

Short Selling Around Corporate Acquisitions

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Abstract

Using daily short sale transactions data for firms traded in the Taiwan Stock Exchange (TWSE) from January 1991 to January 2007, we examine the pattern of short selling trading in the five days prior to 338 acquisition (unscheduled) announcements made by 250 firms. Consistent with the view that short sellers are informed traders, we find that they have the ability to predict and time their trades prior to significant negative acquisition announcements. Specifically, our evidence shows that abnormal short selling prior to acquisition announcements is mostly significantly associated with negative (bad acquisition news) post-announcement abnormal returns. This suggests that informed traders driven by the precision of their information choose to trade on their information early. For comparison purposes, to previous studies that have mainly focused on the trades of short sellers prior to earnings announcements, we also investigate the information content of short sale transactions in the five days leading up to 19396 earnings announcements of 1117 public firms listed in the Taiwan Stock Exchange. Consistent with the short selling activity prior to acquisition announcements, these tests show that short sellers time their trades prior to significant negative earnings announcements. Robustness checks and the undertaking of alternative tests show that daily changes in short sales transactions lead future stock prices, consistent with the notion that the information advantage of short sellers broadens the informativeness of their short sale trades. Our findings suggest that financial market regulators should avoid considering curbing short selling activity and instead encourage frequent dissemination of short selling information to investors.

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1. Introduction

The informational role of short selling activity has received a great deal of attention in recent years. While several studies, including Asquith and Muelbroek (1996), Aitken et al. (1998) among others, find that short sellers are, on average, able to predict lower future returns they provide no evidence whether private information is driving short selling transactions.¹ Dechow, Sloan and Sweeney (1996), Griffin (2003), Efendi, Kinney and Swanson (2005) and Desai, Krishnamurthy and Venkataraman (2006) report that monthly short interest rises prior to events such as Securities Exchange Commission (SEC) actions and class action lawsuits and earnings announcements. Fishman, Hong and Kubik (2006), using monthly short interest data, find that the price of a highly shorted stock is more sensitive to earnings news than a stock with little short interest. For a sample of New York Stock Exchange (NYSE) firms over the 1989-1998 period, Pownall and Simko (2005) show the stock price reaction to short interest increases is more negative for stocks with low analyst coverage. They interpret this result to be in agreement with the view that short sellers are more informative when there are fewer alternative information sources. However, recent empirical studies, point out that monthly short interest has limited ability to predict future abnormal returns. Specifically, it is argued that the negative relation between short selling activity and future firm performance is weak and driven mostly by a few small firms (Asquith, Pathak and Ritter (1996), Cohen, Diether and Malloy (2006)).

Christophe, Ferri and Angel (2004), however, using daily short sale transactions five days prior to earnings announcements, for a sample of 900 NASDAQ firms from September 13 to December 2000,

¹ Dechow, Hutton, Meulbrock and Sloan (2001) show that short-sellers are able to identify overvalued stocks relative to fundamentals. They also find that short sellers tilt their positions toward mispriced securities as suggested by several fundamental ratios.

find that short interest is considerably higher prior to the announcement of negative earnings surprises, suggesting that a significant proportion of short sellers are informed traders. In contrast, Daske, Richardson and Tuna (2005), using the latest available daily short sales data in US market over a longer period of time, from April 1, 2004 to March 31, 2005, find no evidence of informed short selling around negative earnings surprises and management forecasts.

The conflicting US evidence on the ability of short sellers to exploit earnings announcements, and in particular to predict stock price declines, coupled with short selling data limitations have motivated this study.² Most previous studies use monthly short selling data while the more recent studies that use daily short selling transactions rely on very small samples. Moreover, the focus on scheduled announcements, such as earnings, may be partly liable for the mixed evidence reported in prior studies because earnings announcements are likely to be less germane information events to short sellers for several reasons.³ To overcome these problems, we examine the behavior of short sellers in anticipation of unscheduled corporate events using a 17-year long unique dataset of daily short sale transactions. Specifically, in this study we investigate whether short sellers, to the extent that shorting is feasible and relatively inexpensive, can establish profitable trading positions in anticipation of market's reaction to corporate acquisition announcements using daily short sale transactions from the Taiwan Stock Exchange Securities (TWSE)

² See, for example, Au, Doukas and Onayef (2007), among others.

³ First, management can manipulate earnings to achieve earnings surprises (Teoh, Welch, and Wong (1998a, 1998b), Chan, Chan, Jagadeesh, and Lakonishok (2001)). For example, Sloan (1996), find that firms with relatively high (low) levels of abnormal accruals, realizing negative (positive) future abnormal stock returns, concentrate around future earnings announcements. Second, other news releases may be timed to coincide with earnings announcements to temper price movement at the time of earnings news. Third, large negative (positive) earnings surprises, which predict negative (positive) abnormal returns, could be associated with large positive (negative) accruals. Finally, since the likelihood of speculative shorting is probably greater around earnings events this may also explain the mixed results in prior research.

over the 1991-2007 period. Unlike previous studies, we direct our focus on the trading patterns of short sellers around acquisition announcements that are subject to considerable uncertainty with regards to the timing of the announcement relative to scheduled corporate news releases such as earnings and dividends. Hence, acquisition announcements permit us to conduct a more strenuous test about the effectiveness of short sellers to predict stock price declines. Unscheduled corporate events such as acquisitions are more difficult to be anticipated by the average investor and, therefore, more appealing to short sellers in establishing profitable positions by going short on bidders' stock.⁴

Relying on a comprehensive and long dataset of daily short sale transactions, we examine whether short selling around acquisition announcements reflects trading by informed short sellers. If short sellers are, indeed, primarily informed traders, they should be able to anticipate the release of an acquisition announcement and take advantage of the anticipated negative acquisition news by establishing a short position on the stock of the acquiring firm. To the best of our knowledge, previous studies have not examined the behavior of daily short selling activity around acquisitions announcements despite the fact that they are considered as one of the most important corporate events in financial markets. Employing 17 years of daily non-US short interest data allows us to draw inferences about the role of short sellers outside of the US market and thus avoid the standard criticism that observed regularities may be a function of data snooping bias. Moreover, a distinct characteristic of this data set is that investors in Taiwan, unlike in US, cannot short stocks through options. Hence, our dataset provides a unique opportunity to single out the effect of short selling, which might be one of the reasons why previous US

⁴ The possibility of earnings management, however, is likely to make earnings announcements less appealing to short sellers, as prices are not expected to drift dramatically from fundamental values.

studies fail to find a reliable relation between short sale transactions and subsequent stock returns.

The objective of this study is twofold. First, we examine whether short sellers, as informed traders, can predict and time their trades prior to significant negative acquisition announcements. Second, we investigate whether the unusual levels of short selling during the pre-acquisition announcement days reveal that short sellers successfully anticipate the content of these announcements. If short sellers act primarily as informed traders, abnormal increases in short selling should occur with some frequency prior to acquisition announcements that produce negative abnormal announcement returns. That is, the concentration of pre-announcement short selling transactions should be different for negative and positive acquisition announcements. On the other hand, if uninformed speculators and/or hedgers dominate short selling, pre-acquisition announcement short selling trading should be more or less uniformly dispersed across positive, neutral and negative acquisition surprises.

We investigate the link between pre-announcement short selling and post-announcement stock abnormal returns by performing several tests. The first test consists of multivariate regression analysis applied to the full sample, and acquisition announcements classified as ‘positive news’ and ‘negative news’. These tests uncover a significantly negative relationship between unusual level of short selling in the days before the acquisition announcement and the immediate post-announcement cumulative abnormal return, especially for the announcements grouped as ‘negative news’. Consistent with the notion that short sellers are informed traders, the results show that short sellers not only can time acquisition announcements, but also can predict the content of acquisition announcements. These results are in accord with the evidence of Christophe, Ferri and Angel (2004) showing that US short interest is significantly higher prior to the announcement of negative earnings surprises, suggesting that a significant proportion

of short sellers are informed traders. Our second test is design to examine the relation between daily changes in short sale transactions and daily abnormal stock returns using alternative metrics of daily short selling transactions. Consistent with our previous results, this evidence is in support of a significant relation between daily short sale transactions and abnormal stock returns.⁵ Finally, we examine extreme cases in which short selling is unusually high or low and show that abnormally large changes in short selling often precede substantial stock price reactions to acquisition announcements.

For comparison purposes to previous studies that have focused on earnings announcements, we also examined the pattern of short selling activity prior to earnings announcements. These results are consistent with our findings based on acquisition announcements. Specifically, we document unusual levels of short selling during the pre-earnings announcement days indicating that short sellers are successful in anticipating the content of earnings announcements. Overall, our results suggest that abnormal increases in short selling trades precede both acquisition and earnings announcements.

Using a unique 17-years daily non-US equity loan dataset, the evidence in this paper contributes to the growing body of the empirical literature on short selling in several ways. First, in contrast to previous studies that have relied on daily short selling data spanning short time intervals, mainly due the unavailability of long term short sales data, we examine 17-years daily short sale transactions with the aim of identifying whether short sellers act as informed traders that not only can predict the content of unscheduled acquisition announcements but also are able to predict acquisition announcements that the market is expected to perceive as bad news. Second, we provide new evidence on short sellers' behavior

⁵ These results contradict the findings of Daske, Richardson and Tuna (2005) who fail to find that short sellers are able to predict significant negative earnings surprises and that they do not have the ability to predict stock price declines.

around earnings announcements by relying on a unique non-US dataset. Our dataset allows us to determine whether short sellers exhibit similar trading patterns with those in the US. Third, studying the short sellers' exhibit trading patterns outside the US avoids the standard criticism that observed regularities may be related to data mining. Third our results suggest that the information advantage of short sellers broadens the informativeness of their short sale trades. This may be because in Taiwan the flow of information is not as broad as in the US and secondly because short selling for hedging purposes is probably not a widely used practice. Finally, our results have significant implications about financial market regulators who are interested in understanding the information content of short seller activity. Our findings suggest that regulators should avoid considering curbing short selling activity and encourage frequent dissemination of short selling information to investors.

The rest of the paper proceeds as follows. Section 2 describes the data, sample characteristics and outlines the empirical design. Section 3 presents the empirical results. Section 4 conducts a nonparametric robustness test based on extreme cases of short selling and presents the results. Section 5 concludes.

2. Data and Research Design

2.1. Sample Selection

This section describes the data sources, alternative daily short selling measures, acquisition announcements and sample selection process spanning the 1991-2007 period.

2.1.1. Short Sale Data

The source of our data is the Taiwan Stock Exchange Securities. Since January 1991, the TWSE

has released short sale data every trading day.⁶ The short selling data were reported daily in the United Daily News and Economic Daily News of the United Daily News Group. In Taiwan, the number of shares available to borrow depends mainly on the number of shares purchased and managed by brokerage firms for margin traders. Generally, brokerage firms can provide enough shares for those who want to sell short. The daily short selling data in TWSE database includes daily Short Sale Balance, daily transactions in short selling, daily transactions in short shares return and daily net change in Short Sale Balance. The Short Sale Balance represents the total number of shares shorted on a given day for a security (*SHORT*). Daily transactions in short selling, is the number of executed short sale orders on a security on a given day. Daily transaction in short share return is the number of return on the shorted security on a given day. Daily net change in Short Sale Balance is the net change in the amount of shot sale balance for a security on a given day.

In contrast to the US, Taiwan does not have stock options market for individual stocks. Hence, unlike their counterparts in US, investors in Taiwan cannot choose to short a stock through the options market. Diamond and Verrecchia (1987) and Senchack and Starks (1993) both find evidence that option trading tend to reduce the effect of short sales on stock prices. Figlewski and Webb (1993) find evidence that trading in options reduces the effect of constraints on short sales. Therefore, the existence of options market makes it harder to single out the effect of short sale, which might be one of the reasons why some previous US studies fail to find a reliable relationship between short sales and subsequent stock returns. Our data consist of daily short sale balance, short selling transactions, net change in short sale balance, trading volume and outstanding shares, stock prices and stock returns released by the TWSE from

⁶ Since July 2005, the TWSE has made publicly available daily short sale data through its website.

January, 1991 to January, 2007. For our empirical tests, we use three short sale metrics. The first measure, *SHORT*, is the Short Sale Balance which represents the daily balance of the total number of shares a security shorted on a given day. The other two short sale measures are obtained by scaling *SHORT* by the number of shares outstanding (*SHORT/OUTSHARES*) and by trading volume on that security (*SHORT/VOLUME*) on the same day, respectively.

