. Rui** is an Associate Professor at the Chinese University of Hong Kong. He holds a B.S. degree in international economics (1990) from the Institute of International Relations in Beijing, a Msc. degree in Economics (1993) from Oklahoma State University and an MBA in Statistics (1995) and a Ph.D. in Finance (1997), both from the University of Houston in the USA. Prior to joining the CUHK, he taught at the University of Houston and was an associate director of China Accounting and Finance Research Center and an associate professor at the School of Accounting and Finance of the Hong Kong Polytechnic University. Dr. Rui has published more than 30 papers in international reputable journals including *Journal of Financial and Quantitative Analysis, Journal of Banking and Finance, Journal of Corporate Finance, Journal of International Money and Finance, Financial Review, Journal of Financial Research*, *Journal of Accounting and Public Policy, Review of Quantitative Finance and Accounting*, *Journal of Management Studies, Journal of Behavioral Decision Making, Emerging Market Review*, *Journal of Business Research*, *Pacific-Basin Finance Journal* and *Journal of Multinational Financial Management*. Dr. Rui is a Charted Financial Analyst. He is a member of advisory committee of Hong Kong Business Valuation Forum. He is a vice president of Hong Kong Association of Financial Engineer. He is also a research fellow of Shanghai Stock Exchange and Hong Kong Institute for Monetary Research.

[b]Department of Accountancy, City University of Hong Kong, Kowloon Tong, Hong Kong. Tel.: +852-2784-4763; E-mail: acyleung@cityu.edu.hk. **Dr. T.Y. Leung** is an Assistant Professor at Department of Accountancy of City University of Hong Kong. She obtained her Bachelor of Commerce (Honors) from University of Melbourne, Master of Philosophy from Baptist University of Hong Kong and Doctor of Philosophy from Hong Kong Polytechnic University. She is a CPA and a member of Australian Society of Certified Practising Accountants (ASCPA). She has working experience in the commercial firms, non-profit-making organization (Community Chest), public sector (Hong Kong SAR Government) and academic institutions (Hong Kong Polytechnic University,

Shue Yan College and City University of Hong Kong). She has taught subjects in accounting, ethics in accountancy, auditing and taxation.

[c] School of Accounting and Finance, Faculty of Business, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong. Tel.: +852-2766-4952; Fax: +852-2330-9845; E-mail: afwang@inet.polyu.edu.hk. **Dr. Steven Wang** is an associate professor of Finance, School of Accounting and Finance, the Hong Kong Polytechnic University. He obtained his PhD from Queen's University, Canada, and bachelor and master degrees in statistics from Renmin University of China. His teaching and research interests include international financial markets, corporate finance, and financial derivatives. He has published in *Journal of Banking and Finance, Journal of International Money and Finance,* and *Journal of International Financial Markets, Institutions, and Money* etc.

[d] We thank S. Ghon Rhee and participants at the 2007 Financial Management Association European Conference in Barcelona, Spain and the 16th European Financial Management Association Conference in Vienna, Austria for their helpful comments and suggestions. Any errors remain our own. Wang acknowledges the financial support of the Hong Kong Polytechnic University.

Short Interest, Insider Trading, and Stock Returns

1. Introduction

Short selling presumably conveys unfavorable information to the market, which suggests a negative relation between short-selling transactions and market movements. Many markets around the world, including the U.S. market, have imposed short-selling restrictions in an attempt to prevent the excessive market volatility that this activity induces. However, short-selling constraints may lead to an upward bias in stock prices, as the transmission of negative information can be delayed (Miller, 1977). This paper examines the effects of short selling on stock price movements in the Hong Kong stock market.[1]

The regulatory framework and disclosure procedure for short selling in Hong Kong provide us with a favorable empirical study setting. First, the reporting and disclosure requirements for short selling in Hong Kong are more timely, frequent, and available than those that are in place in other more mature financial markets, such as that of the United States. Short selling was prohibited in Hong Kong until January 3, 1994, when the Hong Kong Exchange launched a pilot scheme to allow 17 designated securities to be short sold. In 1996, the number of designated securities was increased to more than 100, and the Hong Kong stock market has since made the transition from a regime that prohibited short selling to a regulated short-selling system. Under this regulated system, stockbrokers are required to identify and report short-selling activity to the Hong Kong Exchange on a daily basis. The Exchange then aggregates the total daily trading shares and market value of short-sale transactions for designated individual stocks and discloses

[1]Hong Kong is gradually becoming one of the world's international financial centers. The Global Financial Centres Index, which evaluates the competitiveness of 46 financial centers worldwide and is published by the City of London, ranked Hong Kong as the third global financial centre behind only London and New York, and described Hong Kong as a thriving regional center that performs well in key areas of competitiveness. In the past decade, trading interest has increased steadily, and this is reflected in Hong Kong's market cap, which has increased almost fourfold from about US$450 billion at the end of 1996 to about US$1.7 trillion in 2007. In contrast, the market cap of the NYSE increased by 2.3 times, the Nasdaq by 2.7 times, London by 2.3 times, Deutsche Borse by 2.5 times, Singapore by 2.7 times, and Australia by 3.5 times.

this information to the public the next day both through its Web site and in the newspapers. In the United States, in contrast, the short interest data for each stock (common and preferred) and warrant is collected by the country's two stock exchanges – the New York Stock Exchange and the American Stock Exchange – on the 15th of each month only, and is then aggregated and published each month in the Wall Street Journal, Barron's, and the New York Times. More recently, the daily disclosure of short-selling data has also become the practice in the United States (Christophe, Ferri and Angel, 2004; Daske, Richardson and Tuna, 2005). The practice in Hong Kong of daily reporting and disclosure and the daily trading data that this practice generates allow us to examine the informational role of short interest and the ability of short sellers to gage market timing. It must be noted that not all stocks can be short sold in Hong Kong. Securities that can be short sold are known as "designated securities," but can be removed from the designated list to become "disqualified" securities. The Hong Kong Exchange market announces the list of designated securities and disqualified securities three times a year,[2] and the data from this practice provides us with a unique opportunity to directly test the hypothesis of Miller (1977). If short-selling constraints lead to an upward bias in stock prices, we expect the announcement of disqualification (the imposition of short-selling constraints) to lead to inflation in the stock price of the securities concerned, whereas the announcement of designation (the removal of short-selling constraints) should induce deflation in the stock price of the securities concerned.

Second, we examine the combined effects of short selling and insider trading, which are both forms of informed trading, on stock price movements. Specifically, we examine whether the insider trading pattern (both in terms of buying and selling) affects the level of abnormal returns

[2]The months in which these announcements are made are not fixed. The first announcement was made on January 3, 1994. In 1995 there was no announcement, and so the number of designated short-selling securities remained at 17. In 1996 and 1997 the announcements were made in March and May, respectively, and of the nine announcements that were made between 1998 and 2000, those in 1998 were made in January, March, and November; those in 1999 in March, September, and November; and those in 2000 in February, May, and August.

in short-selling transactions. Short sales can be motivated by superior information or non-information based purposes, such as hedging needs (Diamond and Verrechia, 1987; Deechow, Hutton, Meulbroek, and Sloan, 2001; Chen and Singal, 2003), whereas insider trading is presumably always based on inside information. Seyhun (1986) finds that directors buy when they expect the share price to increase and sell when they expect the share price to decrease. We hypothesize that as insider purchasing is a signal of future increases in share price, we expect that the insider selling activity of directors around the time of a short-selling transaction helps to confirm the bad signal that is conveyed by the short sale, whereas insider buying activity helps to reduce the negative impact of a short sale that might be based on less accurate information or be for non-information based purposes. The regulatory framework on insider dealing and disclosure in Hong Kong has been in development since 1991. Under the regulations that govern insider-trading activity, insiders (including directors, chief executives and substantial shareholders who own more than a 5% share in listed firms) are allowed to trade the shares of their firm on the market. However, the reporting and disclosure rules require them to notify both the Hong Kong Exchange and their firm of such deals within five business days (from 2003 onward within three days) of the day on which the securities transaction was made.

We find that short-selling activity is a bearish signal with significantly negative abnormal returns after controlling for the market factor, firm size factor, book-to-market factor, and momentum factors. Our findings provide evidence that short-selling transactions have a negative impact on both firm and market. When we examine the combined effects of short selling and insider trading we find, consistent with our hypothesis, that insider purchasing helps to reduce the magnitude of the abnormal losses that are generated by short selling, whereas insider selling does not alter the magnitude of these abnormal losses. Finally, we find that when a tick rule is imposed, the short sale signal is more informative.

The remainder of this paper is organized as follows. Section 2 provides a brief summary of the related research. Section 3 introduces the data and methodology. Section 4 provides the empirical results. Section 5 concludes the paper.

2. Literature Review

Short-selling restrictions are imposed to prevent the volatility that is caused by excessive speculation. Most of the early studies in the finance literature on short selling focus on the impact of the restriction and relaxation of short selling on the market in the United States. Miller (1977) argues that short-selling constraints lead to an upward bias in stock prices, as the transmission of negative information can be delayed. Jarrow (1980) proposes that short-selling restrictions have a substitutive effect on the price of risky assets. Diamond and Verrecchia (1987) find that by relaxing short-selling constraints, price discovery becomes faster, particularly when the news is bad, and that the abnormal returns around the days on which information is publicly announced become less skewed to the left. Other studies examine the relation between short-selling restrictions, volatility, and the leverage effect (French, Schwert, and Stambaugh, 1987; Schwert, 1990; Nelson, 1991; Cheung and Ng, 1992).

