Does short-sale constraint impede long run informational efficiency?

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Abstract

We find significantly lower post earnings announcement returns for stocks that are *exogenously* short-sale prohibited, which supports Miller's (1977) overvaluation hypothesis. Short prohibited stocks also have more left skewed post announcement return, suggesting delayed incorporation of adverse bad news. There is strong evidence of reduction in long-run informational efficiency when there is short-sale constraint and this inefficiency persists several months after earnings announcement. We also suggest short-sale constraint as an alternative explanation to negative post earnings announcement drift, other than investors' underreaction to earnings news. Our results shed light on the debate of removing short-sale prohibition in emerging markets.

Keywords: short-sale constraint, post earnings announcement drift, informational efficiency

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1. Introduction

To short sell a stock, investors need to borrow shares and pay borrowing fees (called loan fees). It is sometimes difficult or impossible to short sell because of high loan fee or institutional restrictions. These result in short-sale constraints.

Current literature on the consequences of short-sale constraint is divided into two streams[1]. The first stream stems from Miller (1977), who proposed an overvaluation hypothesis. In this hypothesis, pessimists are driven out of the market because of short-sale constraints, leaving optimists holding the stock. Therefore, with limited number of shares outstanding, the valuation of the marginal investor is higher than the fair value, which incorporates the pessimists' view as well. The second stream is from Diamond and Verrecchia (1987). They proposed a model in which a rational market maker observes order flow and mades correct expectation of the stock price, taking into account some of negative information is not traded. In their model, although the market maker infers correct expected stock price, he does not know the exact amount of negative information. When the negative information is released and is actually more adverse than expected, there is a large price fall, resulting in a more left-skewed return distribution compared with a stock without short-sale constraint. In both explanations, short-sale constraints hinder the price adjustment to negative information and hence reduce informational efficiency.

Empirical works mainly focus on prediction of returns using different proxies of short-sale constraint, such as short interest, loan fees and institutional holding. Little work has been done on the relationship between short-sale constraint and informational efficiency by picking up an information event such as the earnings announcement (except Reed (2007)). One reason is that most empirical papers on short selling used the data from the U.S., where all stocks can be short sold in principle and it is hard to argue that short-sale constraints in the U.S have a long lasting effect in reducing informational efficiency. Recent research investigating the effects of short-sale constraint in the U.S. uses loan fees to proxy the difficulty to short sell, for example, Geczy, Musto, and Reed (2002), D'Avolio (2002), and Reed (2007). However, using loan fees as a proxy for short-sale constraint cannot distinguish whether it is the difficulty to short *per se* that hinders negative information being incorporated, or the negative

[1] Rubinstein (2004) has a more complete survey.

information drives both high loan rates and negative returns at the same time. This highlights the possible endogeneity issue when looking for a proxy of short-sale constraint.

In this paper, we use Hong Kong data and investigate the effect of *exogenous* short-sale constraint on long-run informational efficiency after earnings announcements. Hong Kong stock market is different from the U.S. market that some stocks listed in Hong Kong Stock Exchange (HKEx) are designated by the exchange as short-sale eligible, while others are short-sale prohibited. HKEx also revises the short – eligibility list regularly such that some stocks are added to and some are removed from the list. This unique institutional feature allows us to avoid the problem of finding a proxy for short-sale constraint and facilitate studying the effect of an exogenous change in short-sale constraint when a stock enters or leave the short eligibility list.

Chang, Cheng and Yu (2007), using Hong Kong data, investigate the effect on returns after lifting the short-sale constraint. They find significantly negative abnormal returns after a stock is allowed to be short sold, thus supporting Miller's (1977) hypothesis. However, their focus is on the effect of being designated as short-sale eligible, while we focus on information events, which are earnings announcements, and investigate the impact of short-sale constraint on information reflection. Our paper is also different from others (such as Reed (2007)), which use the U.S. data and proxies for short-sale constraints, because short-eligibility of a stock in Hong Kong is designated by the exchange and this avoids the possible endogeneity issue when proxies for short-sale constraint are used.

We use post earnings announcement return as a variable for informational efficiency, in addition to return skewness discussed above. Numerous studies, since Ball and Brown (1968), using the U.S. data have found significant cumulative abnormal returns for stocks having extreme unexpected earnings, after an extended period following the announcement. This is explained by investors' delayed recognition of earnings information and hence a form of informational inefficiency. Normally, earnings announcements contain more information than simply the earnings figure. Different investors may interpret the information differently. When a stock is prohibited from short selling, pessimistic investors (those who read the announcement information as negative) cannot short sell and it would take some time for those views to get reflected, resulting in negative post announcement return. In addition, some time after the announcement, stock price plunges when severe negative side of the

announcement information gets recognized and reflected, and this results in more left skewed return compared with stocks that can be short sold.

In this paper, stocks restricted from short selling are shown to have significantly lower post announcement return and more left skewed post announcement return distribution. More importantly, stocks that have entered (left) the short eligibility list are found to have significantly higher (lower) post announcement return skewness, confirming our conjecture discussed above. Our evidence thus supports Miller's (1977) overvaluation hypothesis about short-sale constraint.

In summary, we find strong evidence of reduction in long-run informational efficiency when there is short-sale constraint. This inefficiency persists several months after earnings announcement, and may suggest a real impact on firms' investment decisions. We also suggest short-sale constraint as an alternative explanation to negative post earnings announcement drift, other than investors' underreaction to earnings news. Our results have policy implication to relax short-sale restriction for stock exchanges in Hong Kong and emerging markets where the majority of stocks are prohibited from short selling. In addition, we are the first to document post earnings announcement drift outside the U.S. and U.K. market.

The paper is organized as follows. Section 2 discusses related literature on short selling. Section 3 details our motivation and hypothesis. Section 4 describes the data sources and variables to be used in the following analysis. Section 5 presents empirical results. Section 6 concludes.

2. Literature Review

The debate for short selling activity can be traced back to the last century. Jones and Lamont (2002) describe a central stock loan market in the NYSE in the 1920s'. This central loan market acted as a place for borrowing in the last resort, when borrowers could not find shares elsewhere. It became inactive and finally closed after heavy public opinion pressure condemned short sellers to be the culprit of the 1929 crash. Lamont (2004) describes cases where some firms condemn short sellers for manipulating their prices and those firms adopt actions to make short selling difficult. Nowadays, the

stock loan market in the U.S. is still segmented, and in many stock exchanges, short selling is either restricted or prohibited (see Bris, Goetzmann and Zhu (2007)).

Shorting a share involves costs and risk, which involve search cost of finding a lender, lock-up of proceeds from short selling in the margin account, loan fee and recall risk when the lender calls the shares back at any time in the future. All these make short selling costly and result in short-sale constraint. Indeed, in some markets (such as Hong Kong), some stocks are prohibited from short selling.

Short-sale constraint is an interesting topic to study for the following reasons. One is that celebrated models such as the CAPM and Black-Scholes-Merton option pricing model assume investors can short sell shares without constraint. With short-sale constraint, we may have different implications from the models. The second reason is that short-sale constraint hinders investors with negative view to trade, thus reducing informational efficiency. Our paper focuses on the latter.