2.1.2. Acquisition Announcements

Our acquisitions sample, consist of 367 acquisition announcements for listed firms in the Taiwan Stock Exchange from January 1991 to January 2007. Excluding acquisition announcements for which we were unable to identify the announcement date, our final sample contains 338 acquisitions made by 250 listed companies. Among these companies and during the whole period from January 1991 to January 2007, 186 firms involved in single acquisitions, 44 firms engaged in two acquisition events, 14 firms involved three times acquisition events, 4 firms involved in four acquisitions and one firm involved in 6 acquisitions. Since we are interested to investigate the pattern of short selling prior to acquisition announcements, for any multiple acquisitions announced by a bidder within the same year conducted, we only consider the first acquisition in that year in order to isolate the effects of short selling transactions. As a result, this screening procedure resulted in 182 single acquisitions and 122 multiple acquisitions.⁷ Table 1 presents the key characteristics of the short selling, trading volume and cumulative abnormal returns for the sample of firms involved in acquisitions. The average shorted shares (*SHORT*) on a stock for a given day are 1,462,110 shares. The average ratio of balance of shorted shares scaled by number of

⁷ 74.85% of the acquisition deals involved private companies. Bidders' mean and median Q value is around or above 2. The acquisitions activity increased dramatically after 2000 and peaked in year 2002 (64 acquisitions) and 2005 (69 acquisitions). One third of the acquisitions involved companies from the electronics sector.

outstanding shares (*SHORT/OUTSHARE*) and by number of trading volume (*SHORT/VOLUME*) on a security on a given day is 0.319% and 0.41, respectively. The average two-day cumulative abnormal return is -0.30. The average daily abnormal short selling ($X_{SS}(-5,-1)$) is 1.92.

[Insert Table 1 Here]

2.2. Empirical Design

If short sellers engage in informed trading prior to corporate announcements, such as acquisitions and earnings, there should be a significant relationship between abnormal short selling in the days prior to the announcement date ($t = 0$) and the abnormal stock returns once the information contained in these announcements becomes publicly available. To determine whether abnormal short selling activity occurs prior to such corporate announcements we follow Christophe, Ferri and Angel (2004), and define abnormal short selling the percentage difference between the average daily number of firm shares sold short during the five days preceding the acquisition and earnings announcement ($X_{SS}(-5,-1)$) and the average daily number of the firm's shares sold short during the non-announcement period. Unlike previous studies (Christophe, Ferri and Angel (2004) and Daske, Richardson and Tuna (2005)) that used post-announcement returns ($RET(0,+1)$) to examine the pattern of short selling activity in the days leading up to the earnings announcement date, in our empirical study we investigate the relation between the pre-announcement short selling transactions and the two-day cumulative abnormal returns ($CAR(0,+1)$) in response to acquisition and earnings announcement, respectively. The use of the two-day cumulative abnormal returns is a better proxy for the market's surprise (positive or negative) contained in the announcement than the simple return around the announcement. As in Christophe, Ferri and Angel (2004), we employ use the -110 to -10 time interval before the announcement date as our estimating

period to compute the abnormal return, abnormal short selling and abnormal trading volume. Implicitly, this assumes that the average daily return, short selling and trading volume during the 101 days prior to the announcement is a fair representation of the firm's typical daily level of these variables. More specifically, a stock's average daily abnormal short selling during the five days prior to the acquisition (earnings) announcement $X_SS(-5,-1)$ is measured as:

$$X_SS(-5,-1) = \frac{SS(-5,-1)}{AverageSS(-110,-10)} - 1 \quad (1)$$

where $SS(-5,-1)$ is the average daily number of shares sold short during the five days prior to the announcement, and $AverageSS$ is the average daily number of shares sold short during the -110 to -10 days prior to the announcement date.

To test whether abnormal short selling is associated to information about the upcoming acquisition (earnings) announcement we use the following models:

$$X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon \quad (2)$$

$$R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon \quad (3)$$

where $CAR(0,+1)$ is the cumulative abnormal return of the stock on the announcement date ($t=0$) and the day after the announcement date. $CAR(-5,-1)$ is the cumulative abnormal return five days prior to the announcement. $X_VOL(-5,-1)$ is the average daily abnormal trading volume in the stock over the -5 to -1 day interval measured as follows:

$$X_VOL(-5,-1) = \frac{VOL(-5,-1)}{AverageVOL(-110,-10)} - 1 \quad (4)$$

where $VOL(-5,-1)$ is the average daily trading volume during the five days prior to the announcement, and $AverageVOL(-110 to -10)$ is the average daily trading volume during the non announcement period

from -110 to -10 day. The variable $R_SS(-5,-1)$ is the ratio of shorted shares to traded shares in the stock in the pre-announcement period. The variable $NR_SS(-110 \text{ to } -10)$ is the ratio of shorted shares to traded shares in the non announcement period.

As noted earlier, the $CAR(0,+1)$ variable serves as a proxy for surprise (positive or negative) contained in the announcement. Good (bad) surprises are defined as those announcements that have positive (negative) $CAR(0,+1)$ s. Thus, a negative (positive) 2-day cumulative abnormal return implies that investors viewed the acquisition or earnings announcement as bad (good) news than most had expected. Therefore, a negative and statistically significant β_1 would suggest that short selling abnormally rises prior to disappointing news. Consequently, if short sellers act as informed traders, we would expect that abnormal increases in short selling to occur with some frequency especially prior to acquisition (earnings) announcements that led to negative post-announcement abnormal returns.

Moreover, we also expect that the concentration of pre-announcement short selling transactions to be different in response to negative and positive announcement returns, if short-sellers are indeed informed traders. Specifically, we do not expect significant short selling activity during the days leading to the announcement date if market's response is positive to an acquisition or earnings announcement. That is, if short sellers act as sophisticated and informed traders they will anticipate the way the market is going to react to a corporate announcement and, therefore, establish a short position in bidder's stock only if they anticipate a negative market reaction.

In our second type of test we examine the relation between changes in daily short sale transactions and daily abnormal stock returns using alternative metrics of daily short selling transactions. Specifically, following Daske, Richardson and Tuna (2005), we estimate the following regression

specifications using three different measures of short sales:

$$CAR_{(0,+1)} = \alpha + \beta_1 \% \Delta SHORT_{-1} + \dots + \beta_{10} \% \Delta SHORT_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (5a)$$

$$CAR_{(0,+1)} = \alpha + \beta_1 (\% \Delta SHORT / OUTSHARE)_{-1} + \dots + \beta_{10} (\% \Delta SHORT / OUTSHARE)_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (5b)$$

$$CAR_{(0,+1)} = \alpha + \beta_1 (\% \Delta SHORT / VOLUME)_{-1} + \dots + \beta_{10} (\% \Delta SHORT / VOLUME)_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (5c)$$

where $\% \Delta SHORT_{-t}$, $(\% \Delta SHORT / OUTSHARE)_{-t}$ and $(\% \Delta SHORT / VOLUME)_{-t}$ are the daily percentage changes in short sales based on the three measures (*SHORT*, *SHORT/OUTSHARE* and *SHORT/VOLUME*) lagged on t day, respectively. Again if short sale transactions precede bad acquisition news, we expect to observe negative and statistically significant β coefficients in the above regressions of the two-day announcement cumulative abnormal return on lagged changes in short sale transactions and lagged daily returns.

3. Empirical Results

3.1. Short Selling Transactions and Acquisition Announcements

In this section, we present the results of our empirical analysis that are designed to shed light on whether short sellers target acquisition announcements and engage in unusual short selling transactions before acquisition announcements. To explore how short sellers behave between the pre- and post-announcement period we partition the sample into favorable ($CAR > 0$) and non-favorable ($CAR < 0$) announcements.

3.1.1 Univariate Results

Figure 1 shows the pattern in short sale transactions surrounding acquisition announcements.

Panel A demonstrates the general pattern of executed short sell orders, using *SHARE*, in the 200-day period straddling the acquisition announcement. The vertical line corresponds to the announcement day (day 0). There is steady and dramatic increase in short selling prior to the acquisition announcement. The increase becomes more pronounced 40 days prior to the announcement date and mostly significant in the 10-day period before the announcement date. Panel B of figure 1 shows the pattern of short selling transactions for the favorable ($CAR > 0$) and non-favorable ($CAR < 0$) acquisition announcements. Apparently, there is a distinct difference in the trading behavior of short sellers indicating that their trades are significantly concentrated prior to the non-favorable announcements than that before favorable announcements.⁸ Both short selling trading patterns reveal that short sellers are indeed informed traders in the sense that they are able to time and predict the content of the acquisition announcements. Overall, these figures suggest that there is a strong relation between pre-announcement abnormal short sales and post-announcement two-day abnormal returns.

[Insert Figure 1 Here]

To gain additional insights into the relation between pre-announcement abnormal short sales and post-announcement two-day abnormal returns, we rank stocks into four groups based on the level of abnormal short selling in the pre-announcement period (i.e., top 5%, top 25%, low 25% and low 5% level of abnormal short sales) and expect to find that higher levels of short selling in pre-announcement period should predict lower abnormal returns in the two-day post-announcement period. If short sellers are, indeed, sophisticated and act as informed traders they should be able to predict the content of acquisition announcements, we expect to find a strong and statistically significant difference between the top most

⁸ Similar patterns emerge when we use the other two measures (*SHORT/OUTSHARE* and *SHORT/VOLUME*).

heavily shorted stocks (top 5%) and the rest of the stocks in the sample.

Table 2 reports the two-day abnormal returns following acquisition announcements by the level of pre-announcement abnormal short selling using three measures of short selling. The results are consistent with the prediction in that the level of pre-announcement abnormal short selling is negatively related to the level of post-announcement abnormal returns, especially for anticipated acquisition announcements by short sellers that would trigger a negative market reaction ($CAR(0,+1) < 0$). For instance, as shown in Panel A, the full sample shows a monotonic decline in abnormal returns as we move from the low (5%) to the top (5%) level of short selling. The mean difference between the top (5%) and the rest of the sample is 0.0455 and statistically significant at the 5% level. A similar and more pronounced relation between short selling and abnormal returns emerges for acquisition announcements associated with negative abnormal returns. The mean difference between the top (5%) and the rest of the sample is 0.0017 and statistically significant at the 1% level. The variance difference between the most heavily shorted stocks (top (5%)) and rest of the stocks are also statistically significant, especially for the negative acquisition announcements. For acquisition announcements associated with positive market reactions, abnormal returns rise with the level of abnormal short selling. However, the mean difference between the top (5%) and the rest of the sample is 0.9644 and statistically insignificant at conventional levels. These patterns, as shown in Panels B and C, persist when the other two short selling measures are used. Collectively, these results are consistent with the view that short sellers are informed traders who can predict the content of acquisition announcements and thus adjust the level of their short selling positions accordingly. Moreover, the evidence suggests that short sellers can distinguish between ‘good news’ and ‘bad news’ associated with acquisition announcements.

[Insert Table 2 Here]

3.1.2 Regression Results

To further assess the statistically significant relation emerged in the patterns of figure 1 and Table 2, we report regression results based on equations (2) and (3). Specifically, we focus on the relation between unusual short selling during the pre-acquisition period ($X_{SS}(-5,-1)$, $R_{SS}(-5,-1)$) and the two-day post-acquisition abnormal returns ($CAR(0,+1)$) with standard regression analysis. As argued before, to the extent that such a relationship exists, highly shorted stocks are expected to be associated with negative abnormal returns on the two-day post-announcement period ($CAR(0,+1) < 0$). These results are reported in Table 3 for three different measures of short sale transactions of *SHORT* (Panel A), *SHORT/OUTSHARE* (Panel B) and *SHORT/VOLUME* (Panel C), respectively. Panel A illustrates the regression results based on equations (2) and (3) for the full sample and the subsamples associated with positive ($CAR > 0$) and negative ($CAR < 0$) acquisition announcements. Consistent with our previous results, the β_1 coefficients for the entire sample and the sample of negative ($CAR < 0$) acquisition announcements are negative and are statistically significant at 1 percent level. However, the sample of positive acquisition announcements yields a positive and statistically insignificant β_1 . We find similar results from equation (3), indicating the short sellers are informed traders that not only are able to time the acquisition announcement date, but also predict the content of the announcement. Panels B and C confirm these results when we use *SHORT/OUTSHARE* and *SHORT/VOLUME* as our short sale measures. The β_1 coefficients are mostly negative and statistically significant, reaffirming that short sellers' trades precede negative acquisition announcements.