More recent studies in this area focus on whether short sales are informative, and find that the higher the short interest rate, the more negative the subsequent market reaction (Asquith and Meulbroek, 1996; Deechow, Hutton, Meulbroek, and Sloan, 2001). There is also empirical evidence to suggest a strong relation between short-selling strategies and certain measures of fundamental value (cash flow to price, earnings to price, book to market, and value to market). Short sellers short sell when they expect the share price to fall, and it is therefore hypothesized that aggregate short selling is motivated by a prediction of future market decline. Lamont and Stein (2004), for example, find that aggregate short interest moves in a countercyclical fashion.

Other studies examine the relation between short-selling activity and corporate announcements, such as SEC action (Dechow, Sloan, and Sweeney, 1996), restatement and corrective disclosure (Griffin 2003), and earnings announcements and management forecast announcements (Christophe, Ferri, and Angel, 2004; Daske, Richardson, and Tuna, 2005). Arnold, Butler, Crack, and Zhang (2005) suggest that as short selling is costly, an increase in the cost of short selling strengthens the negative relationship between short interest and subsequent stock performance.

Examples of studies in markets other than that of the United States include those of Ho (1996) and Poitras (2002) using Singaporean data; Aitken, Frino, McCorry, and Swan (1998) using Australian data; and Hoontrakul, Ryan, and Perrakis (2002) using Thai data.[3] Henry and McKenzie (2006) examine the impact of short selling on the price-volume relation using Hong Kong data, and find that short-selling activity has a significant impact on the non-linear and bidirectional relation between volume and volatility. This suggests that the Hong Kong market has demonstrated greater market volatility since the relaxation of short-selling restrictions, and that short-selling transactions help to exacerbate the asymmetric responses to positive and negative innovations in returns.

3. Data and Methodology

3.1 Characteristics of the Hong Kong Regulated Short-Selling Market

The Hong Kong Exchange introduced a short-selling pilot scheme in January 1994, the rules and regulations of which are laid out in the eleventh schedule[4] of the regulatory framework and rules of the exchange. Under the regulated pilot scheme, for the two years between January

[3]In contrast to the monthly disclosure practice in the United States, in Australia short-selling information is disclosed straight after the transaction, with the effect that the negative impact of short sales is incorporated into the intraday stock prices almost immediately (Aitken, Frino, McCorry, and Swan, 1998).

[4]The 11th schedule applies to short selling other than market-maker short selling, derivative warrant liquidity provider short selling, equity-linked index (ELI) liquidity provider short selling, designated index arbitrage short selling, stock futures hedging short selling, derivative warrant hedging short selling, and options hedging short selling.

1994 and March 1996 only 17 securities – termed designated securities – could be short sold, and to conduct such transactions short sellers were obliged to have an exercisable and unconditional right to vest the stocks. In addition, a "tick rule" was established that stated that all short-sale transactions had to be conducted at a price above the current best ask price. A regulated short-selling transaction therefore refers to the sale of designated securities that are not owned by the seller. Such transactions are consummated by the delivery of securities under a securities borrowing and lending agreement that states that the trader shall execute the short-selling transaction by borrowing or obtaining a confirmation from the counterparty that the counterparty has the securities available to lend.

The Hong Kong Exchange revised the pilot scheme in March 1996 and abolished the "tick rule" for two and a half years before reinstating it on September 7, 1998 in response to changes in market conditions.[5] Since then, as a precaution against overly heavy short-selling pressure, the "tick rule" has applied to all short-selling transactions except for those in which stock option market-makers conduct market-making activities for the purpose of hedging a portfolio risk. However, it is still the case that only securities that have been so designated by the Hong Kong Exchange are eligible for short selling. The Exchange revises and announces the number of designated securities on a quarterly basis. The number of designated short-selling securities increased from 17 in 1993 to 113 in 1996,[6] and varied only slightly from then on.

---

[5]The 1997 Asian financial crisis created great selling pressure in most of the financial markets in Asia. In view of the significant losses that were suffered, the Hong Kong government intervened in the Hong Kong financial market by buying stocks and futures. The reinstatement of the "tick rule" was one of the many precautionary measures that were implemented to avoid massive speculative short selling.

[6]A designated security is an automatch stock that is chosen by the Hong Kong Exchange from time to time as being eligible for short selling in accordance with several selection criteria. According to the eleventh schedule of the rules of the Hong Kong Exchange, designated securities are either constituent stocks of indices (for instance, the Hang Seng Index, Hang Seng 100 Index, or Hang Seng MidCap 50 Index) that are the underlying indices of equity index products that are traded on the Hong Kong Exchange or the Hong Kong Futures Exchange; the underlying stocks of stock options that are traded on the Hong Kong Exchange; the underlying stocks of stock futures contracts that are traded on the Hong Kong Futures Exchange; stocks that meet the minimum liquidity requirement for the issuance of basket derivative warrants; stocks with a market capitalization of not less than HK$1 billion and an annual turnover

3.2 Sample and Data

The restrictions on short selling were relaxed in January 1994 when the Hong Kong Exchange allowed 17 designated securities to be short sold in a pilot scheme. As there was little short-selling activity for the 17 designated securities during the initial period of the pilot scheme between 1994 and 1995, our sample starts in 1996. Before 1998, the announcement of designated securities that could be short sold was made once a year, whereas between 1998 and 2000 such announcements were made three times a year.[7] The short-selling announcement and transaction data were obtained from the Monthly Quotations and Research and Planning Division of the Hong Kong Exchange. The share price return data and accounting information were extracted from the Company Returns and Financial Statements files, respectively, of the PACAP database. Our final sample covers the five-year period between 1996 and 2000.

****

TABLE 1 HERE

****

Table 1 reports the statistics of the securities that were eligible for (Panel A) and disqualified from (Panel B) short selling as at the end of the respective year. Panel A shows that for the first two years of the short-selling pilot scheme in 1994 and 1995 only 17 securities (about 3% of the total number of listed firms) were allowed to be short sold. The number increased 6.65 times to 113 in 1996 and again 2.13 times to 241 in 1997, which is the highest number over the sample period. Between 1994 and 2000, the average percentage of designated short-selling

---

to market capitalization ratio of not less than 40%; the Tracker Fund of Hong Kong and other Exchange Traded Funds; and all stocks that are traded under the pilot scheme.

[7]The months in which the announcements are made are not fixed. The first announcement was made on January 3, 1994. In 1995 there was no announcement, and so the number of designated short-selling securities remained at 17. In 1996 and 1997 the announcements were made in March and May, respectively, and of the nine announcements that were made between 1998 and 2000, those in 1998 were made in January, March, and November; those in 1999 in March, September, and November; and those in 2000 in February, May, and August.

securities in relation to the total number of listed firms was 21%. During this period, securities were added to the designation list and others were removed. Panel B shows that for the four years after the initial relaxation of the short-selling restrictions, the number of disqualified securities was small, but in 1998 the numbers of designated and disqualified securities changed substantially, mainly as a result of attempts by the Hong Kong securities authorities to stabilize the very volatile equity market after the 1997 Asian financial crisis. The number of designated securities decreased from 241 to 195 and that of disqualified securities increased from 1 to 146, which together represented 28.64% of the total listed firms. Panel C shows the summary statistics of the short-selling transaction sample. There are 27,085 short-selling transaction records for the period from 1996 to 2000, and the average number (market value) of short-sold shares relative to the total (market value) trading volume is 0.22% (2.07%).

In total, 3,514 announcements of designation and disqualification were made between 1994 and 2000, and 27,085 short-selling transactions were completed between 1996 and 2000. Our sample analysis for the announcement events excludes finance companies (302 cases), which reduces the sample size to 3,212. Of these 3,212 events, 11 cases do not have valid stock code information.

We use the market model to measure the abnormal returns of firms with securities that were designated as eligible for short selling, firms with securities that were removed from the designation list, and firms that carried out short-selling transactions. These sample selection criteria trim the announcement sample down to 1,632 events, which leaves us with a final sample short-selling announcement events sample of 1,871 events, of which 1,095 are designation announcements and 776 are disqualification announcements. Regarding the 27,085 transaction records, the selection criteria eliminates 19,713 records from the sample, which leaves us with

7,372 transaction events in the final sample for the analysis of the share price performance of short-selling transactions.

3.3 Methodology

Event Study of Abnormal Returns

We employ event study and the market model to measure the abnormal returns of short-selling firms and short-selling transactions around designation and disqualification announcements.[8] In the market model, the abnormal return of firm *i* on day *t* (AR_{itm}) is taken as the difference between the realized return of sample firm i and that of the market index. We follow the method of Brown and Warner (1985) to compute the test statistics on the significance of the abnormal returns. The length of our estimation period for the measurement of the standard deviation is the 200 days between t = -300 and t = -101. We measure the abnormal returns around designation announcements, disqualification announcements, and short-selling transactions. As we also observe that there are director dealings around the time that stocks are sold short, we consequently also measure the abnormal returns of the different short-selling events with and without insider trading activity (insider purchasing and insider sales).

