東海大學管理學院財務金融研究所
碩士論文

影響融券之因素與融券策略：

以MSCI台灣指數成份股為例

Determinants and Strategies for Short Sales:

A Study of MSCI Taiwan Index Constituents

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摘要

本文以2006年1月3日至2009年12月31日摩根台灣指數成份股為研究樣本，調查影響融券的主要因素並以此為依樣設計融券策略。本文採用八個融券代理變數並檢驗五個假說和六個融券策略，主要的研究發現包含：(1)當融券代理變數為以融券餘額為基礎的計算時，融券者偏愛成長股而不是價值股；(2)實證結果顯示，並無強烈證據證明融券者交易的股票低交易成本；(3)在台灣，融券者是風險承擔者；(4)融券者會選擇過去股價報酬高的標的來放空，並以周報酬最為明顯；(5)融券行為與認售權證存在正相關；(6)我們利用迴歸結果建立六個融券策略，得到的報酬皆優於原始股價周報酬，平均報酬也隨著持有期間的增加而遞增，證實帳面價值對市值比和過去股價報酬是影響融券策略的重要因子。

關鍵字: 融券、成長股、交易成本、認售權證、交易策略

Abstract

This thesis investigates major determinants for short sales as well as effectiveness of implied trading strategies from January 3 of 2006 to December 31 of 2009. The sample covers 62 constituent stocks from the MSCI Taiwan Index. We adopt eight proxies for short sales to test five hypotheses and six short selling strategies. Major findings include: (1) we support the hypothesis that short sellers prefer growth stocks to value stocks when short sales are proxies by short-interest-based measures; (2) there seems no strong evidence in favor of the hypothesis that short sellers trade stocks with low transaction costs; (3) our results also indicate that short sellers act as risk-bearers in Taiwan; (4) short sellers select stocks with high past returns, in particular, weekly returns; (5) there is a positive link between short sales and relevant put warrants; (6) the six short selling strategies established from the regression results almost yield returns that outperform the benchmark level of weekly returns, indicate that average returns increase with the holding period and the book-to-market ratio and past stock returns are both crucial.

Key words: short sale, growth stock, transaction cost, put warrant, trading strategy

Contents

List of Tables

1. Introduction

Stocks have always been the most popular investment vehicle in the financial market of Taiwan. According to statistics released by the Taiwan Stock Exchange (TSE) in 2009, individual investors account for as high as four-fifth of trades in the local stock market against one-fifth for institutional investors that include foreign investors, investment trusts (mutual funds), and dealers. In addition, individual investors are allowed to conduct margin transactions, which consist of margin purchases and short sales. The former is borrowing money from a broker to purchase stocks. The latter is borrowing a security from a broker and selling it before buying the stock back at a lower price and returning the borrowed shares to the broker.

The margin transaction originated from the US more than a hundred year ago and has four advantages. First, the margin transaction consists in achieving a higher degree of leverage with significant flexibility in terms of trading strategies and relatively low transaction cost. Second, the margin transaction serves to attract more participation by investors and balance demand and supply of funds within the market. Third, the margin transaction enhances the stock market's liquidity and boosts economic development. Finally, the link among the margin trading balance, short interest, and stock price has been regarded by practitioners as one of the most important indicators of stock market performance.

In Taiwan, the margin transaction facility was introduced to the TSE in April of 1974. However, margin transactions exercised at that time included margin purchases only. Short sales were not permitted. It was after Taiwan's government chartered Fuh-Hwa Securities Finance Company for the business of securities loans to short sellers that local short selling

activity really soared. Afterwards, the size of overall margin transactions has substantially increased and now accounts for more than 30% of daily trades on the TSE, which is actually much higher than the average of 15% in foreign equity markets. Therefore, if we long to understand the trend of stock movement in Taiwan, the margin transaction is too important to be neglected.

In literature, most of the studies that discuss the margin transaction in the stock market place focus on the buy-and-hold strategy based on margin purchases rather than the behavior of short sales. Works on short selling mainly concerns the link between short sales and stock returns, the connection between short sales and fundamentals, the role for transaction costs, effectiveness of short selling strategies, and the relation with options. Woolridge and Dickison (1994) find short selling has no significant effect on future stock prices. Asquith and Meulbroke (1995) find that high short interest predicts negative abnormal returns for NYSE and AMEX stocks. Kot (2007) finds short sellers trade stocks based on the past trend. Diether et al. (2009) analyze trading strategies that buys stocks with low short selling activity and sells short stocks with high short selling activity and find that such strategies generate an abnormal return of roughly 1.39% and 1.41% per month for NYSE and Nasdaq stocks respectively. Dechow et al. (2001) focus on fundamentals and find that companies with low fundamental-to-market ratios tend to exhibit high short interest and low abnormal returns in the future. They also find firms with a high short position tend to have a larger market value, pay lower dividends, and have greater institutional ownership, implying lower transaction costs of short sales. Danielsen and Sorescu (2001) and Blau (2009) analyze the link with options. The former find a positive relation between short selling and option trading. The latter show that during the 61-day window surrounding option listings daily shorting activity does not increase and instead decreases when options are introduced. Overall studies in the

key factors that directly influence short sellers seem to be absent, in particular, for short selling behavior in Taiwan. Under increasing importance of the margin transaction in Taiwan's financial market and recent deregulation with respect to the margin transaction, we attempt to find primary determinants for short sales before examination of effectiveness of short selling strategies.

This thesis investigates major determinants for short sales as well as effectiveness of implied trading strategies. We adopt eight proxies for short sales to test five hypotheses and six short selling strategies. Our findings support the hypothesis that short sellers prefer growth stocks to value stocks when short sales are proxies by short-interest-based measures. However, there seems no strong evidence supporting hypothesis that short sellers trade stocks with low transaction costs. Our results also indicate that short sellers act as risk-bearers in Taiwan and short sellers select stocks with high past returns, in particular, weekly returns. It is also found that there is a positive link between short sales and relevant put warrants. Finally, among the six short selling strategies established from the regression results, average returns increase with the holding period and almost all strategies yield returns that outperform the benchmark level of weekly returns. It also suggests that the book-to-market ratio and past stock returns are both crucial.