As discussed in the introduction, Miller (1977) implies overvaluation while Diamond and Verrecchia (1987) argue unbiased price but left skewness for stock returns. Although Diamond and Verrecchia (1987) criticize Miller (1977) for assuming that optimists do not learn and do not consider the possible negative views of the absent pessimists, their model assume there is a rational market maker who can rationally expect the stock price by observing the order flow and inferring composition of investors who are short constrainted.

Indeed, empirical results about the effect of short-sale constraint are mixed with respect to Miller (1977) versus Diamond and Verrecchia (1987)'s implication. For example, Chen, Hong and Stein (2002), Jones and Lamont (2002) and Asquith, Pathak and Ritter (2005), among others, document short-sale constraints lead to overvaluation. On the other hand, Senchack and Starks (1993) find that an unexpected increase in short interest is related to contemporaneous negative returns, consistent with Diamond and Verrecchia (1987) that investors learn and incorporate negative information.

Although the two theories lead to quite different implications, they share a common theme: short-sale constraints reduce informational efficiency, with the above empirical works providing indirect evidence. However, a more direct way to look at this issue is, suggested by Diamond and Verrecchia (1987), to investigate return changes and distributions around earnings announcements. One problem of

adopting this approach in the U.S. is the lack of proper measure of short-sale constraints. All the stocks listed in NYSE and NASDAQ can be short sold in principle and a proxy is needed to measure the extent of short-sale constraints. Reed (2007) uses short loan rate to proxy for short-sale constraint around earnings announcement days and finds more negative returns for stocks having high loan rates. However, it is not very clear whether it is the difficulty to short that hinders negative information being incorporated, or the negative information drives high loan rates and negative return at the same time.

We choose Hong Kong stock market in which the exchange designates a list of stocks eligible for short selling and circumvent the issue of finding a proxy for short-sale constraint and the possible endogeneity problem (whether private information drives both short-sale constraint and negative stock return). For example, Chang, Cheng and Yu (2007) test the overvaluation hypothesis and find that when a stock is allowed to be short in Hong Kong, there is significant negative return around the event window. This gives a clean interpretation and prefect setting to test the effect of short-sale constraint.

3. Hypotheses Development

We study the effect of exogenous short-sale prohibition on informational efficiency, using (post) announcement return and (post) announcement return skewness.

There are numerous empirical works documenting pronounced post earnings announcement return for stocks having extreme earnings surprise (for example, Ball and Brown (1968), Bernard and Thomas (1989) and many others). Fama (1998) regards this phenomenon as an anomaly showing investors' underreaction. Delayed investors recognition to earnings information is the main explanation for post earnings announcement drift (PEAD).

Normally, besides the earnings per share, firms also release other important information in their annual reports, which involve progress of existing projects, discussion of future prospects, opportunities and challenges. Therefore, there is much more information contained in an earnings announcement than the earnings figure per se. This viewpoint is also suggested by Brandt, Kishore, Santa-Clara and Venkatachalam (2008). Different investors may interpret these pieces of information

differently. Those think the firm is good will buy, whereas those hold a negative view try to sell or even short sell. With short-sale prohibition, those potential short sellers are not able to short sell, leaving only optimists buying around earnings announcement days. Hence under the overvaluation hypothesis, for short-prohibited stocks, positive announcement return is likely to driven by optimists, and even if the announcement return is negative, there is still overpricing because those really pessimists cannot short sell. This constitutes negative future return when negative information gets reflected in the stock price. In addition, Miller's overvaluation hypothesis implies no negative drift for stocks that are short-eligible. On the other hand, Diamond and Verrecchia (1987) would imply there is no drift for short-prohibited stocks, because investors can rationally expect the amount of negative information held by pessimists. Therefore, we have the following hypothesis:

Hypothesis 1: Under overvaluation hypothesis, there are negative drifts for post announcement returns for short-prohibited stocks.

Diamond and Verrecchia (1987) predicts more left-skewed return distribution for short-sale constrained stocks around announcement dates than unconstrained stock. The intuition is that when there is insider trading before announcement dates, some extreme negative information can be reflected in the stock price through short selling. In contrast, for those short-sale constrained stocks, extreme negative information can only be reflected at or after the announcement, resulting in more left-skewed announcement return. Essentially, the allowance of insider trading before announcement dates is necessary for this result. However, in Hong Kong, insiders are not allowed to trade starting 1 month before the announcement. Therefore, extreme negative information cannot be reflected through short selling by insiders, even though the stock is short-eligible. In this case, there are two possible consequences for skewness of announcement return. The first, following Diamond and Verrecchia, is that at earnings announcement, for short-eligible stocks, activity by short sellers help the extreme negative information gets reflected; while for short-prohibited stocks, *all* the investors[2] can still interpret the report correctly and drive prices down when there is extreme bad information. This implies there will not be much difference for skewness of announcement date return for short-eligible versus short-prohibited. The second possible scenario is, following Miller, for short-eligible stocks,

[2] The reason for emphasis of all the investors is that even if a handful of investors take the report optimistically, they will become the marginal buyers and this would result in the second scenario.

pessimists[3] short sell reflecting extreme negative information, driving more left skewed announcement return; while for short-prohibited stocks, pessimists cannot short sell and optimists ignore this piece of extreme negative information until some time after announcement when it is reflected. Therefore, in the second scenario, the timing of reflection of extreme negative information is different for short-eligible versus short-prohibited stocks. For short-eligible stocks, it is reflected around the announcement dates, while for short-prohibited stocks, there is delayed reflection. This implies short-eligible stocks should have more left skewed return than short-prohibited stocks around announcement dates, whereas the reverse holds for post announcement dates. From the above discussion, we have hypothesis 2:

Hypothesis 2: Under Miller's argument, stock returns are more left-skewed for short-eligible stocks than short-prohibited stocks around announcement dates, whereas for post announcement dates, the reverse holds.

The alternative of the above hypothesis is that there is not much difference in return skewness among short-eligible and short-prohibited stocks, whether around announcement dates or in post announcement periods.

The unique feature of stock entering and exiting the short-eligibility list in Hong Kong market allows us to test hypothesis 2 in another dimension. If the argument behind hypothesis 2 holds, the return skewness of a stock should be aligned with those stocks having the same short-eligibility status (eligible or prohibited). Then, we should also see a change in both post and announcement return skewness when a stock enters or exits the short-eligibility list. For example, when stocks which are originally short-prohibited become shortable, then the announcement day return should be more left-skewed and post announcement return should become more right-skewed when we compare before and after the event. We hypothesize the following:

Hypothesis 3: For stocks entering the designated short selling list, its announcement return skewness should be smaller, and post-announcement return skewness should be larger.

[3] We interchange the terms pessimists and those correctly interpreting negative information.

Hypothesis 4: For stocks exiting the designated short selling list, its announcement return skewness should be larger, and post-announcement return skewness should be smaller.

