Essays on Short Selling and Margin Trading in China

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ABSTRACT

This thesis investigates the impact of regulation allowing short selling and margin trading in the Chinese equity market. The first essay examines the impact of the implementation of short selling and margin trading on March 31, 2010 and its impact on stock prices, liquidity, and volatility of pilot programme A-shares. The results suggest that prices of pilot A-shares decline relative to matched Chinese A-shares and cross-listed Hong Kong H-shares, which suggests that the effect of short selling is greater than margin buying. However, inconsistent with developed markets evidence and the perspective of Chinese regulators, this essay finds a significant decline in liquidity following the short selling and margin trading activity. A possible explanation for this result is a reluctance to invest in pilot programme A-shares by less informed investors in the presence of better informed counterparts. The second essay uses an event study approach to examine abnormal stock returns and trading volume surrounding the key short selling and margin trading programme announcement date on February 12, 2010 and its subsequent implementation on March 31, 2010 for the pilot A-shares. Regression analysis is also conducted to investigate which factors are influencing the observed abnormal returns. The event study presents evidence of negative price reaction and lower trading volume following both the announcement and implementation of short selling and margin trading for eligible stocks. The lower abnormal returns are consistent with the overvaluation hypothesis, however, the decline in trading activity is contrary to developed market evidence. Lower trading activity implies higher risk of information asymmetry existing in China. The final essay examines the effect of short selling and margin trading on efficiency, characteristics of stock return distributions, and price clustering for eligible securities during both the initial short selling and

margin trading pilot programme phase on March 31, 2010, as well as, the programme's extension to a wider group of securities on the December 5, 2011. The main findings are that there is no consistent improvement in pricing efficiency across the different measures after the introduction and subsequent expansion of short selling and margin buying. The positive skewness of abnormal returns is reduced, which is consistent with the prediction of theoretical models. We also find some evidence that price clustering on average declines for the eligible stocks.

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CHAPTER ONE

INTRODUCTION

This chapter provides an overview of the three essays contained in this thesis. In particular, it outlines the motivations and the need to study the regulation lifting short sales and margin buying constraints in the Chinese market. The chapter concludes by outlining a framework for the remainder of the thesis.

1.1 Introduction

One of the key research questions within the finance discipline is how new information is incorporated into stock prices. If a capital market is efficient, then security prices quickly adjust to the arrival of new information. Consequently, investors should not be able to earn abnormal returns. The theoretical model of Miller (1977) suggests that when short-sale constraints are in place, security prices reflect the views of optimistic investors generally and thus prices tend to be overvalued. The investors that possess negative news cannot enter the market in the presence of short-sale restrictions, and thus some of the adverse information is not incorporated in prices. The overvaluation argument has significant implications for the efficient market hypotheses, since one of the critical roles of equity markets is price discovery. In an efficient market, prices reflect all the available information (Fama, 1970). A number of studies document that short-sale constraints hinder the price discovery process.[1]

A study by Morck, Yeung and Yu (2000) suggests that the evidence from developed markets may not be generalizable to emerging markets, due to the prevalence of differences in regulatory environments and market mechanisms. Moreover, in emerging markets the investors are generally less sophisticated than developed markets. Given the aforementioned arguments, the primary focus of this thesis is to examine the impact of regulation that removes short sales and margin trading constraints on the emerging Chinese market. Specifically, this thesis aims to study the importance of short-sales introduction on the stock returns, liquidity and price behaviour of affected securities in China by using three different sets of methodology.

[1] See, for example, Chang, Cheng, and Yu (2007) and Bris, Goetzmann, and Zhu (2007).

At a time when most of the developed equity markets around the globe enforced various short-sales constraints, the state council in China approved in-principle the trial launch of securities lending and margin borrowing on January 8, 2010. Afterwards the financial regulator in China, the China Securities Regulatory Commission (CSRC) announced the launch of the much-awaited short selling and margin trading pilot programme on February 12, 2010. Under the pilot programme, which came into effect on March 31, 2010, only 90 stocks were allowed to be sold short and bought on margin. Those stocks are constituents of the Shanghai Stock Exchange 50 Index (SSE-50) and Shenzhen Stock Exchange Component Index (SZSE-40). This list was revised once in July 2010 due to changes in the composition of SSE-50 and SZSE-40 indices. Finally, on November 25, 2011, the CSRC announced the abolition of the pilot programme and a turn to normal operation by expanding the list to a further 190 stocks and 7 Exchange Traded Funds (ETFs), which came into effect on December 5, 2011. Those stocks are constituents of SSE-180 and SZSE-100 indices.

This thesis comprises three interconnected essays. The first essay investigates the introduction of the pilot short selling and margin trading programme implemented on March 31, 2010. The essay uses pre- and post-periods to examine the impact of lifting the short sales and margin trading ban on stock prices, liquidity, and volatility of pilot programme stocks relative to matched A-shares and cross-listed H-shares. Following the relaxation of short-sale restrictions, pessimist investors can enter into the market and subsequently, the stock price declines and liquidity improves. Previous studies find a decline in prices (e.g., Chang, Cheng, and Yu, 2007; Leece, Lepone, McKenzie, and Segara, 2012) and improvement in liquidity measures (e.g., Charoenrook and Daouk, 2005) following the relaxation of short-sale constraints.

The second essay in this thesis examines market reaction to the announcement on February 12, 2010 and implementation on March 31, 2010 of the pilot programme using an event study. The short selling and margin trading was launched for the first time in China, hence it is also interesting to investigate the market reaction around the announcement date. The event study allows for consideration of run-up and run-down effects of pilot programme announcement and implementation. Specifically, the essay explores the impact of China's short selling and margin trading announcement and implementation on pilot stocks abnormal returns and trading volume. Previous studies find abnormal negative returns following the relaxation of short-sale constraints (e.g., Ofek and Richardson, 2003; and Chang, Cheng and Yu, 2007). On the other hand, Chang, Cheng and Yu (2007) find no significant change in abnormal returns around the announcement of lifting of short-sales constraints; while Boulton and Braga-Alves (2010) find positive abnormal returns around the announcement of short-sales restrictions. Further, Diether, Lee, and Werner (2009) find no change in average returns around the announcement and implementation of suspending uptick and/or bid price short-sale price tests (i.e. relaxation of shorting constraints).

The final essay of this thesis examines the impact of pilot programme short selling and margin trading and its subsequent expansion on price efficiency, stock return distributions, and price clustering. Supplementing the analysis in the first two essays, a regulatory decision to remove the short selling and margin buying ban is likely to facilitate more efficient price discovery process in Chinese market. Since one of the objectives of China Securities Regulatory Commission (CSRC) to launch margin trading and securities lending is "*to integrate more information into securities prices*

and form the internal price stability mechanism." [2] Prior literature, such as Bris, Goetzmann and Zhu (2007) and Saffi and Sigurdsson (2011), documents improvement in price efficiency measures where short-selling constraints are less binding. Boehmer and Wu (2013) also find an improvement in price efficiency when there is more short sales activity. Similarly, Aitken, Brown, Buckland, Izan and Walter (1996) document reduction in price clustering through options trading and short sales that facilitate efficient price discovery. Regarding characteristics of stock return distributions, the earlier literature provided mixed evidence (e.g., Bris, Goetzmann and Zhu, 2007; Saffi and Sigurdsson, 2011).

The remainder of this chapter provides an outline for each of the three essays and underlines the important contribution that each essay makes to the existing body of knowledge. Section 1.2 presents an overview of the relative impact of short selling and margin trading on prices, liquidity, and volatility of pilot securities. Section 1.3 offers evidence of the reaction to the short selling and margin trading programme announcement and the introduction on stock returns and trading volume. Section 1.4 shows the effect of relaxation of short sales and margin buying restrictions on pricing efficiency, distributional characteristics of stock returns, and price clustering. Section 1.5 lists research outputs from this thesis. Finally, Section 1.6 summarises the structure of the remainder of the thesis.

1.2 Essay One

In March 31, 2010, the China Securities Regulatory Commission (CSRC) allowed margin buying and short selling. This change in regulation happened at a time when financial regulators around the globe were increasing short-sale restrictions to

[2] See, http://www.csrc.gov.cn/pub/csrc_en/newsfacts/release/200812/t20081229_69251.htm

counter the effects of Global Financial Crisis (GFC). The relaxation of short-sale (margin borrowing) constraints is expected to cause a decline (increase) in the price of pilot securities compared to their Chinese non-pilot stocks and cross-listed H-shares. Previous empirical research into short-sale restrictions, such as Chang, Cheng and Yu (2007) and Ofek and Richardson (2003) has consistently revealed negative abnormal returns following the lifting of short-sale constraints in a number of different international capital markets. On the other hand, reductions in short selling restrictions are expected to improve the overall liquidity in equity markets (e.g., Charoenrook and Daouk, 2005).

There are several reasons why an examination of the impact of short selling and margin borrowing in China contributes to the existing literature. Firstly, the simultaneous implementation of securities lending and margin borrowing programme offers the opportunity to assess the relative effect of each. Secondly, this is a study of the introduction of short selling and margin trading on liquidity in an emerging market. The liquidity issue has received relatively less attention in emerging markets than developed markets. Thirdly, limited evidence is available on the effect of short sales and margin trading on stock returns in emerging markets.[3]

This essay finds that relative prices of pilot A-shares decrease more than their matched non-pilot A-shares and cross-listed H-shares following the removal of short-sales and margin borrowing restrictions. The evidence is consistent with Miller's (1977) overvaluation hypothesis and implies that short selling effect is stronger than the margin buying effect. However, contrary to the developed markets literature and objectives of the Chinese financial regulators, relative liquidity in Pilot A-shares

[3] However, Lamba and Ariff (2006) find increasing returns following the removal of short selling restrictions in Malaysia.

deteriorated following the introduction of pilot programme. The decline in liquidity is consistent with Ausubel's (1990) theory that uninformed investors avoid investing in stocks with higher asymmetric information risk. The better informed investors in China may exploit the short selling and margin trading activity against their less informed counterparts. Thus uninformed investors drive away from investing in pilot A-shares for fear of losing their investments.

1.3 Essay Two

During the GFC of 2008-09, short sellers were blamed for spreading rumors and driving the stock prices down especially the financial sector stocks (e.g., Beber and Pagano, 2013). Thus policy makers in many international markets imposed short-sale constraints to revive smooth functioning of equity markets and contain the price declines. Miller's (1977) overvaluation model suggests that when short-sale restrictions are binding, the pessimistic investors with private information cannot engage in trading process. Hence, security prices generally reflect the optimist investors' opinion and deviate upward from the underlying value. In other international markets, Chang, Cheng, and Yu (2007), using the event study approach, find a significant 0.55% negative abnormal return on the implementation dates in Hong Kong. However, they find no significant price changes around the announcement of allowing short selling. Ofek and Richardson (2003) also find 33% negative returns over a six-month period following the relaxation of shorting constraints for underlying securities relative to the index in U.S.

The regulation of removing a short sales and margin borrowing ban allows pessimist investors and cash-constrained investors, who otherwise cannot trade, to invest in the pilot programme A-shares. Ofek and Richardson (2003) find increase in

trading volume immediately following the relaxation of short-sale restrictions. In addition, the short-sales constraints imposed during the GFC in developed markets result in deterioration in liquidity measures, such as, a decline in trading activity (e.g., Boehmer, Jones and Zhang, 2013; and Beber and Pagano, 2013). Therefore, the second essay investigates the impact of the announcement and implementation of the short selling and margin trading pilot programme on stock abnormal returns and volume by performing an application of the event study method. Moreover, cross-sectional regression analysis is carried out to examine which variables are associated with observed announcement and implementation abnormal returns.

This essay provides two important contributions to the existing body of knowledge. Firstly, to the researcher's knowledge, this study is the first to document the impact of both the announcement and implementation of short-sale regulation on trading volume using individual securities. Similarly, no study seems to have examined the announcement and implementation returns following the lifting of margin borrowing restrictions in emerging economies: the findings would bring about new understanding to those issues. More importantly, the evidence would suggest how trading volume might change following the announcement and implementation of pilot programme rules in an emerging market like China. Given the differences in regulatory environments and market structures, the evidence from developed markets may not be inferable to emerging markets (e.g., Morck, Yeung and Yu, 2000). Secondly, this essay appears to be the first that documents the announcement day and implementation day returns following the changes in margin borrowing regulation in the emerging Chinese market. Therefore, an investigation with a focus on an emerging market is warranted. The essay finds significant decline in abnormal returns around the announcement and implementation of pilot programme. The lower announcement returns in pilot A-shares

suggest that investors seem to be wary of impending short sales and thus prices decline following the announcement. The lower implementation returns are consistent with Miller's (1977) model that suggests short-sales constraints prevent pessimistic informed investors from trading and thus prices reflect mainly the views of optimistic investors. In addition, the lower trading activity in pilot A-shares is inconsistent with the broader literature on short selling and margin trading. But this decline in trading volume is consistent with Ausubel's (1990) model that following the announcement and launch of a pilot programme the uninformed investors are reluctant to trade in pilot A-shares against better informed counterparts for fear of capital loss.

1.4 Essay Three

The third essay investigates the effect of short selling and margin trading on price efficiency, stock returns distributions, and price clustering. In addition to the original 90 Pilot stocks, this essay also uses an additional 197 securities which were available to be short sold and margin traded on December 5, 2011 to illustrate the importance of relaxing short-sale and margin trading constraints in China.

It is well documented that there is a link between price efficiency and environments where short selling is less constrained.[4] Many financial regulators around the world are of the view that unchecked short-sale activity can destabilise prices, while some academic findings suggest otherwise (e.g., Saffi and Sigurdsson, 2011). Short-sale restrictions prevent pessimist informed investors from trading in the market and hence the prices adjust slowly. While these facts are well documented, there is still relatively little empirical research that examines the relationship between short-selling

[4] See, for example Bris, Goetzmann, and Zhu (2007); and, Saffi and Sigurdsson (2011).

and / or margin buying constraints on stock returns stability using actual short sales and margin buying data in emerging markets.[5]

This essay therefore aims to fill this gap in the current literature by examining the effect of short selling and margin borrowing on the price efficiency, characteristics of stock return distributions, and price clustering of affected securities in China.[6] Moreover, prior to short-sales introduction and its subsequent expansion, put options were non-existent in China, which suggests that adverse information could not be fully incorporated into security prices before the regulation change. On the other hand, the effect of margin borrowing might be limited, as optimist investors could invest prior to the margin borrowing introduction and expansion by borrowing against house and other assets.

The third essay finds no consistent change in different pricing efficiency measures following the lifting of short-sales constraints, which is inconsistent with the existing literature. Consistent with Xu's (2007) model, the positive skewness of abnormal returns is significantly reduced for affected securities with higher short-sales activity. Further, the price clustering behaviour observed in the Chinese equity market prior to the regulation change has also weakened in the post-period. This evidence provides some support of more informed trading in affected securities following the removal of short selling and margin borrowing restrictions.

[5] A study on Taiwanese market by Cheng, Yan, Zhao and Chang (2012) also examined the effect of relaxation of short sale constraints on pricing efficiency using actual short sales data.

[6] After completing this essay, we come across another working paper by Chang, Luo and Ren (2012) who also examine the effect of short selling and margin trading on overvaluation, price efficiency and stock return distributions in China.

1.5 Research Outputs from the Thesis

Essay One:

The first essay contained in this thesis has been accepted for publication in the following journal:

Sharif, S., Anderson, H.D., & Marshall, B.R. (2013) Against the Tide: The Commencement of Short Selling and Margin Trading in Mainland China. *Accounting & Finance – Forthcoming*.

Moreover, this essay has been presented at the following forums:

Sharif, S., Anderson, H.D., & Marshall, B.R. (2011) Against the Tide: The Commencement of Short Selling and Margin Trading in Mainland China. *24th Australasian Finance and Banking Conference*, Sydney, December 2011.

Sharif, S., Anderson, H.D., & Marshall, B.R. (2012) Against the Tide: The Commencement of Short Selling and Margin Trading in Mainland China. *16th New Zealand Finance Colloquium*, Auckland, February 2012.

Essay Two:

The part of second essay has been accepted for publication in the following journal:

Sharif, S., Anderson, H.D., & Marshall, B.R. (2013) The Announcement and Implementation Reaction to China's Margin Trading and Short Selling Pilot Programme. *International Journal of Managerial Finance – Forthcoming.*

1.6 Structure of the Thesis

The remainder of this thesis is structured as follows. The first essay which investigates the impact of short selling and margin trading regulation on prices, liquidity, and volatility of pilot stocks is presented in Chapter 2. Appendices to Chapter 2 include a) eligibility criteria for market participants to conduct short selling and margin buying activity, and b) list of pilot stocks allowed for selling short and buying on margin. The second essay that provides evidence on the reaction of short selling and margin trading programme announcement and introduction on stock returns and trading volume is presented in Chapter 3. An appendix to Chapter 3 includes event study results using market returns based on equal-weighted index to test the strength of results observed with value-weighted index returns and correlation matrix.

Chapter 4 presents the third essay which examines the impact of introduction and expansion of short sales and margin buying regulation on pricing efficiency, distributional characteristics of stock returns, and price clustering of affected securities. An appendix to Chapter 4 includes tables of robustness checks between pre- and post-period for affected A-shares minus cross-listed H-shares and correlation matrix. Chapter 5 outlines the key findings and implications of three essays along with potential areas for future research.

CHAPTER TWO

ESSAY ONE

This chapter presents the first essay which investigates the impact of the introduction of short selling and margin trading regulation on prices, liquidity, and volatility of selected pilot programme A-shares. Chan, Kot, and Yang (2010) examine the A-H premiums when short selling is prohibited for all Chinese A-shares. In contrast, this chapter examines the removal of short-sales ban and implementation of margin trading on selected pilot A-shares. If the short selling effect dominates the margin borrowing effect, then consistent with Miller's (1977) hypothesis, we would expect the A-H premium to decline in the post-period. Further, matched non-pilot Chinese stocks are also examined to further test how the change in regulation impacts the pilot stocks.

A brief overview of the effects of short-sale constraints on market quality is provided in Section 2.1 of the chapter. An overview of Chinese securities lending and margin borrowing regulation is provided in Section 2.2. This helps to build the case for the importance of relaxing short-sale restrictions in Chinese market. Section 2.3 proposes the hypotheses, while Section 2.4 outlines the data and methodology. Section 2.5 and 2.6 present the results and conclusion respectively. The essay's appendix and reference list is presented in the last sections of this thesis.