The remainder of this thesis is organized as follows. Chapter 2 reviews related research and summarizes main findings. Our sample data and methodology to be applied for empirical analysis are presented in Chapter 3. Chapter 4 discusses empirical results and compares short sale strategies. Chapter 5 concludes.

2. Literature Review

This chapter reviews relevant works in literature as regards determinants and strategies for short sales. Five issues are covered: the link between short sales and stock returns, the connection between short sales and fundamentals, the role for transaction costs, effectiveness of short selling strategies, and the relation with options.

2.1 Stock Returns and Short Selling Strategies

In literature, research on short selling adopted different proxy variables to capture short sales. For example, Woolridge and Dickison (1994) use short interest divided by the number of traded shares as a proxy for short sale and show that short selling has no significant effect on future stock prices, implying that short sales are not necessarily a bullish or bearish indicator for the stock market. Asquith and Meulbroke (1995) use short interest and divide it into high and low levels. They find that high short interest predicts negative abnormal returns for NYSE and AMEX stocks. Desai et al. (2002) yield the same conclusion for Nasdaq stocks. Yeh (2004) employs the difference in the weekly short interest over the number of shares outstanding as a proxy for short sales, and empirical supports that firms with an extremely low level of short selling create significantly positive stock returns whereas firm with an extremely high level of short selling result in significantly negative returns. Kot (2007) measures short selling directly with short interest rather than the difference as in Yeh (2004) and finds short sellers trade stocks based on the past trend. They short loser stocks over the previous one-year period and expect stock prices to continue to decrease in the near future.

Given the empirical results proposed by Asquith and Meulbroke (1995) and Yeh (2004), short sellers should sell stocks with high short selling since high short selling predict negative abnormal returns. Diether et al. (2009) therefore analyze trading strategies conducted by short sellers of NYSE- and Nasdaq-listed stocks for the period from January 2 to December 30 of 2005. The trading strategy that buys stocks with low short selling activity and sells short stocks with high short selling activity generates an abnormal return of roughly 1.39% and 1.41% per month for NYSE and Nasdaq stocks respectively.

2.2 Short Sales and Fundamentals

In addition to the link with stock returns, others, for instance Dechow et al. (2001), investigate the relationship between short sellers and fundamental-to-market ratios such as the cash-flow-to-price, earnings-to-price, book-to-market, and value-to-market ratios. They argue that companies with low fundamental-to-market ratios tend to exhibit high short interest and low abnormal returns in the future.

Diether et al. (2009) define book-to-market terciles based on NYSE breakpoints, and find that low book-to-market stocks (growth stocks) have on average greater short selling activities than high book-to-market stocks (value stocks). Their finding echo D'Avolio (2002) and Jones and Lamont (2002), who both support that short interest tends to be higher for low book-to-market stocks.

2.3 Short Sales and Transaction Costs

A third subject for study of short selling focuses on the role for transaction costs. Dechow et al. (2001) apply the method proposed by Asquith and Meulbroek's (1995) with distinction between high and low short interests. They define "High Short" as a dummy variable that takes the value of one in observations with short positions greater than half a percent of shares outstanding and zero otherwise. Following this approach, the authors find firms with a high short position tend to have a larger market value, pay lower dividends, and have greater institutional ownership, implying lower transaction costs of short sales.

D'Avolio (2002) shows that the main suppliers of stock loans are institutional investors. He finds that the degree of institutional ownership explains much of the variation in securities loans across stocks and that stocks with low institutional ownership are more expensive to borrow. As a result, the short sales constraints are most likely to affect stocks with low institutional ownership. In a similar fashion, Nagel (2005) indicates that short sale constraints are more binding among stocks with low institutional ownership, and, when institutional ownership is low, shares to be lent for short selling is more sparse so that short selling become more expensive.

2.4 Short Sales and Options

Despite that short sales are closely related with options, there exist divergent views on the link between options and short selling. On one hand, Brent et al. (1990), Figlewski and Webb (1993), and Danielsen and Sorescu (2001) find a positive relation between short selling and option trading. The reasons could be that stocks are sold short to hedge the option

position, or because of the arbitrage opportunity if there is a price difference between options and underlying stocks. On the other hand, Kot (2007) regards options as a substitute for short selling. Blau (2009) argue that there is a negative relation between short selling and option trading when we isolate the effect of short selling constraints. They show that during the 61-day window surrounding option listings daily shorting activity does not increase and instead decreases when options are introduced.

3. Data and Methodology

This chapter presents the data source adopted by our research as well as the econometric methodology to be applied for empirical investigation.

3.1 Data Source

The sample in this thesis covers the constituent stocks in the Morgan Stanley Capital International (MSCI) Taiwan Index for the period from January 2006 to December 2009. The MSCI is a leading provider of equity indices, and its indices have become the most widely adopted benchmarks by global institutional investors. The MSCI Taiwan constituents are from mscibarra.com and information about past addition and deletion of constituents stocks is from the Taiwan Economic Journal (TEJ). Data relevant to the firms whose stocks constitute the index are obtained from the TSE where they are listed. Compilation of the MSCI Taiwan Index began in 1988 and initially included 77 stocks listed on the TSE. It is capitalization-weighted and is comprises of stocks of large, medium, and small enterprises, covering 70% of Taiwan stock market capitalization. The MSCI Taiwan Index and the TSE Weighted Index are highly correlated.