Calendar-time Portfolio Approach to Abnormal Returns

Following the methodological framework of Desai, Ramesh, Thiagarajan, and Balachandran (2002), we examine the relation between the level of short interest and stock returns. This calendar-time approach, which was initially advocated by Mitchell and Stafford (2000), addresses the problem of cross-sectional dependence and takes into account the cross-sectional correlation among the individual stocks in a portfolio. The calendar-time portfolio

[8]For robustness, we also use the control firm approach to compute the abnormal returns (Barber and Lyon 1997).

approach of Desai, Ramesh, Thiagarajan, and Balachandran (2002) uses monthly short interest data for the period from June 1988 to December 1994, and employs the monthly returns of stocks that had a short interest level of at least 2.5% (as a percentage of the number of outstanding shares) in the previous month to form the monthly return of the portfolio. The monthly portfolio returns are then regressed on a four-factor model, the first three factors of which (market factor, size factor, and book-to-market ratio) are the risk factors of Fama and French (1992) and the fourth factor of which is the momentum factor of Carhart (1997).

As the Hong Kong Exchange reports short-selling activity on a daily basis, we adopt a calendar-time portfolio approach that uses daily data. We do not include all of the firms with shares that were short sold in our daily portfolio, and rather than measuring the level of short interest as a percentage of the number of outstanding shares as in the study of Desai, Ramesh, Thiagarajan, and Balachandran (2002), we assess the intensity of daily short-selling activity (the level of short interest to total shares outstanding) as a percentage of the daily trading volume (total daily trading volume to total shares outstanding). We use this short interest to daily volume ratio as our measure of short-selling activity intensity, and posit that the higher the ratio, the more negative the market reaction. Similar to the approach of Desai, Ramesh, Thiagarajan, and Balachandran (2002), we also examine the changes in the alpha values using different levels of short interest. In addition to the "All" sample that includes all observations (6,499) for the period from May 1, 1996 to December 29, 2000, we also form three equally weighted daily portfolios of stocks for the occasions when the daily percentages of short sold shares reached 0.00075%, 0.00125%, and 0.00175% on the previous day. We re-balance the equally weighted portfolios on a daily basis to add stocks with a short sold interest rate that reaches our cut-off points and drop stocks with a short sold interest rate that does not reach our cut-off points. For the cut-off of

0.00125%, we have 4,613 daily observations, and for the 0.00175% cut-off point there are 4,112 daily observations.

In addition to using the level of short interest as a cut-off point, we also use the number of days between two consecutive short-selling transactions as a measure of the trading intensity of short selling. We divide the observations into four subsamples: "Day-to-day Short-selling Transactions," which includes events in which short-selling transactions are conducted on a daily basis (6,361 observations); "No Previous Transaction for 5 Days," which includes events in which two consecutive short-selling transactions occur more than 5 days but less than 10 days apart (471 observations); "No Previous Transactions for 10 Days," which includes events in which two consecutive short-selling transactions occur more than 10 days but less than 15 days apart (166 observations); and "No Previous Transactions for 15 Days," which includes events in which two consecutive short-selling transactions occur more than 15 days apart (374 observations).

We then regress the daily return for our portfolio on the four factors of market, size, book-to-market ratio, and momentum, as follows.

$$Portfolio\ Return = \alpha_0 + \beta_1\ Market + \beta_2\ Size + \beta_3\ BM + \beta_4\ Momentum. \quad (1)$$

In the equation, *Portfolio Return* is the average of the 10-day return of a portfolio that comprises stocks with short interests percentages rates that reached the cut-off point on the previous day. *Market* is the average of the 10-day return of the market return. *Size* is the size factor. We divide the firms into five categories according to the market value of their equity and rank them from small to large in each of the size categories. *Size* is then taken as the difference of the average return of the smallest firms and the average return of the largest firms. *BM* is the book-to-market factor. To compute this, we divide the firms into five categories according to their

book-to-market values (the ratio of book value to market value of equity), and classify them into value firms and growth firms. *BM* is then taken as the difference of the average return of the firms with the highest values and the average return of the firms with the lowest values. *Momentum* is the momentum factor, which is the difference between the average of the two highest returns and that of the two lowest returns of the size quintile portfolio according to the market value of equity.[9] The intercept α_0 is the coefficient on short interest, which is the measure for abnormal returns that are caused by short-selling transactions. We expect the sign for α_0 to be negative, because this will indicate that short-selling activity sends a bearish signal.

Short-selling Activity and the Aggregate Market Return

Following Chowdhury, Howe and Lin (1993), we use the vector autoregressive model (VAR) to examine the causality relation between short-selling activity and the aggregate market return with monthly (one lag), weekly (two lags), and daily (five lags) data. In the VAR model, the tests of Granger causality are based on a simple *F* test, in which the *F*-statistics test the null hypothesis that the independent variables do not Granger-cause the dependent variable. We take the short interest rate to be the percentage of trading volume and trading value, and examine the Granger-causality relation between aggregate short-selling activity (*SS*) and the market return (*MR*) as follows.

$$MR_t = \sum_{i=1}^{T} \alpha_i MR_{t-i} + \sum_{i=1}^{T} \beta_i SS_{t-i} \,, \tag{2}$$

where MR_t is the market return at time *t* and MR_{t-i} is the market return at time *t-i*. We use different measurements of SS_{t-i} for trading volume and trading value. For trading volume, *SS* is the ratio of

[9]To measure the momentum factor, we calculate the average previous return over 300 days for all of the stocks in the industry firm category of the PACAP database. We then divide the stocks into five groups according to their market value (price times the number of outstanding shares). We rank the average previous return of the stocks in each size quintile portfolio from lowest to highest. The momentum factor for the stocks in the same size quintile portfolio is the difference between the average of the highest returns (winners) and the average of the lowest returns (losers).

short-sold shares to total shares traded, whereas for trading value it is the ratio of the total market value of short-sold shares to the total market value of all shares traded. The time horizon is monthly, weekly, or daily.

Cross-Sectional Model of the Returns of Short-selling Transactions

Many short-selling empirical studies (e.g., Senchack and Starks, 1993) show that the magnitude of the abnormal returns that are associated with short-selling transactions is related to the characteristics of the firm and the intensity of the transactions, and that abnormal returns reflect the stock market's perception of the quality of the information that is held by the short sellers. Similar to other studies, we construct a cross-sectional model to examine the relationship between the cumulative abnormal returns (*CAR*), short-selling transactions, and insider purchasing after controlling for certain firm characteristics, as follows.

$$CAR = \alpha_0 + \beta_1 \, SSValue + \beta_2 \, InsBuy + \beta_3 \, LnSize + \beta_4 \, Option + \beta_5 \, TimeD, \qquad (3)$$

where *CAR* is the abnormal return over various periods ($+1 \le t \le +10$, $+10 \le t \le +60$, $+10 \le t \le +120$, and $+10 \le t \le +150$).

Diamond and Verrecchia (1987) propose that the negative market reaction to short-selling transactions is due to the unfavorable information that is carried by the short interest rate. However, evidence for the relation between short interest and abnormal returns is mixed. Figlewski (1981) and Woolridge and Dickinson (1994) do not find a significant relation between short selling and abnormal returns, but Desai, Ramesh, Thiagarajan, and Balachandran (2002) find that firms with a large short position experience significantly negative abnormal returns. We therefore include a proxy – *SSValue* – for the trading volume of informed short sellers, and hypothesize it to be positively related to the value of private information. *SSValue* is the measure

of the intensity of short-selling activity as measured by the log value of the market value of short-sold shares.

Seyhun (1986) finds that directors buy when they expect the share price to increase and sell when they expect the share price to decrease. We examine whether the trading pattern of directors (both in terms of buying and selling) affects the level of abnormal returns of short-selling transactions by including an insider trading dummy variable – *InsBuy* – in the regression model that takes a value of 1 if there was insider purchasing around the time of the short-selling transaction, and 0 otherwise. We expect insider purchasing around the time of the short-selling transaction to help reduce the negative impact of short sales on the cumulative abnormal returns.

Firm size is used as a proxy for the information environment of a firm. In general, larger firms are more likely to be followed by analysts, and there is hence more publicly available information about them than there is for smaller firms. Therefore, the information content of short-selling transactions for larger firms should be relatively less than that for smaller firms. We include *LnSize* as a measure of firm size to control for the size effect in our regression model, which is measured as the natural log of the market value of a firm's equity (which is the product of price and the number of outstanding shares) on the transaction date.

When short selling is prohibited, options trading is an alternative action for investors who anticipate future stock price movements. As short selling can be costly, investment strategies that make use of options (such as buying put options and selling call options) can create the same short position but at a relatively lower cost. Informed traders who expect the share price to decrease in the future may choose to engage in options trading (by writing a call or buying a put) if it is available, rather then short selling shares. There should therefore be a difference in the market reaction to short-selling transactions for optioned and non-optioned stocks that are designated as eligible for short selling (Figlewski and Gwendolyn, 1993; Senchack and Starks,

1993). In addition, the availability of options trading also makes information more open to the market, which may reduce the information content of short-selling transactions. The variable *Option*, which is a dummy variable that takes a value of 1 if the stock is an optioned stock and 0 otherwise, is therefore included in our regression model to control for the potential effect of tradable options on the market reaction to short-selling transactions. We expect a less negative reaction to the short selling of optioned stocks.