When we look at the control variable $CAR(-5,-1)$, which represents the movement of the stock

price five days before the acquisition announcement, it shows that it enters these regressions with a statistically insignificant β_2 coefficient implying that there is not significant downward pressure on the stock price in the days leading up to the announcement. Namely, a pre-announcement increase (decrease) in the bidder's stock price does appear to affect short selling by inducing some investors to short (long) the overvalued (undervalued) stock. Hence, the insignificance of this control variable suggests that the model does not incorrectly attribute all the pre-announcement short selling to expectations about the acquisition announcement. In sum, there is no contemporaneous relation between abnormal short selling and the CAR(-5,-1). Finally, the coefficient of second control variable, X_VOL (-5, -1), which accounts for the contemporaneous relation between abnormal short selling and volume increases, indicates that increases in volume facilitate short selling as it becomes easier to short.

[Insert Table 3 Here]

3.1.3 Alternative Regression Results

In this section we report results based on regressions of daily changes in short sale transactions and the 2-day post-acquisition abnormal returns. This test is also designed to determine whether short sellers establish trading positions prior to negative acquisition news. Table 4 reports the results. Panel A reports regression results based on the entire sample of announcements and using different short sale measures, suggest that there is a significant and negative relation between changes in short selling and 2-day post-acquisition abnormal returns, as the $\Delta SHORT_t$ variable enters these regressions with several significant coefficients. The regression results in Panel B, based on negative acquisition announcements also demonstrate that the $\Delta SHORT_t$ variable enters these regressions with statistical coefficients, suggesting that short sellers are able to trade prior to negative corporate news. The magnitude of these

coefficients is more pronounced than in Panel A. More significant results are found for lagged daily return variable, RET_{t-1} , regardless of short sale measure used. These results are consistent with our previous evidence, but in sharp contrast with the evidence of Daske, Richardson and Tuna (2005) who could not find evidence in support of the view that short sellers' trades concentrate prior to negative corporate news.

[Insert Table 4 Here]

3.2. Short Selling Transactions and Earnings Announcements

To draw comparisons with previous studies that have focused on scheduled corporate announcements (Christophe, Ferri and Angel (2004) and Daske, Richardson and Tuna (2005)), we also investigate the behavior of short sellers prior to earnings announcements. The sample of earnings used in the analysis contains 54952 earnings announcements of listed firms in the Taiwan Stock Exchange from January 1971 to January 2007. In order to avoid clustering effects in earnings announcements and compare our results to previous studies, we only focus on earnings announcements that are at least 90 days away from each other (i.e., quarterly earnings announcements). Therefore, the original sample was reduced to 26912 earnings announcements. However, because the short selling data is only available since 1991, our final sample of earnings announcements for the 1991 to 2007 reduced to 19396 earnings announcements.

Panels A and B of Table 5 present the key characteristics of the short selling measures, trading volume, cumulative abnormal returns for the sample of firms with quarterly the earnings announcements. The average shorted shares ($SHORT$) on a stock for a given day are 1,758,630 shares. The average ratio of balance of shorted shares scaled by number of outstanding shares ($SHORT/OUTSHARE$) and by number

of trading volume (*SHORT/VOLUME*) on a security on a given day is 0.255% and 0.51, respectively. The average two-day cumulative abnormal return is -0.48. The average daily abnormal short selling ($X_{SS}(-5,-1)$) is 3.77. Panel C of Table 5 presents the monthly distribution of the 19396 earnings announcements with most taking place in April (39.52%) and August (43.17%).

[Insert Table 5 Here]

Table 6 reports regressions results based the same short selling measures used for the acquisition announcements sample. Panel A reports results for the *SHORT* measure, Panel B reports results for the *SHORT/OUTSHARE* and Panel C reports results for the *SHORT/VOLUME*. As before, we still use the -110 to -10 day period as the pre-announcement period to calculate the abnormal short selling, $X_{SS}(-5,-1)$, abnormal trading volume, $X_{VOL}(-5,-1)$, relative short selling, $R_{SS}(-5,-1)$ and the normal relative short selling, $NR_{SS}(-110,-10)$. The earnings results exhibit a similar pattern with that of the acquisition announcements documented earlier. This evidence reinforces the view that short sellers are informed traders with the ability not only predict the content of scheduled events, such as quarterly earnings announcements, but also predict the content of these announcements.

It is worth noting that this set of results is much more significant, indicating that short sellers are in a better position to predict the content of scheduled announcements than that of unscheduled announcements such as acquisitions. For example, using *SHORT* as the measure of short sale transactions, Panel A illustrates that the regression coefficient β_1 is negative and statistically negative significant at 1% level for both the full sample and the negative earnings news subsample, while it is insignificant, as expected, for the positive earnings news subsample. This pattern also holds for the regression specification (3). Similar results are reported in Panels B and C for the *SHORT/OUTSHARE* and

SHORT/VOLUME short sale measures. Consistent with the evidence of Christophe, Ferri and Angel (2004) our Asian results provide additional support for the view that short sellers are, indeed, informed traders who are able to take short selling positions ahead of negative corporate announcements.⁹

[Insert Table 6 Here]

Table 7 presents results derived from regressions of daily changes in short sale transactions and the 2-day post-earnings abnormal returns. As before, this regression analysis is intended to determine whether short sellers establish trading positions prior to negative earnings announcements. Panels A and B show the regression results for all earnings announcements in our sample and the negative earnings announcements, respectively. These regressions results provide additional evidence that is consistent with the view that short sellers are able to trade prior to negative earnings surprises. Specifically, our results show that there is a systematic relation between post-earnings abnormal returns and daily changes in short sale transactions regardless of the short selling measure used. We find the β_1 coefficient to be negative statistically significant at conventional levels in most regressions. This is also the case for the sample of negative earnings news indicating that short selling precedes bad earnings surprises. These results are in line with the findings of Christophe, Ferri and Angel (2004) but contradict the evidence of Daske, Richardson and Tuna (2005). Unlike previous studies that have relied on small sample data sets, drawing inferences from, perhaps, the largest daily short sales data set, our results are likely to reflect a more reliable relation between the percentage change in short selling and the 2-day post-earnings abnormal returns (i.e., earnings surprises). Furthermore, it is interesting to highlight that the earnings regressions

⁹ As shown in the Appendix, our results remain robust even when we use the -90 to -10 time interval as the pre-announcement period for calculating the abnormal short selling $X_SS(-5,-1)$, abnormal trading volume, $X_VOL(-5,-1)$, relative short selling, $R_SS(-5,-1)$ and the normal relative short selling, $NR_SS(-90,-10)$.

produced more statistically significant β coefficients than the acquisition regressions, reported in results Table 5, indicating that it is probably easier for short sellers to establish trades prior to negative earnings announcements than it is for negative acquisition news. This is probably because, the timing of acquisition announcements is more difficult to predict while this is not the case with quarterly earnings announcements.

[Insert Table 7 Here]

4. Robustness Tests

4.1. Extreme Short Selling Trades Prior to Corporate Announcements

The results presented so far suggest that short sellers, on average, are successful in predicting acquisition and earnings announcements based on information that is unlikely to be publicly disclosed. In this section, we examine the link between unusually high or low short selling in the pre-announcement period and stocks' post-abnormal returns by performing a χ^2 -test.¹⁰ Moreover, we conduct an additional test based on the abnormal relative short selling measure, $XR_SS(-5,-1)$, which estimates unusual short selling as the difference between $R_SS(-5,-1)$ and NR_SS .¹¹ The abnormal relative short selling metric allows us to examine whether the percentage of shorted shares to traded shares differs between the pre- and non-announcement periods. Consequently, while the first test is based on the number of shorted shares, the second tests is based on the ratio of shorted shares to traded shares.

For each abnormal short selling measure, we divide the sample into the highest quintile (20%) of

¹⁰ See Dechow et al. (2001).

¹¹ For instance, if $R_SS(-5,-1)$ is 9% while NR_SS is 5%, the $XR_SS(-5,-1)$ is 4%.

$X_SS(-5,-1)$ or $XR_SS(-5,-1)$ stocks and all other sample stocks. Subsequently, we examine how these groups of stocks are distributed across high $CAR(0,+1)$ (i.e., the 20% of stocks with the highest positive $CAR(0,+1)$ level), low level $CAR(0,+1)$ (i.e., the 20% of stocks with the lowest $CAR(0,+1)$ level), and middle $CAR(0,+1)$ (i.e., the remaining 60% of sample stocks). If short-selling is randomly dispersed across the post-announcement abnormal returns, we expect to observe that the 20% of the observations for each group fall in the high return quintile, 20% in the low CAR quintile, and 60% in the middle CAR quintiles.

Panels A and B of Table 8 present the results for the acquisition and earnings announcements, respectively. The results in Panel A, show that 28.1% of the stocks in the highest $X_SS(-5,-1)$ quintile fall into the low CAR category, while 21.9% fall in the high CAR category. For the other quintiles the corresponding percentages are 17.6% and 20.0%, respectively. The results based on the abnormal relative short selling, $XR_SS(-5,-1)$ measure show that 31.3% of the stocks in the highest $XR_SS(-5,-1)$ quintile fall into the low CAR category, while 25.0% fall in the high CAR category. For the other quintiles, the corresponding percentages are 16.8% and 19.2%, respectively. A similar pattern of results, as shown in Panel B, emerges for the earnings announcement. The χ^2 -test statistics in three out of the four cases examined reject the null hypothesis of independence between unusually high or low short selling in the pre-announcement period and stocks' post-abnormal returns at conventional levels of significance.

Overall, these tests confirm our previous regression results which show that short sellers are able to trade prior to negative corporate news and provide supplemental support for the view that a considerable fraction of unusual pre-announcement short selling activity is driven by short sellers' anticipation of significant negative corporate announcements.

[Insert Table 8 Here]

4.2. Post-Corporate Announcement Returns for Extreme Short Selling Trades

We turn our focus now on the predictive power of extreme short selling transactions. For this reason we partition the sample into quintiles by pre-announcement abnormal short selling. Table 9 presents 2-day abnormal returns for firms with the highest level of short selling and the other 90%. In addition, it presents the difference between the highest and lowest quintiles of shorted firms in order to determine whether the firms with the highest short selling activity have superior predictive power than the firms with the lowest short selling. The results of this analysis are presented in Panels A (acquisitions) and B (earnings) for both metrics of abnormal short selling, $(X_SS(-5,-1))$, and abnormal relative short selling $(XR_SS(-5,-1))$. Consistent with our previous findings, the results in Panel A indicate that stocks with the highest short selling activity during the pre-acquisition announcement period have negative 2-day post-announcement mean (-3.02) and median (-1.39) returns that are considerably below the stocks in the rest of the sample (-0.01 and -0.05, respectively). The mean (median) difference is -3.01 (-1.34) between the highest quintile and the rest of the sample is statistically significant. A similar, but somewhat weaker pattern is observed between the highest and lowest quintiles. Results based on the abnormal relative short selling $(XR_SS(-5,-1))$, metric are similar and somewhat stronger. Panel B presents 2-day abnormal returns after the earnings announcements. These results are consistent with the evidence based on acquisition announcements. Overall, these tests demonstrate that high abnormal short selling activity is a superior predictor of acquisition and earnings post-announcement returns. Interestingly, although short selling activity in Taiwan is disclosed to the public daily, our findings suggest that the average investor does not appear to make great use of such information in forming hedge portfolios. That is, despite that

short selling activity is disclosed daily, private information is not efficiently incorporated into stock prices.