In order to maintain the close link between both indices, MSCI adjusts the constituents stocks each quarter, which means that the number of stocks in our sample and the corresponding weight also change quarterly. Therefore, our study prescreens a total of 68 stocks which had neither been removed from the index between January 2006 and December 2009 nor been newly added into the index after January 2006. A firm is deleted from the MSCI Taiwan index for a variety of reasons including the following. First, the firm no longer

reprents its industry. Second, an industry group is over-represented as a result of out-of-favor, mergers, acquisitions, restructuring, and other major market events. Third, securities of the firm have become illiquid. Fourth, restructuring of the firm results in changes in industry classification. Fifth, the firm goes bankrupt or is delisted from the local stock exchange.

Among the prescreened 68 stocks, six had been suspended for the margin transaction during several months and are therefore deleted from our sample, yielding thus 62 constituents in the final sample. Details for these stocks are presented in Table 1. We then collect financial data for the 62 selected stocks from the Taiwan Economic Journal (TEJ) databank. They include the daily short interest, changes in short interest, stock price returns, ownership ratios for foreign investors, investment trusts, dealers, and directors, book-to-market ratio, market value, trading volume, number of outstanding shares, daily high price, and daily low price. In addition, we obtain put warrants and their volume for the MSCI constituents from the website of the TSE. The final dataset covers the period from January 3 of 2006 to December 31 of 2009 with a total of 62 companies and includes a total number of 61,569 daily observations.

3.2 Proxies for Short Sales

As reviewed in Chapter 2, there exists in previous literature different gauges adopted as the proxy for short sales. In this thesis we intend to determine which is the best proxy to capture the behavior of short selling. The following eight proxies for daily short selling are considered and defined as follows:

1. Y_1 = Short interest

2. Y_2 = Change in LN (Y_1)

3. Y_3 = Y_1 over outstanding shares

4. Y_4 = Y_1 over traded shares

5. Y_5 = Change in shorted shares adjusted with the sign

6. Y_6 = Change in LN (Y_5)

7. Y_7 = Y_5 over outstanding shares

8. Y_8 = Y_5 over traded shares

The eight proxies are distinguished into two parts. Y_1 to Y_4 are short sales proxies by short-interest-based measures while Y_5 to Y_8 are changes in shorted share-based measures. Compared with previous literature, we adopt both level and nature-log data and ratios to determine which variable is the best proxy for short selling.

3.3 Empirical Approach

This thesis studies the determinants and strategies for short sales in six steps. First, we apply the unit root test to examine whether all variables are stationary. Second, we assess correlation among aforementioned eight proxies for short sales as a preliminary test for their relevance as the proxy variable. Third, we examine potential multicollinearity among independent variables before the regression analysis. Fourth, we analyze the sign as well as significance for the correlation coefficient between each of the eight proxies for short sales and independent variables to be included in the regression model. Fifth, we conduct the following regression with different proxies for short sales and evaluate significance of each determinant for short sales. Sixth, on the basis of our regression results, we design

corresponding investment strategies and verify whether major determinants for short sales can serve as a good indicator for short sellers to profit in the stock market. The benchmark regression equation is expressed as follows, with Y_{jit} for one of the eight proxies defined in 3.2 $j =1\sim8$ for daily short sales of firm i's stock at time t:

$$Y_{jit} = \beta_0 + \beta_1 BM_{it} + \beta_2 LNMV_{it} + \beta_3 O1_{it} + \beta_4 O2_{it} + \beta_5 O3_{it} + \beta_6 O4_{it}$$
$$+ \beta_7 RISK_{it} + \beta_8 RW_{it} + \beta_9 RM_{it} + \beta_{10} PUT_{it} + \beta_{11} LNPV_{it} + \beta_{12} IRW_{it} ,$$

where BM_{it} stands for the book-to-market ratio, $LNMV_{it}$ for log market value, $O1_{it}$ to $O4_{it}$ for the ownership ratios of foreign investors, investment trusts, dealers, and directors, $RISK_{it}$ for the difference between the high price and the low price divided by the high price as suggested by Diether et al. (2009), RW_{it} and RM_{it} for weekly and monthly stock returns, PUT_{it} for the dummy which equals one as put warrants for firm i's stocks are present at time t and zero otherwise, $LNPV_{it}$ for the log volume of put warrants, and IRW_{it} for weekly returns of the industry index.

We adopt the Augmented Dickey-Fuller test to examine whether all variables are stationary. We find that all variables reject the null hypothesis of a unit root, implying that all of our variables are stationary and can be directly analyzed in the regression model. The descriptive statistics of variables are reported in Table 2. It can be perceived that the mean of short interest (Y_1) is 3,259, and the maximum is 505,570 of Chunghwa Picture Tubes Ltd. (2475) on June 22 of 2007. The reason resides in Tatung Co., Ltd. (2371), which helped Chunghwa Picture Tubes Ltd. (2475) financially so that stock returns had increased sharply 24% since April 2007, raising short interest of Chunghwa Picture. The mean of changes in short shares (Y_5) is only 0.01 and the mean of changes in short shares over traded shares (Y_8)

is -0.23%, implying that as we trade 1,000 shares in the market the shares of short selling will be in average reduced 2.3 shares. The mean of the book-to-market ratio (*BM*) is 0.75, which means that the stock price is overall 1.33 times more than the book value per share in our sample. The mean for the foreign investors ownership ratio (*OI*) reaches a high level of 31.64%, suggesting that these foreign institutional investors also select the MSCI Taiwan Index constituents in their portfolio. The mean for past weekly returns (*RW*) and monthly returns (*RM*) are 0.21% and 0.64% respectively, while the mean of industry weekly returns (*IRW*) is 0.17% slightly lower than weekly returns on individual stocks.

Since we examine a panel dataset, regression can be conducted with the pooled ordinary least squares, random effect, and fixed effect methods, among which the Hausman test that underlines the null hypothesis of a random effect model against the alternative hypothesis of a fixed effect model is required for model specification. Our empirical results reject the null hypothesis. An additional redundant fixed effect test also supports the fixed effect model. Hence the following regression analysis will be based on fixed effect estimation.