We observe that short-selling transactions are not single-day events, and that many are succeeded by further short-selling transactions in the days that follow. Of the 7,372 observations, 6,361 events (86.29%) are day-to-day transactions, but some short-selling transactions are widely spaced in time, with some as much as 10 or 15 days apart. Occasional and frequent short-selling transactions may have differing effects on stock returns. If some informed short sellers trade frequently (daily) because they have superior private information about future declines in stock prices, then we would expect a more negative share price response to a series of short-selling transactions in the short run. However, if some inside transactions represent non-information driven purposes, such as programmed trading and hedging, we would expect a less negative share price response to a series of short-selling transactions. Furthermore, if the market is efficient, then the market reaction to the initial short-selling transaction should be more significant, whereas the reaction to subsequent short-selling transactions should be smaller, as the market should have responded to the unfavorable information that was disclosed by the short seller in the first transaction. We test these hypotheses by including *TimeD* in our regression model, which is a dummy variable that takes a value of 1 if the length of time between two consecutive short-selling transactions is equal to or greater than 10 days, and 0 otherwise.

4. Empirical Results

4.1 Event Study of Abnormal Returns

Miller (1977) argues that in a market with heterogeneous expectations and unrestricted short-selling, investors making extremely pessimistic evaluations will increase as opinion diverges, and short-selling allows them to tone down the propensity of stock (particularly risky stock) to be bid up. Conversely, in a market with short-selling constraints, the stock price is more likely to be bid up.

In our case, the designation announcement relaxes short-selling constraints on the designated securities and therefore increases the amount of outstanding short positions on the market, thus creating more possibilities for a decrease in share prices. However, a counteracting factor is that the disqualification announcement re-imposes short-selling constraints on the disqualified securities, which prevents unfavorable information from being conveyed to the market and may lead to the upward bias of stock prices. We therefore hypothesize that the announcement of a disqualification should lead to the inflation of stock prices, whereas the announcement of a designation should induce the deflation of stock prices.

We report the abnormal return results for the short-selling designation and disqualification announcements in Table 2. Consistent with our hypotheses, we find that the market reacts negatively to designation announcements, but not to disqualification announcements.

****

TABLE 2 HERE

****

We plot the CAR path in Figure 1, from which we can observe that there is a great difference in the market reaction to designation announcements and its reaction to disqualification announcements. It is of no surprise that designation announcements lead to

downward price pressure and that disqualification announcements, or announcements of the re-imposition of short-selling constraints (disqualification) on stocks, lead to inflated prices.

****

Figure 1 HERE

****

The event study results for the short-selling transactions are shown in Table 3 and Figure 2. As has been stated, short-selling transactions are not single-day events, and indeed we find that many short sellers trade repeatedly day after day (86.29%) and within five days (6.39%), with some short-selling transactions being conducted less frequently, such as 10 or 15 days after the previous transaction (7.33%). We therefore divide the observations into four subsamples: "Day-to-day Short-selling Transactions," "No Previous Transaction for 5 Days," "No Previous Transactions for 10 Days," and "No Previous Transactions for 15 Days."

In Table 3, the cumulative abnormal returns over the +10+60, +10+120, and +10+150 periods for the entire sample and the four subsamples are significantly negative, and range from -2.78% to -12.79%. The cumulative abnormal returns over the +1+10 period for the entire sample and the "Day-to-day Short-selling Transactions" subsample are also negative and significant. However, the market reaction to the "No Previous Transactions for 15 days" subsample is more pronounced in the long run. Compared with the other subsamples, the magnitude of the cumulative abnormal returns for the "No Previous Transactions for 15 days" subsample is the most negative, as is clearly shown in both Table 3 and Figure 2. For example, in Table 3, the *CAR* over the +1+120 period for the "Day-to-day Short-selling Transactions" subsample is -6.76%, whereas the *CAR* for the "No Previous Transactions for 15 days" subsample is -10.69%. In summary, the CAR analysis results indicate that frequent short-sale transactions have a more negative impact in the short run, whereas less frequent short-sale transactions have a more negative impact in the long run. As has been stated, some frequent short sales do indeed have a

strong short-term impact, but some may just be noise, or transactions that are driven by non-information based needs. Less frequent short sales are more likely to be driven by information, and have a larger and longer impact.

****

TABLE 3 HERE

****

****

FIGURE 2 HERE

****

We examine the market reaction to short-selling transactions to measure whether trading by short sellers conveys unfavorable information. In addition to examining the changes in the market reaction to short-selling transactions, we also explore the impact of short-selling transactions on the trading strategy of directors and the changes in the market reaction to the various trading patterns that are displayed by informed directors and short sellers. The results are reported in Table 4 and Figure 3.

****

TABLE 4 HERE

****

We divide the sample into three subsamples. The "Short-selling Transactions Only" subsample comprises events that involve only short-selling transactions without insider trading during the study period. The "Short-selling Transactions and Insider Purchasing" subsample comprises events that involve both insider purchasing and short-selling transactions, and the "Short-selling Transactions and Insider Sales" subsample comprises events that involve both insider sales and short-selling transactions. Figure 3 shows the CAR paths for the three subsamples, in which the path of "Short-selling Transactions Only" is downward sloping with a kink in the middle, that of "Short-selling Transactions and Insider Purchasing" is characterized by a markedly changing slope, and that of "Short-selling Transactions and Insider Sales" is an

almost monotonically decreasing slope. Consistent with our hypothesis, we find that insider purchasing helps to reduce the negative impact of short-selling transactions.

****

FIGURE 3 HERE

****

4.2 Calendar-time Portfolio Approach to Abnormal Returns

Table 5 Panel A reports the regression results for the four daily portfolios of stocks of the "All" sample and the 0.00075%, 0.00125%, and 0.00175% short interest subsamples. We are interested in the coefficient of the intercept. A negative sign for the intercept means that firms with shares that are being short sold suffer abnormal losses. The coefficient for the "All" short interest subsample on the intercept is -0.068%, which is significant at the 0.01 level, indicating that the designated short-sold stocks lost a daily abnormal return of 0.068%. This supports the hypothesis that short sellers have better information about firms and that short-selling transactions carry information about future share price declines. We find similar negative and significant results for the other short interest subsamples of 0.00075% (return = -0.071%), 0.00125% (return = -0.074%), and 0.00175% (return = -0.084%), which suggests that the more heavily shorted stocks suffer from increasingly negative and abnormal losses after controlling for the market factor (*Market*), size factor (*Size*), book-to-market ratio (*BM*), and momentum factor (*Momentum*).

Panel B shows the results for the four subsamples using the number of days between two consecutive short-selling transactions. The coefficients of the intercept in the four subsamples are all negative, which indicates that short-selling transactions send bearish signals to the market. In particular, the coefficient of the intercept is significant in the subsample for day-to-day trading, which suggests that the more frequently the short-sellers trade, the more significant the abnormal

loss. These findings provide evidence that short-selling transactions send unfavorable signals to the market, and that the more heavily and more frequently shares are sold short, the more negative the market reaction.

****

TABLE 5 HERE

****

4.3 Short-selling Activity and Aggregate Market Returns

Table 6 shows the test results for the causality relation between the market return and the aggregate measure of short-selling activity. We initially use the augmented Dickey-Fuller (ADF) unit root test to assess the movement of the variables, and although we do not report the results here, find the causality relation variables to be stationary. Panel A and Panel B show the causality results when the aggregate number of short-sold shares (as a percentage of the total trading volume) and aggregate market value of short-sold shares (as a percentage of the total trading value), respectively, are used.

We examine the causality relation over three time-horizons – monthly, weekly, and daily – and find that the causality relation is significant when daily data are used but not when monthly or weekly data are used. In other words, the test results show that there is a causality relation between the market return and lagged short-selling activity over the shorter daily time horizon, which implies that aggregate short-selling activity can be used to predict subsequent short-run market returns. The stronger power of lagged aggregate short-selling activity to predict short-horizon returns may be due to the more timely reporting and disclosure procedures to which short-selling transactions are subject in Hong Kong.

****

TABLE 6 HERE

****

4.4 Cross-Sectional Model of the Returns of Short-selling Transactions

Table 7 reports the results of regression model (3), with the t-statistics for the coefficients adjusted for heteroskedasticity using White's procedure (1980). Previous studies have found that firms with a large short position experience negatively significant abnormal returns (Diamond and Verrecchia, 1987; Desai, Ramesh, Thiagarajan, and Balachandran, 2002), and thus the higher the short interest rate, the greater the negative market reaction should be. We use *SSValue* as the measure for the short interest rate and expect a negative relation between *SSValue* and abnormal returns. Table 7 shows the coefficients on *SSValue*[10] to be significantly negative, which indicates that short-selling activity carries information about future declines in the share price.

In Table 4, we find evidence of director trading around the time of short-selling activity, and therefore use *InsBuy* to test whether the abnormal returns from short-selling transactions are affected by the trading strategy of directors who are trading at the same time. For the long-term abnormal returns $+10 \leq t \leq +60$, $+10 \leq t \leq +120$, and $+10 \leq t \leq +150$, the coefficients on *InsBuy* are positively and significantly related to abnormal returns, which suggests that the buying activity of directors helps to reduce the negative impact of the short-selling activity. As insider purchasing is a signal of future increases in the share price, the buying activity of directors may counter-balance the effect of the signal of a future decrease in the share price that is conveyed by short-selling activity.