[Insert Table 9 Here]

5. Conclusion

In this paper we use a unique and long dataset of daily short sale transactions for a sample of firms traded in the Taiwan Stock Exchange from January 1991 to January 2007, to examine whether short sellers, act as informed traders, trade in anticipation of the sign and magnitude of 338 acquisition announcements made by 250 firms. Consistent with the view that short sellers are informed traders, we find that they have the ability to predict and time their trades prior to significant negative acquisition announcements. Specifically, our results show that abnormal short selling prior to acquisition announcements is mostly significantly associated with negative (bad acquisition news) post-announcement abnormal returns. This suggests that informed traders driven by the precision of their information choose to trade on their information early. For comparison purposes to previous studies, we also examined the trading pattern of short sale transactions in the five days prior to 19396 earnings announcements made by 1117 public firms listed in the Taiwan Stock Exchange. Consistent with the pattern of short selling activity prior to acquisition announcements, we find that short sale transactions precede negative earnings announcements. Collectively, our results suggest that short sellers are able to trade prior to negative corporate news consistent with the view that a considerable fraction of unusual pre-announcement short selling activity is driven by short sellers' anticipation of significant negative corporate announcements. An interesting implication of our results, showing that short sales transactions

lead future stock prices, is that the information advantage of short sellers expands the informativeness of their short sale trades. Finally, despite the timely disclosure of daily short selling activity for a long period of time in Taiwan, our findings suggest that short sellers continue to exhibit strong skills in predicting negative corporate announcements and, therefore, heighten their trades prior to the release of such announcements. The argument of Daske, Richardson and Tuna (2005), then, that short sale transactions do not heavily concentrate in the days leading up to corporate news announcements, is due to the increasing timely public disclosure of short selling information in the US does not seem to gain support in our dataset.

APPENDIX

OLS Regressions Results: Abnormal Short Selling and Abnormal Relative Short Selling for 19396 Earnings Announcements of 1117 Firms Listed in the Taiwan Stock Exchange from 1991 to 2007 Using the -90 to -10 Time Interval to Estimate Abnormal Short Selling

This table reports OLS regression results based of equations (2) and (3) fitted to the full sample and the positive (good news) and negative (bad news) earnings announcements subsamples determined by the sign of the 2-day cumulative abnormal returns $CAR(0,+1)$. The three short sale metrics used are: $SHORT$, is the number of executed short selling orders on a given day for a stock. $SHORT/OUTSHARE$ is the number of short sale trades scaled by the number of shares outstanding ($OUTSHARE$) that day. $SHORT/VOLUME$ is the number of short sale trades scaled by total trading volume ($VOLUME$) that day. The $X_SS(-5,-1)$ variable is the average daily abnormal short selling for a stock in the pre-announcement period (-90, -10), measured as the average daily short selling in the pre-announcement period divided by the average daily shorting selling in the non-announcement period, all minus 1. The $R_SS(-5,-1)$ variable is the ratio of shorted shares to traded shares in a stock in the pre-announcement period(-90, -10). $CAR(0,+1)$ is the stock's 2-day cumulative abnormal return following the earnings announcement measured by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -90 to -10. $CAR(-5,-1)$ represents a stock's cumulative abnormal return from day -5 to day -1 measure by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -90 to -10. The variable $X_VOL(-5,-1)$ is the stock's abnormal volume in the pre-announcement period, measured as the average daily volume in the pre-announcement period divided by the average daily volume in the non-announcement period, all minus 1. The variable NR_SS is the ratio of shorted shares to traded shares in the non-announcement period. P-values are in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: $SHORT$

$$\text{Equation (2): } X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$$

	β_0		β_1		β_2		β_3		Adjusted R ²
Full Sample (n=19396)	2.33454 *** (0.0012)		-1.11782 *** (<0.0001)		-0.23123 ** (0.0444)		1.8232 (<0.0001)		0.0126
M&A with Positive CAR (n=9513)	0.69306 (0.1293)		0.43668 *** (0.0001)		0.24544 *** (<0.0001)		0.30925 *** (<0.0001)		0.0143
M&A with Negative CAR (n=9883)	-5.35152 *** (0.0018)		-1.32715 *** (0.0014)		-1.88709 *** (<0.0001)		23.53843 *** (<0.0001)		0.107

$$\text{Equation (3): } R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$$

	γ_0		γ_1		γ_2		γ_3		Adjusted R ²
Full Sample (n=19396)	0.29248 *** (<0.0001)		-0.0178 *** (0.00060)		0.00981 *** (0.00280)		0.61119 *** (<0.0001)		0.2788
M&A with Positive CAR (n=9513)	0.16949 *** (0.00020)		0.02363 ** (0.02760)		0.02117 *** (0.00010)		0.63112 *** (<0.0001)		0.2924
M&A with Negative CAR (n=9883)	0.17341 *** (<0.0001)		-0.05515 *** (<0.0001)		0.000789 (0.86360)		0.59458 *** (<0.0001)		0.2723

Panel B: SHORT/OUTSHARE

Equation (2): $X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$

	β_0		β_1		β_2		β_3		Adjusted R ²
Full Sample (n=19396)	2.25786 *** (0.0017)		-1.11754 *** (<0.0001)		-0.237 ** (0.0391)		1.8142 *** (<0.0001)		0.0125
M&A with Positive CAR (n=9513)	0.63282 (0.1639)		0.43117 *** (0.0002)		0.23742 *** (<0.0001)		0.30768 *** (<0.0001)		0.014
M&A with Negative CAR (n=9883)	-5.4277 *** (0.0015)		-1.33492 *** (0.0013)		-1.88406 *** (<0.0001)		23.41873 *** (<0.0001)		0.1063

Equation (3): $R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$

	γ_0		γ_1		γ_2		γ_3		Adjusted R ²
Full Sample (n=19396)	0.00215 *** (<0.0001)		-0.00026 *** (<0.0001)		0.00006 ** (0.05880)		0.54041 *** (<0.0001)		0.2714
M&A with Positive CAR (n=9513)	0.00233 *** (<0.0001)		0.000199 ** (0.02400)		0.00013 *** (0.00080)		0.33132 *** (<0.0001)		0.1325
M&A with Negative CAR (n=9883)	-0.000166 (0.68180)		-0.000643 *** (<0.0001)		0.000017 (0.68280)		0.65803 *** (<0.0001)		0.3609

Panel C: SHORT/VOLUME

Equation (2): $X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$

	β_0		β_1		β_2		β_3		Adjusted R ²
Full Sample (n=19396)	1.29869 (0.2118)		-1.64612 *** (<0.0001)		-0.96799 *** (<0.0001)		2.1356 *** (<0.0001)		0.0122
M&A with Positive CAR (n=9513)	0.83225 * (0.0947)		0.23494 ** (0.0597)		0.04361 (0.4299)		0.22884 *** (0.0001)		0.0033
M&A with Negative CAR (n=9883)	-11.34073 *** (<0.0001)		-2.48458 *** (<0.0001)		-3.34822 *** (<0.0001)		29.14059 *** (<0.0001)		0.0851

Equation (3): $R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$

	γ_0		γ_1		γ_2		γ_3		Adjusted R ²
Full Sample (n=19396)	0.00057 *** (<0.0001)		-0.00004 *** (0.0088)		-0.00010 *** (<0.0001)		0.07058 *** (<0.0001)		0.0544
M&A with Positive CAR (n=9513)	0.00067 *** (<0.0001)		-0.000009 (0.7662)		-0.000063 *** (<0.0001)		0.03465 *** (<0.0001)		0.0293
M&A with Negative CAR (n=9883)	0.00017 (0.2528)		-0.00011 *** (0.0014)		-0.00013 *** (<0.0001)		0.13461 *** (<0.0001)		0.0965

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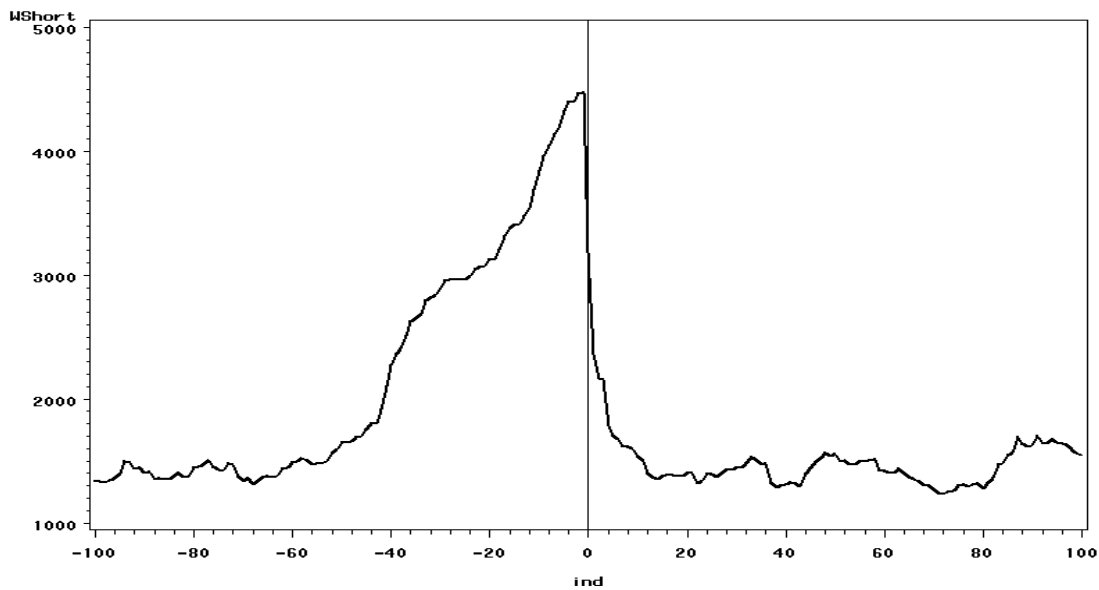
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Figure 1 Short Selling Activity around Acquisition Announcements

This Figure reports average level of short selling surrounding acquisition announcements. The vertical axis, Wshort, stands for the average level of short selling while the horizontal axis, Ind, stands for the days relative to the acquisition announcements ranging from -100 to +100. The sample includes 338 acquisition announcements for listed firms in the Taiwan Stock Exchange from January 1991 to December 2006. In Panel B, the solid line stands for the average level of short selling surrounding bad (negative) acquisition announcements, while dashed line stands for average level of short selling activity surrounding good (positive) acquisition announcements.

Panel A: SHORT All Acquisition Announcements



Panel B: SHORT Bad (Negative) and Good (Positive) Acquisition Announcements

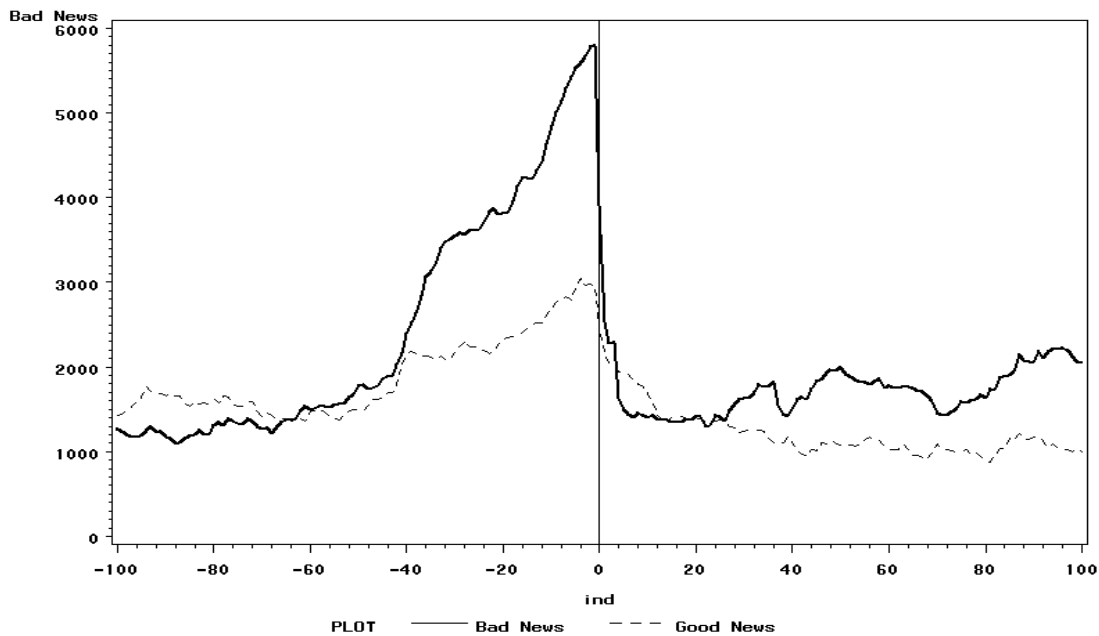


Table 1
Short Selling Sample Characteristics, Trading Volume, Abnormal Return, Abnormal Short Selling and Abnormal Trading Volumes for 338 Acquisition Announcements of 250 Firms Listed in the Taiwan Stock Exchange from 1991 to 2007

This table reports short selling, based on three alternative measures, abnormal short selling, trading volume, abnormal trading volume and abnormal returns for a sample of 250 firms listed in the Taiwan Stock Exchange involved in 338 acquisition announcements from January 1991 to January 2007. The three short sale metrics used are: *SHORT*, is the number of executed short sell orders on a given day for a stock. *SHORT/OUTSHARE* is the number of short sale trades scaled by the number of shares outstanding (*OUTSHARE*) that day. *SHORT/VOLUME* is the number of short sale trades scaled by total trading volume (*VOLUME*) that day. The average daily short sales are measured using these three short sale metrics. A stock's average daily short sale is measured over the 4271-day sample period. A stock's average daily volume is the average daily number of shares traded over the 4271-day sample period. *CAR* is the cumulative abnormal return and the 5-day period *CAR*(-5,-1) is measured by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. The 2-day period *CAR*(0,+1) is measured in the same way and based on the same pre-announcement estimation period from day -110 to -10. The variable *X_SS*(-5,-1) is the average daily abnormal short selling for a stock in the pre-announcement period, measured as the average daily short selling in the pre-announcement 5-day period (-5,-1) divided by the average daily shorting selling in the non-announcement period from day -110 to day -10, all minus 1. The *X_VOL*(-5,-1) variable is a stock's abnormal volume in the pre-announcement period, measured as the average daily volume in the pre-announcement 5-day period (-5,-1) divided by the average daily volume in the non-announcement period from day -110 and -10, all minus 1.