Against the Tide: The Commencement of Short Selling and Margin Trading in Mainland China

Abstract

China's recent removal of short selling and margin trading bans on selected stocks enables testing of the relative effect of margin trading and short selling. We find the prices of the shortable stocks decrease, on average, relative to peer A-shares and cross-listed H-shares, suggesting that short selling dominates margin trading effects. Contrary to the regulators' intention and recent developed market empirical evidence, liquidity declines and bid-ask spreads increase in these shortable stocks. Consistent with Ausubel (1990), together these results imply uninformed-investors avoid the shortable stocks to reduce the risk of trading with informed-investors.

Key words: Short selling, Margin trading, China, Overvaluation, Liquidity, Volatility

JEL Classification: G12, G15, G18

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2.1 Introduction

On March 31, 2010, the China Securities Regulatory Commission (CSRC) permitted margin trading and securities lending for the first time.[7] The launch of short selling in China occurred at a time when market regulators around the world were restricting short selling activities, especially on financial sector stocks.[8] This allows us to document the impact of a country 'swimming against the tide' of international regulation. We examine the effect of margin trading and short sales on relative prices, liquidity, and volatility, using data from Mainland China and Hong Kong.

We contribute to the literature in several ways.[9] Firstly, the dual introduction of short selling and margin trading allows us to assess the relative impact of each. We find the impact of allowing short sales is the stronger of the two. It seems that it is the heightened risk of trading against informed investors that is driving this result. Secondly, we document the introduction of short selling and margin trading on liquidity in an emerging market. These issues have received relatively little attention in emerging markets compared to developed markets. Emerging markets evidence may be different to that from developed markets due to factors such as weaker investor protection (e.g., Morck, Yeung, & Yu, 2000). Contrary to both the regulators' intention and evidence from developed markets, this change in regulation resulted in decreased liquidity. The decline in liquidity implies that investors avoid the stocks the regulation relates to. Thirdly, there is only limited evidence on the impact of short sales and margin trading on stock returns in emerging markets. Lee & Yoo (1993) find no relationship between

[7] See http://www.sse.com.cn/en_us/cs/about/news/en_news_20100331a.html

[8] For instance, the German financial regulator banned naked short selling of shares in its 10 most important financial institutions from May 19, 2010 to March 31, 2011.

[9] A 2010 MSCI research bulletin also considers this event from the perspective of A-H share premiums, while Wang (2011) considers informed trading around the introduction of Chinese margin trading, and Wang (2012) looks at the link between idiosyncratic risk and returns around the implementation of the Chinese regulation.

margin requirements and stock return volatility in Korea and Taiwan, while Lamba and Ariff (2006) find return increases following the relaxation of short-sale constraints in Malaysia. Fourthly, we show empirical results can be sensitive to the matching approach that is used. We use two matching procedures. The first involves matching eligible A-share (pilot programme companies) with ineligible A-share companies (referred to as the M-shares hereafter in the essay) which have similar characteristics, while the second uses the pilot programme cross-listed H-shares. We find some results only hold under one of these approaches.

We show the short selling effect dominates the margin trading effect. In the post-period, the prices of A-shares eligible for short selling and margin trading decrease more than those of non-eligible M-shares (or matched H-shares). As a consequence, the A-M (A-H) premium becomes smaller in the post-period. These results are consistent with the theoretical models of Miller (1977) and Chen, Hong, and Stein (2002) which suggest short sale restrictions tend to inflate prices. However, in contrast to these models, which imply that it is the actions of short sellers that drive prices lower, our results suggest that, consistent with Ausubel (1990), it is the risk of trading against informed investors (in this case) short sellers that lead to the price reduction. Our results are also in accordance with Chan, Kot, and Yang (2010) who show the premium of Chinese listed stocks over their dual listed Hong Kong equivalents becomes relatively larger during market declines, for stocks whose H-shares can be short sold. While the reduction in margin requirements might be expected to increase the relative prices (and premiums) of eligible A-shares, Chinese investors with positive information could already trade prior to the regulation change by borrowing with credit cards and house mortgage agreements (Tarantino, 2008).

We also explore the impact of margin trading and short selling of the eligible A-shares on the trading value ratio between A-share and M-share (H-share) trading value. On announcing the plans to launch the pilot programme, the CSRC's chief motivation is "*to enlarge the supply and demand of funds and securities and increase the trading volume, thus leading to active liquidity*".[10] This motivation is consistent with the finding of most empirical studies. Kolasinksi, Reed, and Thornock (2009) and Boehmer, Jones, and Zhang (2013), document liquidity declines in stocks which have short sale bans imposed. Moreover, margin trading papers such as Seguin (1990) and Hardouvelis and Peristiani (1992), find that lower (higher) margin requirements lead to an increase (decrease) in liquidty.

In contrast to CSRC's motivation and the prior literature we find both absolute and relative liquidity decreases for the pilot programme stocks. Liquidity in Chinese market in general declined in the period we consider, but we show additional declines in pilot stock liquidity. This is not unexpected as the asymmetric information risk increases for the 89 pilot programme stocks enabling insiders with either negative or positive insider information to exploit the asymmetric information more effectively through short selling and margin trading respectively.[11] Ausubel (1990) argues that "*if 'outsiders' expect 'insiders' to take advantage of them in trading, outsiders will reduce their investment*" (p. 1022).[12] Similarly, uninformed investors may seek to reduce their risk of losses to informed investors by only trading to meet their liquidity requirements (Admati and Pfleiderer, 1988). As the pilot programme is effective for only 89 stocks (approximately 6.7% of all A-shares) uninformed investors may be able to find

[10] CSRC news release 2008-10-05 (http://www.csrc.gov.cn/pub/csrc_en/newsfacts/release/200812/t20081229_69251.htm).
[11] The short sales and margin trading is allowed only to the constituent stocks of Shanghai 50 and Shenzhen 40 index, there are 90 pilot stocks, but Henan Shuanghui Investment & Development Co., Ltd did not trade from March 22, 2010 to November 26, 2010 and therefore is excluded from the sample.
[12] Wang (2011) suggests it is most likely that investors with an informational advantage will trade in pilot programme stocks.

appropriate substitute non-pilot stocks to invest in thereby reducing their asymmetric information risk.

Chakravarty, Sarkar, and Wu (1998) suggest insider trading is common in China. Therefore, our results point to 'outsiders' being aware of these facts and directing their trading activity away from the pilot programme stocks as a result. We also find that the frequency and level of short sales is very low. The mean pilot stock has short-sales activity on just 8% of days and, on average, short-sales activity relates to just 0.01% of volume. This indicates the decline in premium of pilot stocks is more likely due to short-sale risk rather than short-sale activity. The overall relative liquidity decline suggests the short sales and margin trading volume in pilot stocks is more than offset by a reduction in other volume.

We find some evidence that the spreads of pilot securities increase, relative to peer firms, after the introduction of margin trading and short selling. This exists in the A-H results but not the A-M results. This result contrasts with Autore, Billingsley, and Kovacs (2011), Beber and Pagano (2013), and Boehmer, Jones, and Zhang (2013), who each show that short sales bans during the global financial crisis lead to wider bid-ask spreads. However, our spread results are consistent with our trading value results. A decrease in trading value and increased spreads both point to a decrease in overall liquidity for the pilot stocks following the introduction of short selling and margin trading.

Previous literature has not formed a consensus on the relation between short selling and / or margin trading and volatility. Scheinkman and Xiong (2003) suggest short-sale constraints may result in increased price volatility. However, Chang, Cheng, and Yu (2007) find higher volatility in individual stocks when short selling is practiced.

Seguin (1990) finds a decrease in volatility when margin trading is allowed, but Hardouvelis and Peristiani (1992) find lower volatility in stocks when margin requirements are increased. Our volatility results are also inconsistent. We find a decrease in volatility after the initiation of short sales and margin trading when firms are matched with M counterparts and an increase in volatility when firms are matched with H counterparts during the down market.

From a public policy perspective, our findings suggest that the introduction of margin trading and short selling aids in the price discovery process. However, the regulation change does not boost the liquidity of the pilot programme securities, as anticipated by the regulators.

The rest of this paper is organised as follows: Section 2.2 contains background on short sales and margin trading regulation in China. Our hypotheses are motivated and stated in Section 2.3. The Data and Methodology are outlined in Section 2.4, while the results are discussed in Section 2.5 and Section 2.6 concludes the paper.

2.2 Chinese Margin Trading and Short Sales Regulation

The purpose of introducing the pilot programme of margin trading and short sales by the China Securities Regulatory Commission (CSRC) is: "*to integrate more information into securities prices. So investors can conduct securities lending or margin trading when the stock price is high or low, thus forming more proper stock prices*."[13] The change of regulation to allow margin trading and short selling was discussed by the CSRC as early as 2006 (Bryan, TieCheng, and Phua, 2010). In October 2008 the CSRC announced that there would soon be a margin trading and securities lending trial.

[13] See http://www.csrc.gov.cn/pub/csrc_en/newsfacts/release/200812/t20081229_69251.htm

However, it was not until January 8, 2010 that China's State Council gave the "in principle" approval to introduce margin trading and security lending on a trial basis (Bryan, TieCheng, and Phua, 2010). Then on February 12, 2010, the CSRC announced the first details of the stocks that would be part of a pilot programme for margin trading and short selling operations (Bryan, TieCheng, and Phua, 2010). Under the programme, CSRC approved 90 blue-chip securities for margin trading and securities lending including 50 from the Shanghai Stock Exchange (SSE) and 40 from the Shenzhen Stock Exchange (SZSE). The pilot programme was formally launched on March 31, 2010 (Bryan, TieCheng, and Phua, 2010). The Implementation Rules are given in Appendix-A.1 and the list of 90 stocks targeted for margin trading and short selling is reported in Appendix-A.2.

2.3 Hypotheses Development

The first hypothesis relates to the effect of short selling and margin trading on the prices of stocks in the pilot programme relative to the price of peer stocks listed in China and cross-listed stocks in Hong Kong. We measure the A-M (A-H) "premium" as the difference of A- and M-share (H-share) prices, and then divide by the A-share price. It is well documented that Chinese-listed firms trade at a premium to their Hong Kong-listed equivalents (e.g. Chan, Kot, and Yang, 2010). The A-H premium is therefore expected to be positive. For the sake of consistency we refer to the difference between A and M prices (relative to the A price) as a "premium". However, since the M companies are simply Chinese-listed firms with similar characteristics to their A company counterparts this "premium" may be negative. This does not affect our analysis as we are focused on the change in premium following the regulation and the

hypothesised direction of the change should be the same in both the A-M and A-H samples.

The introduction of short sales is expected to result in a decrease in the price of pilot companies relative to their peers. The theoretical models of Miller (1977) and Chen, Hong, and Stein (2002) show short sale constraints results in overvaluation as pessimistic investors are prevented from entering the market. The empirical work of Jones and Lamont (2002), and Ofek and Richardson (2003), Chang, Cheng, and Yu (2007), and Chan, Kot, and Yang (2010) also finds that short sale constraints lead to higher relative prices. Hence, removing these constraints (i.e. allowing short sales) on pilot stocks should be expected to result in a decrease in their price relative to peer firms.

Conversely, allowing margin trading permits cash-constrained investors with a positive view on a stock price to trade. This implies the price of pilot firms should be higher, relative to their peers, following the regulation change. Largay (1973) and Hardouvelis and Peristiani (1992) both find the margin size requirement is negatively related to price movements. In the case of China, margin requirements on pilot stocks declined from 100% to a lesser amount so the relative price response of pilot firms should be positive.[14] However, the margin buying effect on pilot stock prices may be limited in case of China, as the optimistic investors can invest in shares by borrowing against house and other assets before the implementation (Tarantino, 2008). Based on the literature discussed above, our two hypotheses are:

Hypothesis 1A: *The A-M and A-H premium is lower when short selling is allowed.*

Hypothesis 1B: *The A-M and A-H premium is higher when margin trading is allowed.*

[14] Refer to Attachment 2 for margin on http://www.sse.com.cn/en_us/cs/about/news/en_news_20100212a.pdf

The theoretical model of Harrison and Kreps (1978) suggests that short-sale restrictions prevents private information of informed traders who are pessimistic and do not own securities from feeding into prices. Charoenrook and Daouk (2005) provide empirical support for this theory. They show markets that permit short selling have relatively greater liquidity in down markets than up markets. Moreover, Chan, Kot, and Yang (2010) find a higher relative volume in H-shares (where short sales are allowed) compared to A-shares (where short sales are banned in their sample) in declining markets. Recent papers by Kolasinksi, Reed, and Thornock (2009), Boehmer, Jones, and Zhang (2013), and Gagnon and Witmer (2010) also find liquidity declines in stocks which have short-sale bans imposed. These findings reveal that when short selling is practiced, more investors are able to enter the market. Moreover, margin trading papers including Seguin (1990) and Hardouvelis and Peristiani (1992), find that decreases (increases) in margin requirements lead to an increase (decrease) in liquidty. Given the above literature based on the evidence of developed markets our second hypothesis is:

Hypothesis 2: The eligible A-shares proportion of trading value increases when margin trading and short selling is allowed.

However, empirical results from emerging markets may vary from their developed market equivalents (e.g., Morck, Yeung, & Yu, 2000). Following the implementation of pilot programme less informed investors are likely to be reluctant to invest in pilot stocks if, as suggested by Asubel (1990), they believe there is more chance of trading against informed investors. The regulators in China set high entry requirements for investors to participate in pilot margin trading and short selling (Wang, 2011). This suggests it is likely that it is mostly better informed institutional investors who short sell and margin trade. The risks to uninformed investors are exacerbated by the well-documented insider trading and investor protection issues in China (e.g.,

Chakravarty, Sarkar, and Wu, 1998). Given the above, it is possible that, consistent with the findings of Ausubel (1990), liquidity declines in pilot programme stocks.

Our third hypothesis deals with bid-ask spreads. The evidence pointing to an increase in liquidity following the introduction of short selling and margin trading implies that spreads should decrease following this regulation change. However, permitting short sales allows those with negative private information to trade on this information. Similarly, informed investors with a positive outlook can better exploit this when margin trading is permitted (e.g. Alexander, Ors, Peterson, and Seguin, 2004). The regulation change could therefore be expected to discourage trading by uninformed investors in the pilot programme stocks as argued by Ausubel (1990) and Admati and Pfleiderer (1988). These two effects point to spreads moving in the opposite direction. However, based on the recent findings of Beber and Pagano (2013) and Boehmer, Jones, and Zhang (2013) that short sales bans lead to wider spreads, we hypothesise that allowing short sales and margin trading will lead to a narrower spread. Our third hypothesis therefore is:

Hypothesis 3: The A-M and A-H relative bid-ask spread differentials decrease when margin trading and short selling is allowed.

There is no consensus in the literature on the relation between short selling and / or margin trading and volatility. Scheinkman and Xiong (2003), propose return volaility increases when short-sale constraints are binding. Similarly, during the U.S. short-sales restriction volatility increases (e.g., Boehmer, Jones, and Zhang, 2013; Kolasinksi, Reed, and Thornock, 2009). However, Chang, Cheng, and Yu (2007) find volatility is higher for individual stocks when short selling is practiced. Hardouvelis and Peristiani (1992) find that increases in margin requirements lead to lower volatility, while

Seguin (1990) finds decreases in margin requirements (by removing the ban on margin trading) leads to a decrease in volatility. Due to the conflicting empirical evidence on the direction of volatility in the short sales and margin trading literature, we do not form a prior opinion on the direction of volatility for the emerging market of China. As such our null hypothesis is as follows:

Hypothesis 4: There is no change to the A-M and A-H relative volatility differential when margin trading and short selling is allowed.

2.4 Data and Methodology

Our study covers the period from October 1, 2009 through June 30, 2010. This is split into a three-month pre period of October 1 – December 31 and a three-month post period of March 31 – June 30.[15] We decided against using the 3 month pre-period of January 1 to March 30, 2010 due to the announcement of the launch of pilot programme and the 90 pilot stocks on February 12, 2010. In order to avoid this contaminating announcement we take three month period prior to this as our pre-period. After removing one stock that didn't trade during the implementation period, the final sample of 89 pilot stocks were part of the margin trading and short selling pilot programme. Fifty are listed on the Shanghai Stock Exchange (SSE) and 39 are listed on the Shenzhen Stock Exchange (SZSE). Data on closing stock prices, trading volume, bid-ask spread, high-low volatility, market capitalization, and number of shares outstanding at daily level for A-shares and H-shares are obtained from Thomson Reuters Datastream. The stock market index, including SSE A-share Index and currency exchange rate between Chinese RMB and Hong Kong Dollar are also obtained from

[15] The ending date of June 30, 2010 is appropriate, as regulators changed eligibility requirements of brokerage firms and there were 5 additions and deletions to the pilot stocks effective from July 1, 2010.

Thomson Reuters Datastream. Further, we obtain the daily short selling and margin trading data from Chinese Securities Market and Accounting Research (CSMAR).

As mentioned in the introduction, we match the 89 pilot programme firms to peer companies using two distinct approaches. The first match is to peer Chinese-listed A-shares. One of the advantages of studying the launch of the pilot programme is that a relatively small number of blue-chip stocks are included in the pilot programme leaving a large number of stocks with similar characteristics to match with. The first matching procedure employed here is similar to the approach applied by Boulton and Braga-Alves (2010). We first require matched candidates to belong to the same industry. For all SSE- and SZSE-listed firms that meet the industry requirement, we calculate the mean market value of equity, closing stock price, volatility of daily returns, and daily turnover between October 1, 2008 and September 30, 2009. The match for each pilot programme stock is determined by finding the peer firm that minimises the following equation:

$$Distance = \Sigma_i \left| (factor_i^{eligible} - factor_i^{matched}) / [\frac{(factor_i^{eligible} + factor_i^{matched})}{2}] \right| \quad (1)$$

where the factor refers to the mean market value of equity, closing stock price, volatility of daily returns, and daily turnover between October 1, 2008 and September 30, 2009. Eligible (matched) firms are those in (not in) the pilot programme. Matches are performed without replacement, resulting in a unique combination for each eligible firm.[16] The difference between the means of pilot and matched sample factors is insignificantly different from zero except market value which is significantly different at 1% level. All data for the matching procedure is obtained from Thomson Reuters Datastream.

[16] We also matched firms with replacement and the results are qualitatively similar.