[10]In Table 7, we report the results using the log value of the market value of short-sold shares as a measure. For robustness, we also employ alternative measures, such as the log value of the number of short-sold shares, the ratio of short-sold shares to total trading volume, and the ratio of short-sold value to total trading value, and the results are similar.

LnSize, which is the log value of the market value of equity, is used as the control variable for the size effect in our regression model. We find *LnSize* to be negatively related to the level of abnormal returns and to be significant for the periods $+10 \leq t \leq +60$, $+10 \leq t \leq +120$, and $+10 \leq t \leq +150$. The negative relation indicates that the market reacts more unfavorably to larger firms with shares that are being short sold.

We use *Option*, which is a dummy variable that takes a value of 1 if the stock is an optioned stock and 0 otherwise, in the model to control for the impact of designated securities that are also optioned stocks. The coefficients on *Option* are positively and significantly related to the level of abnormal returns of short-selling transactions in all of the periods that are examined. This result indicates that optioned stocks react less negatively to short-selling activity, a finding that is consistent with the argument of Senchack and Starks (1993) that there should be a less negative market reaction to the short selling of optioned designated short-selling stocks.

Figure 3 shows that the market reaction to transactions with no short selling in the previous 10 days and 15 days is more pronounced (more positive and more negative) than the reaction to daily transactions. We therefore include *TimeD* in the regression model to examine whether the magnitude of abnormal returns for short-selling transactions is affected by the frequency of short-selling activity. *TimeD* is a dummy variable for length of time in terms of the number of trading days between two consecutive short-selling transactions for the same firm. Table 7 shows that the coefficients on *TimeD* are not significant.

****

TABLE 7 HERE

****

4.4 Impact of the uptick rule

When the Hong Kong Stock Exchange introduced a pilot scheme of regulated short selling in January 1994, an uptick rule was imposed that stipulated that a short sale could not be made below the best current ask price. The uptick rule was abolished in March 1996 and the number of designated securities for short selling increased. Following the 1997 Asian financial crisis, the uptick rule was reinstated on September 7, 1998 due to changes in market conditions. However, short-selling transactions by stock options market-makers to hedge the portfolio risks that result from their market making activities are exempt from the rule. Finally, on December 3, 2001, an exemption from the tick rule on short selling in the stock market for index arbitrageurs and market makers took effect to help improve market liquidity in a falling market.[11]

The uptick rule discourages investors from short selling in a falling market. To examine the effects of the imposition or abolition of the rule on the short-selling behavior of investors, we compare the impact of short sales for different sub-sample periods, that is, sub-samples when the rule was imposed versus those when the rule was not in force. As short sales are more costly when the uptick rule is in force and therefore more informative, we expect the negative impact of short sales to be larger for the period during which when the uptick rule was in place. In Panel A of Table 8, we report the results for the short-selling abnormal returns in the two periods before and after the imposition of the tick rule (September 7, 1998), and find significantly abnormal losses for short-selling transactions in both periods. In addition, we perform a sample comparison to examine whether the impact of short sales is more negative when the uptick rule is in force.

[11]Following the United States, where the uptick rule was eliminated by the SEC on July 6, 2007, the Hong Kong Exchanges and Clearing Limited (HKEx) announced that the tick rule would be suspended in November 2007, subject to the approval of the Securities and Futures Commission (SFC). More recently, however, partly due to the impact of the sub-primary mortgage risk in the United States, the Hong Kong stock market has become very volatile and short-selling activities have increased significantly, and thus the plan to suspend the tick rule in Hong Kong has been postponed to inhibit speculative short-selling activity.

Our parametric test results show that the cumulative abnormal returns are less significant for the "before" period than for the "after" period, providing evidence that the negative impact of short-selling is more severe when the uptick rule is in force. We also repeat our regression analysis with the inclusion of a dummy variable *Tick* that takes the value of 1 if the short-selling transaction day falls after September 7, 1998, and 0 otherwise. The results are reported in Panel B. The coefficients on *Tick* are negative in all of the periods and significant in the $+10 \leq t \leq +60$, $+10 \leq t \leq +120$, and $+10 \leq t \leq +150$ periods. These results support our conjecture that short selling sends a more informative signal when a tick rule is in place to govern short-selling activity.

****

TABLE 8 HERE

****

5. Conclusion

Short selling is not very common, as many countries have imposed constraints on the activity. However, regardless of whether it is permitted or prohibited, there is a substantial body of empirical research that investigates the information content of short interest on the firm level and the market level, the information effects of short-selling constraints, and the profitability of short selling. Such research mainly focuses on U.S. data, and although there are some studies that examine short-selling activity in other countries, to date few studies have been published that use data from Asian markets.

Using a comprehensive database of short-selling and insider trading transactions in Hong Kong for the period 1996 to 2000, we examine the characteristics of short selling and insider trading and the impact of the two practices on stock prices. Short sellers make trades very

frequently, and we therefore find that short selling has a significantly negative impact on a firm. The market is found to react negatively to designation announcements and short-sell transactions, and our event study identifies that short-selling transactions result in large cumulative abnormal losses. These results indicate that short sellers have private information. When we examine the combined effects of short selling and insider-trading activity, we find that insider purchasing helps to reduce the negative impact of short-selling transactions. Our regression results suggest that the magnitude of these losses is related to the intensity of the short-selling activity, whether insider-trading activity is taking place, and whether the designated security is also an optioned stock. Finally, we find short selling to be a more informative signal when a tick rule is imposed on short-selling activity.

References

Aitken, M. J., A. Frino, M. S. McCorry and P. L. Swan, 1998, Short sales are almost instantaneously bad news: Evidence from the Australian Stock Exchange, *Journal of Finance* 53, pp. 2205-2223.

Arnold, T., A. W. Butler, T. F. Crack and Y. Zhang, 2005, The information content of short interest: A natural experiment, *Journal of Business* 78, pp. 1307-1335.

Asquith, P. and L. Meulbroek, 1996, An empirical investigation of short interest, Unpublished working paper. Harvard University, Boston.

Barber, B. M. and J. D. Lyon, 1997, Detecting long-run abnormal stock returns: The empirical power and specification of test statistics, *Journal of Financial Economics* 43, pp. 341-372.

Boehmer, E., C. M. Jones, and Z. Zhang, 2006, Which shorts are informed? Working Paper.

Brown, S. and J. Warner, 1985, Using daily stock returns: The case of event studies, *Journal of Financial Economics* 14, pp. 3-31.

Carhart, M., 1997, On persistence in mutual fund performance, *Journal of Finance* 52, pp. 57-82.

Chen, H., and V. Singal, 2003, Role of speculative short sales in price formation: Case of the weekend effect, *Journal of Finance* 58, pp. 685-705.

Cheung, Y. W. and L. K. Ng, 1992, Stock price dynamics and firm size: An empirical investigation, *Journal of Finance* 47, pp. 1985-1997.

Chowdhury, M., J. S. Howe and J. C. Lin, 1993, The relation between aggregate insider transactions and stock market returns, *Journal of Financial and Quantitative Analysis* 28, pp. 431-437.

Christophe, S. E., M. G. Ferri and J. J. Angel, 2004, Short-selling prior to earnings announcements, *Journal of Finance* 59, pp. 1845-1875.

Daske, H., S. A. Richardson and Ī. Tuna, 2005, Working paper, Wharton School, University of Pennsylvania.

Deechow, P. M., A. P. Hutton, L. Meulbroek and R. G. Sloan, 2001, Short-sellers, fundamental analysis and stock returns, *Journal of Financial Economics* 61, pp. 77-106.

Dechow, P. M., R. G. Sloan and A. P. Sweeney, 1996, Causes and consequences of earnings manipulation: An analysis of firms subject to enforcement actions by the SEC, *Contemporary Accounting Research* 13, pp. 1-36.

Desai, H., K. Ramesh, S. R. Thiagarajan and B. V. Balachandran, 2002, An investigation of the informational role of short interest in the Nasdaq market, *Journal of Finance* 57, pp. 2263-2287.

Diamond, D. W. and R. E. Verrecchia, 1987, Constraints on short-selling and asset price adjustment to private information, *Journal of Financial Economics* 18, pp. 277-311.

Fama, E. F. and K. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, pp. 3-56.

Figlewski, S., 1981, The informational effects of restrictions on short sales: Some empirical evidence, *Journal of Financial and Quantitative Analysis* 16, pp. 463-476.

Figlewski, S., and P. W. Gwendolyn, 1993, Options, short sales, and market completeness, *Journal of Finance* 48, pp. 761-777.

French, K. R., G. W. Schwert and R. F. Stambaugh, 1987, Expected stock returns and volatility, *Journal of Financial Economics* 19, pp. 3-29.

Griffin, P., 2003, A league of their own? Financial analysts' response to restatements and corrective disclosure, *Journal of Accounting, Auditing and Finance* 18, pp. 479-518.

Henry, Ó. T. and M. McKenzie, 2006, The impact of short selling on the price-volume relationship: Evidence from Hong Kong, *Journal of Business* 79, pp. 671-691.

Ho, K. W., 1996, Short-sales restrictions and volatility: The case of the Stock Exchange of Singapore, *Pacific-Basin Finance Journal* 4, pp. 377-391.

Hoontrakul, P., P. J. Ryan and S. Perrakis, 2001, The volume-return relationship under asymmetry of information and short sales prohibitions, Working paper, Chulalongkorn University.