4. Data and Variables Description

We obtain data for firms listed in Hong Kong Stock Exchange from various sources. The data period is from 1 Jan 2000 to 7 Dec 2007. Daily stock return, trading volume, size, annual earnings announcement dates and earnings per share are obtained from Datastream. We collect both the eligibility announcement and effective dates for changes in short eligibility status from the website of Hong Kong stock exchange. There are 732 entering the list events and 382 exiting the list events, with 567 stocks eligible for short selling by the end of November 2007. Industry classification for stocks, option listing and delisting dates are from the exchange's website. In case of unassigned industry classification from the exchange, classification from Datasteam is used to make the closest possible match[4].

Chang, Cheng and Yu (2007) find that firms being added to the short eligibility list experienced an abnormal negative return. Therefore, to avoid possible confounding effects from a change in short selling membership during the announcement and post-announcement period, a firm-announcement observation is removed if the firm is added or removed from the designated short selling list starting a month before the announcement date and ending 6 months after the announcement. In addition, firms having a market capitalization of less than HKD$100 million[5] one month before the announcement are removed from the firm-announcement sample. This brings a total of 5368 firm announcement observations, with 3783 from short-prohibited firms.

[4] Hereafter we refer an annual earnings announcement as 'announcement'.

[5] Approximately USD$12.8 million.

We measure excess return as cumulative abnormal return[6] over an industry-size matched portfolio. For each industry, two size portfolios are constructed according to size-breakpoints calculated from the previous year end's market value of equity. It should be noted that when composing the size portfolio, we remove firms having an announcement (both annual and interim) centered one month for that date. This is to purge possible contamination effects on the benchmark portfolio from other announcing firms, in particular when announcement dates tend to cluster together. Announcement date excess return is defined as the cumulative abnormal return over the 3 trading days event window:

$$Exret(-1,1)_{i,a} = \sum_{t=-1}^{t=1}(ret(t)_{i,a} - industry\_size\_ret(t)_{i,a}), \quad (2)$$

for stock i and its announcement date a and industry_size_ret is the return of the industry-size-matched portfolio.

Post announcement excess return for stock i, after d trading days of its announcement date a is defined as follows:

$$Exret(2,d)_{i,a} = \sum_{t=2}^{t=d}(ret(t)_{i,a} - industry\_size\_ret(t)_{i,a}) \quad (3)$$

Size adjusted excess returns are constructed in the similar way, with four size portfolios being constructed. Size adjusted returns essentially produce the same results as industry-size adjusted returns.

We define the announcement as good news if the announcement excess return is positive, and vice versa for bad news. In the literature, IBES analyst forecast data are often used to compare the actual earnings value, and define good news or bad news when the actual value is above or below the average analysis' forecasts respectively. However, IBES database does not have a large coverage on firms in Hong Kong, both in terms of number of firms covered and number of analysis following for each firm. Data errors in the IBES announcement dates also deter us from using IBES as well[7].

[6] Alternatively, we may use buy-and-hold abnormal return. However, as Fama (1988) points out, buy-and-hold abnormal return may carry over and magnify benchmark model error. Our results are robust to both cumulative abnormal return and buy-and-hold abnormal return specifications.

[7] There are only 2977 firm-announcement observations from IBES during our sample period, as opposed to 6432 from Datastream. In addition, upon manual check with the exchange website, there are frequent cases when announcement dates from IBES does not match with the actual one and the mismatches are sometimes greater than one week. In contrast, Datastream's announcement dates are correct.

5. Empirical findings

[insert Table 1 here]

[insert Figure 1, 2, 3 here]

Table 1 shows summary statistics for announcement and post announcement returns. We classify market reaction, measured by the sign of size-adjusted excess return, into good news and bad news. We focus on four months post announcement return, rather than longer time period because firms in Hong Kong usually have earnings announcement semi-annually[8]. Firm announcement observations corresponding to the top and bottom 1% of the extreme 90 trading days post announcement return are screened off to avoid the undue impact of outliers. Six month post announcement returns are available upon request. Visualized in Figure 1, there are pronounced patterns of post earnings announcement drift for good news, with the short-eligible firms having an obviously different curve than the short-prohibited firms. In particular, in Panel A of Table 1, among firms having good news, firms that are short-sale eligible continue to earn an abnormal return of 4.8%, with a t-value of 5.7, over the following 90 trading days after the announcement. In contrast, the corresponding post-announcement abnormal return for short-prohibited firms is insignificant from zero. The last row of Panel A shows that the drift for short-prohibited firms is significantly lower than those short eligible firms. The result is striking that there is a vast difference in post announcement return, and short-sale eligibility seems to be responsible for the difference.

Figure 2 illustrates the vast difference in post announcement return between the short eligibility groups for bad news. In Panel A of Table 1, among firms having bad news, the short-prohibited firms continue to drop by an additional 3% 90 days after the announcement, whereas the short eligible firms experience a significant drift of 2.2%. Again, the difference in drifts is significantly different, with short-prohibited firms earning lower post announcement abnormal return than short-eligible firms. Figure 3 shows the patterns combined for both good and bad news. They are consistent to the above discussion, that is, short-prohibited firms underperform short-eligible firms after earnings announcement.

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[8] Six month post announcement returns are available upon request.

Table 2 shows similar results using size portfolio return as an alternative benchmark measure. However, there is a significant positive drift of 2.6% for short-prohibited firms after good news, while in Table 1 there is no such a drift using industry-size-adjusted abnormal return. But in both Tables, short-prohibited firms underperform short-eligible firms after earnings announcement, no matter after good news or bad news, and they have significant negative drift after bad news. We also notice in Panel B of both Tables 1 and 2 that within each short eligibility group, the post announcement abnormal returns are significantly lower after bad news than good news.

Results from Tables 1 and 2 provide support to hypothesis 1: short-sale constraint may hinder the reflection of negative information contained in earnings announcement, driving negative post announcement return for short-prohibited stocks. In particular, the negative drift for short prohibited firms after bad news suggests that the marginal investors do not fully incorporate the negative side of the announcement information.

[insert Table 3 here]

In order to investigate the effect of short-sale prohibition on announcement date excess return, the following regression is run:

$$Exret(-1,1)_{i,a} = a + b * short\_eligibility_{i,a} + c * sign_{i,a} * short\_eligibility_{i,a} + d * sign_{i,a} * short\_prohibition_{i,a} + e * \log(size_{i,month-1}) + f * Ret\_variance_{i,a-5,to,a-20} + g * options_{i,a} + \varepsilon_{i,a} \quad (4)$$

where $Exret(-1,1)_{i,a}$ is the 3 day announcement industry-size-adjusted abnormal return for stock i on announcement date a;

$sign_{i,a}$ is a dummy variable equals to one if $Exret(-1,1)_{i,a}$ is positive, and minus one otherwise;

$short\_eligibility_{i,a}$ is a dummy variable equals to one when stock i is short-eligible on date a, and zero otherwise;

$short\_prohibition_{i,a}$ is a dummy variable equals to one when stock i is short-prohibited on date a, and zero otherwise;

$\ln(size_{i,month-1})$ is the log of market value of equity in the previous month;

$Ret\_variance_{i,a-5,to,a-20}$ is the return variance over the past 3 weeks, and

$options_{i,a}$ is a dummy variable equals to one when there is stock i has options traded on date a, and zero otherwise.