Panel A: Alternative Short Sale Measures and Trading Volume

	Average Daily <i>SHORT</i> (000's)	Average Daily <i>SHORT/OUTSHARE</i>	Average Daily <i>SHORT/VOLUME</i>	Average Daily Trading Volume (000's)
	250 Stocks	250 Stocks	250 Stocks	250 Stocks
Mean	1462.11	0.319%	0.41	4,680.84
Medium	423.14	0.182%	0.27	2,203.62
Std	4294.54	0.359%	1.01	7,729.06
Maximum	49843.19	1.861%	12.52	70,815.91
Minimum	0.00	0.00%	0.00	77.08

Panel B: Cumulative Abnormal Returns, Abnormal Short Sales and Abnormal Volume

	<i>CAR</i>		<i>X_SS</i>	<i>X_VOL</i>
	Period (-5,-1)	Period (0,+1)	Period (-5,-1)	Period (-5,-1)
Mean	0.60	-0.30	1.92	0.29
Medium	0.10	-0.23	-0.04	-0.18
Std	7.77	3.43	7.36	1.98
Maximum	21.38	11.26	62.96	17.39
Minimum	-16.66	-16.71	-1.00	-0.96

Table 2
Short Selling and Cumulative Abnormal Returns for 338 Acquisition Announcements of 250 Firms
Listed in the Taiwan Stock Exchange from 1991 to 2007

This table reports the relation between two-day abnormal returns following acquisition announcements, ($CAR(0,+1)$), of 338 completed acquisitions made by 250 Taiwan publicly traded firms during the period from January 1991 to January 2007 and the pre-announcement abnormal short selling, ($X_{SS}(-5, -1)$), for three alternative measures of short interest. The ($X_{SS}(-5, -1)$) is the average daily abnormal short selling for a stock in the pre-announcement period, measured as the average daily short selling in the pre-announcement 5-day period (-5,-1) divided by the average daily shorting selling in the non-announcement period from day -110 to day -10, all minus 1. The three short sale metrics used to estimate $X_{SS}(-5, -1)$ are: *SHORT*, is the number of executed short sell orders on a given day for a stock. *SHORT/OUTSHARE* is the number of short sale trades scaled by the number of shares outstanding (*OUTSHARE*) that day. *SHORT/VOLUME* is the number of short sale trades scaled by total trading volume (*VOLUME*) that day. Stocks are classified into four groups based on the level of abnormal short selling activity in the pre-announcement period (i.e., top 5%, top 25%, low 25% and low 5% level of abnormal short sales) In each Panel, results are reported for the full sample that includes all the acquisition announcements, positive CAR sample that consists of the acquisitions with positive $CAR(0,+1)$ (i.e., good corporate news) and the negative CAR sample that consists of the acquisitions with negative $CAR(0,+1)$ (i.e., bad corporate news). *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Using *SHORT* as short selling measure

	Level of Short Selling				Mean	Median	t-tests (Top5%-Rest#)	
	Low 5%	Low 25%	Top 25%	Top 5%			Equal of Mean	Equal of Variance
Full Sample	0.49932	0.10645	-1.28795	-2.43209	-0.19688	-0.18198	0.0455 **	0.0012 ***
Positive CAR	1.78854	1.94108	2.65058	3.30103	2.20944	1.67671	0.9644	0.3182
Negative CAR	-2.1342	-2.25955	-3.29944	-5.56513	-2.44279	-1.81223	0.0017 ***	<0.0001 ***

Panel B: Using *SHORT/OUTSHARE* as short selling measure

	Level of Short Selling				Mean	Median	t-tests (Top5%-Rest#)	
	Low 5%	Low 25%	Top 25%	Top 5%			Equal of Mean	Equal of Variance
Full Sample	0.49932	-0.14654	-1.34045	-2.7409	-0.19688	-0.18198	0.0338 **	0.0013 ***
Positive CAR	1.78854	2.01002	2.61466	3.30103	2.20944	1.67671	0.9644	0.3182
Negative CAR	-2.13423	-2.64091	-3.03853	-5.56513	-2.44279	-1.81223	0.0017 ***	<0.0001 ***

Panel C: Using *SHORT/VOLUME* as short selling measure

	Level of Short Selling				Mean	Median	t-tests (Top5%-Rest#)	
	Low 5%	Low 25%	Top 25%	Top 5%			Equal of Mean	Equal of Variance
Full Sample	-0.04058	-0.11297	-0.93203	-5.56513	-0.19688	-0.18198	0.0843 *	0.0006 ***
Positive CAR	1.78749	2.00774	2.55898	3.0201	2.20944	1.67671	0.7912	0.8026
Negative CAR	-3.21952	-2.34559	-2.88149	-5.56513	-2.44279	-1.81223	0.0039 ***	<0.0001 ***

Table 3
OLS Regressions Results: Abnormal Short Selling and Abnormal Relative Short Selling for
304 or 338 Acquisition Announcements of 250 Firms Listed in the Taiwan Stock Exchange
from 1991 to 2007

This table reports OLS regression results based of equations (2) and (3) fitted to the full sample and the positive (good news) and negative (bad news) acquisition announcements subsamples determined by the sign of the 2-day cumulative abnormal returns $CAR(0,+1)$. The three short sale metrics used are: $SHORT$, is the number of executed short sell orders on a given day for a stock. $SHORT/OUTSHARE$ is the number of short sale trades scaled by the number of shares outstanding ($OUTSHARE$) that day. $SHORT/VOLUME$ is the number of short sale trades scaled by total trading volume ($VOLUME$) that day. The $X_SS(-5,-1)$ variable is the average daily abnormal short selling for a stock in the pre-announcement period, measured as the average daily short selling in the pre-announcement period divided by the average daily shorting selling in the non-announcement period, all minus 1. The $R_SS(-5,-1)$ variable is the ratio of shorted shares to traded shares in a stock in the pre-announcement period. $CAR(0,+1)$ is the stock's 2-day cumulative abnormal return following the acquisition announcement measured by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. $CAR(-5,-1)$ represents a stock's cumulative abnormal return from day -5 to day -1 measure by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. The variable $X_VOL(-5,-1)$ is the stock's abnormal volume in the pre-announcement period, measured as the average daily volume in the pre-announcement period divided by the average daily volume in the non-announcement period, all minus 1. The variable NR_SS is the ratio of shorted shares to traded shares in the non-announcement period. P-values are in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: $SHORT$

Equation (2): $X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$

Acquisition News	β_0	β_1	β_2	β_3	Adjusted R ²
Full Sample (n=198)	1.07595 *** (0.0052)	-0.29495 *** (0.0095)	-0.10115 (0.1371)	2.78754 *** (<0.0001)	0.5940
Acquisitions CAR >0 (n=94)	0.5655 (0.3921)	0.10292 (0.6331)	0.03091 (0.7113)	2.74593 *** (<0.0001)	0.2762
Acquisitions CAR <0 (n=104)	-0.11346 (0.8843)	-0.66989 *** (0.0025)	-0.15722 (0.1435)	2.73371 *** (<0.0001)	0.6758

Equation (3): $R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$

Acquisition News	γ_0	γ_1	γ_2	γ_3	Adjusted R ²
Full Sample (n=198)	0.73163 (0.17070)	-0.4282 *** (0.00170)	0.01741 (0.83720)	1.37958 *** (<0.0001)	0.4618
Acquisitions CAR >0 (n=94)	0.43461 (0.71080)	0.0294 (0.93660)	0.10592 (0.43640)	1.19458 *** (<0.0001)	0.4791
Acquisitions CAR <0 (n=104)	-1.12705 (0.15750)	-0.67091 *** (0.00040)	0.01219 (0.90320)	2.1441 *** (<0.0001)	0.5197

Panel B: SHORT/OUTSHARE

Equation (2): $X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$

Acquisition News	β_0	β_1	β_2	β_3	Adjusted R ²
Full Sample (n=198)	1.06784 *** (0.0065)	-0.30655 *** (0.0082)	-0.10881 (0.1165)	2.65822 *** (<0.0001)	0.5636
Acquisitions CAR >0 (n=94)	0.52086 (0.4304)	0.10909 (0.6130)	0.03472 (0.6776)	2.72685 *** (<0.0001)	0.2746
Acquisitions CAR <0 (n=104)	-0.13498 (0.8656)	-0.68913 *** (0.0023)	-0.17809 (0.1058)	2.59773 *** (<0.0001)	0.6459

Equation (3) $R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$

Acquisition News	γ_0	γ_1	γ_2	γ_3	Adjusted R ²
Full Sample (n=198)	0.00979 *** (0.00360)	-0.00205 ** (0.02020)	0.000022 (0.96690)	0.46876 *** (<0.0001)	0.171
Acquisitions CAR >0 (n=94)	0.01002 (0.16260)	-0.00054 (0.81500)	0.000639 (0.44800)	0.36865 *** (<0.0001)	0.1681
Acquisitions CAR <0 (n=104)	-0.0023 (0.65840)	-0.00302 *** (0.01490)	-2.4E-05 (0.97100)	1.67161 *** (<0.0001)	0.3392

Panel C: SHORT/VOLUME

Equation (2): $X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$

Acquisition News	β_0	β_1	β_2	β_3	Adjusted R ²
Full Sample (n=198)	0.62739 *** (0.0008)	-0.05322 (0.3275)	-0.05624 (0.1051)	0.57086 *** (0.0026)	0.0563
Acquisitions CAR >0 (n=94)	0.47834 (0.2631)	0.08915 (0.5248)	-0.0406 (0.4776)	0.34775 (0.3431)	-0.0239
Acquisitions CAR <0 (n=104)	0.10756 (0.7268)	-0.20524 *** (0.0166)	-0.04543 (0.2912)	0.61736 *** (0.0038)	0.1666

Equation (3): $R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$

Acquisition News	γ_0	γ_1	γ_2	γ_3	Adjusted R ²
Full Sample (n=198)	-0.00018 (0.6729)	-0.00011 (0.3341)	0.00001 (0.8761)	1.46387 *** (<0.0001)	0.4374
Acquisitions CAR >0 (n=94)	0.00035 (0.2050)	0.00005 (0.5706)	0.00004 (0.2201)	0.41793 *** (<0.0001)	0.3466
Acquisitions CAR <0 (n=104)	-0.000425 (0.6448)	-0.00003 (0.9055)	0.000065 (0.5871)	2.02191 *** (<0.0001)	0.5597