Jarrow, R., 1980, Heterogeneous expectations, restrictions on short sales and equilibrium asset prices, *Journal of Finance* 35, pp. 1105-1114.

Lamont, O. A. and J. C. Stein, 2004, Aggregate short interest and market valuations, Working paper, National Bureau of Economic Research

Mitchell, M. L. and E. Stafford, 2000, Managerial decisions and long-term stock price performance, *Journal of Business* 73, pp. 283-329.

Miller, E., 1977, Risk, uncertainty and divergence of options, *Journal of Finance* 32, pp. 1151-1168.

Nelson, D. B., 1991, Conditional heteroskedasticity in asset returns: A new approach, *Econometrica* 45, pp. 347-370.

Poitras, G., 2001, Short sales restrictions, dilution and the pricing of rights issues on the Singapore Stock Exchange, *Pacific-Basin Finance Journal* 10, pp. 141-162.

Schwert, G. W., 1990, Stock volatility and the Crash of '87, *Review of Financial Studies* 3, pp. 77-102.

Senchack, A. J. and L. T. Starks, 1993, Short-sale restrictions and market reaction to short-interest, *Journal of Financial and Quantitative Analysis* 28, pp. 177-194.

Seyhun, H. N., 1986, Insiders' profits, costs of trading and market efficiency, *Journal of Financial Economics* 16, pp. 189-212.

White, H., 1980, A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, *Econometrica* 48, pp. 817-838.

Woolridge, J. R. and A. Dickinson, 1994, Short-selling and common stock prices, *Financial Analysts Journal* 50, pp. 20-28.

Table 1
Descriptive Statistics of Short-selling Activity in Hong Kong

Year	Finance	Utilities	Properties	Consolidated Enterprises	Industrials	Hotels	Others	Total	% of Number of Listed Firms
Panel A: Announcements of Securities Eligible for Short Selling									
1994	2	5	5	5	0	0	0	17	3.16%
1995	2	5	5	5	0	0	0	17	3.09%
1996	17	7	27	46	10	6	0	113	19.12%
1997	24	8	43	83	73	8	2	241	36.19%
1998	23	9	37	49	68	5	4	195	28.34%
1999	20	8	34	45	65	5	4	181	25.67%
2000	21	9	28	63	77	6	5	209	28.36%
Panel B: Announcements of Securities Removed from the Designated List for Short Selling									
1994	0	0	0	0	0	0	0	0	0.00%
1995	0	0	0	0	0	0	0	0	0.00%
1996	0	1	0	0	0	0	0	1	0.17%
1997	0	1	0	0	0	0	0	1	0.15%
1998	6	1	23	60	51	4	1	146	21.22%
1999	3	1	5	7	7	1	0	24	3.40%
2000	3	1	9	6	8	1	0	28	3.80%

Panel C: Trading Activity of Short-selling Firms and the Market

Year	Number of Short-sold Shares	Total Market Trading Shares	% of Short-sold to Total Trading Shares	Market Value of Short-sold Shares	Total Market Trading Value	% of Short-sold to Market Trading Value
1996	410.79	329,192.69	0.12%	6,902.04	1,286,989.24	0.54%
1997	1,570.11	1,079,958.51	0.15%	25,895.99	3,508,944.75	0.74%
1998	2,688.81	539,316.51	0.50%	59,836.52	1,596,716.58	3.75%
1999	2,461.54	1,048,976.56	0.23%	62,305.37	1,772,494.79	3.52%
2000	3,421.50	1,903,270.41	0.18%	73,263.56	2,833,396.57	2.59%
Total	10,552.75	4,900,714.67	0.22%	228,203.48	10,998,541.92	2.07%

Table 2

Abnormal Returns around Designation and Disqualification Announcements

A Designation Announcement refers to a date on which the Hong Kong Exchange announces the list of designated securities that are eligible for short-selling transactions. A Disqualification Announcement refers to a date on which the Hong Kong Exchange announces the disqualification of designated securities from being eligible for short-selling transactions. As the Hong Kong Exchange makes designation and disqualification announcements every quarter, we classify the announcement events into "First" announcements (the first time a firm's securities are designated or disqualified) and "Other" announcements (events not classified as "First"). The market model is used to compute the abnormal returns.

	Designation Announcement			Disqualification Announcement
	All	First	Other	First
Sample Size	1095	236	859	86
Event Day	Abnormal Return (t-statistics)			
-1+1	-0.0167	-0.0146	-0.0173	0.0287
	(-2.16)*	(-1.43)	(-2.06)*	(1.07)
0	-0.0089	-0.0107	-0.0084	0.0061
	(-2.00)*	(-1.82)	(-1.74)	(0.39)
-3+3	-0.0259	-0.0088	-0.0308	0.0456
	(-2.19)*	(-0.56)	(-2.39)*	(1.11)
-5+5	-0.0453	-0.0218	-0.0521	0.0414
	(-3.06)**	(-1.12)	(-3.23)**	(0.80)
-10+10	-0.0333	-0.0061	-0.0411	0.1032
	(-1.63)	(-0.22)	(-1.85)	(1.45)

*significant at the 5% level.
**significant at the 1% level.

Figure 1
Cumulative Abnormal Return Path

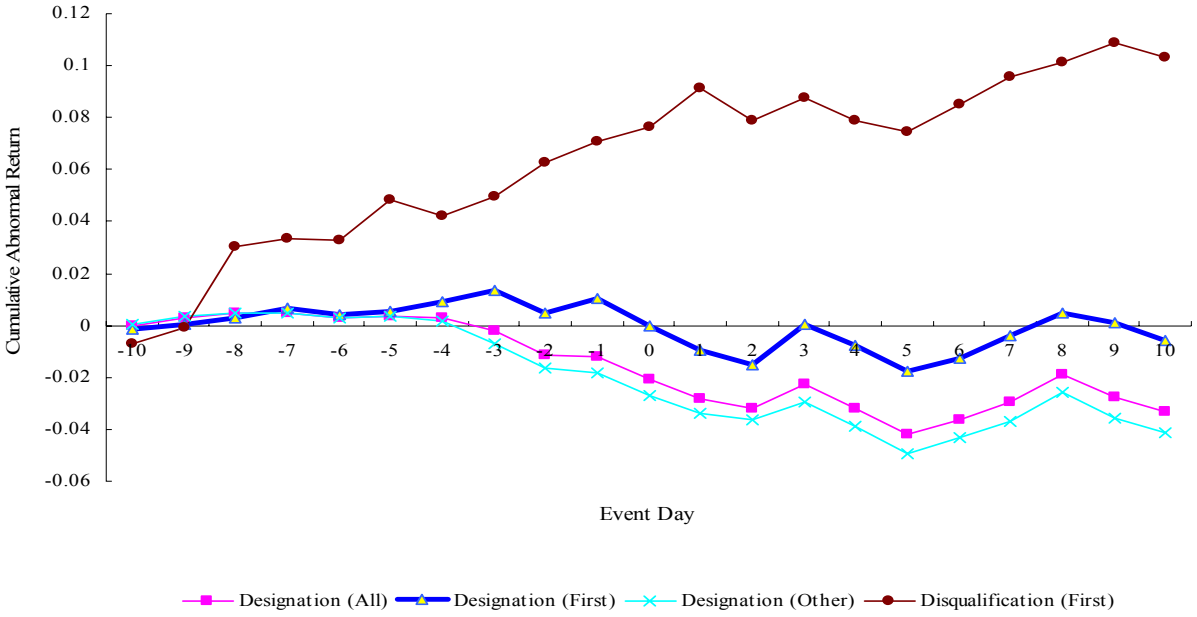

Table 3
Abnormal Returns of Short-selling Transactions

Short-selling transactions are not single-day events. The "Day-to-day Short-selling Transactions" subsample includes events in which short-selling transactions are conducted daily. The "No Previous Transaction for 5 Days" subsample includes events in which the two consecutive short-selling transactions are more than 5 days but less than 10 days apart. The "No Previous Transactions for 10 Days" subsample includes events in which the two consecutive short-selling transactions are more than 10 days but less than 15 days apart. The "No Previous Transactions for 15 Days" subsample includes events in which the two consecutive short-selling transactions are more than 15 days apart. The market model is used to measure the abnormal returns.

	Cumulative Abnormal Return (t-statistics) [Number of Observations]				
	All Events [7372]	Day-to-day Short-selling Transactions [6361]	No Previous Transactions for 5 Days [471]	No Previous Transactions for 10 Days [166]	No Previous Transactions for 15 Days [374]
+1+10	-0.0053	-0.0055	-0.0018	0.0052	-0.0108
	(-5.14)**	(-4.98)**	(-0.42)	(0.72)	(-1.78)
+10+60	-0.0302	-0.0278	-0.0451	-0.0352	-0.0501
	(-12.92)**	(-11.08)**	(-4.71)**	(-2.15)*	(-3.65)**
+10+120	-0.0700	-0.0676	-0.0771	-0.0599	-0.1069
	(-20.32)**	(-18.28)**	(-5.46)**	(-2.48)*	(-5.28)**
+10+150	-0.0832	-0.0805	-0.0881	-0.0788	-0.1279
	(-21.44)**	(-19.31)**	(-5.54)**	(-2.90)**	(-5.61)**

*significant at the 5% level.
**significant at the 1% level.