Similarly, for four month post announcement returns, we have the following regression:

$$Exret(2,90)_{i,a} = a + b * short\_eligibility_{i,a} + c * sign_{i,a} * short\_eligibility_{i,a} + d * sign_{i,a} * short\_prohibition_{i,a} + e * \log(size_{i,month-1}) + f * Ret\_variance_{i,a-5,to,a-20} + g * options_{i,a} + \varepsilon_{i,a} \quad (5)$$

where $Exret(2,90)_{i,a}$ is the four months post announcement excess return for stock i after announcement date a.

The coefficient of the term short_eligibility is the main focus of this paper, and we predict that it should be negative in equation (5). The two interaction terms, sign*short_eligibility and sign*short_prohibition, capture different behavior of short eligible and short prohibited firms after good or bad news. We run equations (4) and (5), both unconditional on the nature of the news and conditional on good or bad news, in which the interaction terms are omitted.

Table 3 shows coefficient estimates for the regression equation (4). In the second and fourth specifications, the coefficients for return variance are significant, meaning that when stock return is more volatile, it tends to react more in the direction of the earnings news; the coefficients for size are highly significant and in the opposite direction to the nature of news, so for a larger firm, there is in general smaller reaction in magnitude to earnings news, possibly because of more analyst coverage, such that more information is already incorporated into the stock price before announcement. However, the coefficient estimates for short-eligibility dummy are not significant after controlling for size and with the interaction terms.

Table 4 shows the results for regression equation (5), using 90 trading days post announcement return as dependent variable. We see that the estimates for short eligibility dummy are all highly significantly positive even after controlling for firm characteristics and the magnitude is large enough to have

economics meaning. For example, in specification 2, given a negative announcement excess return, short-prohibited stocks will earn 3.9% less than short-eligible stocks after 4 months, controlling for other factors. This suggests relatively poor post announcement performance for short-prohibited stock, and provides strong evidence supporting hypothesis 1 of overvaluation.

Comparing the coefficients for short dummy in Tables 3 and 4, they are not significant during announcement period but are significantly positive afterwards, meaning that the marginal investors of short prohibited firms are not aware of negative information when interpreting earnings news. This result is consistent with hypothesis 1 on overpricing.

After looking at the post announcement return, we examine another measure of informational efficiency on bad news, which is return skewness. We hypothesize that quick reflection of extreme negative information for short-eligible stocks results in more left-skewed announcement return than short-prohibited stocks, and those extreme negative information gets reflected for short-prohibited stocks as time goes by, making their post announcement return more left skewed instead.

[insert Table 5 here]

Table 5 compares the moment estimates across the short eligibility groups and provides the p-values for the null hypothesis that the two statistics numbers are the same. Taking mean as an example, the p-value is calculated using a bootstrap procedure: we randomly draw with replacement x number of samples from short-prohibited group, where x is the total number of short-eligible samples. Then a simulated mean is calculated for these x simulated samples. This procedure is repeated 10,000 times to produce a distribution of simulated mean. The actual mean of short-eligible stocks is compared with this simulated distribution, and p-value is the ranking of the actual mean among those 10,000 simulated, divided by 10,000. Therefore, a p-value of 1% means the mean for short-eligible stocks is significantly lower than that for short-prohibited stocks. Sometimes there is a p-value of 1, meaning that the actual statistics is higher than all the simulated ones.

We see that, in Panel A, the 3 days announcement abnormal return is significantly more left skewed for short eligible stocks (0.245) than for short-prohibited stocks (1.578) and the same holds for

standard deviation and kurtosis. Panel B reports the corresponding moment statistics for post announcement abnormal return. Consistent with the previous empirical results, short eligible stocks have a higher (at 5.4% significance level) post announcement return than short-prohibited stocks. While short eligible stocks have more left skewed return around announcement, the reverse is true for the post announcement period. In particular, short prohibited stocks have a post announcement return skewness of 0.468, which is lower than 0.612 for short eligible stocks. In Panels C and D, the sample is divided based on good news or bad news and statistics similar to Panel B are produced respectively. Post announcement return skewness for short-prohibited firms is shown to be significantly lower after good news, although it is not significant after bad news.

Results in Table 5 suggest that more extreme negative information tend to be incorporated for short-eligible stocks around announcement while it tends to be reflected after the announcement for short-prohibited stocks. They are consistent to our conjecture that without insider trading before the announcement, extreme bad news will be reflected at the announcement for short eligible stocks, whereas short-sale prohibition combined with optimist marginal investors make it reflected long time afterwards, contributing to a more negatively return skewness in the post announcement period.

[insert Table 6 and 7 here]

Since Hong Kong Stock Exchange regularly revises the list of stocks designated for short selling, where some stocks are added to and some are removed from the list. This provides an ideal natural experiment to test the effect of change in short-sale eligibility on the cross-sectional distribution of announcement and post announcement return.

In Tables 6 and 7, we identify event dates for change in short-eligibility and match them with the nearest announcement dates before and after the event date (with the requirement the event date does not lie within one month before and six months after the announcement date). Summary statistics for addition events (Table 6) and removal events (Table 7) are produced, with each table further divided into announcement returns (Panel A) and post announcement events (Panel B). Our analysis is conducted by comparing the summary statistics before and after the event. For example,

the Panel A of Table 6 focuses on announcement return distribution for addition events. The column 'before the event' provides summary statistics for stock before experiencing an addition event, i.e. when it is still short-eligible. Similarly, the column 'after the event' provides statistics after the stock is added to short eligibility list, i.e. after it becomes short eligible. The bootstrap procedure is done in a similar way to Table 5, but it is done by focusing only on the group of firms experiencing the event, rather than including all the other firms. We choose the group with more observations as the control group from which simulated samples are drawn. For example, in Panel A of Table 6, there are more observations before the addition events (313) than after the event (291), so the observations before the addition events are chosen to be the control group[9]. Because the sample and control groups are of similar sizes, observations equal to one-half of the size of the sample groups are drawn from the control group for each bootstrap simulation[10].

We hypothesize that for stocks experiencing addition (removal) event, compared with the pre-event statistics, its announcement return skewness should be smaller (larger), and post-announcement return skewness should be larger (smaller). First we focus on the skewness coefficients across the listing event, and then discuss the bootstrap results.

In Table 6, Panel A focuses on the effect of addition events on the announcement return. For those firms experiencing an addition event, we find a significantly smaller return skewness after the event (0.917 v.s. -0.025), which is consistent to our prediction. Panel B shows that the post announcement return skewness increases (0.356 v.s. 0.438) after a stock is added to the designation list. This result is consistent to our prediction as well, although the difference is not significant.

In Panel A of Table 7, the announcement return skewness after a firm is removed from the list is smaller (0.339 v.s. -0.581), which is quite puzzling and contrary to our prediction. Panel B shows post

[9] This arises due to the requirement that the earnings announcement dates to be included need to be 1 month before and 6 months after the change in short eligibility event date and some firms do not have a long series of earnings announcements satisfying the requirement.