Table 4

Regression Analysis of Daily Changes in Short Sale Transactions and Abnormal Returns for 338 Acquisition Announcements of 250 Firms Listed in the Taiwan Stock Exchange from 1991 to 2007

$$CAR_{(0,+1)} = \alpha + \beta_1 \% \Delta SHORT_{-1} + \dots + \beta_{10} \% \Delta SHORT_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (5)$$

$$CAR_{(0,+1)} = \alpha + \beta_1 (\% \Delta SHORT / OUTSHARE)_{-1} + \dots + \beta_{10} (\% \Delta SHORT / OUTSHARE)_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (6)$$

$$CAR_{(0,+1)} = \alpha + \beta_1 (\% \Delta SHORT / VOLUME)_{-1} + \dots + \beta_{10} (\% \Delta SHORT / VOLUME)_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (7)$$

This table reports OLS regression results of these equations fitted to the full sample and the negative (bad news) acquisition announcements subsamples determined by the sign of the 2-day cumulative abnormal returns, $CAR(0,+1)$. The three short sale metrics used are: $SHORT$, is the number of executed short sell orders on a given day for a stock. $SHORT/OUTSHARE$ is the number of short sale trades scaled by the number of shares outstanding ($OUTSHARE$) that day. $SHORT/VOLUME$ is the number of short sale trades scaled by total trading volume ($VOLUME$) that day. $CAR(0,+1)$ is the stock's 2-day cumulative abnormal return following the acquisition announcement measured by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. The $\% \Delta SHORT_{-j}$ is the daily percentage change in the number of executed short sell orders on a given day for a stock. The $\% \Delta SHORT/OUTSHARE$ is the daily percentage change in is the number of short sale trades scaled by the number of shares outstanding, and the $\% \Delta SHORT/VOLUME$ is the daily percentage change in the number of short sale trades scaled by total trading volume that day. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Regression Analysis of Daily Changes in Short Sale Transactions and Abnormal Returns (All Acquisition Announcements)

<i>SHORT</i>			<i>SHORT/OUTSHARE</i>			<i>SHORT/VOLUME</i>		
Variables	Coefficient	P-Value	Variables	Coefficient	P-Value	Variables	Coefficient	P-Value
Intercept	-0.38098	0.2807	Intercept	-0.36597	0.2995	Intercept	-0.46263	0.1601
$\% \Delta SHORT_{-1}$	-0.0902	0.9012	$\% \Delta SHORT_{-1}$	-0.08843	0.9031	$\% \Delta SHORT_{-1}$	-0.52069	0.3813
$\% \Delta SHORT_{-2}$	-0.75524	0.6122	$\% \Delta SHORT_{-2}$	-0.75619	0.6118	$\% \Delta SHORT_{-2}$	0.53456	0.3908
$\% \Delta SHORT_{-3}$	-1.1919	0.3651	$\% \Delta SHORT_{-3}$	-1.18188	0.3688	$\% \Delta SHORT_{-3}$	-0.27779	0.6767
$\% \Delta SHORT_{-4}$	2.10923	0.2906	$\% \Delta SHORT_{-4}$	2.08739	0.2951	$\% \Delta SHORT_{-4}$	0.84174	0.3145
$\% \Delta SHORT_{-5}$	-1.24956	0.4291	$\% \Delta SHORT_{-5}$	-1.2814	0.4186	$\% \Delta SHORT_{-5}$	-0.35084	0.6131
$\% \Delta SHORT_{-6}$	-2.86178	0.1262	$\% \Delta SHORT_{-6}$	-2.75717	0.1301	$\% \Delta SHORT_{-6}$	-0.97808	0.1112
$\% \Delta SHORT_{-7}$	-0.7578	0.5501	$\% \Delta SHORT_{-7}$	-0.75506	0.5518	$\% \Delta SHORT_{-7}$	-0.17747	0.7866
$\% \Delta SHORT_{-8}$	-0.90217	0.6836	$\% \Delta SHORT_{-8}$	-0.88988	0.6876	$\% \Delta SHORT_{-8}$	-0.499	0.4664
$\% \Delta SHORT_{-9}$	0.29216	0.8045	$\% \Delta SHORT_{-9}$	0.29128	0.8052	$\% \Delta SHORT_{-9}$	0.06344	0.9156
$\% \Delta SHORT_{-10}$	-0.29901	0.7892	$\% \Delta SHORT_{-10}$	-0.29601	0.7913	$\% \Delta SHORT_{-10}$	-0.25346	0.6797
RET_{-1}	-0.06038	0.6903	RET_{-1}	-0.05927	0.6956	RET_{-1}	0.01606	0.9092
RET_{-2}	0.09136	0.4933	RET_{-2}	0.0921	0.49	RET_{-2}	0.15144	0.2551
RET_{-3}	0.0073	0.9528	RET_{-3}	0.0044	0.9715	RET_{-3}	-0.03437	0.7714
RET_{-4}	-0.31792	** 0.0202	RET_{-4}	-0.31433	** 0.0217	RET_{-4}	-0.19534	0.1308
RET_{-5}	0.22898	* 0.0737	RET_{-5}	0.22504	* 0.0789	RET_{-5}	0.17998	0.1199
RET_{-6}	-0.01269	0.9244	RET_{-6}	-0.0209	0.8737	RET_{-6}	-0.1393	0.2225
RET_{-7}	-0.10237	0.4145	RET_{-7}	-0.09605	0.4459	RET_{-7}	-0.10061	0.3925
RET_{-8}	-0.11518	0.3931	RET_{-8}	-0.11155	0.4073	RET_{-8}	-0.08109	0.5112
RET_{-9}	-0.17241	0.1541	RET_{-9}	-0.17233	0.1543	RET_{-9}	-0.0595	0.5883

RET ₋₁₀	0.17779	0.1665	RET ₋₁₀	0.17472	0.173	RET ₋₁₀	0.16421	0.1681
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**Panel B: Regression Analysis of Daily Changes in Short Sale Transactions and Abnormal Returns
(Negative Acquisition Announcements)**

<i>SHORT</i>			<i>SHORT/OUTSHARE</i>			<i>SHORT/VOLUME</i>					
Variables	Coefficient	P-Value	Variables	Coefficient	P-Value	Variables	Coefficient	P-Value			
Intercept	-2.50511	***	<0.0001	Intercept	-2.52711	***	<0.0001	Intercept	-2.81627	***	<0.0001
%ΔSHORT ₋₁	-2.67926	**	0.0232	%ΔSHORT ₋₁	-2.63187	**	0.0243	%ΔSHORT ₋₁	-1.10515		0.1368
%ΔSHORT ₋₂	-0.15394		0.2196	%ΔSHORT ₋₂	-0.18697		0.9077	%ΔSHORT ₋₂	-0.20495		0.7865
%ΔSHORT ₋₃	1.95873		0.2196	%ΔSHORT ₋₃	2.17025		0.1715	%ΔSHORT ₋₃	-0.21049		0.8088
%ΔSHORT ₋₄	2.76013		0.2512	%ΔSHORT ₋₄	2.94183		0.2246	%ΔSHORT ₋₄	0.35879		0.7459
%ΔSHORT ₋₅	-0.57912		0.7918	%ΔSHORT ₋₅	-0.26237		0.9053	%ΔSHORT ₋₅	-0.76827		0.4156
%ΔSHORT ₋₆	1.45397		0.598	%ΔSHORT ₋₆	1.98077		0.4457	%ΔSHORT ₋₆	-0.47119		0.6076
%ΔSHORT ₋₇	-0.32483		0.8589	%ΔSHORT ₋₇	-0.06575		0.9714	%ΔSHORT ₋₇	-1.37115		0.1211
%ΔSHORT ₋₈	-3.89578		0.1752	%ΔSHORT ₋₈	-4.04211		0.1582	%ΔSHORT ₋₈	-1.418	*	0.0872
%ΔSHORT ₋₉	-0.37096		0.802	%ΔSHORT ₋₉	-0.34079		0.8172	%ΔSHORT ₋₉	-0.60485		0.4307
%ΔSHORT ₋₁₀	-1.15877		0.5526	%ΔSHORT ₋₁₀	-1.15581		0.5521	%ΔSHORT ₋₁₀	-0.71499		0.4313
RET ₋₁	0.42339	**	0.0156	RET ₋₁	0.43399	**	0.0118	RET ₋₁	0.30709	**	0.0526
RET ₋₂	0.23638	*	0.0901	RET ₋₂	0.23412	*	0.0917	RET ₋₂	0.26259	*	0.0922
RET ₋₃	-0.23163	*	0.0902	RET ₋₃	-0.23729	*	0.0813	RET ₋₃	-0.11844		0.4125
RET ₋₄	-0.09702		0.5992	RET ₋₄	-0.1102		0.5519	RET ₋₄	0.17416		0.3346
RET ₋₅	0.30913	**	0.0371	RET ₋₅	0.32401	**	0.0313	RET ₋₅	0.13082		0.3883
RET ₋₆	-0.11249		0.5152	RET ₋₆	-0.12627		0.4298	RET ₋₆	-0.00672		0.9608
RET ₋₇	-0.08038		0.5806	RET ₋₇	-0.09605		0.5138	RET ₋₇	-0.0225		0.8893
RET ₋₈	0.21425		0.2138	RET ₋₈	0.21091		0.217	RET ₋₈	0.15947		0.3578
RET ₋₉	-0.45456	***	0.0051	RET ₋₉	-0.45528	***	0.0046	RET ₋₉	-0.44775	***	0.0034
RET ₋₁₀	0.11258		0.4722	RET ₋₁₀	0.11374		0.4659	RET ₋₁₀	0.17875		0.2202

Table 5

Short Selling Sample Characteristics, Trading Volume, Abnormal Return, Abnormal Short Selling and Abnormal Trading Volumes for 19396 Earnings Announcements of 1117 Firms Listed in the Taiwan Stock Exchange from 1991 to 2007

This table reports short selling, based on three alternative measures, abnormal short selling, trading volume, abnormal trading volume and abnormal returns for a sample of 1117 firms listed in the Taiwan Stock Exchange involved in 19396 earnings announcements from January 1991 to January 2007. The three short sale metrics used are: *SHORT*, is the number of executed short sell orders on a given day for a stock. *SHORT/OUTSHARE* is the number of short sale trades scaled by the number of shares outstanding (*OUTSHARE*) that day. *SHORT/VOLUME* is the number of short sale trades scaled by total trading volume (*VOLUME*) that day. The average daily short sales are measured using these three short sale metrics. A stock's average daily short sale is measured over the 4271-day sample period. A stock's average daily volume is the average daily number of shares traded over the 4271-day sample period. *CAR* is the cumulative abnormal return and the 5-day period *CAR*(-5,-1) is measured by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. The 2-day period *CAR*(0,+1) is measured in the same way and based on the same pre-announcement estimation period from day -110 to -10. The variable *X_SS*(-5,-1) is the average daily abnormal short selling for a stock in the pre-announcement period, measured as the average daily short selling in the pre-announcement 5-day period (-5,-1) divided by the average daily shorting selling in the non-announcement period from day -110 to day -10, all minus 1. The *X_VOL*(-5,-1) variable is a stock's abnormal volume in the pre-announcement period, measured as the average daily volume in the pre-announcement 5-day period (-5,-1) divided by the average daily volume in the non-announcement period from day -110 and -10, all minus 1.