Figure 2
Cumulative Abnormal Return Path

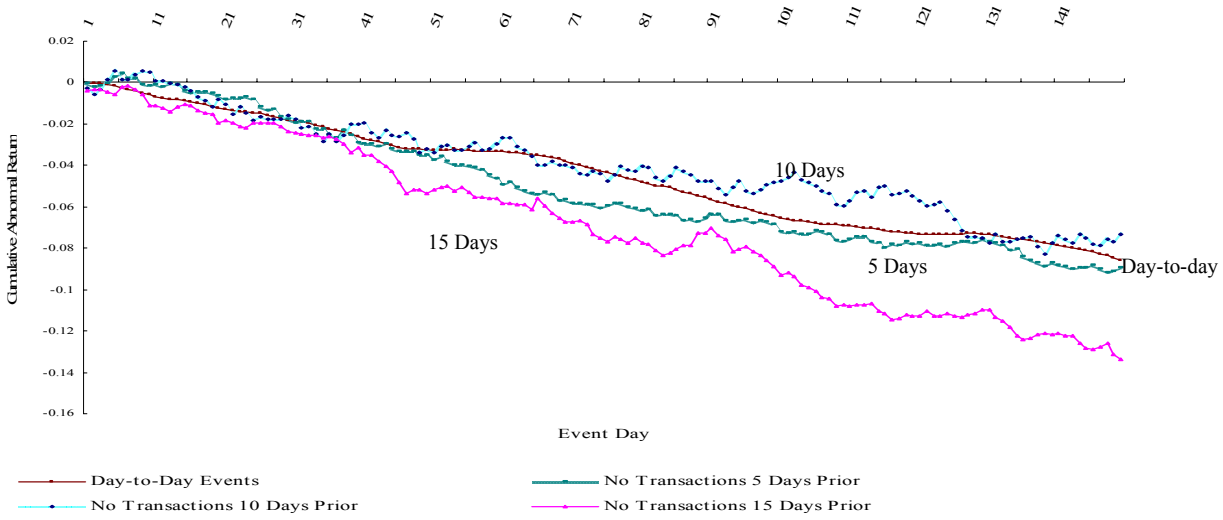

Table 4

Abnormal Returns of Short-selling Transactions with Insider Trading

The "Short-selling Transactions Only" subsample comprises events that involve short-selling transactions without insider-trading activity during the study period. The "Short-selling Transactions and Insider Purchasing (Sales)" subsample comprises events that involve both insider purchasing (sales) and short-selling transactions. The market model is used to measure the abnormal return.

	Short-selling Transactions Only	Short-selling Transactions and Insider Purchasing	Short-Selling Transactions and Insider Sales
Sample Size	2386	3045	1941
Event Day		Cumulative Abnormal Return (t-statistic)	
+1+10	-0.0049	-0.0072	-0.0029
	(-2.87)**	(-3.72)**	(-1.45)
+10+60	-0.0290	-0.0398	-0.0165
	(-7.57)**	(-9.09)**	(-3.70)**
+10+120	-0.0618	-0.0742	-0.0729
	(-10.92)**	(-11.47)**	(-11.07)**
+10+150	-0.0705	-0.0794	-0.1035
	(-11.06)**	(-10.89)**	(-13.96)**
+10+200	-0.1354	-0.0702	-0.1355
	(-18.23)**	(-8.27)**	(-15.70)**
+10+250	-0.1718	-0.0714	-0.1716
	(-20.60)**	(-7.49)**	(-17.70)**
+10+300	-0.1908	-0.0831	-0.1888
	(-20.82)**	(-7.93)**	(-17.72)**

*significant at the 5% level.
**significant at the 1% level.

Figure 3
Cumulative Abnormal Return Path

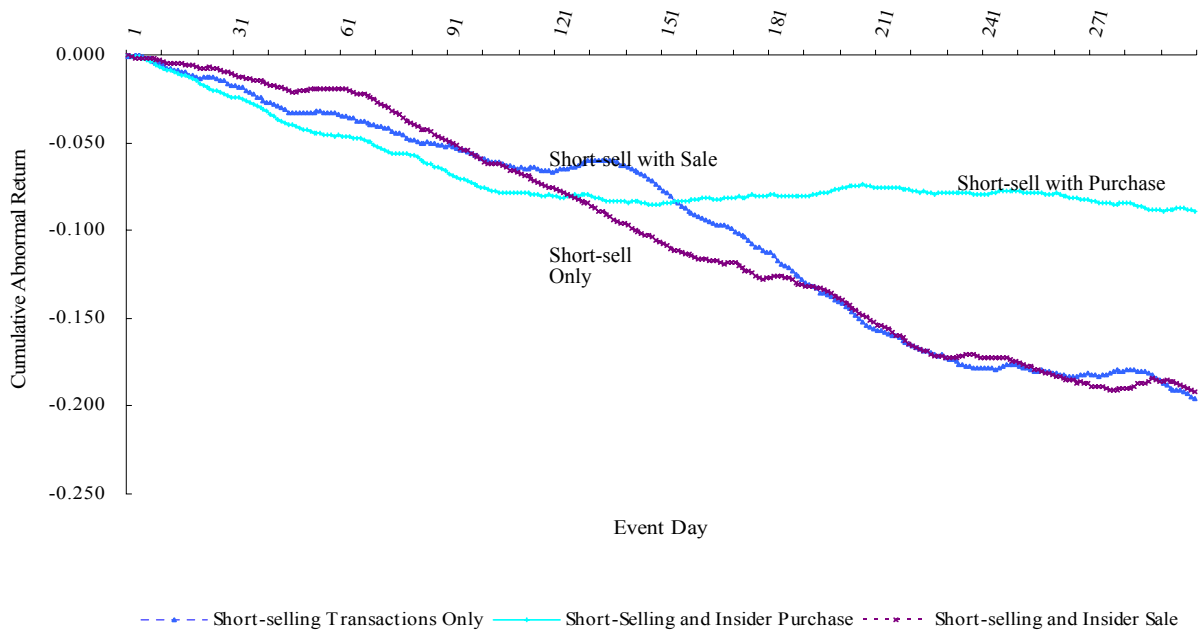

Table 5
Calendar-time Portfolio Abnormal Returns

$$Portfolio\ Return = \alpha_0 + \beta_1\ Market + \beta_2\ Size + \beta_3\ BM + \beta_4\ Momentum \quad (1).$$

Portfolio Return is the average of the 10-day return of the portfolio that comprises stocks with a short interest that reached the cut-off point on the previous day. *Market* is the average 10-day return of the market return. *Size* is the size factor. *BM* is the book to the market factor. *Momentum* is the momentum factor. The *t*-statistics are adjusted for heteroskedasticity using White's procedure (1980).

Panel A: Using the daily ratio of short sold shares to the daily trading volume as the cut-off points

Short Interest Percentage	All	0.00075%	0.00125%	0.0075%
	Beta Coefficient (t-statistics)			
Intercept	-0.00068	-0.00071	-0.00074	-0.00084
	(-2.78)**	(-2.77)**	(-2.67)**	(-2.87)**
Market	1.05116	1.03214	1.03868	1.03965
	(49.28)**	(45.69)**	(42.52)**	(41.40)**
Size	-0.00133	-0.00201	-0.00260	-0.00286
	(-1.55)	(-2.12)*	(-2.56)**	(-2.63)**
BM	0.00105	0.00074	0.00081	0.00104
	(2.12)*	(1.44)	(1.50)	(1.84)
Momentum	0.00056	0.00038	0.00042	0.00060
	(1.00)	(0.64)	(0.65)	(0.88)
Adjusted R^2	0.4029	0.4079	0.4082	0.4194
F statistics	1097.0740	910.6326	796.4047	743.3454
P-value	0.00	0.00	0.00	0.00

Panel B: Using the number of days between two consecutive short-selling transactions as the cut-off points.

	Day-to-day Short-selling Transactions	No Previous Transactions for 5 Days	No Previous Transactions for 10 Days	No Previous Transactions for 15 Days
	Beta Coefficient (t-statistics)			
Intercept	-0.0007	-0.0005	-0.0005	-0.0021
	(-3.02)**	(-0.44)	(-0.35)	(-1.66)
Market	1.0503	1.1735	0.7652	1.0096
	(49.21)**	(12.47)**	(5.30)**	(7.44)**
Size	-0.0025	0.0042	0.0094	0.0068
	(-2.99)**	(1.07)	(1.32)	(1.57)
BM	0.0013	-0.0060	-0.0002	0.0075
	(2.75)**	(-2.00)*	(-0.06)	(2.40)*
Momentum	0.0005	0.0012	0.0024	0.0027
	(0.90)	(0.32)	(0.70)	(0.91)
Adjusted R^2	0.4132	0.3766	0.2917	0.2129

F statistics	1099.0080	71.6797	17.9904	24.5352
P-value	0.00	0.00	0.00	0.00

*significant at the 5% level.
**significant at the 1% level.

Table 6

Tests of the Causality Relation between Market Returns and Aggregate Short-Selling Activity

$$MR_t = \sum_{i=1}^{T} \alpha_i MR_{t-i} + \sum_{i=1}^{T} \beta_i SS_{t-i} \cdot \quad (2)$$

MR_t is the market return at time t and $MR_{t\text{-}i}$ is the market return at time t-i. In terms of trading volume, *SS* is the ratio of the total number of short-sold shares to the total number of shares traded. In terms of trading value, *SS* is the ratio of the total market value of short-sold shares to the total market value of shares traded. The time horizon is monthly, weekly, or daily.