The second matching procedure involves sourcing data for the Hong Kong-listed share of each of the 89 pilot programme stocks. Using data from the website of Hong Kong Stock Exchange (HKEx), we find 26 of the 89 companies have shares listed in Hong Kong. The matching procedures each have their strengths and weaknesses. The first matching procedure has the advantage of using firms trading on the same exchange, however the disadvantage is that it is not always possible to find a matched firm of a similar size.[17] The second matching procedure uses prices of the same company, however, the exchange is different. These two approaches therefore complement each other.

We investigate whether the regulation resulted in changes in four variables. We calculate each variable each day using both M and H control firms, but all formulae below are based on M shares. To calculate Premium between A- and H-stocks, we converted HKG dollar H-stock prices to Chinese RMB. Following Chan, Kot, and Yang (2010), Premium is calculated as:

$$Premium\ (A-M) = \frac{Price_A - Price_M}{Price_A} \tag{2}$$

Following the methodology of Gagnon and Witmer (2010), we construct the A-M value ratio as:

$$Value\_Ratio = \frac{RMB\ Volume_A}{RMB\ Volume_A + RMB\ Volume_M} \tag{3}$$

[17] It is worth noting that the pilot sample consists of firms that are typically larger than those they are matched to. These are likely to be less susceptible to general negative market sentiment than small firms (e.g., Reinganum, 1981) which, if anything, bias our results away from the decline in A-M premium we document.

In accordance with Boulton and Braga-Alves (2010) the difference in spread is calculated as:[18]

$$Spread\_Diff_{i,t} = \log\left(\frac{Ask_A - Bid_A}{\frac{Ask_A + Bid_A}{2}}\right) - \log\left(\frac{Ask_M - Bid_M}{\frac{Ask_M + Bid_M}{2}}\right) \quad (4)$$

We follow Helmes, Henker, and Henker (2010) and calculate the volatility difference as:[19]

$$Volatility\_Diff_{i,t} = \log\left(\frac{High_A - Low_A}{\frac{High_A + Low_A}{2}}\right) - \log\left(\frac{High_M - Low_M}{\frac{High_M + Low_M}{2}}\right) \quad (5)$$

2.5 Empirical Results

2.5.1 Univariate Analysis

In Table 2.1, we present the mean and median levels for each of our variables of interest in the three-month pre- and post-periods. All analysis is carried out for the sample of 89 pilot firms and 89 matched equivalent companies listed in China (M-shares) and for 26 of the pilot firms which can be matched with their Hong Kong-listed shares data. We calculate changes for pilot firms in Panels A and D and their matched peer firms in Panels B and E, but the most insightful results are in Panels C and F. This contain changes in the differences between pilot and peer firms.

Panels C and F show the mean A-stock premium declines after the regulation allowing short sales and margin trading is introduced. This falls by 6.1% and 8.8% compared to matched M and H shares respectively. Both these declines are statistically significant at the 1% level. The other four panels show that prices of Chinese stocks

[18] The log function in spread differential and volatility differential depict the natural logarithm (i.e. logarithm with base e). Also the control variables used in multivariate regressions with log are transformed with the natural logarithm.

[19] The authors calculated the difference in range based high-low volatility, whereas we computed the difference in relative high-low volatility measure between the pilot stock and its match.

declined on average in the post period compared to the pre period, but the pilot stock prices declined by more than their matched peers. Short-selling can be expected to drive prices lower, while margin trading is likely to have a positive impact on prices. The premium results therefore indicate the short selling effect is the stronger of the two and provide support for Hypothesis 1A.

The value ratios, as shown in Panels C and F, also decline in the post period. This indicates the RMB value (volume) of trading in pilot programme stocks declined relative to M and H share value following the regulation. The other panels show the value of trades in A, M, and H shares was lower in the period following the introduction of the regulation, but, as indicated in Panels C and F, the decline was proportionally larger in A shares. This result runs counter to our hypothesis 2. Like the regulators who introduced the regulation, we expected both margin trading and short selling to result in an increase in liquidity. Our finding is, however, consistent with the proposition of Ausubel (1990). He suggests uninformed investors may decide not to trade if they are concerned they will be trading with an investor with superior information. Allowing short selling and margin trading give informed investors more opportunity to exploit their informational advantage so it is possible this scares less well informed investors away.

The bid-ask spread of A shares relative to M shares does not change following the regulation. However, the A-H spread differential increases. This runs contrary to our hypothesis 3 that spreads would decrease due to an increase in liquidity, but it is consistent with our trading value results. The decline in trading value and an increase in spreads both suggest a decrease in overall liquidity. The volatility results are inconclusive. A-share volatility decreases relative to M-share volatility after the

Table 2.1: Univariate Results

This table reports the mean and median of several variables and their differences. In Panel A the mean and median of each variable is measured for affected sample from October 1, 2009 through December 31, 2009 (before the launch of margin trading and short-sale pilot programme in Mainland China i.e. Pre-period) and from March 31, 2010 through June 30, 2010 (after the launch of short-sale and margin trading pilot programme in Mainland China i.e. Post-period) along with difference in means, medians, and their p-values. In Panel B the means and medians of each variable is measured for all matched A-stocks not included in the pilot programme. Panel C is the difference between affected and matched sample. In Panel D the mean and median of each variable is measured for affected A-shares from October 1, 2009 through December 31, 2009 (i.e. Pre-period) and from March 31, 2010 through June 30, 2010 (i.e. Post-period) along with difference in means, medians, and their p-values. In Panel E the means and medians of each variable is measured for cross-listed H-shares. Panel F reports the difference between A- and H-shares.

	Mean				*Median*			
	Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
Panel A: Affected Sample (N=89)								
Price_A	21.0969	18.0773	-3.0196	0.0001	15.6200	12.9100	-2.7100	0.0001
Value_A	717.9164	395.6796	-322.2370	0.0001	519.2247	287.4420	-231.7827	0.0001
Spread_A	-7.2682	-7.0879	0.1803	0.0001	-7.2651	-7.0947	0.1704	0.0001
Volatility_A	-3.4774	-3.4727	0.0047	0.6095	-3.4916	-3.4666	0.0251	0.1696
Panel B: Matched Sample (N=89)								
Price_M	18.2824	16.4327	-1.8497	0.0001	16.3900	13.3600	-3.0300	0.0001
Value_M	227.2960	147.1536	-80.1424	0.0001	173.0580	96.3359	-76.7221	0.0001
Spread_M	-7.1675	-7.0112	0.1563	0.0001	-7.2503	-7.0566	0.1937	0.0001
Volatility_M	-3.4074	-3.3481	0.0593	0.0001	-3.4237	-3.3313	0.0924	0.0001
Panel C: Affected - Matched Sample								
Premium	-0.0441	-0.1051	-0.0610	0.0001	-0.0174	-0.0065	0.0109	0.0250
Value_Ratio	0.7296	0.7031	-0.0265	0.0001	0.7449	0.7208	-0.0241	0.0001
Spread_Diff	-0.1087	-0.0923	0.0164	0.2462	-0.0276	-0.0331	-0.0055	0.2947
Volatility_Diff	-0.0721	-0.1275	-0.0553	0.0001	-0.0660	-0.1380	-0.0721	0.0001

Table 2.1 (Continued)

Panel D: Affected Sample - A shares (N=26)								
	Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
Price_A	17.7233	15.1802	-2.5431	0.0001	12.8350	9.7900	-3.0450	0.0001
Value_A	783.2905	426.8246	-356.4660	0.0001	593.6255	308.5567	-285.0688	0.0001
Spread_A	-7.0603	-6.8993	0.1610	0.0001	-6.9546	-6.8007	0.1539	0.0001
Volatility_A	-3.5782	-3.6003	-0.0221	0.2020	-3.6054	-3.6063	-0.0008	0.2890
Panel E: Matched Sample - H shares (N=26)								
Price_H	14.7497	13.9415	-0.8082	0.1365	8.1505	7.4461	-0.7044	0.0029
Value_H	575.6409	501.3429	-74.2980	0.0027	308.5068	274.7565	-33.7503	0.0583
Spread_H	-6.1821	-6.1644	0.0178	0.4155	-6.2719	-6.3395	-0.0675	0.2739
Volatility_H	-3.6022	-3.6038	-0.0017	0.9209	-3.6095	-3.6092	0.0003	0.8785
Panel F: Affected - Matched Sample								
Premium	0.1971	0.1090	-0.0882	0.0001	0.1102	0.0320	-0.0782	0.0001
Value_Ratio	0.6377	0.5282	-0.1095	0.0001	0.6935	0.5545	-0.1390	0.0001
Spread_Diff	-0.8722	-0.7341	0.1382	0.0001	-0.7552	-0.5785	0.1766	0.0001
Volatility_Diff	0.0316	0.0043	-0.0272	0.1528	0.0417	0.0138	-0.0279	0.2621

regulation but does not change relative to H-share volatility. This inconclusive result is consistent with prior literature and hypothesis 4.

2.5.2 Short Sales and Margin Trading Activity Summary Statistics

We present statistics relating to the level and frequency of short sales and margin trading activity in Table 2.2. The Short-Sales (Margin-Trading) Ratio is the ratio of short sales (margin trading) to total volume. This is calculated each day for each stock. A time series average is then computed for each stock and summary statistics are based on the stock average numbers. The proportions relate to the fraction of days there is short sales or margin trading activity respectively in each stock. Again, statistics are based on the stock numbers.

The Table 2.2 results indicate short sales and margin trades only account for a small fraction of the volume traded in each pilot stock in the three-month period following the regulation change. Short sales contribute just 0.01% of the total volume for the average stock. Margin trades contribute just 0.2% on average. This lack of activity is reasonably consistent across stocks. The stock with the most short sales (margin trading) activity has just 0.19% (0.84%) of volume driven by this activity. The proportion of days with short sales activity is just 7.9% for the average stock. The equivalent number is considerably higher for margin trading (66.3%), which indicates a reasonably high frequency. Figure 2.1 shows the proportion of average daily volume that relates to short sales and margin trading in the three-month period following the regulation change. While, margin trading activities shows growth over the period, short sales do not and clearly the trades are small and relatively inconsequential when compared to total volume.

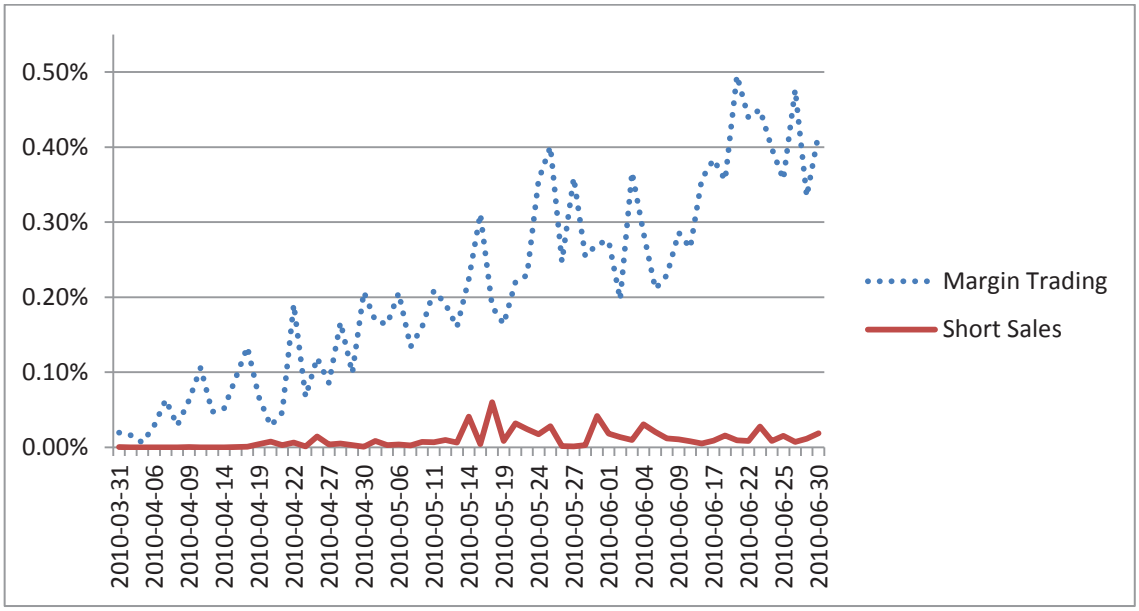
Table 2.2: Short Sale and Margin Trading Activity Summary Statistics

These statistics relate to the stocks that were allowed to be sold short and traded on margin between March 31, 2010 and June 30, 2010. The short sale (margin trading) ratio relate to the short sale (margin trading) volume divided by total volume. This time series average is calculated for each stock and cross-sectional statistics are then calculated. The short sale (margin trading) proportion is the proportion of days when there is short sales (margin trading) activity. Statistics are calculated across all stocks.

Variable	Mean	Median	Minimum	Maximum	Std. Deviation
Short Sale Ratio	0.0001	0.0000	0.0000	0.0019	0.0003
Margin Trading Ratio	0.0021	0.0018	0.0003	0.0084	0.0014
Short Sale Proportion	0.0794	0.0000	0.0000	0.8305	0.1563
Margin Trading Proportion	0.6629	0.6833	0.2333	0.9322	0.1659

Figure 2.1: Daily Short Sale and Margin Trading Activity

This figure shows the average proportion of daily volume that relates to short sales and margin trading for the 89 pilot stocks for each day from March 31, 2010 through June 30, 2010. Each day for each stock we calculate the short sale (margin trading) volume divided by total volume. We then calculate the daily cross-sectional average.



These results clearly indicate that the decline in premium in Table 2.1 is not due to the short sellers driving prices down. Rather, it appears to be a result of market

participants being concerned about the potential for short sellers to drive prices lower. This concern appears to manifest itself in investors reducing their trading in pilot stocks, which combined with the increased asymmetric information risk results in an increase in spreads. We address these issues in the next section on multivariate analysis.

2.5.3 Multivariate Analysis

A multivariate fixed effect panel regression framework is employed to test whether the introduction of margin purchases and securities lending has any effect on eligible A-shares in mainland China.

2.5.3.1 Premium

To test hypothesis 1, we estimate a number of regression models to examine how the premium changes between eligible A-shares and non-eligible M-shares (i.e. changes in A-M premium) and also between a subsample of A-shares and shortable H-shares (i.e. changes in A-H premium) from pre-period to post-period. To control for fixed effects and autocorrelations of the residuals, we estimate Equations (6a) and (6b) using ordinary least squares regression and adjust the t-values by Rogers standard errors clustered at the firm level. The regression models are as follows:

$$Premium_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_MKT_{i,t}^{A} + ControlVariables + \varepsilon_{i,t} \quad (6a)$$

$$Premium_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_RET_{i,t}^{A} + ControlVariables + \varepsilon_{i,t} \quad (6b)$$

where the dependent variable is A-M (or A-H) share premium. *Post_period*$_t$ is a dummy variable that is set to one for the period from March 31, 2010 to June 30, 2010, when

margin trading and short selling is permitted for the 90 pilot stocks and zero otherwise. Following Chan, Kot, and Yang (2010) we run the regression with two different interaction dummy variables to represent declining markets. *Post_period*Dummy_MKT*^{A} is an interaction dummy variable set to one on days the market declines during the post-period and zero otherwise. *Post_period*Dummy_RET*^{A} is an interaction dummy variable set to one, on days the pilot programme stock declines during the post-period and zero otherwise. These dummy variables are particularly appropriate given the results in Section 2.5.2. Days when the market is declining are likely to be those days when there is heightened concern about the risk of trading against short sellers. We follow Chan, Kot, and Yang (2010) and include spread and volatility control variables. The results are presented in Panels A and B of Table 2.3.

The main result of the regression analysis is that the A-M (A-H) premium is negatively related to the post-period dummy and the interaction term as shown in Model (1)A, (1)B, and (1)C of Panels A and B. This is consistent with our hypothesis 1A that the premium becomes smaller when short selling is allowed in China. Further, this effect of smaller premiums is more pronounced on days when the Chinese stock markets decline. The evidence also suggests that the effect of short sellers dominates the Chinese market as compared to margin purchasers during the period examined.

The results of some control variables are inconsistent with expectations. For example, in Model (1)E of Panel A, the evidence indicates the A-M premium is negatively associated with M-share volatility, suggesting that an increase in M-share volatility is accompanied by an increase in M-share prices and, thus, a decline in the A-M premium. Furthermore, in Model (1)E of Panel B, only one estimation model with control variables has significant and consistent results with what we expected. That is, the A-H premium is positively associated with H-share volatility, suggesting that an

increase in H-share volatility is accompanied by a decrease in H-share prices and, thus, the A-H premium increases.

2.5.3.2 Trading Value Ratio

We test hypothesis 2 that A-M (A-H) value ratio is higher for those A shares allowed for margin trading and short selling than for those ineligible in China i.e. matched M shares and shortable H shares in Hong Kong.[20] We estimate regression models similar to equations (6a) and (6b), except that the dependent variable is $Value\_Ratio_{i,t}$.

The results are presented in Panels A and B of Table 2.4. The key variable of interest is the post-period and the interaction term. Similar to our univariate results, we find evidence contrary to our hypothesis 2; the coefficient on the post-period dummy and the interaction term is significantly negative in Model (1)A and (1)B of Panels A and B. This means that A-share trading value declined relative to M-share (H-share) following the introduction of the pilot programme. Similarly, when the A-share market goes down, for the group of affected A-share stocks, there is a decline of A-share trading value relative to M-share (H-share) trading value. Our results are inconsistent with the literature that documents liquidity increases when short sale constraints and margin requirements are reduced. However, the evidence is consistent with the model of Ausubel (1990) as uninformed investors reduce their exposure to the increased asymmetric information risk by reducing trading activity or simply avoiding the 89 pilot stocks.

Unlike the regression results in Panels A and B of Table 2.3, where $Premium_{i,t}$ is used as the dependent variable, the coefficients associated with the control variables in

[20] For A-H value ratio the M-share RMB volume is replaced with H-share dollar volume.

Table 2.3: Premium Regressions

Panel A (B) reports the results of fixed-effects panel regressions for the 89 (26) pilot and M (H) matched stocks. The dependent variable is premium, which is calculated for each stock as (pilot stock price – matched stock price) / pilot stock price. The sample period is from October 1, 2009 to June 30, 2010. *Post_period* is a dummy variable that is equal to one for the period from March 31, 2010 to June 30, 2010 and zero otherwise. *Post_period*Down_dummy* is an interaction dummy variable set to one, when the return of A-share market (MKT^A) in Models 1 and individual pilot A-share (RET^A) in Models 2 is less than 0 during the post-period and zero otherwise.

$$Premium_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_MKT_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

$$Premium_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_RET_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

The t-value is adjusted by the Rogers standard error clustered by firm. *, **, *** indicate significant at 10%, 5%, and 1% level, respectively.