On the basis of the benchmark regression equation presented above, five hypotheses are to be tested as follows in addition to two control variables that are the director ownership ratio and weekly returns of the industry index for the firm's stocks.

Hypothesis 1 : Short sellers prefer growth to value stocks.

As argued by Dechow et al. (2001), companies with a low book-to-market ratio (growth stocks) tend to have high short interest, with the annual book-to-market ratio sorted into ten levels. This is because growth stocks general have high returns in the short term so that short

sellers anticipate stock price and see a room for profit. Hence the parameter β_1 is expected to be significantly negative.

Hypothesis 2 : Short sellers conduct the trading as transaction costs are low.

Also in Dechow et al. (2001), it is found that in the US stock market short sellers select securities whose short selling requires low transaction costs, mainly reflected in the larger market value and high institution ownership. A larger market value implies more outstanding shares, making short seller more easier short sell. Similarly, high institutional ownership often prefers higher liquidly of stocks. Since market participants are different in the stock markets in the US and in Taiwan, we consider three types of ownership: the ownership ratios of the so-called "three major institutional investors", i.e. foreign investors, investment trusts, and dealers. These joint proxies for institution ownership allow us to better test whether Taiwan's short sellers consider transaction costs in trading. In sum, this hypothesis relates β_2, β_3, β_4, and β_5 in the benchmark regression model.

Hypothesis 3 : Short sellers act as risk-bearers.

Short selling bears relatively high risk in a continually bull market, because the maximum loss is unlimited. Following the definition of risk by Diether et al. (2009), we measure the difference between the high price and the low price divided by the high price for firm i's stocks at time t and test significance of β_7.

Hypothesis 4 : Short sellers select stocks with high past returns.

Investors who speculate through short selling expect to profit from a decline in the security's price. If short sellers earn abnormal returns, it is believed that high stock returns lead to high short interest. Tsai (2005) find a positive relation between one-day lag of stock returns and the stock's short interest ratio. In this thesis we use both past weekly returns and past monthly returns to test this hypothesis, which implies significance of β_8 and β_9.

Hypothesis 5 : Short sales are positively linked with related put warrants.

Danielsen and Sorescu (2001) find a positive relation between short selling and options, and Diether et al. (2009) find that stocks with actively traded puts have higher short selling activity. With few stock puts issued and traded in Taiwan, investors who attempt to profit from downside price movement can only rely on limited put warrants traded on the TSE. Therefore we use put warrants and their volume to test the link between short selling and options by significance of β_{10} and β_{11}.

4. Empirical Results

This chapter examines correlation among variables, discuss major results from regression analysis elucidated in the previous chapter, and assess effectiveness of short selling strategies.

4.1 Correlation Analysis

Table 3 reports correlation coefficients among the eight proxies of short selling. Except for the pair between short interest (Y_1) and short interest divided by outstanding shares (Y_3), whose correlation is high (0.79), the rest correlations range between -0.04 and 0.7. Table 4 shows low correlation between independent variables in the regression model and supports absence of multicollinearity. Table 5 shows correlation matrices between each of the short selling proxy and independent variables but the sign of correlation is inconsistent. Further regression analysis is hence called for.

4.2 Estimation Results

Table 6 reports regression results. In terms of adjusted R^2, it is perceived that the regressions using Y_2 and Y_3 as the dependent variable have the highest value (43% and 32%). In contrast, the explanatory power remains much lower (0.01 ~ 0.04) as Y_5 to Y_8 are adopted, suggesting that these may not be appropriate proxies for short sales.

We first examine Hypothesis 1 postulated in Chapter 3. It is found that the association between the book-to-market ratio (*BM*) and four proxies of short selling (Y_1 to Y_4) is negative

at 10% significance. Based on this result, firms with a lower book-to-market ratio (growth stocks) have higher short selling, supporting Hypothesis 1 that short sellers prefer growth stocks (low book-to-market ratio) to value stocks. However, the link turns significantly positive as Y_6 and Y_8 are considered.

Hypothesis 2 is tested with the estimated coefficients for the market value (*LNMV*) and ownership ratios of foreign institutions, investment trusts, and dealers (*O1* to *O3*). For *LNMV*, the coefficient is positive as short sales are measured by Y_2, Y_6, and Y_8 but the sign is inversed as Y_1, Y_3, and Y_4 are concerned. In this regard, there seems no strong evidence supporting Hypothesis 2 that short sellers trade stocks with low transaction costs. In terms of institution ownership ratios, we find a positive relation between *O1* and Y_2, Y_3, and Y_7 and between *O2* and Y_1 to Y_4. Hence, lower transaction costs relevant with high ownership by foreign investors and investment trusts encourage short selling behavior.

To test Hypothesis 3, we use the difference in the high price and the low price divided by the high price (*RISK*) to examine whether short sellers are risk bearers in Taiwan. Our empirical analysis shows a significantly positive link between *RISK* and all proxies of short selling except Y_4. This hypothesis is therefore substantiated.

For Hypothesis 4, all short selling proxies except Y_4 are positively sensitive to past weekly returns (*RW*), while Y_1, Y_2, Y_3, Y_4 and Y_7 are positively correlated with past monthly returns (*RM*), implying that the higher past returns, the more intensified short selling activities is today, which is evidence in favor of Hypothesis 4.

The final hypothesis relates options represented by Taiwan's put warrants. It is found that Y_2, Y_3, and Y_4 are positively associated with the dummy of put warrants (*PUT*), and this positive link is also present for the volume of put warrants (*LNPV*) and Y_1, Y_3, Y_4, and Y_6. Overall, Hypothesis 5 is also validated by our regression results.