Panel A: Alternative Short Sale Measures and Trading Volume

	Average Daily <i>SHORT</i> (000's)	Average Daily <i>SHORT/OUTSHARE</i>	Average Daily <i>SHORT/VOLUME</i>	Average Daily Trading Volume (000's)
	1117 Stocks	1117 Stocks	1117 Stocks	1117 Stocks
Mean	1758.63	0.255%	0.51	3,257.33
Medium	205.29	0.133%	0.20	1,220.52
Std	26827.76	0.314%	3.89	6,617.24
Maximum	889996.00	2.232%	116.25	69,159.75
Minimum	0.00	0.00%	0.00	0.00

Panel B: Cumulative Abnormal Returns, Abnormal Short Sales and Abnormal Volume

	<i>CAR</i>		<i>X_SS</i>	<i>X_VOL</i>
	Period(-5,-1)	Period(0,+1)	Period(-5,-1)	Period(-5,-1)
Mean	-0.72	-0.48	3.77	0.22
Medium	-0.71	-0.40	-0.51	-0.25
Std	6.29	4.12	95.65	4.63
Maximum	33.67	16.80	8227.13	480.70
Minimum	-40.33	-29.98	-1.00	-0.99

Panel C: Monthly Distribution of Earnings Announcements

	JAN	FEB	MAR	APR	MAY	JUN	Total
N	110	274	1076	7665	599	203	
%	0.57%	1.41%	5.55%	39.52%	3.09%	1.05%	
	JUL	AUG	SEP	OCT	NEV	DEC	
N	264	8373	184	257	117	274	19396
%	1.36%	43.17%	0.95%	1.33%	0.60%	1.41%	100%

Table 6

OLS Regressions Results: Abnormal Short Selling and Abnormal Relative Short Selling for 19396 Earnings Announcements of 1117 Firms Listed in the Taiwan Stock Exchange from 1991 to 2007

This table reports OLS regression results based of equations (2) and (3) fitted to the full sample and the positive (good news) and negative (bad news) earnings announcements subsamples determined by the sign of the 2-day cumulative abnormal returns $CAR(0,+1)$. The three short sale metrics used are: $SHORT$, is the number of executed short sell orders on a given day for a stock. $SHORT/OUTSHARE$ is the number of short sale trades scaled by the number of shares outstanding ($OUTSHARE$) that day. $SHORT/VOLUME$ is the number of short sale trades scaled by total trading volume ($VOLUME$) that day. The $X_SS(-5,-1)$ variable is the average daily abnormal short selling for a stock in the pre-announcement period, measured as the average daily short selling in the pre-announcement period divided by the average daily shorting selling in the non-announcement period, all minus 1. The $R_SS(-5,-1)$ variable is the ratio of shorted shares to traded shares in a stock in the pre-announcement period. $CAR(0,+1)$ is the stock's 2-day cumulative abnormal return following the earnings announcement measured by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. $CAR(-5,-1)$ represents a stock's cumulative abnormal return from day -5 to day -1 measure by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. The variable $X_VOL(-5,-1)$ is the stock's abnormal volume in the pre-announcement period, measured as the average daily volume in the pre-announcement period divided by the average daily volume in the non-announcement period, all minus 1. The variable NR_SS is the ratio of shorted shares to traded shares in the non-announcement period. P-values are in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: $SHORT$

Equation (2): $X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$

Earnings News	β_0		β_0		β_0		β_0		Adjusted R ²
Full Sample (n=19396)	2.5072 *** (0.0041)		-1.311121 *** (<0.0001)		-0.2624 ** (0.0583)		2.00076 *** (<0.0001)		0.0126
Earnings CAR>0 (n=9513)	0.53343 (0.3244)		0.51814 *** (0.0001)		0.27407 *** (<0.0001)		0.34167 *** (<0.0001)		0.0142
Earnings CAR<0 (n=9883)	-6.13758 *** (0.0031)		-1.3514 *** (0.0071)		-2.14855 *** (<0.0001)		26.84521 *** (<0.0001)		0.1136

Equation (3): $R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$

Earnings News	γ_0		γ_1		γ_2		γ_3		Adjusted R ²
Full Sample (n=19396)	0.312 *** (<0.0001)		-0.02011 *** (0.00010)		0.00741 ** (0.02750)		0.59629 *** (<0.0001)		0.2445
Earnings CAR>0 (n=9513)	0.18954 *** (<0.0001)		0.02409 ** (0.02880)		0.0183 *** (0.00010)		0.60576 *** (0.00010)		0.2534
Earnings CAR<0 (n=9883)	0.18322 *** (<0.0001)		-0.05859 *** (<0.0001)		-0.00124 (0.79090)		0.5864 *** (<0.0001)		0.2412

Panel B: $SHORT/OUTSHARE$

$$\text{Equation (2): } X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$$

Earnings News	β_0	β_0	β_0	β_0	Adjusted R ²
Full Sample (n=19396)	2.4257 *** (0.0054)	-1.31028 *** (<0.0001)	-0.2685 ** (0.0523)	1.99057 *** (<0.0001)	0.0126
Earnings CAR>0 (n=9513)	0.47487 (0.3785)	0.51147 *** (0.0001)	0.26556 *** (<0.0001)	0.34029 *** (<0.0001)	0.0139
Earnings CAR<0 (n=9883)	-6.22295 *** (0.0026)	-1.36222 *** (0.0066)	-2.14405 *** (<0.0001)	26.69816 *** (<0.0001)	0.1127

$$\text{Equation (3): } R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$$

Earnings News	γ_0	γ_1	γ_2	γ_3	Adjusted R ²
Full Sample (n=19396)	0.19808 *** (<0.0001)	-0.01385 *** (0.00310)	0.01503 *** (<0.0001)	0.73319 *** (<0.0001)	0.4078
Earnings CAR>0 (n=9513)	0.09669 *** (0.01930)	0.01825 ** (0.05780)	0.02621 *** (<0.0001)	0.75138 *** (<0.0001)	0.4311
Earnings CAR<0 (n=9883)	0.117 *** (0.00370)	-0.04067 *** (<0.0001)	0.00593 (0.15710)	0.71738 *** (<0.0001)	0.3933

Panel C: SHORT/VOLUME

$$\text{Equation (2): } X_SS(-5,-1) = \beta_0 + \beta_1 CAR(0,+1) + \beta_2 CAR(-5,-1) + \beta_3 X_VOL(-5,-1) + \varepsilon$$

Earnings News	β_0	β_1	β_2	β_3	Adjusted R ²
Full Sample (n=19396)	1.35954 (0.2870)	-2.00959 *** (<0.0001)	-1.16233 *** (<0.0001)	2.51104 *** (<0.0001)	0.0129
Earnings CAR>0 (n=9513)	0.73643 (0.2137)	0.27949 ** (0.0585)	0.04603 (0.4816)	0.27683 *** (<0.0001)	0.0041
Earnings CAR<0 (n=9883)	-13.3619 *** (<0.0001)	-2.62147 *** (0.0005)	-4.06393 *** (<0.0001)	35.66121 *** (<0.0001)	0.0987

$$\text{Equation (3): } R_SS(-5,-1) = \gamma_0 + \gamma_1 CAR(0,+1) + \gamma_2 CAR(-5,-1) + \gamma_3 NR_SS(-110,-10) + \varepsilon$$

Earnings News	γ_0	γ_1	γ_2	γ_3	Adjusted R ²
Full Sample (n=19396)	0.00055 *** (<0.0001)	-0.00004 *** (0.0087)	-0.00010 *** (<0.0001)	0.09086 *** (<0.0001)	0.0586
Earnings CAR>0 (n=9513)	0.00065 *** (<0.0001)	-0.000008 (0.7704)	-0.0000634 *** (<0.0001)	0.04856 *** (<0.0001)	0.0369
Earnings CAR<0 (n=9883)	0.000142 (0.3324)	-0.00011 *** (0.0013)	-0.00013 *** (<0.0001)	0.16675 *** (<0.0001)	0.0968

Table 7

Regression Analysis of Daily Changes in Short Sale Transactions and Abnormal Returns for 19396 Earnings Announcements of 1117 Firms Listed in the Taiwan Stock Exchange from 1991 to 2007

$$CAR_{(0,+1)} = \alpha + \beta_1 \% \Delta SHORT_{-1} + \dots + \beta_{10} \% \Delta SHORT_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (5)$$

$$CAR_{(0,+1)} = \alpha + \beta_1 (\% \Delta SHORT / OUTSHARE)_{-1} + \dots + \beta_{10} (\% \Delta SHORT / OUTSHARE)_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (6)$$

$$CAR_{(0,+1)} = \alpha + \beta_1 (\% \Delta SHORT / VOLUME)_{-1} + \dots + \beta_{10} (\% \Delta SHORT / VOLUME)_{-10} + \lambda_1 RET_{-1} + \dots + \lambda_{10} RET_{-10} + \varepsilon \quad (7)$$

This table reports OLS regression results of these equations fitted to the full sample and the negative (bad news) earnings announcements subsamples determined by the sign of the 2-day cumulative abnormal returns, $CAR(0,+1)$. The three short sale metrics used are: $SHORT_t$ is the number of executed short sell orders on a given day for a stock. $SHORT/OUTSHARE$ is the number of short sale trades scaled by the number of shares outstanding ($OUTSHARE$) that day. $SHORT/VOLUME$ is the number of short sale trades scaled by total trading volume ($VOLUME$) that day. $CAR(0,+1)$ is the stock's 2-day cumulative abnormal return following the earnings announcement measured by the cumulative difference between actual return and marked model estimated expected return based on the pre-announcement estimation period from day -110 to -10. The $\% \Delta SHORT_{-t}$ is the daily percentage change in the number of executed short sell orders on a given day for a stock. The $\% \Delta SHORT/OUTSHARE$ is the daily percentage change in is the number of short sale trades scaled by the number of shares outstanding, and the $\% \Delta SHORT/VOLUME$ is the daily percentage change in the number of short sale trades scaled by total trading volume that day. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Regression Analysis of Daily Changes in Short Sale Transactions and Abnormal Returns
(All Earnings Announcements)

<i>SHORT</i>				<i>SHORT/OUTSHARE</i>				<i>SHORT/VOLUME</i>			
Variables	Coefficient		P-Value	Variables	Coefficient		P-Value	Variables	Coefficient		P-Value
Intercept	-0.44138	***	<0.0001	Intercept	-0.4398	***	<0.0001	Intercept	-0.43362	***	<0.0001
$\% \Delta SHORT_{-1}$	-0.21182	**	0.0434	$\% \Delta SHORT_{-1}$	-0.20174	**	0.0515	$\% \Delta SHORT_{-1}$	-0.12255	*	0.0643
$\% \Delta SHORT_{-2}$	-0.12409		0.3054	$\% \Delta SHORT_{-2}$	-0.13646		0.2519	$\% \Delta SHORT_{-2}$	-0.19129	***	0.0112
$\% \Delta SHORT_{-3}$	-0.22803	**	0.042	$\% \Delta SHORT_{-3}$	-0.22192	**	0.0451	$\% \Delta SHORT_{-3}$	-0.19299	***	0.0103
$\% \Delta SHORT_{-4}$	0.04328		0.7319	$\% \Delta SHORT_{-4}$	0.02702		0.8274	$\% \Delta SHORT_{-4}$	0.06712		0.393
$\% \Delta SHORT_{-5}$	0.02301		0.8533	$\% \Delta SHORT_{-5}$	0.03021		0.8044	$\% \Delta SHORT_{-5}$	-0.12592	*	0.1005
$\% \Delta SHORT_{-6}$	0.03642		0.7481	$\% \Delta SHORT_{-6}$	0.02965		0.7909	$\% \Delta SHORT_{-6}$	-0.11815		0.1139
$\% \Delta SHORT_{-7}$	-0.07259		0.5392	$\% \Delta SHORT_{-7}$	-0.06481		0.5781	$\% \Delta SHORT_{-7}$	0.01069		0.8863
$\% \Delta SHORT_{-8}$	0.02279		0.8355	$\% \Delta SHORT_{-8}$	0.01612		0.8818	$\% \Delta SHORT_{-8}$	-0.03567		0.6248
$\% \Delta SHORT_{-9}$	-0.02276		0.8328	$\% \Delta SHORT_{-9}$	-0.01563		0.8832	$\% \Delta SHORT_{-9}$	-0.13042	*	0.0648
$\% \Delta SHORT_{-10}$	0.01907		0.8499	$\% \Delta SHORT_{-10}$	0.01366		0.8907	$\% \Delta SHORT_{-10}$	-0.13098	**	0.0435
RET_{-1}	0.14269	***	<0.0001	RET_{-1}	0.14212	***	<0.0001	RET_{-1}	0.13302	***	<0.0001
RET_{-2}	0.07828	***	<0.0001	RET_{-2}	0.07901	***	<0.0001	RET_{-2}	0.07185	***	<0.0001
RET_{-3}	0.06613	***	0.0003	RET_{-3}	0.06604	***	0.0003	RET_{-3}	0.058	***	0.0009
RET_{-4}	0.04515	***	0.017	RET_{-4}	0.046	***	0.0148	RET_{-4}	0.05431	***	0.0024
RET_{-5}	0.0283		0.1311	RET_{-5}	0.02772		0.138	RET_{-5}	0.03166	*	0.0732
RET_{-6}	-0.01649		0.3762	RET_{-6}	-0.01614		0.3856	RET_{-6}	-0.01146		0.5165
RET_{-7}	-0.03032	*	0.1059	RET_{-7}	-0.03074	*	0.1008	RET_{-7}	-0.0279		0.115
RET_{-8}	0.04514	***	0.0144	RET_{-8}	0.04538	***	0.0138	RET_{-8}	0.04606	***	0.0082
RET_{-9}	0.03215	*	0.0955	RET_{-9}	0.03159	*	0.1008	RET_{-9}	0.03283	*	0.0725
RET_{-10}	-0.01157		0.5302	RET_{-10}	-0.01135		0.5376	RET_{-10}	-0.01017		0.5563