Panel A: China Match	**SSE A-share Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	-0.0610**		-0.0584**	-0.0067	-0.0564**		-0.0528**	-0.0050	-0.0501*
	(-2.25)		(-2.22)	(-0.27)	(-2.17)		(-1.96)	(-0.20)	(-1.88)
*Post_period*Down_dummy*		-0.0461**	-0.0043**	0.0053	-0.0060	-0.0512**	-0.0152	0.0026	-0.0184
		(-2.29)	(-2.04)	(1.14)	(-1.14)	(-2.36)	(-1.12)	(0.27)	(-1.33)
Relative Bid-Ask Spread (A-share)				-0.2794***				-0.2794***	
				(-5.38)				(-5.38)	
Relative Bid-Ask Spread (M-share)					0.0651				0.0655
					(1.40)				(1.41)
Relative Price Volatility (A-share)				-0.0196				-0.0195	
				(-0.53)				(-0.53)	
Relative Price Volatility (M-share)					-0.1410***				-0.1411***
					(-3.17)				(3.18)
Intercept	-0.0441	-0.0608	-0.0441	-2.1461***	-0.0555	-0.0608	-0.0441	-2.1458***	-0.0536
	(-1.06)	(-1.40)	(-1.06)	(-5.15)	(-0.17)	(-1.39)	(-1.06)	(-5.15)	(-0.16)
Observations	10890	10890	10890	9851	10249	10890	10890	9851	10249
R-Squared	0.0044	0.0021	0.0044	0.1698	0.0369	0.0025	0.0045	0.1698	0.0370

Table 2.3 (Continued)

Panel B: Hong Kong Match	**SSE A-share Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	-0.0885***		-0.0840***	-0.0840***	-0.0862***		-0.0940***	-0.0928***	-0.0941***
	(-5.96)		(-5.70)	(-4.35)	(-5.83)		(-5.03)	(-4.48)	(-5.15)
*Post_period*Down_dummy*		-0.0678***	-0.0071***	-0.0063*	-0.0048	-0.0550***	0.0096	0.0082	0.0084
		(-6.48)	(-5.77)	(-1.92)	(-1.40)	(-4.42)	(0.60)	(0.52)	(0.59)
Relative Bid-Ask Spread (A-share)				0.0217				0.0215	
				(0.41)				(0.41)	
Relative Bid-Ask Spread (H-share)					0.0793				0.0792
					(1.59)				(1.58)
Relative Price Volatility (A-share)				0.1001**				0.1002**	
				(2.08)				(2.09)	
Relative Price Volatility (H-share)					0.0706*				0.0708*
					(1.77)				(1.78)
Intercept	0.1975***	0.1742***	0.1975***	0.7106	0.9422**	0.1681***	0.1975***	0.7099	0.9423**
	(4.04)	(3.53)	(4.04)	(1.61)	(2.42)	(3.37)	(4.04)	(1.60)	(2.42)
Observations	2931	2931	2931	2828	2926	2931	2931	2828	2926
R-Squared	0.0295	0.0153	0.0296	0.0623	0.0860	0.0095	0.0296	0.0624	0.0861

Panel A and B of Table 2.4 are highly significant. We find that the $Value\_Ratio_{i,t}$ is positively related to M-share (H-share) bid-ask spread, and positively (negatively) related to A-share (M-share) volatility.

We also estimate the regression model using individual stock returns rather than market returns to form a dummy variable for declining returns. These results, which are reported in the last four columns of Panels A and B in Table 2.4 are qualitatively similar to those reported for the A-share index market return. Again, the evidence is inconsistent with hypothesis 2, with the coefficient on the post-period dummy and the interaction term being significantly negative in Model (2)B, (2)C, (2)D, and (2)E in Panels A and B of Table 2.4 respectively. This suggests that when the A-share price of an individual stock goes down, there is a decline of A-share trading value relative to the M-share (H-share) trading value. Finally, the coefficients of the relative volatility and relative spread in Model (2)D and (2)E are similar to those in Model (1)D and (1)E in Table 2.4.

2.5.3.3 Relative Bid-Ask Spread Differential

We test hypothesis 3 that the A-M (A-H) relative spread differential $Spread\_Diff_{i,t}$ is lower for those A shares allowed for margin trading and short selling than for those ineligible in China i.e. matched M shares and shortable H shares in Hong Kong. We estimate regression models similar to equations (6a) and (6b), except that the dependent variable here is $Spread\_Diff_{i,t}$.

The results presented in Panels A and B of Table 2.5 are inconsistent with our hypothesis 3 of a decline in the A-M (A-H) spread differential following the change in regulation. The A-H results (Panel B) show a clear pattern of an increase in relative spreads following the change in regulation. This is evident in Models (1)A, (1)C, (1)D,

Table 2.4: Value Ratio Regressions

Panel A (B) reports the results of fixed-effects panel regressions for the 89 (26) pilot and M (H) matched stocks. The dependent variable is Value_Ratio, which is computed for each stock as pilot stock value / (pilot stock value + matched stock value). The sample period is from October 1, 2009 to June 30, 2010. *Post_period* is a dummy variable that is equal to one for the period from March 31, 2010 to June 30, 2010 and zero otherwise. *Post_period*Down_dummy* is an interaction dummy variable set to one, when the return of A-share market (MKT^A) in Models 1 and individual pilot A-share (RET^A) in Models 2 is less than 0 during the post-period and zero otherwise.

$$Value\_Ratio_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_MKT_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

$$Value\_Ratio_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_RET_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

The t-value is adjusted by the Rogers standard error clustered by firm. *, **, *** indicate significant at 10%, 5%, and 1% level, respectively.

Panel A: China Match	**SSE A-Share Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	-0.0265**		-0.0252**	-0.0233**	-0.0238**		-0.0207*	-0.0193*	-0.0180*
	(-2.33)		(-2.25)	(-1.99)	(-2.16)		(-1.85)	(-1.67)	(-1.68)
*Post_period*Down_dummy*		-0.0203**	-0.0022	-0.0031	-0.0066**	-0.0247***	-0.0102**	-0.0103*	-0.0172***
		(-2.36)	(-0.77)	(-0.93)	(-2.02)	(-2.76)	(-2.13)	(-1.93)	(-3.65)
Relative Bid-Ask Spread (A-share)				-0.0012				-0.0010	
				(-0.07)				(-0.06)	
Relative Bid-Ask Spread (M-share)					0.0364**				0.0367**
					(2.24)				(2.25)
Relative Price Volatility (A-share)				0.0230**				0.0228**	
				(1.97)				(1.96)	
Relative Price Volatility (M-share)					-0.0470***				-0.0472***
					(-4.70)				(-4.71)
Intercept	0.7296***	0.7225***	0.7296***	0.7999***	0.8298***	0.7233***	0.7296***	0.8005***	0.8310***
	(57.18)	(54.56)	(57.18)	(6.14)	(6.99)	(54.65)	(57.18)	(6.14)	(7.02)
Observations	10298	10298	10298	9647	9905	10298	10298	9647	9905
R-Squared	0.0003	0.0030	0.0060	0.0097	0.0461	0.0042	0.0065	0.0101	0.0472

Table 2.4 (Continued)

Panel B: Hong Kong Match	**SSE A-Share Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	-0.1095***		-0.1035***	-0.0966***	-0.1053***		-0.0898***	-0.0874***	-0.0908***
	(-5.43)		(-5.09)	(-4.79)	(-5.17)		(-4.38)	(-4.48)	(-4.55)
*Post_period*Down_dummy*		-0.0844***	-0.0093**	-0.0089**	-0.0088*	-0.0963***	-0.0335**	-0.0255*	-0.0342**
		(-5.52)	(-2.37)	(-2.56)	(-1.87)	(-5.28)	(-2.25)	(-1.81)	(-2.51)
Relative Bid-Ask Spread (A-share)				-0.0253				-0.0251	
				(-0.54)				(-0.53)	
Relative Bid-Ask Spread (H-share)					0.0780**				0.0780**
					(2.52)				(2.52)
Relative Price Volatility (A-share)				0.1523***				0.1517***	
				(4.37)				(4.34)	
Relative Price Volatility (H-share)					0.0534				0.0536
					(1.40)				(1.40)
Intercept	0.6377***	0.6092***	0.6377***	1.0010***	1.3124***	0.6106***	0.6377***	1.0008***	1.3133***
	(16.19)	(15.68)	(16.19)	(2.98)	(5.02)	(15.27)	(16.19)	(2.98)	(5.04)
Observations	2878	2878	2878	2828	2878	2878	2878	2828	2878
R-Squared	0.0551	0.0287	0.0553	0.1653	0.1126	0.0358	0.0577	0.1666	0.1151

(1)E, (2)D, and (2)E. The post-period dummy variable is not consistently statistically significant in the M matching results (Panel A), but when it is statistically significant it is positive (see Models (1)C, (1)E, and (2)E). However, the interaction dummy variable representing the incremental impact of down periods in the post period is sometime positive in Panel B, which is difficult to explain. Overall, we conclude there is evidence that spreads increase rather than decrease following the change in regulation.

Although the results are inconsistent with the recent literature on short sale bans during the global financial crisis, our evidence is consistent with our trading activity results. An increase in the ability of informed traders to extract higher returns from margin trading and short selling appears to lead to greater asymmetric information risk which is consistent with wider bid-ask spreads in the 89 pilot stocks. The decrease in liquidity could also be expected to flow directly into wider bid-ask spreads.

2.5.3.4 Relative Volatility Differential

We test hypothesis 4 that there is no clear trend in the A-M (A-H) relative volatility differential $Volatility\_Diff_{i,t}$ after the regulation is introduced. We estimate regression models similar to equations (6a) and (6b), except that the dependent variable here is $Volatility\_Diff_{i,t}$. The results are presented in Panels A and B of Table 2.6. The key variables of interest are the post-period dummy and the interaction term. As discussed in the hypotheses development section, we do not expect a consistent change in the relative volatility differential, due to mixed empirical findings in different settings.

Our results support our prediction. We find a decrease in the volatility of A shares relative to their M counterparts in the post period yet an increase in A stock volatility relative to their H peers in the post regulation period (in down markets). For

Table 2.5: Panel Regressions of Difference in Relative Bid-Ask Spread

Panel A (B) reports the results of fixed effects panel regressions for the 89 (26) pilot and M (H) matched stocks. The dependent variable is Spread_Diff, which is calculated for each stock as log[pilot stock (Ask – Bid)/((Ask + Bid)/2)] – log[matched stock (Ask – Bid)/((Ask + Bid)/2)]. The sample period is from October 1, 2009 to June 30, 2010. *Post_period* is a dummy variable that is equal to one for the period from March 31, 2010 to June 30, 2010 and zero otherwise. *Post_period*Down_dummy* is an interaction dummy variable set to one, when the return of A-share market (MKT^A) in Models 1 and individual pilot A-share (RET^A) in Models 2 is less than 0 during the post-period and zero otherwise.

$$Spread\_Diff_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_MKT_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

$$Spread\_Diff_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_RET_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

The t-value is adjusted by the Rogers standard error clustered by firm. *, **, *** indicate significant at 10%, 5%, and 1% level, respectively.

Panel A: China Match	**SSE A-shares Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	0.0164		0.0422*	-0.0211	0.0895***		0.0152	-0.0373	0.0621*
	(0.68)		(1.64)	(-0.59)	(2.82)		(0.57)	(-1.04)	(1.92)
*Post_period*Down_dummy*		-0.0128	-0.0428***	-0.0444***	-0.0357**	0.0126	0.0021	-0.0185	0.0110
		(-0.70)	(-3.20)	(-3.07)	(-2.54)	(0.66)	(0.12)	(-1.06)	(0.58)
log(Price) A-share				-0.3443***				-0.3442***	
				(-5.48)				(-5.46)	
log(Price) M-share					0.0810				0.0817
					(1.07)				(1.08)
log(Volume) A-share				0.0060				0.0063	
				(0.15)				(0.16)	
log(Volume) M-share					0.1055**				0.1061**
					(2.45)				(2.46)
Relative Price Volatility (A-share)				0.0264				0.0256	
				(0.78)				(0.76)	
Relative Price Volatility (M-share)					0.0539				-0.0535
					(0.68)				(0.67)
Intercept	-0.1087**	-0.0964*	-0.1087**	0.8846	-1.1210*	-0.1040**	-0.1087**	0.8785	-1.1294*
	(-2.41)	(-2.16)	(-2.41)	(1.47)	(-1.78)	(-2.30)	(-2.41)	(1.46)	(-1.79)
Observations	9290	9290	9290	9290	9290	9290	9290	9290	9290
R-Squared	0.0001	0.0001	0.0006	0.1318	0.0239	0.0001	0.0001	0.1314	0.0236

Table 2.5 (Continued)

Panel B: Hong Kong Match	**SSE A-shares Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	0.1382***		0.1287**	0.1514***	0.1358***		0.1048	0.1443**	0.1238**
	(3.07)		(2.32)	(3.17)	(2.90)		(1.52)	(2.74)	(2.29)
*Post_period*Down_dummy*		0.1080***	0.0149	0.0280	0.0038	0.1301***	0.0570	0.0436	0.0245
		(3.70)	(0.53)	(0.97)	(0.14)	(3.18)	(0.85)	(0.90)	(0.45)
log(Price) A-share				-0.5141***				-0.5130***	
				(-5.40)				(-5.41)	
log(Price) H-share					-0.3199***				-0.3197***
					(-3.60)				(-3.59)
log(Volume) A-share				0.2223***				0.2233***	
				(3.44)				(3.44)	
log(Volume) H-share					0.2404***				0.2404***
					(4.82)				(4.83)
Relative Price Volatility (A-share)				-0.2082***				-0.2076***	
				(-3.32)				(-3.33)	
Relative Price Volatility (H-share)					-0.3095***				-0.3095***
					(-6.74)				(-6.75)
Intercept	-0.8722***	-0.8367***	-0.8722***	-2.6842***	-3.7128***	-0.8405***	-0.8722***	-2.6958***	-3.7132***
	(-6.92)	(-6.63)	(-6.92)	(-2.83)	(-5.29)	(-6.55)	(-6.92)	(-2.84)	(-5.29)
Observations	2829	2829	2829	2828	2829	2829	2829	2828	2829
R-Squared	0.0064	0.0034	0.0064	0.4211	0.3954	0.0047	0.0069	0.4213	0.3955

the A-M volatility differential, we find that the coefficient on both the post-period and the interaction term is significantly negative in Model (1)A, (1)B, and (2)B of Panel A. This means that when the A-share market (or individual A-share return) goes down there is a decline of A-share high-low volatility relative to M-share in the post-period. The evidence of Panel A for A-M volatility differential is broadly consistent with previous short selling literature that relaxing short-sale constraints reduces the excess volatility, but inconsistent with prior empirical findings that decrease in margin requirements increases volatility.

However, the A-H volatility differential becomes significantly positive when the market is down during the post-period in Model (1)C. Similarly, after inclusion of both A- and H-share log(price), and log(volume) in Model (1)D and (1)E, the A-H volatility differential remained strongly positive for the interaction term. Hence our volatility results are mixed.

2.5.3.5. Results Summary

Our results suggest it is the risk rather than the reality of short-sales activity that leads to the prices of pilot programme stocks decreasing on average, relative to their peers, following the regulation change. Liquidity decreases in pilot programme stocks (relative to matched firms), which is also consistent with uninformed investors reducing trading activity due to the heightened risk of being adversely affected by informed traders. This explanation is also in line with the increase in pilot programme stock spreads (compared to peer firms). There is no consistent pattern of changes in volatility following the regulation. As mentioned earlier, our key results are robust to matching pilot programme stocks with their Hong Kong listed H-shares and similar firms listed in China. As a final robustness check we rule out the possibility that there was a

Table 2.6: Panel Regressions of Difference in Relative Volatility

Panel A (B) reports the results of fixed-effects panel regressions for the 89 (26) pilot and M (H) matched stocks. The dependent variable is Volatility_Diff, which is calculated for each stock as log[pilot stock (High – Low)/((High + Low)/2)] log[matched stock (High – Low)/((High + Low)/2)]. The sample period is from October 1, 2009 to June 30, 2010. *Post_period* is a dummy variable that is equal to one for the period from March 31, 2010 to June 30, 2010 and zero otherwise. *Post_period*Down_dummy* is an interaction dummy variable set to one, when the return of A-share market (MKT^A) in Models 1 and individual pilot A-share (RET^A) in Models 2 is less than 0 during the post-period and zero otherwise.

$$Volatility\_Diff_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_MKT_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

$$Volatility\_Diff_{i,t} = \alpha_0 + \alpha_1 Post\_period_t + \alpha_2 Post\_period_t * Dummy\_RET_{i,t}^A + ControlVariables + \varepsilon_{i,t}$$

The t-value is adjusted by the Rogers standard error clustered by firm. *, **, *** indicate significant at 10%, 5%, and 1% level, respectively.