In addition to the five hypothesis examined above, we also use past industry weekly returns (*IRW*) and the ownership ratio of directors (*O4*) as supplementary control variables. The former is negatively linked with all proxies for short sales except Y_7, implying that an overall bullish market may actually dampen short selling of individual stocks. The latter is positively related to Y_1, Y_3, and Y_4 but inversely related to Y_2. Compared to the institution ownership, the ownership of directors may not constitute transaction costs for short sellers.

4.3 Short Selling Strategies

As adjusted R^2 is low for the regressions using Y_5 to Y_8 as the explained variable, we now place focus on Y_1 to Y_4 to conduct additional regression analysis, where two interaction terms, *BM*RW* and *BM*RM*, are included in the regression model and estimation results are reported in Table 7. Based on results in Tables 6 and 7, we establish six short selling strategies. In contrast with previous studies that directly use short interest to design the trading strategy, we establish short sale strategies with determinants for short sales. Following the overlapping holding period methodology by Jegadeesh and Titman (1993), we set the portfolio holding periods as respectively one week, two weeks, three weeks, and four weeks.

Considering various timing at which investors may receive information to make new trading decision, we calculate portfolio returns by four different methods. Hypothesis 4

indicates that if investors observe an increase in weekly returns then they can short the stock. Suppose today is Monday and the holding period is one week. The first type of returns is from the investment that an investor short sells (longs) the stock following a rise (fall) in weekly returns calculated by the closing price on Monday, and closes the short (long) position by the opening price next Monday. The second type of returns is from the investment that this investor short sells (longs) the stock following a rise (fall) in weekly returns calculated by the closing price on Monday but closes the position by the closing price next Monday. The third type of returns is from the investment based on the opening price on Tuesday and the closing price next Monday, and finally the fourth type of returns on the opening price on Tuesday and the opening price next Tuesday.

Table 8 summarizes returns for various short selling strategies. Effectiveness of these strategies is compared with the average weekly returns for all the 62 constituents over the whole same period, which is at 0.21%. First, we consider Strategy 1 based on Hypothesis 1. On each trading day, we divide the stocks into five groups by the book-to-market ratio. The strategy consists in shorting (longing) the lowest (highest) group. It is found that returns based on the first method are slightly worse than returns based on the other methods no matter how long the holding period is, and the longer the holding period the higher the returns. Almost all returns are greater than the benchmark level of returns, i.e. 0.21%.

Strategies 2 and 3 are founded on Hypothesis 4 and look at past weekly returns monthly returns respectively. We short (long) with positive (negative) weekly or monthly returns and find that the two-week holding period yields the highest returns. However, Strategy 3 leads to loss with a 4-week holding period. This is inconsistent with Strategy 1, which implies joint investigation into Hypothesis 1 and Hypothesis 4.

Strategy 4, which follows Hypothesis 5, shorts (long) the stock that has (not) put warrants. Table 8 shows that, as in Strategy 1, the longer the holding period the higher the returns. Average returns are 0.69% with a 4-week holding period, much higher than our benchmark returns at 0.21%.

Since the previous four strategies yield different conclusion about the holding period, attention now turns to the joint effect of the book-to-market ratio and past stock returns. First we modify the benchmark regression model with an interaction term. It is found that the coefficient for *BM*RW* as an additional determinant for Y_2 and Y_3 is significantly negative, which suggests that short selling will increase when *BM* is low and *RW* is high. The same results are found from the regression that incorporates *BM*RM* as an interaction term. This leads us to Strategies 5 and 6. Strategy 5 shorts (long) the stock with the lowest (highest) book-to-market ratio and positive (negative) weekly returns, and the average returns are over 0.21% and increasing with the holding period. For example, 4-week returns rise to 1.08% against 0.68% for 1-week returns. Similarly, Strategy 6 shorts (longs) the stock with the lowest (highest) book-to-market ratio and positive (negative) monthly returns. The average performance is slightly worse than Strategy 5.

In sum, strategies based on the first method for calculation of returns (closing to opening) are generally the worst compared to strategies based on other methods, and average returns increase with the holding period, in particular for Strategies 5 and 6 that are founded on both Hypothesis 1 and Hypothesis 4. This suggests that the book-to-market ratio and past stock returns are crucial for short sellers.

5. Conclusion

This thesis examines 62 constituent stocks of the MSCI Taiwan Index from January 3 of 2006 to December 31 of 2009 and investigates major determinants for short sales as well as effectiveness of implied trading strategies. We adopt eight proxies for short sales to test five hypotheses and six short selling strategies. The primary empirical results can be summarized in six points.

First, our findings support the hypothesis that short sellers prefer growth stocks (low book-to-market ratio) to value stocks when short sales are proxies by short-interest-based measures. This result echoes Dechow et al. (2001).

Second, regression analysis fails to propose strong evidence in favor of the role of transaction costs in a short seller's trading decision. More specifically, low transaction costs that result from a high level of institution ownership ratios for foreign investors, investment trust, and dealers, unnecessarily encourage short selling activity.

Third, it is overall substantiated that short sellers are risk bearers in Taiwan's stock market for all gauges of short sales except for short interest over traded shares. This finding is also consistent with that in Diether et al. (2009).

Fourth, we show that short sellers select stocks with high past returns, in particular, weekly returns that strongly relate to all proxies for short sales except the short interest over traded shares. This evidence follows Tsai (2005).

Fifth, there is a positive link between short sales and relevant put warrants. This result is also similar to that in Diether et al. (2009).

Finally, among the six short selling strategies established from the regression results, the strategy based on returns calculated from the closing price to the opening price over a given period performs worse than others. Average returns increase with the holding period and almost all strategies yield returns that outperform the benchmark level of weekly returns. It also suggests that the book-to-market ratio and past stock returns are both crucial.

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Table 1 Sample Stocks

The sample period is from January 3 of 2006 to December 31 of 2009. There are 62 constituent stocks from the MSCI Taiwan Index.