[10] There is a tradeoff for the number of observations to draw from the control group. On the one hand, drawing too little samples each time will give noisy simulated moment statistics. On the other hand, drawing too many samples will render the bootstrap procedure meaningless. Say for example there are n observations for both the sample and control groups, and we draw n-1 observations from the control group each time. The resulting distribution of moment statistics will not give any meaningful variation for comparison, because it will be very close to the actual number of the control group. Having half of the sample to draw is arbitrary, but we still obtain qualitatively similar results when one third of the samples are drawn each time.

announcement returns are significantly more left skewed after a removal event, which is consistent to our prediction. The latter observation suggests that after a firm is removed from the designated list, we expect to see more extreme bad news reflected after the earnings announcement.

Overall, Tables 6 and 7 provide moderate support of our hypothesis, but the small sample sizes of those addition and removal events may be liable of some of the mixed results.

6. Conclusion

By looking at exogenous short-sale prohibitions imposed by the Hong Kong stock exchange, we overcome the endogeneity issue of identifying short-sale constraint in the U.S. data and find strong evidence of short-sale prohibition reducing long run informational efficiency by hindering negative information being reflected. Reduction in informational efficiency arises because pessimists who hold negative information are driven out of the market due to short-sale prohibition, and negative information gets slowly incorporated over months, resulting in a negative post earnings announcement drift. In particular, short-prohibited stocks, on average, are found to have more negative post earnings announcement returns and higher chances of large negative return. Our evidence thus supports Miller's (1977) overvaluation hypothesis about short-sale constraint. We suggest short-sale constraint as an alternative explanation to negative post earnings announcement drift, other than investors' underreaction to earnings news. Our findings would shed light on the issue of relaxing short-sale constraint in emerging markets, where the possible improvement in informational efficiency may be important to firm managers who make investment decision based upon market reaction around earnings announcements.

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Figure 1.

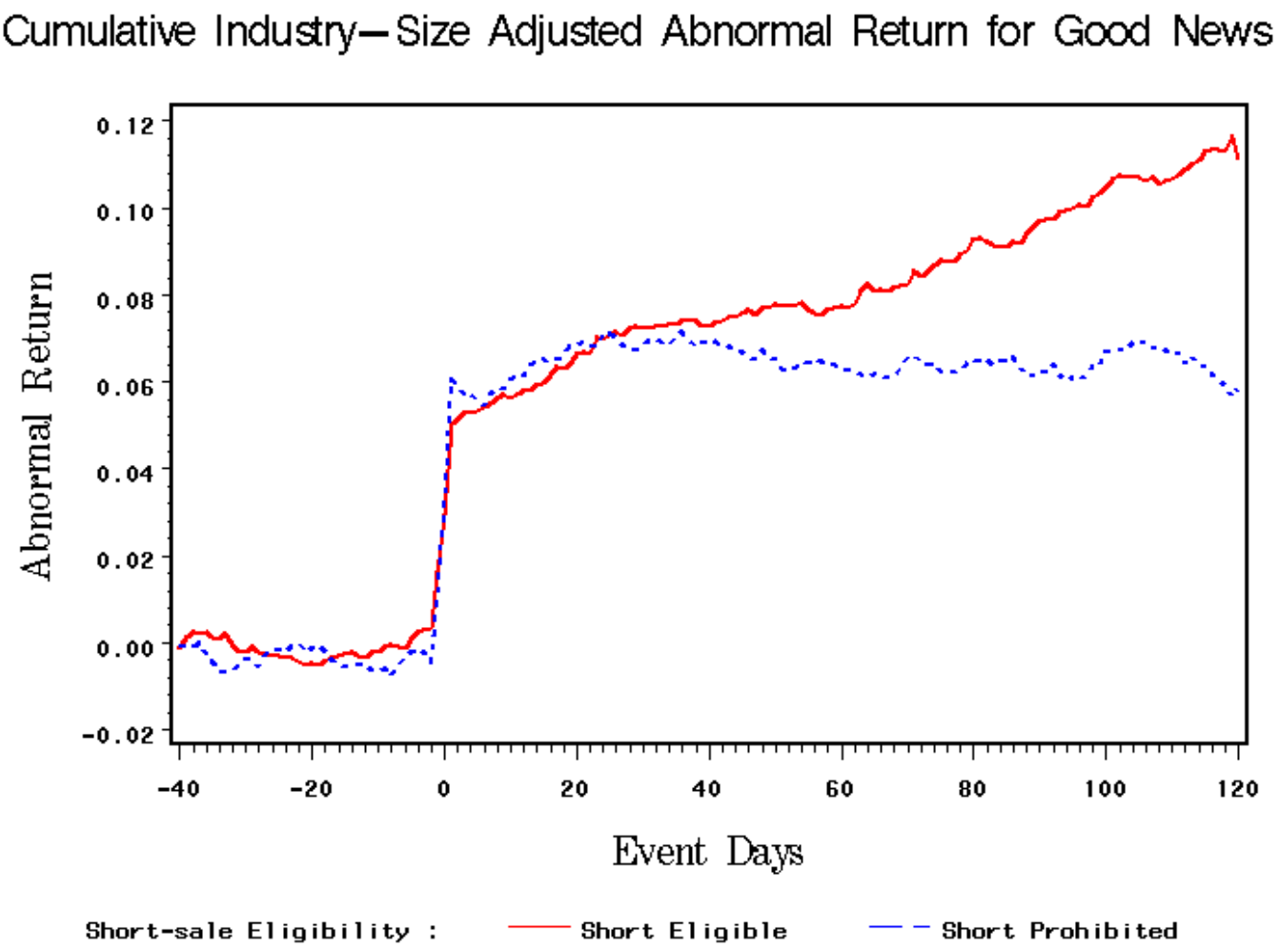

Figure 1 plots cumulative industry-size adjusted abnormal return for good news, starting from 40 trading days prior to earnings announcement for short eligible and short prohibited firms respectively. Cumulative abnormal return is measured using an industry-size matched portfolio as benchmark portfolio. Good news is defined as positive abnormal return around the 3 days earnings announcement window. Firms with market capitalization less than HKD 100 million are excluded from the analysis and firm-announcement observations corresponding to the top and bottom 1% of extreme 90 days post announcement abnormal returns are screened off to avoid the undue impact of outliers.

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Figure 2.