**Panel B: Regression Analysis of Daily Changes in Short Sale Transactions and Abnormal Returns
(Negative Earnings Announcements)**

<i>SHORT</i>			<i>SHORT/OUTSHARE</i>			<i>SHORT/VOLUME</i>					
Variables	Coefficient	P-Value	Variables	Coefficient	P-Value	Variables	Coefficient	P-Value			
Intercept	-2.95062	***	<0.0001	Intercept	-2.95014	***	<0.0001	Intercept	-2.96141	***	<0.0001
% Δ SHORT ₋₁	-0.34389	***	0.0006	% Δ SHORT ₋₁	-0.32683	***	0.0009	% Δ SHORT ₋₁	0.00955		0.8811
% Δ SHORT ₋₂	-0.2876	***	0.0121	% Δ SHORT ₋₂	-0.31161	***	0.0058	% Δ SHORT ₋₂	-0.02821		0.6903
% Δ SHORT ₋₃	-0.24035	**	0.0228	% Δ SHORT ₋₃	-0.2207	**	0.0345	% Δ SHORT ₋₃	0.0404		0.575
% Δ SHORT ₋₄	-0.08526		0.462	% Δ SHORT ₋₄	-0.11541		0.3076	% Δ SHORT ₋₄	0.10092		0.1689
% Δ SHORT ₋₅	-0.11166		0.3382	% Δ SHORT ₋₅	-0.08212		0.4693	% Δ SHORT ₋₅	0.04344		0.549
% Δ SHORT ₋₆	-0.14263		0.1763	% Δ SHORT ₋₆	-0.1648		0.112	% Δ SHORT ₋₆	0.0526		0.4562
% Δ SHORT ₋₇	-0.24281	**	0.0259	% Δ SHORT ₋₇	-0.22175	**	0.0388	% Δ SHORT ₋₇	0.07551		0.2903
% Δ SHORT ₋₈	-0.04563		0.6677	% Δ SHORT ₋₈	-0.06276		0.5501	% Δ SHORT ₋₈	0.09906		0.1581
% Δ SHORT ₋₉	-0.05423		0.5923	% Δ SHORT ₋₉	-0.03269		0.7425	% Δ SHORT ₋₉	-0.06795		0.3159
% Δ SHORT ₋₁₀	-0.09822		0.2909	% Δ SHORT ₋₁₀	-0.11586		0.2056	% Δ SHORT ₋₁₀	-0.09929	*	0.1032
RET ₋₁	0.17008	***	<0.0001	RET ₋₁	0.16897	***	<0.0001	RET ₋₁	0.15624	***	<0.0001
RET ₋₂	0.09016	***	<0.0001	RET ₋₂	0.09158	***	<0.0001	RET ₋₂	0.07756	***	<0.0001
RET ₋₃	0.07776	***	<0.0001	RET ₋₃	0.07692	***	<0.0001	RET ₋₃	0.0684	***	<0.0001
RET ₋₄	0.04862	***	0.0057	RET ₋₄	0.05018	***	0.0042	RET ₋₄	0.05019	***	0.0026
RET ₋₅	0.03552	**	0.0446	RET ₋₅	0.03391	**	0.0543	RET ₋₅	0.03034	*	0.0689
RET ₋₆	0.02531		0.1513	RET ₋₆	0.02661		0.1309	RET ₋₆	0.02087		0.2137
RET ₋₇	-0.01453		0.4107	RET ₋₇	-0.01553		0.3785	RET ₋₇	-0.02601		0.1204
RET ₋₈	0.01401		0.4143	RET ₋₈	0.01465		0.3926	RET ₋₈	0.01116		0.4915
RET ₋₉	0.00201		0.9117	RET ₋₉	0.00062		0.9726	RET ₋₉	-0.00073		0.9663
RET ₋₁₀	0.02967	*	0.0787	RET ₋₁₀	0.03049	*	0.0705	RET ₋₁₀	0.02147		0.1752

Table 8
Chi-Square Tests of the Relation between Post-Announcement Abnormal Returns and the Levels of Abnormal Short Selling and Abnormal Relative Short Selling Prior to Acquisition and Earnings Announcements for Firms Traded in the Taiwan Stock Exchange from 1991 to 2007

This table reports chi-square tests that evaluate whether stocks' classification into the highest quintile or the other four quintiles, based on their abnormal short selling, $X_SS(-5,-1)$, and abnormal relative short selling, $XR_SS(-5,-1)$, during the five pre-announcement days (-5,-1), is independent of their post-announcement cumulative abnormal return, $CAR(0,+1)$. $CAR(0,+1)$ is the stock's 2-day cumulative abnormal return following acquisition (Panel A) and earnings (Panel(B)) announcements, measured by the cumulative difference between actual return and market model estimated return based on the pre-announcement estimation period from day -110 to -10. The variable $X_SS(-5,-1)$ is the average daily abnormal short selling for the stock in the pre-announcement period, measured as average daily short selling in the pre-announcement period divided by average daily short selling in the non announcement period, all minus one. The variable $XR_SS(-5,-1)$ is a stock's abnormal relative short selling in the pre-announcement period, measured as $R-SS(-5,-1) - NR-SS$, where $R-SS(-5,-1)$ is the ratio of shorted shares to traded shares in the stock in the pre-announcement period and $NR-SS$ is the ratio of shorted shares to traded shares in the non-announcement period. Low, Middle and High cumulative abnormal returns (CAR) quintile(s) represent the 20% lowest, middle 60% and 20% highest set of sample firms based upon 2-day post announcement period cumulative abnormal returns. Probability is the level of significance at which the hypothesis of independence can be rejected.

Panel: A: Acquisitions Announcements

		Low	Middle	High	Total
		CAR	CAR	CAR	
		Quintile	Quintile	Quintile	
A1: Abnormal Short Selling, $X_SS(-5,-1)$					
	Expected %	20	60	20	100
Highest Quintile	Observations	9	16	7	32
	Percentage	28.1	50.0	21.9	100
Other Quintiles	Observations	22	78	25	125
	Percentage	17.6	62.4	20.0	100
				χ^2 Stat	2.128
				Probability	0.25 < p < 0.5
A2: Abnormal Relative Short Selling, $XR_SS(-5,-1)$					
	Expected %	20	60	20	100
Highest Quintile	Observations	10	14	8	32
	Percentage	31.3	43.8	25.0	100
Other Quintiles	Observations	21	80	24	125
	Percentage	16.8	64.0	19.2	100
				χ^2 Stat	4.860
				Probability	0.05 < p < 0.1

Panel B: Earnings Announcements

		Low CAR Quintile	Middle CAR Quintile	High CAR Quintile	Total
B1: Abnormal Short Selling, $X_{SS}(-5,-1)$					
	Expected %	20	60	20	100
Highest Quintile	Observations	579	1368	489	2436
	Percentage	23.8	56.2	20.1	100
Other Quintiles	Observations	1856	5938	1947	9741
	Percentage	19.1	61.0	20.0	100
				χ^2 Stat	29.158
				Probability	p<0.0001
B2: Abnormal Relative Short Selling, $XR_{SS}(-5,-1)$					
	Expected %	20	60	20	100
Highest Quintile	Observations	656	1283	497	2436
	Percentage	26.9	52.7	20.4	100
Other Quintiles	Observations	1856	5938	1947	9741
	Percentage	19.1	61.0	20.0	100
				χ^2 Stat	81.349
				Probability	p<0.0001

Table 9
Post Announcement Cumulative Abnormal Returns for Different Groups of Firms Listed in the Taiwan Stock Exchange from 1991 to 2007 Based on Abnormal Short Selling and Abnormal Relative Short Selling

This table reports 2-day cumulate abnormal returns, $CAR(0, +1)$, following acquisition (Panel A) and earnings (Panel B) announcement for firms sorted into quintiles by pre-announcement abnormal short-selling, $X_SS(-5,-1)$, and abnormal relative short-selling, $XR_SS(-5,-1)$. The variable $X_SS(-5,-1)$ is the average daily abnormal short selling for the stock in the pre-announcement period, measured as average daily short selling in the pre-announcement period divided by average daily short selling in the non announcement period, all minus one. The variable $XR_SS(-5,-1)$ is a stock's abnormal relative short selling in the pre-announcement period, measured as $R_SS(-5,-1) - NR_SS$, where $R_SS(-5,-1)$ is the ratio of shorted shares to traded shares in the stock in the pre-announcement period and NR_SS is the ratio of shorted shares to traded shares in the non-announcement period. Each panel compares the highest quintile with the others (i.e., rest of the sample), the lowest quintile with the others, and the highest with the lowest quintiles. The sample consists of 157 acquisition announcements and 12177 earnings announcements, respectively. Differences in means (medians) are evaluated with two-sided t-test (Wilcoxon Rank Sum Test). In this table we use the highest 10% quintile and lowest 10% quintile for grouping. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Acquisition Announcements

A1: Abnormal Short Selling, $X_SS(-5,-1)$						
	Mean	Median	25th Percentile	75th Percentile	Minimum	Maximum
Highest quintile (n=15)	-3.02%**	-1.39%***	-3.84%	-0.32%	-16.71%	2.91%
Other 90% (n=142)	-0.01	-0.05	-1.81	1.65	-10.82	11.26
Difference	-3.01***	-1.34***				
Lowest quintile (n=16)	-0.84	-0.52***	-2.64	0.90	-8.69	5.75
Other 90% (n=141)	-0.24	-0.23	-1.84	1.59	-16.71	11.26
Difference	-0.6	-0.29				
Highest quintile (n=15)	-3.02**	-1.39***				
Lowest quintile (n=16)	-0.84	-0.52***				
Difference	-2.18	-0.87				
A2: Abnormal Relative Short Selling, $XR_SS(-5,-1)$						
Highest quintile (n=19)	-2.43%**	-1.47%***	-3.46%	0.82%	-16.71%	6.41%
Other 90% (n=178)	-0.04	-0.06	-1.57	1.71	-12.99	11.26
Difference	-2.39***	-1.41**				
Lowest quintile (n=20)	0.06	0.67***	-1.32	1.52	-8.26	5.86
Other 90% (n=177)	-0.31	-0.23	-1.81	1.59	-16.71	11.26
Difference	0.37	0.9				
Highest quintile (n=19)	-2.43**	-1.47***				
Lowest quintile (n=20)	0.06	0.67***				
Difference	-2.49*	-2.14**				

Panel B: Earnings Announcements

B1: Abnormal Short Selling, $X_{SS}(-5,-1)$						
	Mean	Median	25th Percentile	75th Percentile	Minimum	Maximum
Highest quintile (n=1217)	-0.75%***	-0.80%***	-3.34%	1.46%	-29.98%	15.94%
Other 90% (n=10960)	-0.45%***	-0.37%***	-2.39	1.57	-18.15	16.80
Difference	-0.3%***	-0.43%***				
Lowest quintile (n=1218)	-0.25%**	-0.30%***	-2.22	1.56	-17.04	15.74
Other 90% (n=10959)	-0.51%***	-0.41%***	-2.49	1.56	-29.98	16.80
Difference	0.26%**	0.11				
Highest quintile (n=1217)	-0.75%***	-0.80%***				
Lowest quintile (n=1218)	-0.25%**	-0.30%***				
Difference	-0.50%***	-0.50%***				

B2: Abnormal Relative Short Selling, $XR_{SS}(-5,-1)$						
Highest quintile (n=1939)	-0.98%***	-0.90%***	-3.53%	1.48%	-29.98%	15.94%
Other 90% (n=17457)	0.07%**	0.00	-2.16	2.32	-18.11	16.80
Difference	-1.05%***	-0.90%***				
Lowest quintile (n=1940)	-0.55%***	-0.47%***	-2.74	1.75	-17.17	16.80
Other 90% (n=17456)	0.02	-0.03	-2.23	2.31	-29.98	16.17
Difference	-0.57%***	-0.44%***				
Highest quintile (n=1939)	-0.98	-0.90%***				
Lowest quintile (n=1940)	-0.55%***	-0.47%***				
Difference	-0.43%***	-0.43%***				