Code	Company Name
1101	Taiwan Cement Corp.
1102	Asia Cement Corp.
1216	Uni-President Enterprises Corp.
1301	Formosa Plastics Corp.
1303	Nan Ya Plastics Corp.
1326	Formosa Chemicals & Fiber Corp.
1402	Far Eastern New Century Corporation
1434	Formosa Taffeta Co., Ltd.
1504	Teco Electric & Machinery Co., Ltd.
1605	Walsin Lihwa Corp.
1717	Eternal Chemical Co., Ltd.
1722	Taiwan Fertilizer Co., Ltd.
1802	Taiwan Glass Ind Co., Ltd.
2002	China Steel Corp.
2105	Cheng Shin Rubber Ind. Co., Ltd.
2201	Yulon Motor Co., Ltd.
2301	Lite-On Technology Corp.
2303	United Microelectronics Corp.
2308	Delta Electronics, Inc.
2311	Advanced Semiconductor Engineering, Inc.
2315	MITAC International Corp.
2317	Hon Hai Precision Ind. Co., Ltd.
2323	CMC Magnetics Corp.
2324	Compal Electronics, Inc.
2325	Siliconware Precision Ind. Co., Ltd.
2330	Taiwan Semiconductor Mfg. Co., Ltd.
2347	Synnex Technology International Corp.
2353	Acer Inc.
2354	Foxconn Technology Co., Ltd.
2356	Inventec Corp.

2357	Asustek Computer Inc.
2371	Tatung Co., Ltd.
2379	Realtek Semiconductor Corp.
2382	Quanta Computer Inc.
2395	Advantech Co., Ltd.
2409	AU Optronics Corp.
2412	Chunghwa Telecom Co., Ltd.
2454	Mediatek Incorporation
2475	Chunghwa Picture Tubes Ltd.
2498	HTC Corporation
2603	Evergreen Marine Corp. (Taiwan) Ltd.
2606	U-Ming Marine Transport Corp.
2609	Yang Ming Marine Transport Corp.
2615	Wan Hai Lines Ltd.
2801	Chang Hwa Commerciai Bank, Ltd.
2854	Polaris Securities Co., Ltd.
2880	Hua Nan Financial Holdings Co., Ltd.
2881	Fubon Financial Holding Co., Ltd.
2882	Cathay Financial Holding Co., Ltd.
2883	China Development Financial Holding Corp
2884	E.Sun Financial Holding Co., Ltd.
2885	Yuanta Financial Holding Co., Ltd.
2886	MEGA Financial Holding Co., Ltd.
2887	Taishin Financial Holding Co., Ltd.
2890	Sinopac Financial Holdings Co., Ltd.
2891	Chinatrust Financial Holding Company Ltd
2892	First Financial Holding Co., Ltd.
2912	President Chain Store Corp.
3008	Largan Precision Co., Ltd.
3009	Chi Mei Optoelectronics Corp.
3045	Taiwan Mobile Co., Ltd.
9904	Pou Chen Corporation

Table 2 Descriptive Statistics

The sample period is from January 3 of 2006 to December 31 of 2009. There are 62 constituent stocks from MSCI Taiwan Index. Y_1 is short interest. Y_2 is change in LN (Y_1). Y_3 is Y_1 over outstanding shares. Y_4 is Y_1 over traded shares. Y_5 is change in short shares adjusted with the sign. Y_6 is change in LN (Y_5). Y_7 is Y_5 over outstanding shares. Y_8 is Y_5 over traded shares. *BM* is the book-to-market ratio. *LNMV* is the log market value. *O1* is the foreign investors ownership ratio. *O2* is the investment trust ownership ratio. *O3* is the dealer ownership ratio. *O4* is the directors ownership ratio. *RISK* is the difference between the high price and the low price divided by the high price. *RW* is the weekly return. *RM* is the monthly return. *PUT* is the dummy which equals one as put warrants for firm's stocks are present at time t and zero otherwise. *LNPV* is the log volume of put warrants. *IRW* is weekly return of the industry index.

	Mean	Median	Maximum	Minimum	Std. Dev.
Y_1	3259.34	888.00	505570.00	0.00	15594.08
Y_2	6.42	6.79	13.13	0.00	2.19
Y_3	0.10	0.03	6.13	0.00	0.25
Y_4	17.04	7.13	1779.32	0.00	34.26
Y_5	0.01	0.00	54663.00	-99366.00	1227.73
Y_6	-0.24	0.00	10.91	-11.51	4.37
Y_7	0.00	0.00	1.76	-1.57	0.03
Y_8	-0.23	0.00	89.98	-569.35	4.15
BM	0.75	0.65	7.14	0.00	0.52
LNMV	11.60	11.55	14.47	9.28	0.98
O1	31.64	30.45	76.20	3.37	15.93
O2	1.52	0.91	19.85	0.00	1.88
O3	0.34	0.17	10.75	0.00	0.82
O4	18.88	15.82	47.49	3.00	11.25
RISK	0.03	0.02	0.13	0.00	0.02
RW	0.21	0.58	33.62	-32.53	5.77
RM	0.64	0.89	54.91	-80.07	11.75
PUT	0.29	0.00	1.00	0.00	0.45
LNPV	0.89	0.00	12.60	0.00	2.93
IRW	0.17	0.61	26.49	-21.09	4.35

Table 3 Correlations among Short Selling Proxies

See Table 2 for explanation of all variables. Except for the correlation between Y_2 and Y_8, all correlations are at the 1% level of significance.