Panel A: Aggregate Short-Selling Activity as a Percentage of Total Trading Volume

Horizon	Lag	MR_{-1}	MR_{-2}	MR_{-3}	MR_{-4}	MR_{-5}	SS_{-1}	SS_{-2}	SS_{-3}	SS_{-4}	SS_{-5}	
		Coefficient [t-statistic]										F
Month	1	-0.0135					0.1047					0.2289
		[-0.10]					[0.65]					
Week	1	0.0603					0.0179					0.4495
		[0.94]					[0.14]					
Week	2	0.0555	0.0696				-0.0671	0.1732				0.8732
		[0.87]	[1.08]				[-0.46]	[1.19]				
Day	1	0.0265					-0.0405					0.4915
		[0.90]					[-0.33]					
Day	2	0.0274	-0.0570				-0.0896	0.0581				1.2483
		[0.93]	[-1.95]				[-0.55]	[0.36]				
Day	3	0.0339	-0.0595	0.1079			-0.0798	0.0857	-0.0148			3.1282**
		[1.16]	[-2.04]	[3.70]			[-0.48]	[0.47]	[-0.09]			
Day	4	0.0422	-0.0635	0.1110	-0.0753		-0.0618	0.0910	0.0102	-0.0840		3.1882**
		[1.43]	[-2.17]	[3.80]	[-2.56]		[-0.37]	[0.49]	[0.06]	[-0.50]		
Day	5	0.0403	-0.0611	0.1085	-0.0762	-0.0235	-0.0881	0.0832	-0.0161	-0.1753	0.1812	2.7424**
		[1.36]	[-2.07]	[3.70]	[-2.59]	[-0.80]	[-0.52]	[0.45]	[-0.09]	[-0.94]	[1.07]	

Panel B: Aggregate Short-Selling Activity as a Percentage of Total Trading Value

Horizon	Lag	MR_{-1}	MR_{-2}	MR_{-3}	MR_{-4}	MR_{-5}	SS_{-1}	SS_{-2}	SS_{-3}	SS_{-4}	SS_{-5}	
		Coefficient [t-statistic]										F
Month	1	-0.0156					0.0335					0.5856
		[-0.11]					[1.07]					
Week	1	0.0629					0.0275					1.0749
		[0.99]					[1.13]					
Week	2	0.0598	0.0745				0.0278	0.0014				0.8563
		[0.92]	[1.16]				[0.64]	[0.03]				
Day	1	0.0283					0.0150					0.6529
		[0.97]					[0.66]					
Day	2	0.0288	-0.0559				0.0024	0.0139				1.2917
		[0.98]	[-1.91]				[0.07]	[0.41]				
Day	3	0.0347	-0.0594	0.1098			0.0004	0.0149	0.0085			3.2383**
		[1.18]	[-2.03]	[3.76]			[0.01]	[0.40]	[0.24]			
Day	4	0.0427	-0.0641	0.1111	-0.0730		0.0011	0.0099	-0.0009	0.0116		3.2192**
		[1.45]	[-2.18]	[3.79]	[-2.49]		[0.03]	[0.26]	[-0.02]	[0.32]		
Day	5	0.0413	-0.0610	0.1108	-0.0706	-0.0231	0.0030	0.0130	0.0029	0.0177	-0.0186	2.6615**
		[1.40]	[-2.06]	[3.76]	[-2.39]	[-0.78]	[0.08]	[0.33]	[0.07]	[0.47]	[-0.51]	

*significant at the 5% level.

**significant at the 1% level.

Table 7
Regression analysis

$$CAR = \alpha_0 + \beta_1 \, SSValue + \beta_2 \, InsBuy + \beta_3 \, LnSize + \beta_4 \, Option + \beta_5 \, TimeD. \qquad (3)$$

CAR is the abnormal return over various periods ($+1 \le t \le +10$, $+10 \le t \le +60$, $+10 \le t \le +120$, and $+10 \le t \le +150$). *SSValue* is the log value of the market value of short-sold shares. *InsBuy* is a dummy variable that takes a value of 1 if there is insider purchasing around the time of a short-selling transaction, and 0 otherwise. *LnSize* is the natural log of the market value of a firm's equity. *Option* is a dummy variable that takes a value of 1 if the stock is an optioned stock, and 0 otherwise. *TimeD* is a dummy variable for length of time in terms of the number of trading days between two consecutive short-selling transactions for the same firm, and takes a value of 1 if the length of time is equal to or greater than 10 days, and 0 otherwise. The t-statistics are adjusted for heteroskedasticity using White's procedure (1980).

	$+1 \le t \le +10$	$+10 \le t \le +60$	$+10 \le t \le +120$	$+10 \le t \le +150$
	Beta Coefficient (t-statistics)			
Intercept	-0.0046	0.1169	0.1511	0.1910
	(-0.29)	(2.98)	(2.65)	(3.07)
SSValue	-0.0002	-0.0055	-0.0149	-0.0161
	(-0.30)	(-3.32)**	(-5.84)**	(-5.47)**
InsBuy	-0.0027	0.0124	0.0284	0.0367
	(-1.29)	(2.49)*	(4.42)**	(4.94)**
LnSize	-0.0003	-0.0068	-0.0071	-0.0101
	(-0.31)	(-2.41)*	(-1.76)	(-2.23)*
Option	0.0152	0.0768	0.1831	0.2101
	(5.65)**	(10.69)	(18.09)**	(18.21)**
TimeD	0.0038	-0.0041	0.0171	0.0134
	(0.77)	(-0.38)	(1.05)	(0.77)
Adjusted R^2	0.0065	0.0244	0.0664	0.0683
F statistics	10.5073	37.2619	103.9612	107.2295
p-value	[0.00]	[0.00]	[0.00]	[0.00]

*significant at the 5% level.
**significant at the 1% level.

Table 8
Analysis on Tick Rule Imposition

CAR is the abnormal return over various periods (+1 ≤ t ≤ +10, +10 ≤ t ≤ +60, +10 ≤ t ≤ +120, and +10 ≤ t ≤ +150). *SSValue* is the log value of the market value of short-sold shares. *InsBuy* is a dummy variable that takes a value of 1 if there is insider purchasing around the time of a short-selling transaction, and 0 otherwise. *LnSize* is the natural log of the market value of a firm's equity. *Option* is a dummy variable that takes a value of 1 if the stock is an optioned stock, and 0 otherwise. *TimeD* is a dummy variable for length of time in terms of the number of trading days between two consecutive short-selling transactions for the same firm, and takes a value of 1 if the length of time is equal to or greater than 10 days, and 0 otherwise. Tick is a dummy that takes a value of 1 if the short-selling transaction day falls after Sept 7, 1998, and 0 otherwise. The t-statistics are adjusted for heteroskedasticity using White's procedure (1980).

Panel A: CAR Table for the two samples of time periods

	All Events	Before Sept 7, 1998	After Sept 7, 1998	Before and After Sept 7, 1998
Sample Size	7372	4955	2417	
Event Day	Cumulative Abnormal Return (t-statistics)			Mean CAR Diff (t-statistics)
+1+10	-0.0053	-0.0045	-0.0068	0.0023
	(-5.14)**	(-5.17)**	(-2.90)**	(1.03)
+10+60	-0.0302	-0.0172	-0.0551	0.0379
	(-12.92)**	(-8.71)**	(-10.43)**	(7.08)**
+10+120	-0.0700	-0.0430	-0.1176	0.0746
	(-20.32)**	(-14.76)**	(-15.08)**	(9.09)**
+10+150	-0.0832	-0.0468	-0.1471	0.1003
	(-21.44)**	(-14.25)**	(-16.74)**	(10.62)**

Panel B: Regression Results

	+1 ≤ t ≤ +10	+10 ≤ t ≤ +60	+10 ≤ t ≤ +120	+10 ≤ t ≤ +150
	Beta Coefficient (t-statistics)			
Intercept	-0.0101	0.0528	0.0217	0.0161
	(-0.63)	(1.27)	(0.36)	(0.24)
SSValue	-0.0001	-0.0038	-0.0114	-0.0114
	(-0.09)	(-2.28)*	(-4.52)**	(-3.96)**
InsBuy	-0.0029	0.0103	0.0242	0.0309
	(-1.37)	(2.08)*	(3.76)**	(4.18)**
LnSize	-0.0003	-0.0059	-0.0053	-0.0076
	(-0.24)	(-2.09)*	(-1.31)	(-1.69)
Option	0.0151	0.0753	0.1802	0.2061
	(5.61)**	(10.50)**	(17.93)**	(18.09)**
TimeD	0.0041	0.0001	0.0254	0.0247
	(0.85)	(0.01)	(1.54)	(1.39)
Tick	-0.0033	-0.0374	-0.0755	-0.1021
	(-1.46)	(-6.86)**	(-9.43)**	(-11.06)**
Adjusted R^2	0.0067	0.0319	0.0794	0.0873
F statistics	9.1508	40.7316	105.0910	116.4510
p-value	0.00	0.00	0.00	0.00

*significant at the 5% level.
**significant at the 1% level.