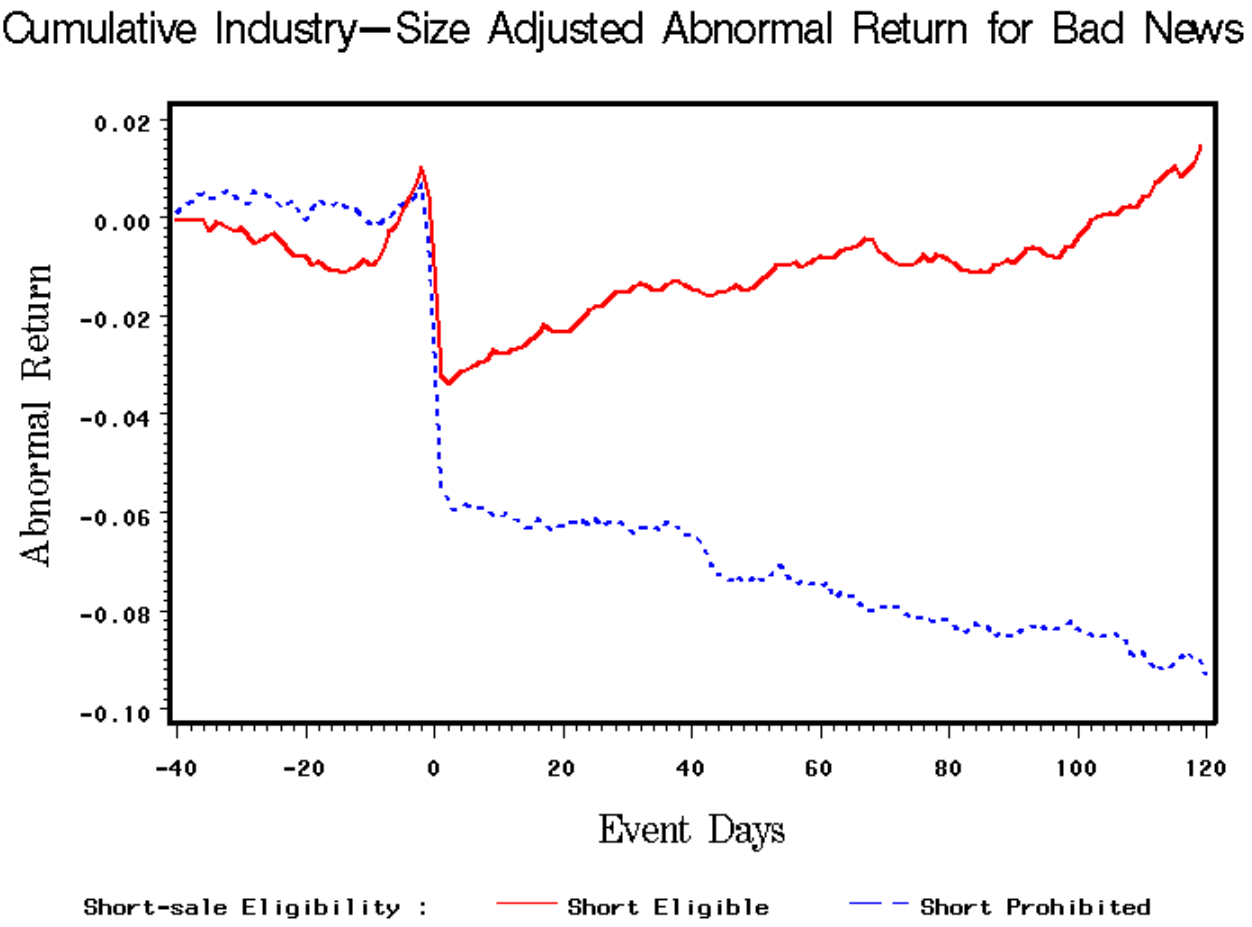

Figure 2 plots cumulative industry-size adjusted abnormal return for bad news, starting from 40 trading days prior to earnings announcement for short eligible and short prohibited firms respectively. Cumulative abnormal return is measured using an industry-size matched portfolio as benchmark portfolio. Bad news is defined as negative abnormal return around the 3 days earnings announcement window. Firms with market capitalization less than HKD 100 million are excluded from the analysis and firm-announcement observations corresponding to the top and bottom 1% of extreme 90 days post announcement abnormal returns are screened off to avoid the undue impact of outliers.

Figure 3.

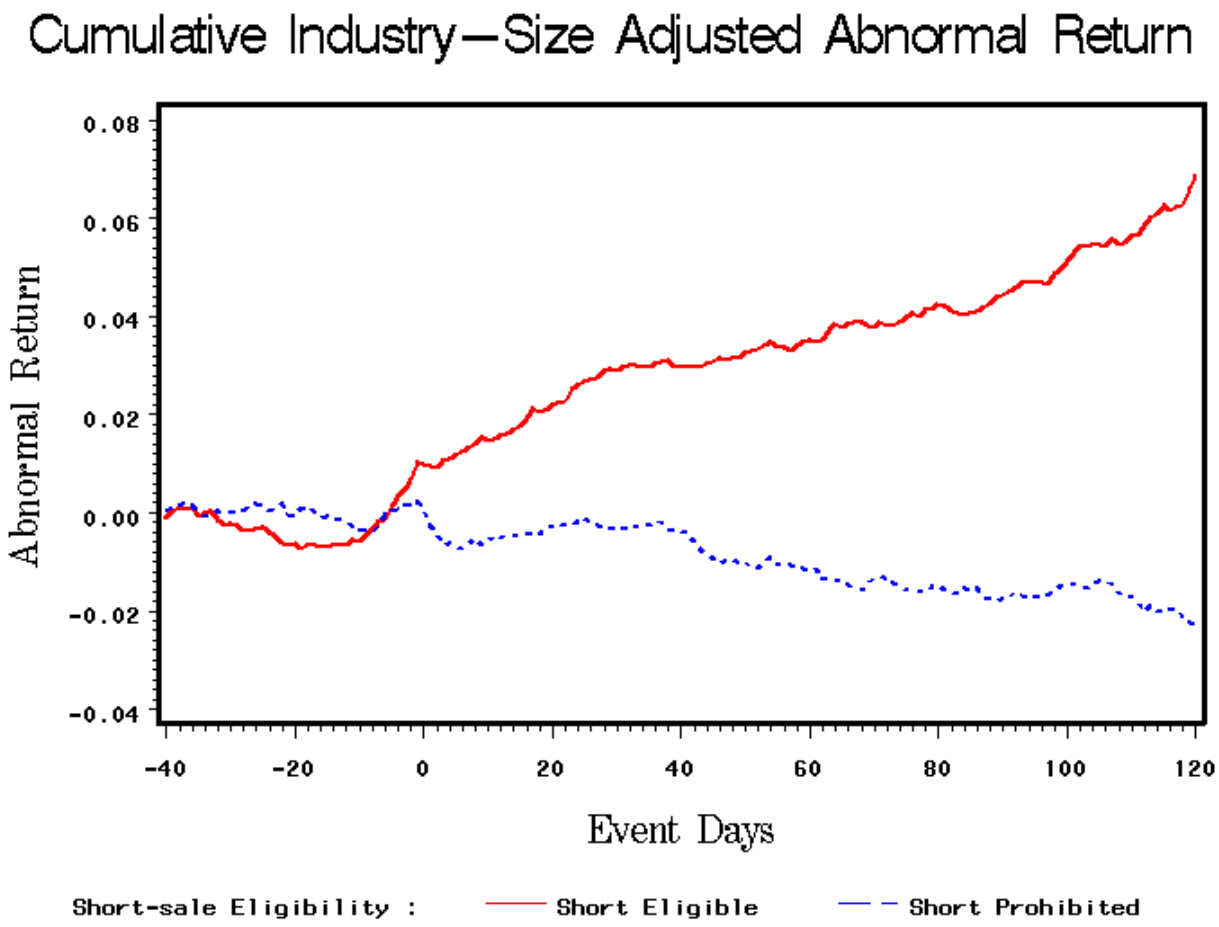

Figure 3 plots cumulative industry-size adjusted abnormal return for good news and bad news combined, starting from 40 trading days prior to earnings announcement for short eligible and short prohibited firms respectively. Cumulative abnormal return is measured using an industry-size matched portfolio as benchmark portfolio. Firms with market capitalization less than HKD 100 million are excluded from the analysis and firm-announcement observations corresponding to the top and bottom 1% of extreme 90 days post announcement abnormal returns are screened off to avoid the undue impact of outliers.