Panel A: China Match	**SSE A-Shares Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	-0.0553**		-0.0586**	-0.0286	-0.0926***		-0.0502*	-0.0236	-0.0843***
	(-2.49)		(-2.49)	(-1.15)	(-3.74)		(-1.89)	(-0.86)	(-3.15)
*Post_period*Down_dummy*		-0.0367**	0.0054	0.0093	-0.0016	-0.0442***	0.0091	0.0009	-0.0165
		(-2.13)	(0.45)	(0.78)	(-0.13)	(-2.99)	(-0.60)	(0.06)	(-1.06)
log(Price) A-share				0.1145**				0.1144**	
				(2.40)				(2.39)	
log(Price) M-share					-0.0596				-0.0600
					(-1.11)				(-1.11)
log(Volume) A-share				0.0244				0.0243	
				(1.12)				(1.11)	
log(Volume) M-share					-0.0785***				-0.0787***
					(-3.26)				(-3.27)
Intercept	-0.0721***	-0.0887***	-0.0721***	-0.6455**	0.8160**	-0.0872***	-0.0721***	-0.6437**	0.8188**
	(-3.01)	(-3.74)	(-3.01)	(-2.30)	(2.47)	(-3.50)	(-3.01)	(-2.28)	(2.48)
Observations	10283	10283	10283	10283	10283	10283	10283	10283	10283
R-Squared	0.0030	0.0011	0.0030	0.0217	0.0229	0.0015	0.0030	0.0216	0.0231

Table 2.6 (Continued)

Panel B: Hong Kong Match	**SSE A-Shares Index**					**Individual A-Share**			
	(1)A	**(1)B**	**(1)C**	**(1)D**	**(1)E**	**(2)B**	**(2)C**	**(2)D**	**(2)E**
Post_period	-0.0272		-0.0622	0.0601	-0.0609		-0.0083	0.1026**	-0.0077
	(-0.68)		(-1.50)	(1.32)	(-1.49)		(-0.21)	(2.45)	(-0.20)
*Post_period*Down_dummy*		0.0099	0.0550**	0.0704***	0.0553**	-0.0381	-0.0324	0.0028	-0.0308
		(0.29)	(2.23)	(3.14)	(2.24)	(1.17)	(-1.46)	(0.14)	(-1.42)
log(Price) A-share				0.2132***				0.2123***	
				(4.38)				(4.36)	
log(Price) H-share					0.0344				0.0340
					(0.83)				(0.82)
log(Volume) A-share				0.2092***				0.2082***	
				(5.84)				(5.43)	
log(Volume) H-share					0.0062				0.0061
					(0.25)				(0.24)
Intercept	0.0316	0.0145	0.0316	-2.7585***	-0.1109	0.0291	0.0316	-2.7456***	-0.1083
	(0.90)	(0.44)	(0.90)	(-5.40)	(-0.36)	(0.88)	(0.90)	(-5.35)	(-0.35)
Observations	2876	2876	2876	2876	2876	2876	2876	2876	2876
R-Squared	0.0007	0.0001	0.0021	0.0983	0.0047	0.0012	0.0012	0.0961	0.0037

systematic change in the relation between Chinese listed A-shares and their H-share counterparts by looking at A and H stock pairs that were not affected by the regulation change. These results are available from the authors on request.

2.6 Conclusion

We examine the effect of margin trading and short sales on relative prices, trading value, bid-ask spreads, and price volatility. Our results contribute to the literature in several ways. We have an event that includes both margin trading and short selling, which allows us to see the relative effect of each. Further, the introduction of short selling occurred at a time when market regulators across the globe were increasing restrictions around the short selling activities. Cash-constrained investors with a positive view of stocks could purchase stocks by borrowing against their house and prior to the commencement of pilot programme. Hence, it is unsurprising that our results show that the short-selling effect dominates the margin-trading effect. After the launch of the pilot programme by Chinese regulators the prices of A-shares eligible for short selling and margin trading decrease more than those of non-eligible M-shares (or matched H-shares). As a result, the A-M (A-H) premium becomes smaller in the post-period. Thus the premium results are consistent with the theoretical models of Miller (1977) and Chen, Hong, and Stein (2002) that constraining short sellers causes overvaluation.

However, we find actual short-sales activity is very low. In contrast to the theoretical short-selling models it appears it is investor selling due to the risk of trading against informed investors (short sellers) rather than the actions of short sellers that drive prices lower in China. This result is broadly consistent with the Ausubel's (1990) theory.

The liquidity decline is significantly larger for the pilot firms' A-shares when compared to both the pilot firms' H-shares and a matched A-share sample. This is inconsistent with both the short selling and margin trading literature and the Chinese regulator's desire for the pilot programme to improve liquidity. However, this evidence supports Ausubel's (1990) prediction that uninformed traders will reduce or avoid trading in situations when they expect an increased likelihood of transacting with informed traders.

Moreover, our results illustrate that the spreads of pilot stocks increase, relative to matched H-shares after the launch of pilot programme. Again the results are in contrast with our hypothesis and the broad literature that demonstrate that short sales bans during the global financial meltdown lead to wider spreads. However, it is in agreement with our trading activity finding. The ability of informed traders to exploit superior private information appears to lead to an increase in bid-ask spreads in the presence of margin trading and short selling for pilot securities.

Finally, our volatility results are mixed. We find that after the launch of pilot programme, the volatility decreases when firms are matched with M-shares, but volatility does not change when matched with H-shares. However, the A-H volatility increases during the down market following the introduction of pilot programme. Hence, this evidence is consistent with previous literature that has formed no consensus on the relation between short selling and/or margin trading and volatility.

CHAPTER THREE

ESSAY TWO

This chapter presents the second essay which investigates the effects of announcement and implementation of short selling and margin trading programme on stock returns and trading volume. An event study is conducted to investigate the changes in stock returns and volume around announcement and implementation of pilot programme. Cross-sectional regression analysis is also conducted to examine which factors are influencing the observed returns following announcement and implementation. Chang, Cheng, and Yu (2007) investigate the impact of short selling at every revision (addition and deletion) of short sale eligible list of securities in the Hong Kong stock exchange. In our study the margin trading and short-sale constraints are relaxed for the first time in China and both the announcement and implementation events are considered.

An overview of the impact of short-sale constraints announcement and introduction on equity markets is provided in Section 3.1 of the chapter. Section 3.2 provides literature review and development of hypotheses. Section 3.3 provides data, key dates of regulation changes, and methodologies. Section 3.4 presents the results and robustness tests. Section 3.5 concludes this essay. The part of this essay is accepted for publication in the *International Journal of Managerial Finance* as outlined in Chapter One Section 1.5. The essay's appendix and reference list is presented in the last sections of this thesis.

The Announcement and Implementation Reaction to China's Margin Trading and Short Selling Pilot Programme

Abstract

We examine the impact of China's 2010 margin trading and short selling pilot programme on stock returns and trading volume. The market reacts negatively to both the programme announcement and implementation, with significantly lower returns and trading volumes in the pilot stocks. The negative stock price reaction is anticipated by Miller's (1977) overvaluation hypothesis in the presence of short-sales restrictions. While lower volume is contrary to the developed market empirical evidence, it is consistent with Ausubel's (1990) theory, which implies that uninformed investors reduce their investment in pilot stocks to avoid the risk of trading against informed investors.

Key words: *Short selling, Margin trading, China, Information asymmetry, Overvaluation, Volume*

JEL Classification: G12, G14, G18

3.1 Introduction

We investigate how the announcement and implementation of short-sales and margin trading regulation affects Chinese stocks. The Chinese regulators launched a pilot programme on March 31, 2010, allowing short sales and margin trading for 50 Shanghai Stock Exchange (SSE) and 40 Shenzhen Stock Exchange (SZSE) index stocks. The decision to relax a blanket ban on short selling and margin trading in China coincided with regulators in many countries enacting a new wave of short selling restrictions.[21] During the global financial crisis (GFC) of 2008-2009, short sellers were blamed for driving down stock prices and were subsequently constrained by regulators around the world (e.g., Gruenewald, Wagner and Weber, 2010). Nonetheless, short sales have been shown to facilitate market efficiency, assist in the price discovery process (e.g., Bris, Goetzmann and Zhu, 2007), and improve market liquidity (e.g., Charoenrook and Daouk, 2005).

We conduct an event study to examine the impact of the announcement and implementation of the pilot programme on stock prices by comparing market model abnormal returns of the pilot firms with a matched sample of non-pilot firms and cross-listed H-shares. Miller's (1977) overpricing theory suggests overpricing prevails when pessimistic investors cannot enter the market in the presence of short-sales restrictions. Consistent with Miller's (1977) hypothesis, we find significant negative abnormal returns following the introduction of short sales. Investors appear to anticipate the pending decline in prices, as prices also drop upon the announcement of the short-selling programme. The short-sales announcement and implementation effects dominate

[21] For example see http://www.sec.gov/news/press/2010/2010-26.htm

any positive impact of the announcement and introduction of margin trading which is unsurprising given cash-constrained bullish investors could already buy securities by borrowing against houses.[22]

We find that pilot firms, on average, experience a significant decline in trading volume around the announcement of the introduction of short selling and margin trading. This result suggests that uninformed investors may avoid investing in the pilot stocks following the announcement of the pilot programme due to concerns about being exploited by informed investors when the short selling legislation is implemented. Similarly, the trading volume of pilot firms declined significantly around the commencement of the pilot programme. This result is consistent with the theoretical model of Ausubel (1990), which suggests that uninformed investors will avoid investing if there is a greater possibility of trading with an informed counterparty.

Our paper makes several contributions to the literature. A number of studies have examined the impact of short selling on stock prices using emerging markets data (e.g., Bris, Goetzmann and Zhu, 2007; Lamba and Ariff, 2006). However, to the best of our knowledge, none have addressed the impact of both the announcement and implementation of short selling rule changes on liquidity using individual stock data.[23] Similarly, no study appears to have investigated the announcement day and implementation day returns following the introduction of margin purchases rule changes in emerging markets. Due to the differences in regulatory environments and market

[22] For example see http://china.org.cn/business/2007-01/21/content_1196802.htm

[23] Sharif, Anderson, and Marshall (2012) consider mean and median liquidity levels before and after the implementation of the pilot stock programme but they do not use an event study which gives a richer insight into liquidity changes around both the announcement and implementation of the pilot programme. Moreover, Charoenrook and Daouk (2005) provide international evidence on the effect of short-sale constraints on liquidity. Yet their sample looked at liquidity using aggregate market data only. Wang (2011) looks at the link between the introduction of Chinese margin trading and informed trading, and Wang (2012) considers the link between returns around the implementation of Chinese short-selling regulation and idiosyncratic risk.

mechanisms, the evidence from developed markets may not be generalizable to emerging markets (e.g., Morck, Yeung and Yu, 2000).

We use a comprehensive matching procedure which includes two groups of peer stocks. Firstly, A-shares with similar characteristics which are not in the pilot programme and secondly, the cross-listed Hong Kong H-share counterpart of each pilot stock (where this is available). It is important to have a robust matching approach to ensure any documented results are a result of the legislation change.

A developed market study that is related to this paper is that of Chang, Cheng and Yu (2007) who study the introduction of short sales in Hong Kong. Our study differs due to its focus on an emerging market, the consideration of the joint introduction of short selling and margin trading, and the use of a setting where put options and index futures did not exist prior to the short selling legislation change. This means it was not possible for pessimistic investors to trade based on their view prior to the introduction of the short-sales rule change in China.

We also conduct cross-sectional regression analysis in an attempt to determine which factors are influencing the documented announcement and implementation returns. The results indicate that firms in the finance industry have more negative announcement and implementation CARs than firms in other industries. This is consistent with investors perceiving finance sector firms as vulnerable to heavy short selling. Several countries banned short selling predominantly in financial sector stocks during the global financial crisis (e.g. Austria, Canada, Portugal, and the U.K.), so it is possible investors were concerned the availability of Chinese financial firms for short selling would make these stocks a target. Short selling accounts for a relatively small proportion of total trading in the post-regulation implementation period. This suggests

the price and volume effects we document are mainly due to investors being concerned about being exploited by those with an (negative) information advantage. However, we do find some evidence that stocks with more short-sales activity have a larger price decline.

We expect more negative returns following the implementation of the short-sale and margin trading regulation changes for overvalued firms. It is natural to expect that short sellers (margin buyers) would target (avoid) stocks which are relatively overvalued. It is also likely that the announcement returns will be more negative as investors anticipate the implementation effect and act accordingly. Using several proxies for overvaluation we find significantly higher CARs for pilot stocks that are relatively more overvalued following the pilot programme commencement, which is somewhat puzzling. However, the evidence is consistent with Wang's (2012) finding that more overvalued firms carry higher idiosyncratic risk that deters pessimistic investors from short selling. Hence the prices of overvalued pilot stocks decline less following the commencement of short selling.

Miller (1977) suggests that the overvaluation of stocks is more pronounced in the presence of shorting constraints when divergence of opinion is high. Given this, we expect more negative announcement CARs for pilot stocks with high ex-ante differences of opinion. Our results are inconclusive on this front. Stocks with a higher standard deviation of abnormal returns prior to the regulation change have a lower implementation returns which is consistent with the Miller (1977) hypothesis. However, stocks with high prior turnover, our second proxy for differences in opinion, have higher implementation returns.

The remainder of the paper is organised as follows. Section 3.2 presents the literature review and develops the hypotheses. Section 3.3 describes the key dates, data and methodology. Section 3.4 presents our event study results and regression analyses, while section 3.5 concludes the study.

3.2 Literature review and hypotheses development

Morck, Yeung and Yu (2000) find emerging stock markets do not process information as effecitvely as developed stock markets. This suggests that empirical findings in developed markets may not always hold in emerging markets. However, the lack of emerging market evidence in this area means that we have to largely rely on studies in developed markets when forming our hypotheses.

Miller (1977) suggests that short-sales restrictions can lead to stocks becoming overvalued. This implies that the prices of stocks that were previouly unable to be short sold should decline once they can be sold short. Autore, Billingsley and Kovacs (2011) and Chang, Cheng and Yu (2007) both find evidence in support of Miller's (1977) hypothesis. It seems logical that the announcement of pending legislation allowing short sales will also lead to negative returns as investors anticipate the negative returns that are likely to occur when the regulation is implemented and sell their holdings ahead of this. Boulton and Braga-Alves (2010) present evidence that supports this notion. They show that the announcement of regulation banning naked short sales in financial firms leads to an immediate (in this case positive) return effect. Studies such as Seguin (1990) imply that the announcement of margin trading legislation should lead to a positive return reaction. However, we expect this to be dwarfed by the negative reaction to pending short-sales introduction. Prior to the legislation change, investors with a negative view had no way of trading on this yet those with a positive view could borrow

against their house or other assets and invest if they were cash-constrained. Hence, our first hypothesis is:

Hypothesis 1: The returns of pilot securities decrease following the pilot programme regulation announcement.

Miller's (1977) hypothesis suggests that short-sale restrictions prevent bad news from being fully reflected in the stock prices, leading to overvaluation. Chang, Cheng and Yu (2007) and Chen, Hong and Stein (2002) present empricial results that are consistent with Miller's (1977) hypothesis. For the reasons outlined in the motivation for *Hypothesis 1*, we expect the negative short-sales effect to outweigh the positve margin trading effect. Thus, we expect that pilot stocks are associated with negative abnormal returns following the relaxation of short-sales ban which leads us to hypothesise:

Hypothesis 2: The returns of pilot securities decrease following the implementation of the pilot programme.

The majority of prior empirical research that focuses on the liquidity impact of short sales or margin trading regulation changes consider settings where the announcement and implementation dates are the same (e.g. Pruitt and Tse, 1996). This makes it difficult to form a prediction on the announcement effect from these papers. However, Ausubel's (1990) theoretical model implies that uninformed investors may be hesitant about investing in pilot stocks after the regulation announcement due to concerns about trading against informed investors in the post-implemented period. This leads us to hypothesise:

Hypothesis 3: Trading volumes of pilot securities decrease following the pilot programme regulation announcement.

Previous empirical evidence suggests the relaxation of short selling constraints leads to an improvement in liquidity (e.g., Biais, Bisière and Décamps, 1999; Charoenrook and Daouk, 2005). Similarly, studies investigating the impact of short-sale bans in developed markets during the GFC suggest that liquidity deteriorates when constraints are imposed (e.g., Boehmer, Jones and Zhang, 2013; Gagnon and Witmer, 2010). Moreover, Hardouvelis and Peristiani (1992) find an increase in liquidity when margin requirements decrease.[24] However, Ausubel's (1990) model implies a decrease in trading volume following the regulation change. He suggests that uninformed investors will avoid investing if there is a greater possibility of trading with an informed counterparty, resulting in a decrease in liquidity. Ausubel's (1990) model may be particularly relevant to the Chinese setting where, as noted by Chakravarty, Sarkar, and Wu (1998), information asymmetry is likely to be a bigger issue than in developed markets due to insider trading, share manipulation and no legally codified investor protection rights.[25] The divergent implications of extant literature lead us to *Hypothesis 4A* (based on the developed market literature), and *Hypothesis 4B* (based on Ausubel's theoretical model) as stated below.

Hypothesis 4A: Trading volumes of pilot securities increase following the implementation of the pilot programme.

Hypothesis 4B: Trading volumes of pilot securities decrease following the implementation of the pilot programme.

[24] In the case of China, allowing margin trading is equivalent to relaxing margin requirements. Prior to the change in regulation, investors have to buy stocks using their own resources (i.e. margin of 100%).
[25] High information asymmetry has been shown to be a determinant of the A to B share discount (Chan, Menkveld and Yang, 2008).

3.3 Key Dates, Method and Data

While the China Securities Regulatory Commission (CSRC) discussed possible regulation changes to allow short selling and margin trading as early as 2006, it was not until January 8, 2010 that China's State Council gave "in principle" approval for a margin trading and short selling pilot programme (Bryan, TieCheng, and Phua, 2010). However, none of these announcements stated which stocks would be affected by the regulation or when the margin trading and short selling pilot programme would commence.

On February 12, 2010 the Shanghai Stock Exchange (SSE) and the Shenzen Stock Exchange (SZSE) published a list of 90 firms (pilot stocks) selected for the margin trading and short selling pilot programme. In this study we take February 12, 2010 as the Announcement Day as it is the first date that investors had knowledge of what stocks would be affected by the regulation change. On March 31, 2010, the margin trading and securities lending pilot programme was implemented and therefore marks the first day that short selling was both legal and feasible within China's markets for selected stocks (Bryan, TieCheng, and Phua, 2010).[26] As such, in this study the March 31, 2010 is referred to as the Implementation Day.

We examine the abnormal returns (ARs) and cumulative abnormal returns (CARs) surrounding the announcement and implementation day of margin buying and short selling for the pilot stocks. Our measures are based on the ordinary least squares (OLS) market model following Chang, Cheng, and Yu (2007). The model is defined as:

$$AR_i^m(t) = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{Mt} \quad (1)$$

[26] The interested reader should refer to Bryan, TieCheng, and Phua (2010) and Sharif, Anderson, and Marshall (2012) for more details on the key dates.

and

$$\mathrm{CAR}_{\mathrm{i}}^{\mathrm{m}}(\mathrm{t}_1, \mathrm{t}_2) = \sum_{\mathrm{t}=\mathrm{t}_1}^{\mathrm{t}_2}(\mathrm{R}_{\mathrm{it}} - \hat{\alpha}_{\mathrm{i}} - \hat{\beta}_{\mathrm{i}}\mathrm{R}_{\mathrm{Mt}}) \quad (2)$$

where R_{it} and R_{Mt} are stock's *i*'s return and the market return respectively. The market return is calculated as the value-weighted average return of all A-shares[27] traded on the Shanghai and Shenzhen Stock Exchanges (aggregate A-share market). $AR_i^m(t)$ is the abnormal return on day t, whereas $CAR_i^m(t_1,t_2)$ is the cumulative abnormal return for the event window (t_1, t_2). We report results for both the $CAR_{0,5}$ and a longer $CAR_{0,25}$ event windows. The longer event window chosen captures any returns drift between the pilot programme's announcement and implementation dates.