	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8
Y_1	1.00							
Y_2	0.31	1.00						
Y_3	0.79	0.40	1.00					
Y_4	0.58	0.44	0.70	1.00				
Y_5	0.04	0.03	0.05	-0.04	1.00			
Y_6	0.01	0.04	0.02	-0.04	0.37	1.00		
Y_7	0.03	0.04	0.06	-0.05	0.69	0.45	1.00	
Y_8	-0.02	0.00	-0.03	-0.16	0.49	0.45	0.67	1.00

Table 4 Correlations among Independent Variables

See Table 2 for explanation of all variables. *O1*/*RW*, *O1*/*IRW*, *O4*/*LNPV*, *RW*/*PUT*, and *RM*/*PUT* are insignificant. *O2*/*IRW*, *O4*/*RW*, *RISK*/*RM*, and *PUT*/*IRW* are at the 5% significance level. The rest of the correlations are at the 1% significance level.

	BM	LNMV	O1	O2	O3	O4	RISK	RW	RM	PUT	LNPV	IRW
BM	1.00											
LNMV	-0.46	1.00										
O1	-0.39	0.49	1.00									
O2	-0.24	-0.06	-0.05	1.00								
O3	-0.03	-0.03	-0.12	0.03	1.00							
O4	-0.06	-0.14	-0.45	0.01	0.06	1.00						
RISK	0.11	-0.17	-0.03	0.25	0.02	-0.07	1.00					
RW	-0.07	0.03	0.00	0.02	0.03	0.01	-0.02	1.00				
RM	-0.15	0.06	0.02	0.07	0.05	0.02	-0.01	0.5	1.00			
PUT	-0.06	0.30	0.14	0.16	0.02	-0.14	0.07	0.00	0.00	1.00		
LNPV	-0.07	0.16	0.11	0.03	-0.01	0.00	0.02	0.02	0.04	0.47	1.00	
IRW	-0.05	0.02	-0.01	-0.01	0.02	0.01	-0.09	0.77	0.42	0.01	0.02	1.00

Table 5 Correlations with Short Selling Proxies

See Table 2 for explanation of all variables. $Y_1/O4$, Y_4/RW, Y_5/BM, $Y_5/LNMV$, $Y_5/O1$, $Y_5/O2$, $Y_5/O4$, Y_5/PUT, $Y_5/LNPV$, $Y_6/O1$, $Y_6/O2$, $Y_6/O3$, Y_7/BM, $Y_7/O1$, $Y_7/O2$, $Y_7/O3$, Y_8/BM, $Y_8/O1$, $Y_8/O3$ and $Y_8/O4$ are insignificant. $Y_3/O4$ is at the 5% significance. The rest are at the 1% significance level.

	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8
BM	0.04	0.02	-0.08	-0.06	0.00	-0.01	0.00	0.00
LNMV	0.03	0.22	-0.07	-0.01	0.00	0.01	0.00	0.02
O1	-0.04	0.14	-0.02	0.01	0.00	0.00	0.00	0.01
O2	0.04	0.21	0.36	0.17	0.00	0.00	-0.01	-0.01
O3	-0.01	-0.03	0.00	-0.03	0.00	0.01	0.00	0.00
O4	0.00	-0.29	-0.01	-0.02	0.00	0.01	0.00	0.01
RISK	0.03	0.14	0.12	-0.07	0.02	0.03	0.03	0.02
RW	0.03	0.05	0.06	0.00	0.08	0.18	0.12	0.07
RM	0.07	0.10	0.12	0.06	0.04	0.08	0.04	0.01
PUT	0.04	0.30	0.1	0.09	0.00	-0.01	-0.01	0.00
LNPV	0.03	0.16	0.06	0.07	0.00	0.00	0.00	0.00
IRW	0.02	0.03	0.04	0.01	0.03	0.09	0.05	0.03

Table 6 Regression Results

See Table 2 for explanation of all variables. The numbers in parenthesis are standard errors. *, **, and *** indicate respectively significance at the 10%, 5%, and 1% level.

	Y_1		Y_2		Y_3		Y_4	
BM	-6020.53 ***	(280.04)	-0.06 *	(0.03)	-0.11 ***	(0.00)	-9.98 ***	(0.62)
LNMV	-1919.48 ***	(345.53)	0.29 ***	(0.04)	-0.05 ***	(0.01)	-3.36 ***	(0.77)
O1	-156.86 ***	(14.27)	0.00 **	(0.00)	0.00 ***	(0.00)	-0.03	(0.03)
O2	923.00 ***	(51.74)	0.23 ***	(0.01)	0.04 ***	(0.00)	2.37 ***	(0.12)
O3	-1004.75 ***	(111.98)	-0.13 ***	(0.01)	-0.01 ***	(0.00)	-1.42 ***	(0.25)
O4	160.03 ***	(18.18)	-0.02 ***	(0.00)	0.00 ***	(0.00)	0.41 ***	(0.04)
RISK	12297.25 ***	(3674.32)	8.27 ***	(0.44)	0.14 **	(0.06)	-305.97 ***	(8.17)
RW	39.71 **	(15.82)	0.01 ***	(0.00)	0.00 ***	(0.00)	-0.13 ***	(0.04)
RM	90.71 ***	(5.60)	0.02 ***	(0.00)	0.00 ***	(0.00)	0.16 ***	(0.01)
PUT	186.63	(175.17)	0.66 ***	(0.02)	0.02 ***	(0.00)	4.16 ***	(0.39)
LNPV	154.39 ***	(28.71)	0.00	(0.00)	0.00 ***	(0.00)	0.41 ***	(0.06)
IRW	-74.70 ***	(20.12)	-0.01 ***	(0.00)	0.00 ***	(0.00)	-0.08 *	(0.04)
Adj R^2	0.22		0.43		0.32		0.20	