Table 1. Post earnings announcement return – industry-size adjusted

Panel A

	Short Eligibility	N	Abnormal return over the event days (-1,1)	(2,10)	(2,90)
Good News	All	2434	0.059	0.002	0.015
			37.041	1.027	2.491
	Yes	772	0.046	0.006	0.048
			27.683	2.347	5.697
	No	1662	0.065	0.000	0.000
			29.750	0.157	-0.043
	P-value of difference across short eligibility group		0.000	0.154	0.000
Bad News	All	2728	-0.056	-0.003	-0.015
			-50.745	-1.504	-2.613
	Yes	759	-0.042	0.005	0.022
			-28.096	1.525	2.596
	No	1969	-0.062	-0.006	-0.030
			-43.902	-2.289	-4.033
	P-value of difference across short eligibility group		0.000	0.008	0.000

Panel B

	Short Eligibility	P-value of difference in excess return over the event days within short eligibility group (-1,1)	(2,10)	(2,90)
Good News Versus Bad News	Yes	0.000	0.705	0.037
	No	0.000	0.097	0.006

In Panel A, the top number is the mean, and the bottom one is the t-value

Sign of 3-day abnormal return is used to define good news or bad news. Abnormal return is measured as the cumulative abnormal return using a industry-size-matched portfolio. Firms with market capitalization less than HKD 100 million are excluded from the analysis and firm-announcement observations corresponding to the top and bottom 1% of extreme 90 days post announcement abnormal returns are screened off to avoid the undue impact of outliers.

Table 2. Post earnings announcement return – size-adjusted

Panel A

	Short Eligibility	N	Excess return over the event days (-1,1)	(2,10)	(2,90)
Good News	All	2426	0.059	0.004	0.031
			36.451	1.739	5.157
	Yes	772	0.046	0.006	0.042
			26.530	2.052	4.929
	No	1654	0.065	0.003	0.026
			29.357	1.003	3.288
	P-value of difference across short eligibility group		0.000	0.506	0.164
Bad News	All	2749	-0.055	-0.006	-0.010
			-49.901	-2.650	-1.755
	Yes	773	-0.042	0.001	0.015
			-28.581	0.361	1.736
	No	1976	-0.061	-0.009	-0.020
			-42.729	-3.043	-2.739
	P-value of difference across short eligibility group		0.000	0.021	0.002

Panel B

	Short Eligibility	P-value of difference in excess return over the event days within short eligibility group (-1,1)	(2,10)	(2,90)
Good News Versus Bad News	Yes	0.000	0.262	0.030
	No	0.000	0.005	0.000

In Panel A, the top number is the mean, and the bottom one is the t-value

Sign of 3-day abnormal return is used to define good news or bad news. Abnormal return is measured as the cumulative abnormal return using a size-matched portfolio. Firms with market capitalization less than HKD 100 million are excluded from the analysis and firm-announcement observations corresponding to the top and bottom 1% of extreme 90 days post announcement abnormal returns are screened off to avoid the undue impact of outliers.

Table 3. Short constraint and announcement return

	Bad news		Good news		Combined			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-0.062	-0.108	0.064	0.109	-0.004	0.001	0.000	-0.003
	-46.592	-17.158	32.999	11.771	-2.627	1.090	-0.016	-0.596
Short Eligibility	0.020	-0.002	-0.018	0.005	0.007	0.001	0.009	0.000
	7.896	-0.432	-5.042	0.960	2.391	0.564	2.050	0.075
Short Eligibility *sign						0.044		0.044
						24.258		24.289
Short Prohibition *sign						0.063		0.063
						54.600		54.588
Ln(size)		0.008		-0.008			-0.001	0.001
		7.729		-5.081			-0.495	0.845
Options		-0.010		0.001			-0.002	-0.007
		-1.706		0.173			-0.319	-1.419
Return-Variance		-0.435		0.654			-0.167	0.007
		-2.754		2.610			-0.887	0.047
R^2	0.023	0.049	0.011	0.026	0.001	0.423	0.001	0.423
N	2514	2514	2265	2265	4779	4779	4779	4779

Table 3 presents estimates for the regression:

$$Exret(-1,1)_{i,a} = a + b * short\_eligibility_{i,a} + c * sign_{i,a} * short\_eligibility_{i,a} + d * sign_{i,a} * short\_prohibition_{i,a}$$

$$+ e * \log(size_{i,month-1}) + f * Ret\_variance_{i,a-5,to,a-20} + g * options_{i,a} + \varepsilon_{i,a}$$

where $Exret(-1,1)_{i,a}$ is the 3 day announcement industry-size-adjusted abnormal return for stock i after announcement date a; $sign_{i,a}$ is a dummy variable equals to one if $Exret(-1,1)_{i,a}$ is positive, and minus one otherwise; $short\_eligibility_{i,a}$ is a dummy variable equals to one when stock i is short-eligible on date a, and zero otherwise; $short_prohibition_{i,a}$is a dummy variable equals to one when stock i is short-prohibited on date a, and zero otherwise; $\ln(size_{i,month-1})$ is the log of market value of equity in the previous month; $Ret\_variance_{i,a-5,to,a-20}$ is the return variance over the past 3 weeks, and $options_{i,a}$ is a dummy variable equals to one when there is stock i has options traded on date a, and zero otherwise.

Sign of 3-day abnormal return is used to define good news or bad news. Abnormal return is measured as the cumulative abnormal return using a industry-size-matched portfolio. Firms with market capitalization less than HKD 100 million are excluded from the analysis and firm-announcement observations corresponding to the top and bottom 1% of extreme 90 days post announcement abnormal returns are screened off to avoid the undue impact of outliers.