We use the Boehmer, Masumeci, and Poulsen (1991) standardised cross-sectional test statistic to examine the mean abnormal returns for our event study. This test is robust to cross-sectional variation in abnormal returns. We also use a nonparametric sign test that is free from the assumption about the distribution of abnormal returns.

To test for abnormal volume changes surrounding the announcement (*Hypothesis 3*) and implementation dates (*Hypothesis 4A&B*) we follow Anderson, Rose, and Cahan (2006) where abnormal volume (AV) is calculated as:

$$\mathrm{AV}_{\mathrm{i,t}} = \frac{\mathrm{V}_{\mathrm{i,t}}}{\mathrm{EV}_{\mathrm{i}}} - 1 \quad (3)$$

where EV is the expected volume based on the daily trading volume (V) for the same firm calculated during the estimation period t-30 to -255 trading days prior to the

[27] The market benchmark is also likely to be impacted by the margin trading and short selling programme and the impact of this is to make it harder to prove our *Hypotheses 1 and 2*. For this reason we also re-run all the event study analysis presented in this paper using an equally-weighted index (also see Footnote 32).

announcement and implementation dates. The cumulative abnormal volume, $CAV_{0,5}$ and $CAV_{0,25}$ event windows are constructed in the normal manner.

For robustness we provide two controls of the stock market reaction to the margin trading and short selling pilot programme. Firstly, we compare the pilot firms' abnormal returns and volumes to a sample of 90 firms whose A-shares are not eligible for short selling and margin trading; and secondly, we directly control for firm specific information by comparing a pilot firm's A-share reaction to that of their cross-listed H-share around the announcement and implementation dates.

For the A-share matching procedure, we match each of the 90 pilot firms to peer non-eligible firms.[28] The matching procedure is similar to the method applied by Boulton and Braga-Alves (2010) and Sharif, Anderson, and Marshall (2013). First, for each pilot stock we select all non-eligible peer firms that are listed on the same stock exchange and have the same industry classification. Then, from this pool of non-eligible peer firms we choose (without replacement) the firm that is closest to the pilot firm's characteristics of 1) average daily market capitalization, 2) closing stock price, 3) volatility (standard deviation) of the daily returns, and 4) daily turnover calculated for the year ending September 30, 2009. More specifically, the match for every pilot programme eligible firm is ascertained by selecting the non-eligible peer firm that minimises the following equation:

$$\text{Distance} = \Sigma_i \left| (\text{factor}_i^{\text{pilot}} - \text{factor}_i^{\text{matched}}) / [\frac{(\text{factor}_i^{\text{pilot}} + \text{factor}_i^{\text{matched}})}{2}] \right| \quad (4)$$

Panels A and B of Table 3.1 show that the variables used for matching the pilot stocks with non-pilot stocks are insignificantly different from zero with the exception of

[28] One pilot stock is not traded following the implementation of programme during our sample period. Thus the number of stocks on implementation is 89.

Table 3.1: Summary Statistics

This table reports statistics for the pilot and the matched sample for each industry. Four variables are calculated over the period from October 1, 2008 to September 31, 2009. These variables are used to construct the matched sample.

Panel A: Pilot sample

Industry	Closing Price		Market Capitalization (RMB 'M')		Turnover %		Return Volatility %		N
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
Financials	13.29	12.31	160,578	84,792	1.34	1.15	3.27	3.33	24
Basic Materials	15.00	12.01	55,593	35,170	2.19	1.56	3.96	3.99	23
Industrials	11.09	8.77	59,824	38,961	1.39	1.36	3.17	3.13	16
Oil & Gas	12.54	12.30	897,018	680,037	0.81	0.12	2.83	2.83	3
Consumer Services	11.38	8.76	32,392	33,486	1.17	1.23	3.60	3.59	5
Technology	11.72	11.88	55,709	22,163	1.78	1.43	3.36	3.20	3
Consumer Goods	26.53	13.13	38,306	21,121	0.93	1.00	2.98	3.08	10
Utilities	7.77	9.59	43,663	23,112	0.96	0.57	2.16	2.31	3
Healthcare	25.79	27.37	12,669	14,338	1.61	1.81	2.92	3.10	3
Overall	15.01	12.90	150,639	105,909	1.35	1.14	3.14	3.17	90

Panel B: Matched sample

Industry	Closing Price		Market Capitalization (RMB 'M')		Turnover %		Return Volatility %		N
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
Financials	11.72	11.57	18,480	12,857	1.37	1.16	3.60	3.70	24
Basic Materials	12.76	12.36	15,938	12,580	1.92	1.44	3.86	3.96	23
Industrials	10.35	9.59	16,097	17,482	1.39	1.13	3.27	3.37	16
Oil & Gas	12.69	14.34	24,237	22,780	0.81	0.79	3.17	3.24	3

Table 3.1 (Continued)

	Closing Price		Market Capitalization (RMB 'M')		Turnover %		Return Volatility %		N
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
Consumer Services	12.28	9.13	13,680	7,450	1.19	1.27	3.12	3.06	5
Technology	11.82	12.79	3,575	2,251	1.48	0.76	3.30	3.08	3
Consumer Goods	18.77	14.87	11,988	12,231	1.24	1.02	2.99	3.08	10
Utilities	5.74	6.79	29,094	13,530	0.96	0.35	2.61	2.64	3
Healthcare	22.79	18.44	7,889	8,257	1.68	1.79	2.66	2.48	3
Overall	13.21	12.21	15,664	12,158	1.34	1.08	3.18	3.18	90

market capitalization that is significantly different at 1% level. Importantly, due to Turnover% being the key criterion of stock eligibility[29] for the margin trading and short selling programme, the daily turnover is very close with a mean of 1.35% for the pilot stocks and 1.34% for the matched A-share sample. The large distance between pilot and match stock market capitalization is unavoidable given the fact that the pilot stocks are constituents of the SSE-50 and SZSE-40 indices and therefore among the largest firms on the respective markets. As noted in, Sharif, Anderson, and Marshall (2013) this size difference is likely to reduce any short selling effect we document rather than exacerbate it.

Further, our second matching method renders market capitalization differences irrelevant as we use a pilot firm's shares that are cross-listed on Hong Kong Stock Exchange (H-shares).[30] There are 26 pilot firms that have cross-listed H-share equivalents and all 26 H-shares were eligible to be short sold on the Hong Kong Stock Exchange at the pilot programme announcement and implementation dates. It has been well documented that A-shares trade at a premium to H-shares (e.g. Zhao, Ma, and Liu, 2005). The fact that the majority of H-shares have historically been able to be short-sold while A-shares have not is likely to be one explanation for the premium, but other factors are also likely to play a role.

Chan, Menkveld, and Yang (2008) find that the informational advantage of local Chinese investors contributes to the premium for A-shares over B-shares that foreigners invested in. This same factor may contribute to the A-H premium.[31] Therefore our two

[29] See Item 4, Article 23 of the *Rules for Implementation of Pilot Margin Trading and Securities Lending in Shanghai Stock Exchange; i.e*., http://static.sse.com.cn/en_us/cs/about/news/en_news_20100212a.pdf

[30] We convert the H-share returns from Hong Kong Dollars to Chinese RMB to avoid any exchange rate changes contaminating our results.

[31] The desire to control for market capitalization differences as opposed to arbitrage considerations are the reason we included H-share match results as a robustness check. The removal of the short-sales ban on A-shares removes one of the impediments to arbitragers wishing to exploit the A-H premium. However, other aspects which have been shown to limit arbitrage remain. These include "noise trader risk" (e.g. De Long, Shleifer, Summers, and Waldmann, 1990) and synchronization risk (e.g. Abreu and Brunnermeier, 2002).

matching procedures complement each other as the first involves similar firms in the identical stock market, while the second involves a subsample of identical firms in a different market.

We calculate differences in abnormal returns and volumes for the 90 pilot A-shares with the 90 matched non-eligible A-shares, as well as, the subsample of 26 pilot stocks that have cross-listed H-shares. The significance of the difference in returns and volumes between the pilot and the two matched samples are evaluated using the means *t*-test and Wilcoxon rank sum test. Further, the difference in the proportion of positive values between the two samples is evaluated using the test for two proportions.

The data are obtained from the China Securities Market and Accounting Research (CSMAR) and Thomson Reuters Datastream (TRD) databases. Consistent with Sharif, Anderson, and Marshall (2013), TRD data are used to identify matches for each pilot firm and the generation of summary statistics in Table 3.1. TRD are also used for industry classifications and H-share price and volume data. All other data, including A-share price and volume data, market indices, short-sales and margin trading activity, accounting data, and corporate governance variables are from CSMAR.

3.4. Results

We begin our results by discussing the pilot programme announcement returns (section 3.4.1) and volumes (section 3.4.2) followed by robustness tests using our second matching procedure (3.4.3). Next we present the pilot programme implementation returns (section 3.4.4), volumes (section 3.4.5) and robustness tests

Table 3.2: Event Study Abnormal Returns and Cumulative Abnormal Returns around Announcement

This table reports abnormal returns and selected CARs surrounding the announcement of the CSRC's pilot short selling and margin trading programme on February 12, 2010. Panel A shows value weighted abnormal returns for the 90 pilot programme stocks and a control sample of 90 stocks matched on industry, market value of equity, closing stock price, daily turnover, and daily return volatility. We follow Boehmer et al. (1991) and construct standardised cross-sectional test statistics to test mean abnormal returns. The proportion of positive returns and nonparametric sign test are also reported. In Panel B, the pilot-matched difference of returns and tests of significance are presented along with the difference in fraction of positive returns. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Announcement Returns – Value weighted

Days	Pilot sample		Matched sample	
	Abnormal returns	Positive proportion	Abnormal returns	Positive proportion
-5	0.0010	0.49	-0.0064**	0.31***
-4	0.0002	0.48	0.0019*	0.58***
-3	0.0017**	0.64***	0.0012	0.52*
-2	0.0018	0.46	-0.0014	0.42
-1	0.0020	0.55***	-0.0009	0.38
0	-0.0041***	0.31**	-0.0003	0.42
1	0.0000	0.49	0.0021	0.53**
2	-0.0054***	0.27***	0.0022*	0.50
3	-0.0009	0.40	0.0019*	0.55**
4	-0.0023**	0.36*	0.0024*	0.51
5	-0.0029***	0.32**	-0.0021**	0.35**
Announcement $CAR_{0,5}$	-0.0154***	0.26***	0.0061*	0.51*
Announcement $CAR_{0,25}$	-0.0355***	0.26***	-0.0131*	0.37*

Panel B: Differences between pilot and matched sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	0.0074	2.61***	2.87***	0.18	2.42**
-4	-0.0017	-0.78	-1.52	-0.11	-1.29
-3	0.0005	0.23	1.46	0.12	1.26
-2	0.0031	1.53	1.01	0.03	0.09
-1	0.0029	1.36	2.09***	0.17	1.58
0	-0.0038	-1.77*	-1.27	-0.11	-1.61*
1	-0.0021	-0.96	-0.52	-0.04	-0.60
2	-0.0077	-2.69***	-2.99***	-0.23	-2.89***
3	-0.0028	-1.44	-2.02**	-0.15	-1.96**
4	-0.0047	-2.25**	-2.17**	-0.15	-1.96**
5	-0.0008	-0.37	0.61	-0.03	-0.31
Announcement $CAR_{0,5}$	-0.0215	-3.35***	-3.40***	-0.26	-3.53***
Announcement $CAR_{0,25}$	-0.0224	-2.16**	-2.01**	-0.11	-1.61*

using the second matching procedure (section 3.4.6). Finally in section 3.4.7 we present cross-sectional regression results for announcement and implementation CARs.

3.4.1 Event Study Results – Announcement Returns

The pilot programme announcement returns presented in Table 3.2 reveal a decline in value-weighted returns[32] of 0.41% on the announcement day for pilot stocks (see Panel A) which is significant at the 1% level. The matched stocks' return on the same day is -0.03% with the pilot-matched stock difference being significant at the 10% level.

The $CAR_{0,5}$ and $CAR_{0,25}$ windows following pilot programme announcement are -1.54% and -3.55% which are both significant at the 1%. After controlling for the matched stock returns, the pilot stocks exhibit significantly lower abnormal returns with a 2.15% difference over the shorter $CAR_{0,5}$ and 2.24% for the longer window. Further, the negative announcement reaction is wide-spread with 74% of pilot stocks experiencing negative abnormal returns over the event windows. The pilot-match differences are statistically significant using the means *t*-test, Wilcoxon rank sum test, and the proportion test. Figure 3.1 plots the difference in CARs between the pilot and matched sample based on the value-weighted market model for five days either side of the announcement of the short selling and margin trading pilot programme.

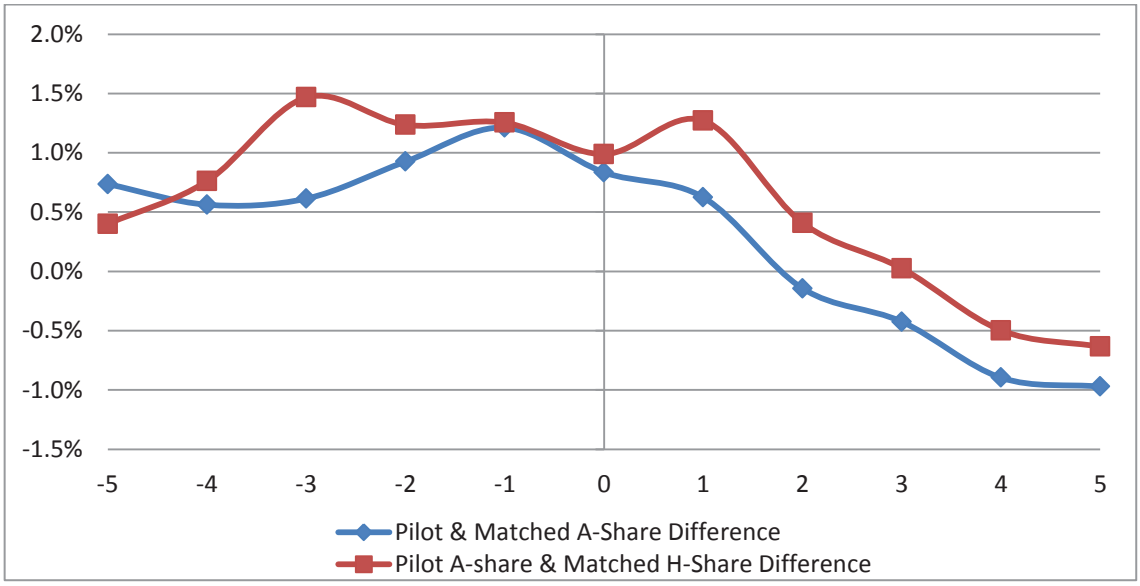
The Chinese stock markets declined during the period examined[33], but even after controlling for both general market movements and returns of firms matched by

[32] As discussed in Footnote 27, the value-weighted benchmark is itself likely to be affected for the pilot programme which makes it harder to prove *Hypotheses 1 and 2*. For this reason we also re-run all the event study analysis presented in this paper using market returns based on an equally-weighted index. As expected the magnitude of abnormal returns is larger for the equally-weighted index. For example, on the announcement date the equally-weighted $CAR_{0,5}$ and $CAR_{0,25}$ was -3.65% and -6.45% respectively, compared to -1.54% and -3.55% reported here using the value-weighted index. Similarly, the CARs for the implementation date are -3.26% and -7.37% for the equally-weighted benchmark compared to -1.09% and -2.03% reported here for the value-weighted. However, once the differences (reported in Panel B of Tables 3.2 and 3.5) between the pilot and matched samples returns are examined, both the difference in magnitude and their significance levels are very similar. The full results for the equally-weighted index are shown in Appendix-B.

[33] Overall, China's A-share market total market capitalization shrink by 5% from the announcement date to the end of study period. Moreover, the SSE composite index fell by 9.2% during our study period.

Figure 3.1: Difference in cumulative abnormal returns around announcement.

This figure reports difference in value-weighted CARs between pilot and matched A- or H-share control samples. The abnormal returns are calculated based on the OLS market model around announcement event. An announcement event is defined as one in which 90 pilot stocks are announced on February 12, 2010 that can be bought on margin or sold short from the implementation date. The announcement day is denoted as day 0. For the market model, the estimation window is (-255, -30).



industry and other common characteristics, the pilot stock returns are significantly lower as reported in Panel B. The negative announcement reaction confirms *Hypothesis 1* and is consistent with the argument that investors drive pilot stock prices down in anticipation of the short-sales ban removal and that this effect dwarves any positive margin trading reaction.

3.4.2 Event Study Results – Announcement Trading Volume

The results for the trading volume surrounding the pilot programme announcement are shown in Table 3.3. For the entire pilot sample, shown in Panel A, the daily abnormal volume around the announcement is significantly lower (or negative) than the expected volume at the 1% level. However, consistent with an overall declining market and falling volumes during the sample period, the matched firms also have a

Table 3.3: Event Study Abnormal Volumes and Cumulative Abnormal Volumes around Announcement

This table reports abnormal volumes and selected CAVs surrounding the announcement of the CSRC's pilot short selling and margin trading programme on February 12, 2010. Panel A shows abnormal volumes for the 90 pilot programme stocks and a control sample of 90 stocks matched on industry, market value of equity, closing stock price, daily turnover, and daily return volatility. Abnormal volumes are measured relative to the same firm expected daily trading volume estimated during $t_{-255\ to\ -30}$ from the event date. Abnormal Volumes of -0.50 would mean the actual volumes is reduced by 50% of the expected volumes. The proportion of positive volumes and sign test are also reported. In Panel B, the pilot-matched difference of volumes and tests of significance are presented along with the difference in fraction of positive abnormal volumes. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Announcement Volumes

Days	Pilot sample		Matched sample	
	Abnormal volumes	Positive proportion	Abnormal volumes	Positive proportion
-5	-0.4209***	0.08***	-0.3535***	0.20***
-4	-0.6253***	0.04***	-0.5654***	0.09***
-3	-0.6625***	0.01***	-0.5800***	0.07***
-2	-0.6122***	0.02***	-0.5953***	0.03***
-1	-0.6027***	0.07***	-0.5944***	0.06***
0	-0.6303***	0.02***	-0.6160***	0.03***
1	-0.6213***	0.02***	-0.5618***	0.11***
2	-0.5010***	0.07***	-0.5426***	0.09***
3	-0.4960***	0.08***	-0.4789***	0.08***
4	-0.3076***	0.14***	-0.2798***	0.24***
5	-0.4835***	0.16***	-0.3935***	0.14***
Announcement $CAV_{0,5}$	-2.9983***	0.07***	-2.8415***	0.07***
Announcement $CAV_{0,25}$	-12.8986***	0.04***	-10.7749***	0.09***

Panel B: Differences between pilot and matched sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	-0.0674	-0.97	-0.86	-0.12	-2.49**
-4	-0.0599	-1.32	-0.72	-0.04	-1.26
-3	-0.0825	-1.18	-0.45	-0.06	-2.03**
-2	-0.0169	-0.33	-0.02	-0.01	-0.48
-1	-0.0083	-0.20	-0.42	0.01	0.32
0	-0.0143	-0.37	-0.27	-0.01	-0.48
1	-0.0595	-1.32	-0.05	-0.09	-2.52**
2	0.0416	0.65	0.49	-0.02	-0.59
3	-0.0171	-0.38	-0.39	0.00	0.00
4	-0.0278	-0.41	-0.79	-0.10	-1.79*
5	-0.0900	-1.49	-1.28	0.01	0.22
Announcement $CAV_{0,5}$	-0.1568	-0.61	-0.26	0.00	0.00
Announcement $CAV_{0,25}$	-2.1237	-2.09**	-1.36	-0.04	-1.26

significant decline in volumes. There is a larger (but insignificant) decline in pilot stocks' trading volume over the day 0 to 5 event window compared to the matched

sample. However, for the longer event window, volumes decline significantly more in pilot compared to matched stocks.[34]

Overall the evidence is consistent with *Hypothesis 3*, in accordance with Ausubel's (1990) theoretical model. Uninformed investors may be reluctant to invest in pilot stocks after the announcement, due to their heightened risk of trading against informed counterparts following the commencement of margin trading and short selling.