	Y_5		Y_6		Y_7		Y_8	
BM	20.74	(24.84)	0.16 *	(0.09)	0.00	(0.00)	0.28 ***	(0.08)
LNMV	-31.15	(30.65)	0.24 **	(0.11)	0.00	(0.00)	0.19 *	(0.10)
O1	-0.57	(1.27)	-0.01 ***	(0.00)	0.00 **	(0.00)	0.00	(0.00)
O2	-10.50 **	(4.59)	-0.06 ***	(0.02)	0.00 ***	(0.00)	-0.03 *	(0.02)
O3	-13.45	(9.93)	-0.03	(0.03)	0.00	(0.00)	0.01	(0.03)
O4	0.98	(1.61)	0.00	(0.01)	0.00	(0.00)	0.00	(0.01)
RISK	1513.20 ***	(325.90)	9.95 ***	(1.14)	0.06 ***	(0.01)	6.80 ***	(1.10)
RW	29.96 ***	(1.40)	0.20 ***	(0.00)	0.00 ***	(0.00)	0.09 ***	(0.00)
RM	0.45	(0.50)	0.00	(0.00)	0.00 **	(0.00)	-0.01 ***	(0.00)
PUT	-15.97	(15.54)	-0.16 ***	(0.05)	0.00	(0.00)	-0.03	(0.05)
LNPV	1.57	(2.55)	0.02 **	(0.01)	0.00	(0.00)	0.00	(0.01)
IRW	-20.78 ***	(1.78)	-0.11 ***	(0.01)	0.00 ***	(0.00)	-0.05 ***	(0.01)
Adj R^2	0.01		0.04		0.02		0.01	

Table 7 Regression Results with Interaction Effects

See Table 2 for explanation of all variables. BM*RW is the interaction term of the book-to-market ratio (BM) and weekly returns (RW). BM*RM is the interaction term of the book-to-market ratio (BM) and monthly returns (RM). The numbers in parenthesis are standard errors. *, **, and *** indicate respectively significance at the 10%, 5%, and 1% level.

	Y_1		Y_2		Y_3		Y_4	
BM	-5983.54 ***	(292.30)	-0.07 **	(0.03)	-0.12 ***	(0.00)	-11.18 ***	(0.65)
LNMV	-1900.58 ***	(348.65)	0.28 ***	(0.04)	-0.05 ***	(0.01)	-4.03 ***	(0.78)
O1	-156.46 ***	(14.30)	0.00 **	(0.00)	0.00 ***	(0.00)	-0.04	(0.03)
O2	923.72 ***	(51.76)	0.23 ***	(0.01)	0.04 ***	(0.00)	2.35 ***	(0.12)
O3	-1001.97 ***	(112.18)	-0.13 ***	(0.01)	-0.01 ***	(0.00)	-1.52 ***	(0.25)
O4	160.10 ***	(18.18)	-0.02 ***	(0.00)	0.00 ***	(0.00)	0.41 ***	(0.04)
RISK	12282.03 ***	(3676.59)	8.30 ***	(0.44)	0.16 ***	(0.06)	-304.28 ***	(8.18)
RW	47.14 **	(20.55)	0.01 ***	(0.00)	0.00 ***	(0.00)	-0.13 ***	(0.05)
RM	86.58 ***	(8.73)	0.02 ***	(0.00)	0.00 ***	(0.00)	0.24 ***	(0.02)
PUT	181.37	(175.56)	0.66 ***	(0.02)	0.02 ***	(0.00)	4.33 ***	(0.39)
LNPV	154.82 ***	(28.72)	0.00	(0.00)	0.00 ***	(0.00)	0.40 ***	(0.06)
IRW	-74.11 ***	(20.16)	-0.01 ***	(0.00)	0.00 ***	(0.00)	-0.07	(0.04)
BM*RW	-9.02	(16.18)	-0.00 *	(0.00)	-0.00 *	(0.00)	-0.00	(0.04)
BM*RM	4.56	(7.28)	-0.00	(0.00)	-0.00 ***	(0.00)	-0.09 ***	(0.02)
Adj R^2	0.22		0.43		0.32		0.20	

Table 8 Short Selling Strategies and Average Returns

We establish six short selling strategies respectively based on *BM*, *RW*, *RM*, *PUT*, *BM*RW*, and *BM*RM*. The holding periods are one week (1W), two weeks (2W), three weeks (3W), and four weeks (4W). We calculate returns by four different methods. CO is the first method that we short the stock with the closing price and close the position with the opening price next week. CC is the second method that we short the stock with the closed price and close the position with the closing price next week. OC is the third method that we short the stock with the opening price and close the position with the closing price next week. OO is the fourth method that we short the stock with the opening price and close the position with the opening price next week. *RW* is the average weekly returns for the 62 constituents.

Strategy	1W					2W					3W					4W				
	CO	CC	OC	OO	RW	CO	CC	OC	OO	RW	CO	CC	OC	OO	RW	CO	CC	OC	OO	RW
BM	0.197	0.242	0.250	0.254	0.210	0.393	0.425	0.433	0.436	0.210	0.621	0.657	0.644	0.691	0.210	0.965	0.987	0.992	1.030	0.210
RW	0.067	0.070	0.201	0.235	0.210	0.195	0.211	0.342	0.339	0.210	0.088	0.127	0.261	0.267	0.210	0.061	0.039	0.172	0.216	0.210
RM	0.107	0.138	0.227	0.271	0.210	0.171	0.163	0.252	0.233	0.210	0.031	-0.006	0.082	0.098	0.210	-0.080	-0.117	-0.028	-0.026	0.210
PUT	0.162	0.150	0.114	0.157	0.210	0.324	0.312	0.275	0.320	0.210	0.505	0.493	0.455	0.504	0.210	0.707	0.692	0.654	0.706	0.210
BM*RW	0.294	0.357	0.533	0.579	0.210	0.655	0.712	0.890	0.890	0.210	0.711	0.799	0.978	0.996	0.210	0.984	0.963	1.140	1.252	0.210
BM*RM	0.352	0.429	0.558	0.613	0.210	0.604	0.635	0.766	0.737	0.210	0.616	0.621	0.751	0.794	0.210	0.816	0.791	0.918	0.967	0.210