Table 4. Short constraint and post announcement return

	Bad news		Good news		Combined			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-0.025	-0.033	0.003	0.078	-0.012	-0.011	0.021	0.021
	-3.490	-0.933	0.453	2.203	-2.323	-2.105	0.858	0.824
Short Eligibility	0.043	0.039	0.044	0.076	0.045	0.044	0.059	0.057
	3.113	1.882	3.305	3.780	4.659	4.528	4.071	3.942
Short Eligibility *sign						0.015		0.015
						1.810		1.794
Short Prohibition *sign						0.014		0.014
						2.751		2.687
Ln(size)		0.001		-0.011			-0.005	-0.005
		0.252		-1.996			-1.238	-1.162
Options		-0.001		-0.008			-0.005	-0.007
		-0.030		-0.254			-0.226	-0.288
Return-Variance		-0.463		-2.996			-1.592	-1.552
		-0.537		-3.150			-2.494	-2.432
R^2	0.003	0.002	0.004	0.010	0.004	0.006	0.005	0.007
N	2514	2514	2265	2265	4779	4779	4779	4779

Table 4 presents estimates for the regression:

$$Exret(2,90)_{i,a} = a + b * short\_eligibility_{i,a} + c * sign_{i,a} * short\_eligibility_{i,a} + d * sign_{i,a} * short\_prohibition_{i,a}$$

$$+ e * \log(size_{i,month-1}) + f * Ret\_variance_{i,a-5,to,a-20} + g * options_{i,a} + \varepsilon_{i,a}$$

where $Exret(2,90)_{i,a}$ is the 90 days post-announcement industry-size-adjusted abnormal return for stock i after announcement date a; $sign_{i,a}$ is a dummy variable equals to one if $Exret(-1,1)_{i,a}$ is positive, and minus one otherwise; $short\_eligibility_{i,a}$ is a dummy variable equals to one when stock i is short-eligible on date a, and zero otherwise; $short_prohibition_{i,a}$is a dummy variable equals to one when stock i is short-prohibited on date a, and zero otherwise; $\ln(size_{i,month-1})$ is the log of market value of equity in the previous month; $Ret\_variance_{i,a-5,to,a-20}$ is the return variance over the past 3 weeks, and $options_{i,a}$ is a dummy variable equals to one when there is stock i has options traded on date a, and zero otherwise.

Sign of 3-day abnormal return is used to define good news or bad news. Abnormal return is measured as the cumulative abnormal return using a industry-size-matched portfolio. Firms with market capitalization less than HKD 100 million are excluded from the analysis and firm-announcement observations corresponding to the top and bottom 1% of extreme 90 days post announcement abnormal returns are screened off to avoid the undue impact of outliers..

Table 5. Statistics for announcement day return

Statistics	Short Prohibited	Short Eligible	Bootstrap p-value of the difference
Panel A: Three day announcement industry-size-adjusted abnormal return			
N	3631	1531	
Mean	-0.004	0.002	0.997
Standard Deviation	0.099	0.062	0.000
Skewness	1.578	0.245	0.006
Excess Kurtosis	13.584	3.036	0.000
Panel B: Post announcement industry-size-adjusted abnormal return			
N	3631	1531	
Mean	-0.016	0.035	1.000
Standard Deviation	0.326	0.236	0.000
Skewness	0.468	0.612	0.946
Excess Kurtosis	1.699	2.517	0.999
Panel C: Post announcement industry-size-adjusted abnormal return, given good news			
N	1662	772	
Mean	0.000	0.048	1.000
Standard Deviation	0.319	0.232	0.000
Skewness	0.426	0.722	0.987
Excess Kurtosis	1.663	2.383	0.990
Panel D: Post announcement industry-size-adjusted abnormal return, given bad news			
N	1969	759	
Mean	-0.030	0.022	1.000
Standard Deviation	0.331	0.239	0.000
Skewness	0.511	0.524	0.608
Excess Kurtosis	1.754	2.653	0.986

Reported are the bootstrap p-values with 10000 times simulation. With the null hypothesis being: sample statistics = control group statistics. Here the control group is the one with more # of obs. Taking mean as an example, the p-value is calculated using a bootstrap procedure: we randomly draw with replacement x number of samples from short-prohibited group, where x is the total number of short-eligible samples. Then a simulated mean is calculated for these x simulated samples. This procedure is repeated 10,000 times to produce a distribution of simulated mean. The actual mean of short-eligible stocks is compared with this simulated distribution, and p-value is the ranking of the actual mean among those 10,000 simulated, divided by 10,000.

Table 6. Addition to short sale designation list

Panel A: Announcement return

	Before (b) (control group)	After (a)	Bootstrap Percentile	Prediction of (a) - (b)	Evidence
N	299	281		-	-
Mean	0.001	0.002	0.411	-	-
Median	-0.001	0.004	0.621	-	-
Stddev	0.076	0.064	0.041	-	-
Skewness	0.917	-0.025	0.008	Negative	Support
Excess Kurtosis	3.040	2.053	0.249	-	-

Panel B: Post announcement return

	Before (b) (control group)	After (a)	Bootstrap Percentile	Prediction of (a) - (b)	Evidence
N	299	281		-	-
Mean	0.117	0.019	0.000	-	-
Median	0.066	0.014	0.900	-	-
Stddev	0.324	0.264	0.011	-	-
Skewness	0.356	0.438	0.545	Positive	Weak Support
Excess Kurtosis	1.409	1.493	0.619	-	-

Reported are the bootstrap p-values with 10000 times simulation. With the null hypothesis being: sample statistics = control group statistics. Here the control group is the one before the addition event. Taking mean as an example, the p-value is calculated using a bootstrap procedure: we randomly draw with replacement x/2 number of samples from the control group, where x is the total number of observations after the event. Then a simulated mean is calculated for these x simulated samples. This procedure is repeated 10,000 times to produce a distribution of simulated mean. The actual mean after the event is compared with this simulated distribution, and p-value is the ranking of the actual mean among those 10,000 simulated, divided by 10,000.

Table 7. Removal from short sale designation list

Panel A: Announcement return

	Before (b)	After (a) (control group)	Bootstrap Percentile	Prediction of (a) - (b)	Evidence
N	131	176		-	-
Mean	-0.009	-0.018	0.794	-	-
Median	-0.006	-0.013	0.295	-	-
Stddev	0.089	0.070	0.997	-	-
Skewness	0.339	-0.581	0.957	Positive	Not support
Excess Kurtosis	1.183	2.158	0.388	-	-

Panel B: Post announcement return

	Before (b)	After (a) (control group)	Bootstrap Percentile	Prediction of (a) - (b)	Evidence
N	131	176		-	-
Mean	-0.064	-0.075	0.590	-	-
Median	-0.094	-0.055	0.104	-	-
Stddev	0.282	0.292	0.519	-	-
Skewness	1.025	-0.009	0.946	Negative	Support
Excess Kurtosis	3.317	2.292	0.814	-	-

Reported are the bootstrap p-values with 10000 times simulation. With the null hypothesis being: sample statistics = control group statistics. Here the control group is the one after the removal event. Taking mean as an example, the p-value is calculated using a bootstrap procedure: we randomly draw with replacement x/2 number of samples from the control group, where x is the total number of observations before the event. Then a simulated mean is calculated for these x simulated samples. This procedure is repeated 10,000 times to produce a distribution of simulated mean. The actual mean after the event is compared with this simulated distribution, and p-value is the ranking of the actual mean among those 10,000 simulated, divided by 10,000.