3.4.3 Announcement Returns Robustness Check

To test whether our results are consistent with the announcement returns and volume evidence, we re-run the event study on a sub-sample of 26 pilot A-shares and their cross-listed H-shares. For conciseness, we only report the difference in returns and volume between the pilot and cross-listed samples, as well as, the difference in proportion of the positive values between the two samples. We observe a significant (at 5% level) decline of 1.82% for the $CAR_{0,5}$ indicating that the A-H share premium narrowed subsequent to the announcement of short selling and margin trading pilot programme.

The difference in proportion between the two sub-samples indicates a relatively larger proportion of pilot firms earn negative abnormal returns. Similar to the A-share matched results for the longer $CAR_{0,25}$ window, pilot A-share returns are lower but insignificant compared to the cross-listed H-share returns. Panel B of Table 3.4 shows a significant total decline in A-share volumes compared to the equivalent H-shares over the event window$_{0,25}$. However, there is no significant difference for the shorter

[34] The significantly lower trading volume in pilot stocks during longer window may suggest that as the time of implementation of pilot programme comes closer, more and more uninformed investors avoid investing in pilot securities.

Table 3.4: Event Study Abnormal Returns and Abnormal Volumes around Announcement: H-Share Controls

This table reports abnormal returns and volumes surrounding the announcement of the CSRC's pilot short selling and margin trading programme on February 12, 2010 in Panel A and B respectively. Daily differences are reported for the 26 pilot programme A-shares and a control sample of 26 cross-listed H-shares. In Panel A (B), the A-H difference of returns (volumes) and tests of significance are presented along with the difference in fraction of positive abnormal returns (volumes). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Announcement Returns - Differences between pilot and cross-listed sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	0.0040	0.94	0.85	0.04	0.28
-4	0.0039	0.98	1.03	0.23	1.71*
-3	0.0069	2.04**	2.10**	0.35	2.51**
-2	-0.0027	-0.73	-0.72	-0.19	-1.40
-1	-0.0008	-0.26	-0.67	0.00	0.00
0	-0.0026	-0.99	-1.16	-0.15	-1.12
1	0.0031	1.14	0.47	0.19	1.41
2	-0.0089	-2.30**	-3.93***	-0.42	-3.17***
3	-0.0043	-1.04	-2.03**	-0.19	-1.40
4	-0.0054	-2.04**	-2.12**	-0.23	-1.68*
5	-0.0009	-0.34	-0.81	-0.15	-1.14
Announcement $CAR_{0,5}$	-0.0182	-1.90*	-2.41**	-0.31	-2.40**
Announcement $CAR_{0,25}$	-0.0089	-0.43	-0.76	-0.15	-1.14

Panel B: Announcement Volume-s- Differences between pilot and cross-listed sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	-0.3996	-4.38***	-3.43***	-0.38	-3.29***
-4	-0.3966	-3.64***	-4.13***	-0.08	-1.04
-3	-0.3536	-5.28***	-4.51***	-0.08	-1.44
-2	-0.2441	-3.17***	-2.90***	-0.04	-1.01
-1	-0.2058	-2.74***	-2.99***	0.00	0.00
0	-0.1675	-3.40***	-3.69***	0.00	0.00
1	-0.0524	-0.70	-2.49**	0.04	1.01
2	0.2825	1.57	0.71	0.12	1.82*
3	0.0250	0.31	0.46	0.08	1.47
4	0.0759	0.82	1.79*	-0.04	-0.56
5	-0.1764	-2.35**	-2.77***	-0.04	-0.56
Announcement $CAV_{0,5}$	0.0659	0.15	1.11	0.08	1.44
Announcement $CAV_{0,25}$	-4.1279	-2.48**	-2.83***	0.00	0.00

window. Overall, the evidence is consistent with the pilot-match results. Figure 3.1 also highlights that post-announcement returns decline for pilot A-share compared to the equivalent cross-listed H-share. The greater negative A-share abnormal returns and narrowing of the A-H premium is consistent with *Hypothesis 1* that investors

Table 3.5: Event Study Abnormal Returns and Cumulative Abnormal Returns around Implementation

This table reports abnormal returns and selected CARs surrounding the implementation of the CSRC's pilot short selling and margin trading programme on March 31, 2010. Panel A show value weighted abnormal returns for the 89 pilot programme stocks and a control sample of 89 stocks matched on industry, market value of equity, closing stock price, daily turnover, and daily return volatility. We follow Boehmer et al. (1991) and construct standardised cross-sectional test statistics to test mean abnormal returns. The proportion of positive returns and nonparametric sign test are also reported. In Panel B, the pilot-matched difference of returns and tests of significance are presented along with the difference in fraction of positive returns. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Implementation Returns – Value weighted

Days	Pilot sample		Matched sample	
	Abnormal returns	Positive proportion	Abnormal returns	Positive proportion
-5	-0.0037***	0.25***	-0.0018*	0.30***
-4	-0.0030***	0.37	-0.0007	0.39
-3	-0.0005	0.41	-0.0009	0.40
-2	0.0054***	0.64***	-0.0026*	0.35**
-1	-0.0014**	0.39	-0.0010	0.39
0	-0.0023	0.25***	0.0008	0.51
1	0.0001	0.39	0.0016	0.40
2	0.0015	0.49	0.0044**	0.52*
3	-0.0025*	0.43	-0.0046*	0.38
4	-0.0032***	0.31**	-0.0032**	0.36*
5	-0.0046***	0.27***	0.0034**	0.55**
Implementation $CAR_{0,5}$	-0.0109***	0.29***	0.0021	0.48
Implementation $CAR_{0,25}$	-0.0203**	0.38	-0.0195	0.40

Panel B: Differences between pilot and matched sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	-0.0019	-1.24	-0.78	-0.05	-0.79
-4	-0.0022	-1.15	0.32	-0.03	-0.29
-3	0.0005	0.24	-0.58	0.01	0.14
-2	0.0081	3.87***	4.44***	0.29	4.10***
-1	-0.0004	-0.23	-0.01	0.00	0.09
0	-0.0031	-1.69*	-2.19**	-0.25	-3.79***
1	-0.0015	-0.79	-0.07	-0.02	-0.16
2	-0.0029	-1.17	-0.73	-0.03	-0.40
3	0.0021	0.68	-0.45	0.05	0.78
4	0.0000	-0.01	0.27	-0.05	-0.68
5	-0.0081	-3.04***	-3.67***	-0.28	-4.01***
Implementation $CAR_{0,5}$	-0.0130	-2.45**	-2.81***	-0.19	-2.70***
Implementation $CAR_{0,25}$	-0.0008	-0.04	-0.16	-0.02	-0.26

immediately lower valuations of A-shares in anticipation of the short-sales commencement.

3.4.4 Event Study Results – Implementation Returns

Table 3.5 presents the abnormal returns surrounding the implementation of the pilot short selling and margin trading programme. Pilot firms experience a decline in returns on average on the implementation day and after controlling for the matched sample returns, the -0.31% difference is significant at the 10% (5%) level for the *t*-value (Wilcoxon test). Panel A reveals significantly lower Pilot firm abnormal returns over both the $CAR_{0,5}$ and $CAR_{0,25}$ windows, however after controlling for the matched sample returns only the shorter window remains significant (see Panel B). Figure 3.2 highlights a declining trend in pilot-matched cumulative abnormal returns during the post-implementation period. The negative implementation reaction is not driven by outliers with the sign test confirming an abnormally greater number of pilot firms experience negative abnormal returns during implementation of short selling and margin trading.

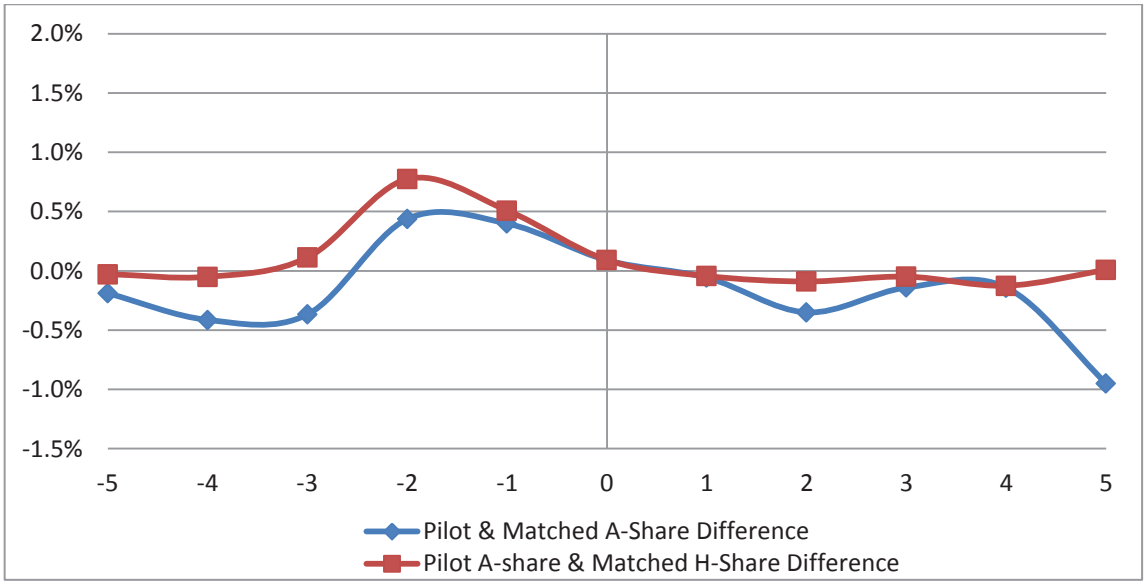
Overall the evidence is consistent with Miller's (1977) theoretical model that short-sale restrictions push prices upward. The removal of short selling constraints for the Chinese pilot stocks results in significantly negative abnormal returns which is consistent with *Hypothesis 2*.

3.4.5 Event Study Results – Implementation Trading Volume

Abnormal trading volumes surrounding the pilot programme initiation are reported in Table 3.6. Pilot firms' trading volume is significantly lower than the matched firms on the implementation day and each of the following 4 trading days (the actual level of significance varies across tests and days). Also the sign test highlights that a greater proportion of pilot firms experience abnormal declines in trading volumes compared to the matched sample. The pilot-matched difference in abnormal volume

Figure 3.2: Difference in cumulative abnormal returns around implementation.

This figure reports difference in value-weighted CARs between pilot and A- or H-share control samples. The abnormal returns are calculated based on the OLS market model around implementation event. An implementation event is defined as one in which 89 pilot stocks can be bought on margin or sold short from March 31, 2010. The implementation day is denoted as day 0. For the market model, the estimation window is (-255, -30).



over the day 0 to 5 window is -0.696 (significant at the 1% and 5% levels Wilcoxon test and *t*-test respectively). This implies that on average, abnormal volumes in pilot stocks are 11.6% lower per day in this window after controlling for abnormal volume in stocks matched by industry and common firm characteristics which include turnover. The magnitude of the pilot sample's abnormal volume of the longer window is also lower than the matched sample (albeit only at the 10% level for the Wilcoxon test).

The decline in volume is inconsistent with *Hypothesis 4A* which is based on empirical evidence from developed markets. However, it is consistent with *Hypothesis 4B*. Ausubel's (1990) model implies that less informed and uninformed investors avoid or reduce their investment when there is a heightened risk of trading against informed investors. The probability of trading against informed short sellers and margin traders

Table 3.6: Event Study Abnormal Volumes and Cumulative Abnormal Volumes around Implementation

This table reports abnormal Volumes and selected CAVs surrounding the implementation of the CSRC's pilot short selling and margin trading programme on March 31, 2010. Panel A shows abnormal volumes for the 89 pilot programme stocks and a control sample of 89 stocks matched on industry, market value of equity, closing stock price, daily turnover, and daily return volatility. Abnormal volumes are measured relative to the same firm expected daily trading volume estimated during $t_{-255\ to\ -30}$ from the event date. Abnormal Volumes of -0.50 would mean the actual volumes is reduced by 50% of the expected volumes. The proportion of positive volumes and sign test are also reported. In Panel B, the pilot-matched difference of volumes and tests of significance are presented along with the difference in fraction of positive abnormal volumes. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Implementation Volumes

Days	Pilot sample		Matched sample	
	Abnormal volumes	Positive proportion	Abnormal volumes	Positive proportion
-5	-0.5599***	0.06***	-0.4871***	0.16***
-4	-0.5829***	0.04***	-0.4231***	0.15***
-3	-0.5373***	0.07***	-0.4384***	0.16***
-2	-0.1336***	0.36***	-0.2192***	0.25***
-1	-0.4398***	0.12***	-0.2830***	0.25***
0	-0.4430***	0.08***	-0.3635***	0.16***
1	-0.3113***	0.15***	-0.1893***	0.28***
2	-0.2238***	0.18***	-0.0937	0.33***
3	-0.2799***	0.17***	-0.0890	0.33***
4	-0.3947***	0.16***	-0.2489***	0.18***
5	-0.2775***	0.21***	-0.2456***	0.21***
Implementation $CAV_{0,5}$	-1.9015***	0.12***	-1.2055***	0.20***
Implementation $CAV_{0,25}$	-6.9661***	0.19***	-5.0853***	0.24***

Panel B: Differences between pilot and matched sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	-0.0728	-1.49	-0.98	-0.10	-2.32**
-4	-0.1598	-2.78***	-1.27	-0.10	-2.43**
-3	-0.0989	-1.69*	-0.22	-0.09	-2.01**
-2	-0.0855	1.40	1.66*	0.11	1.73*
-1	-0.1568	-2.41**	-1.61	-0.10	-1.89*
0	-0.0795	-1.13	-2.07**	-0.08	-1.72*
1	-0.1220	-1.96**	-2.80***	-0.13	-2.33**
2	-0.1301	-1.41	-2.31**	-0.15	-2.38**
3	-0.1909	-2.44**	-3.12***	-0.16	-2.58***
4	-0.1458	-1.91*	-2.84***	-0.02	-0.43
5	-0.0319	-0.46	-1.10	0.00	0.00
Implementation $CAV_{0,5}$	-0.6960	-2.05**	-3.14***	-0.08	-1.51
Implementation $CAV_{0,25}$	-1.8807	-1.43	-1.73*	-0.04	-0.73

may be particularly high in China. For example, Wang (2011) suggests that due to high threshold imposed by CSRC, it is mostly institutional investors who are eligible to trade

on margin following the introduction of the pilot programme. Further, Lee, Li and Wang (2010) observe that institutional investors on Shanghai market are typically better informed.

3.4.6 Implementation Returns Robustness Check

The second matching method using the 26 pilot A-shares and their respective cross-listed H-shares is shown in Table 3.7. Consistent with our results reported in section 3.4.4, the $CAR_{0,5}$ is lower for pilot A-shares compared to pilot H-shares which implies a narrowing of the A-H premium, however the difference is not significant. There is a significant decline in volume over the shorter ($days_{0,5}$) and longer ($days_{0,25}$) windows for the pilot A-shares compared to the same companies' cross-listed H-shares. In fact, the pilot firms A-shares' abnormal volume is 32.4% lower per day on average during the shorter window compared to the same firms' H-shares. Although the pilot cross-listed subsample is small, the evidence is generally consistent with our main results. Further, Figure 3.2 also highlights a sharp decline on the implementation day in A-H cumulative abnormal returns.

In summary our implementation findings are consistent with *Hypothesis 2* and Miller's (1977) theoretical model that negative abnormal returns are associated with relaxation in short-sale constraints. In contrast, the significant decline in trading volume following the commencement of pilot programme is not consistent with *Hypothesis 4A* which was based on the extant developed market's empirical findings. However, our Chinese emerging market findings are consistent with Ausubel's (1990) theoretical model that uninformed and less informed investors are reluctant to invest if the possibility of trading against informed counterparts is high.

Table 3.7: Event Study Abnormal Returns and Abnormal Volume around Implementation: H-Share Controls

This table reports abnormal returns and volumes surrounding the implementation of the CSRC's pilot short selling and margin trading programme on March 31, 2010 in Panel A and B respectively. Daily differences are reported for the 26 pilot programme A-shares and a control sample of 26 cross-listed H-shares. In panel A (B), the A-H difference of returns (volumes) and tests of significance are presented along with the difference in fraction of positive abnormal returns (volumes). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Implementation Returns - Differences between pilot and cross-listed sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	-0.0005	-0.14	-0.59	-0.23	-1.68*
-4	-0.0003	-0.11	0.28	0.12	0.84
-3	0.0017	0.42	0.38	0.08	0.56
-2	0.0068	2.19**	2.06**	0.15	1.11
-1	-0.0024	-0.88	1.05	-0.08	-0.56
0	-0.0043	-1.32	-1.42	-0.31	-2.40**
1	-0.0012	-0.45	-0.80	-0.08	-0.57
2	-0.0002	-0.08	0.21	0.19	1.41
3	0.0000	0.02	-0.16	-0.08	0.56
4	-0.0008	-0.57	-1.60	-0.15	-1.14
5	0.0007	0.12	0.84	-0.19	-1.44
Implementation $CAR_{0,5}$	-0.0058	-0.80	-1.09	-0.12	-0.92
Implementation $CAR_{0,25}$	0.0157	0.67	0.41	-0.08	-0.55

Panel B: Implementation Volume - Differences between pilot and cross-listed sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	-0.1930	-2.32**	-3.21***	-0.19	-2.32**
-4	-0.2755	-4.25***	-3.82***	-0.28	-2.43**
-3	-0.2136	-2.58**	-2.21**	-0.21	-2.01**
-2	0.3425	3.83***	3.29***	0.34	1.73*
-1	-0.3078	-3.89***	-3.36***	-0.31	-1.89*
0	-0.3546	-2.79***	-3.03***	-0.35	-1.72*
1	-0.2776	-3.15***	-3.87***	-0.28	-2.33**
2	-0.5841	-4.35***	-5.24***	-0.58	-2.38**
3	-0.1617	-1.53	-2.44**	-0.16	-2.58***
4	-0.4585	-3.34***	-4.05***	-0.46	-0.43
5	-0.1149	-1.24	-1.72*	-0.11	0.00
Implementation $CAV_{0,5}$	-1.9464	-3.64***	-4.22***	-0.08	-2.57**
Implementation $CAV_{0,25}$	-4.5333	-2.21**	-2.69***	0.00	0.00

3.4.7 Cross-Sectional Regressions of Abnormal Returns around Announcement and Implementation

We use a number of regression models to explore the factors that influence the observed announcement and implementation pilot firm CARs.[35] The regression model is as follows:

$$CAR_i^m(t_1, t_2) = \alpha + \beta MT\_Ratio + \gamma SS\_Ratio + \sum Overvaluation\ proxies + \sum Divergence\ of\ opinion\ proxies + \sum Corporate\ governance\ proxies + \sum Industry\ dummies + \varepsilon \quad (5)$$

Model 1 examines the impact of short selling and margin trading volume on implementation CARs, while proxies for over-valuation, divergence of opinion and corporate governance are presented in models 2 to 4. In model 5, we examine whether particular industries drive the results. We now briefly discuss the proxies used in each model and the results. Tables 3.8 and 3.9 report the results of a multivariate analysis of $CAR_{0,5}$ and $CAR_{0,25}$ around the announcement and introduction of the pilot programme respectively.

Model 1 of Table 3.9, tests the impact of *MT_Ratio* and *SS_Ratio* (measured as average daily margin buying or short selling volume divided by total volume traded) on the observed implementation returns. Margin trading allows cash-constrained investors with a positive outlook to have their views impounded in stock prices, while removal of short-sale constraints allows pessimistic investors to participate in the market. As such, we would expect a positive coefficient for the *MT_Ratio* and negative coefficient for the *SS_Ratio*.

[35] We rule out potential biases in the regression results due to multicollinearity problem as none of the explanatory variables are strongly correlated with others as shown in Table B.3 in Appendix-B.

Table 3.8: Cross-Sectional Regressions of Cumulative Abnormal Returns around Announcement

This table reports OLS regressions surrounding the announcement of the CSRC's pilot short selling and margin trading programme on February 12, 2010. The dependent variable is value-weighted $CAR_{0,5}$ in Panel A and $CAR_{0,25}$ in Panel B. *Relative_M/B* and *Relative_P/E* is market to book ratio and price to earnings ratio as of December 31, 2009 respectively. *Relative_CFO* is operating cash flows in year 2009 to total assets at the beginning of 2009, and *Relative_Debt* is the total liabilities to total assets ratio as at December 31, 2009. Each pilot stock's explanatory variable in Model 2 is divided by the same industry median. *Turnover* is the daily ex ante volume of trade, averaged over the period of (-255, -30) and scaled by outstanding shares. $Sigma_{ab}$ is the standard deviation of daily abnormal returns in the estimation window of (-255, -30) based on the market model. *Board_Ind* is the fraction of independent directors on the board. *Board_Size* is the number of directors in each firm. *State_Dummy* is equal to one where state ownership is greater than the median state ownership for pilot stocks, otherwise zero. Industry dummies in Model 5 are equal to one where, pilot firm belongs to the particular industry, otherwise zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A	**Dependent Variable: Value-weighted $CAR^{m}_{(0,5)}$**				
	Exp Sign	Model 2	Model 3	Model 4	Model 5
Intercept		-0.0574***	-0.0208	0.0011	-0.0116**
t-stat		(-2.94)	(-1.22)	(0.03)	(-2.05)
Relative_M/B	-	-0.0071			
t-stat		(-1.00)			
Relative_P/E	-	0.0004			
t-stat		(0.05)			
Relative_CFO	+	0.0024			
t-stat		(0.75)			
Relative_Debt	-	0.0401***			
t-stat		(3.18)			
Turnover	-		-0.0005		
t-stat			(-1.43)		
$Sigma_{ab}$	-		0.8582		
t-stat			(0.97)		
Board_Ind	+			-0.0295	
t-stat				(-0.42)	
Board_Size	-			0.0001	
t-stat				(0.04)	
State_Dummy	+/-			-0.0120	
t-stat				(-1.20)	
Finance_Dummy	-				-0.0280**
t-stat					(-2.07)
Basic_Materials_Dummy					-0.0427***
t-stat					(-3.13)
Industrials_Dummy					0.0089
t-stat					(0.60)
Consumer_Goods_Dummy					-0.0067
t-stat					(-0.39)
No. of obs.		90	90	90	90
Adjusted R^2		0.0809	0.0012	0.0000	0.1457

Table 3.8 (Continued)

Panel B		**Dependent Variable: Value-weighted $CAR^{m}_{(0,25)}$**			
	Exp Sign	Model 2	Model 3	Model 4	Model 5
Intercept		-0.0744***	-0.0208	-0.0713	-0.0176
t-stat		(-2.69)	(-1.22)	(-1.28)	(-1.11)
Relative_M/B	-	-0.0109			
t-stat		(-1.07)			
Relative_P/E	-	-0.0114			
t-stat		(-1.08)			
Relative_CFO	+	-0.0052			
t-stat		(-1.17)			
Relative_Debt	-	0.0626***			
t-stat		(3.50)			
Turnover	-		-0.0002		
t-stat			(-0.30)		
$Sigma_{ab}$	-		-2.4533*		
t-stat			(-1.89)		
Board_Ind	+			0.0090	
t-stat				(0.09)	
Board_Size	-			0.0036	
t-stat				(1.49)	
State_Dummy	+/-			-0.0195	
t-stat				(-1.32)	
Finance_Dummy	-				0.0030
t-stat					(0.15)
Basic_Materials_Dummy					-0.0427***
t-stat					(-2.58)
Industrials_Dummy					0.0089
t-stat					(0.06)
Consumer_Goods_Dummy					-0.0067
t-stat					(-1.79)
No. of obs.		90	90	90	90
Adjusted R^2		0.1709	0.0012	0.0153	0.1012

When $CAR_{0,5}$ is the dependent variable, *SS_Ratio* is negative and significant at the 5% level implying that higher short selling activity leads to more negative returns. However, it should be noted that only 15 of 89 stocks experienced short-sales activity during the day 0 to 5 window. Therefore actual short-sales activity cannot explain the pervasive negative abnormal returns experienced by over 70% of pilot stocks during this window. When the dependent variable is $CAR_{0,25}$ (see Panel B of Table 3.9) the *SS_Ratio* exhibits the expected negative sign but is insignificant. In both equations the

Table 3.9: Cross-Sectional Regressions of Cumulative Abnormal Returns around Implementation

This table reports OLS regressions surrounding the implementation of CSRC's 2010 pilot short selling and margin trading programme on March 31, 2010. The dependent variable is value-weighted $CAR_{0,5}$ in Panel A and $CAR_{0,25}$ in Panel B. *MT_Ratio* and *SS_Ratio* is the average daily margin-buying or short selling volume divided by total volume traded during event window. *Relative_M/B* and *Relative_P/E* is market to book ratio and price to earnings ratio as of December 31, 2009 respectively. *Relative_CFO* is operating cash flows in year 2009 to total assets at the beginning of 2009, and *Relative_Debt* is the total liabilities to total assets ratio as at December 31, 2009. Each pilot stock's explanatory variable in Model 2 is divided by the same industry median. *Turnover* is the daily ex ante volume of trade, averaged over the period of (-255, -30) and scaled by outstanding shares. $Sigma_{ab}$ is the standard deviation of daily abnormal returns in the estimation window of (-255, -30) based on the market model. *Board_Ind* is the fraction of independent directors on the board. *Board_Size* is the number of directors in each firm. *State_Dummy* is equal to one where state ownership is greater than the median state ownership for pilot stocks, otherwise zero. Industry dummies in Model 5 are equal to one where, pilot firm belongs to the particular industry, otherwise zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A		**Dependent Variable: Value-weighted $CAR^{m}_{(0,5)}$**				
	Exp Sign	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept		-0.0072*	-0.0336**	-0.0216*	0.0311	0.0049
t-stat		(-1.94)	(-2.49)	(-1.80)	(1.22)	(0.73)
MT_Ratio	+	-5.8089				
t-stat		(-1.35)				
SS_Ratio	-	-3.4699**				
t-stat		(-2.05)				
Relative_M/B	-		0.0095*			
t-stat			(1.89)			
Relative_P/E	-		0.0143***			
t-stat			(2.76)			
Relative_CFO	+		-0.0008			
t-stat			(-0.36)			
Relative_Debt	-		0.0009			
t-stat			(0.10)			
Turnover	-			0.0009***		
t-stat				(3.50)		
$Sigma_{ab}$	-			-0.4951		
t-stat				(-0.80)		
Board_Ind	+				-0.0433	
t-stat					(-0.92)	
Board_Size	-				-0.0028**	
t-stat					(-2.50)	
State_Dummy	+/-				0.0138**	
t-stat					(2.04)	
Finance_Dummy	+/-					-0.0357***
t-stat						(-4.03)
Basic_Materials_Dummy						0.0006
t-stat						(-0.07)
Industrials_Dummy						-0.0095
t-stat						(-0.97)
Consumer_Goods_Dummy						-0.0428***
t-stat						(-3.72)
No. of obs.		89	89	89	89	89
Adjusted R^2		0.0388	0.1010	0.1117	0.0769	0.2517

Table 3.9 (Continued)

Panel B		**Dependent Variable: Value-weighted $CAR^{m}_{(0,25)}$**				
	Exp Sign	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept		-0.0191	-0.0676	-0.0130	0.0627	0.0134
t-stat		(-1.12)	(-1.37)	(-0.31)	(0.66)	(0.49)
MT_Ratio	+	1.4760				
t-stat		(0.12)				
SS_Ratio	-	-0.0975				
t-stat		(-0.71)				
Relative_M/B	-		0.0401**			
t-stat			(2.19)			
Relative_P/E	-		0.0312*			
t-stat			(1.65)			
Relative_CFO	+		-0.0056			
t-stat			(-0.70)			
Relative_Debt	-		-0.0129			
t-stat			(-0.40)			
Turnover	-			0.0035***		
t-stat				(4.00)		
$Sigma_{ab}$	-			-4.3892**		
t-stat				(-2.02)		
Board_Ind	+				-0.1243	
t-stat					(-0.70)	
Board_Size	-				-0.0042	
t-stat					(-1.00)	
State_Dummy	+/-				0.0254	
t-stat					(1.00)	
Finance_Dummy	+/-					-0.0860**
t-stat						(-2.42)
Basic_Materials_Dummy						0.0013
t-stat						(0.04)
Industrials_Dummy						-0.0202
t-stat						(-0.52)
Consumer_Goods_Dummy						-0.0710
t-stat						(-1.54)
No. of obs.		89	89	89	89	89
Adjusted R^2		0.0000	0.0614	0.1379	0.0000	0.0664

MT_Ratio coefficients are insignificant. This is consistent with our discussion in the hypothesis development section where we expected the negative short-sales effect to dominate the positive margin trading effect on stock returns as investors could already effectively margin trade through personal borrowing.

In model 2, we examine the effect of overvaluation on the observed returns. Miller's (1977) overvaluation hypothesis suggests that investors with negative signals are unable to enter the market due to the restrictions on short selling. Therefore absence

of short sellers, compounded by the dominance of unsophisticated individual investors in China may induce overvaluation. Griffin and Lemmon (2002) find overpricing in low book-to-market securities with high leverage ratios. In model 2 we use four overvaluation measures, including market to book ratio (M/B), price to earnings ratio (P/E), operating cash flows to total assets ratio (CFO) and total liabilities to total assets ratio (debt). To measure the overvaluation of a pilot stock relative to its industry peers, each pilot stock's variable is divided by the same industry median variable. This gives us the four overvaluation proxies of *Relative_M/B, Relative_P/E, Relative_CFO*, and *Relative_Debt.* Overvalued pilot stocks may be sold more aggressively after the announcement in anticipation of short selling. Also, during the implementation period we expect short sellers (margin traders) to target (avoid) firms which are overvalued, highly levered, and poor operating cash flows relative to their industry peers. Therefore, we expect negative coefficients for *Relative_M/B*, *Relative_P/E*, and positive for *Relative_CFO*.

For model 2, when the pilot programme announcement CARs is the dependent variables (Table 3.8), the *Relative_Debt* coefficient is positive and significant at the 1% level. This implies that the short selling and margin trading programme announcement had a positive (or less negative) impact on pilot firms with higher debt ratios within the industry. The coefficients of other variables are not different from zero. For the model 2 regressions of the implementation $CAR_{0,5}$ and $CAR_{0,25}$ reported in Table 3.9, the coefficients on *Relative_M/B* and *Relative_P/E* are positive and statistically significant. Therefore those with higher M/B and P/E ratios relative to their industry peers have higher returns during the implementation period. These results are not consistent with the predicted relationships where we expect the short sellers (margin-buyers) would target (avoid) those pilot stocks with relatively higher overvaluation following the

commencement of short selling. However, our results are consistent with Wang (2012) who finds pessimist investors avoid short selling stocks that are more overvalued and have high idiosyncratic risk. Hence relatively more overvalued pilot stocks decline less during the initiation period of short selling.

In model 3, we test the dispersion of investors' opinion on observed returns. The second condition of Miller's (1977) theoretical model suggests that when investors have more diverse views about a particular firm, security overvaluation is more evident in the presence of short-sale constraints. Chang, Cheng and Yu (2007) find that in the presence of short-sale constraints, firms with higher divergence of opinion have significantly lower CARs following the initiation of short sales in the Hong Kong market. Hence when greater ex-ante differences of opinion exist we would expect lower (more negative) abnormal returns following the regulation change. Following Chang, Cheng and Yu (2007) we use ex-ante *Turnover* measured as the daily traded volume divided by shares outstanding and $Sigma_{ab}$[36] which is the standard deviation of the stock's abnormal returns as proxies for dispersion of opinion. Based on the prior literature we expect negative coefficients on *Turnover* and $Sigma_{ab}$.

In Table 3.8, where the dependent variable is the pilot programme announcement returns, Panel A shows that both *Turnover* and the $Sigma_{ab}$ are insignificant variables in explaining the $CAR_{0,5}$. However, for the longer event window returns reported in Panel B, $Sigma_{ab}$ is negative and marginally significant at 10% level. This finding suggests that the post-announcement CARs are negatively associated with a higher ex-ante standard deviation of abnormal returns. Table 3.9 reveals that *Turnover* is significantly positively related to implementation CARs, whereas a significant

[36] Due to the high correlation of 0.85 between the ex-ante standard deviation of the stock's raw returns and ex-ante standard deviation of the stock's abnormal returns, we have not included the $Sigma_{raw}$ variable.

negative coefficient for $Sigma_{ab}$ is observed for $CAR_{0,25}$. Overall, our model 3 results on divergence of opinion are inconclusive. Consistent with the second condition of Miller's (1977) theory, we find that pilot firms with a higher ex-ante standard deviation of abnormal returns experience more negative announcement and implementation returns. In contrast, firms with higher prior turnover experience positive returns during the implementation period.

Model 4 examines the effects of corporate governance structure on the observed returns. Jensen's (1993) proposition states that firms with over-sized boards are less likely to operate effectively and this is empirically supported by Yermack (1996). Regarding ownership structure, Estrin and Perotin (1991) assert that government / state-owned firms do not focus on profit maximization due to political and economic objectives, and thus the corporate performance remains weak. However, Sun, Tong and Tong (2002) find a positive relationship between Chinese government ownership and corporate performance. Thus, corporate governance structure proxies are; *Board_Ind* which is the fraction of independent directors on the board, *Board_Size* is the number of directors, and *State_Dummy* which is equal to one where state ownership is greater than the median state ownership for pilot stocks, otherwise zero. We expect returns to be positively related to *Board_Ind* and negatively related to *Board_Size*.

We find no significant relationships between the corporate governance variables and announcement period returns as reported for Model 4 in Table 3.8. However in Panel A of Table 3.9, the significant (5% level) negative coefficient for *Board_Size* implies that firms with over-sized boards experience lower returns. We also find that higher state ownership (*State_Dummy)* has a positive impact on the implementation

$CAR_{0,5}$. This result is consistent with Sun, Tong and Tong (2002) finding that state ownership aids in better firm performance.

Model 5 tests the industry impact on pilot firm returns where an industry dummy is equal to one if pilot firms belong to a particular industry, otherwise zero. Given the continued focus on the financial sector world-wide during the announcement and implementation of pilot programme, we argue that financial sector stocks within the pilot sample may be targeted by short sellers. Hence, we expect a negative coefficient on *Finance_Dummy* after the announcement as investors and short sellers may push prices downwards in anticipation of impending short sales and following the commencement of short sales respectively.

In Model 5 of Table 3.8, the coefficient on *Finance_Dummy* is significantly negative for the shorter window (refer Panel A). This suggests Chinese investors are concerned about financial sector pilot stocks following the announcement of the introduction of short selling. The coefficient on *Basic_Materials_Dummy* is also significantly negative for both Panels A and B. The implementation returns in Model 9 show that the coefficient on *Finance_Dummy* is negative and statistically significant in both panels. This is consistent with investors perceiving a greater risk of short sellers targeting finance sector stocks.[37]

3.5 Conclusion

The Chinese Securities Regulatory Commission (CSRC) announced a regulation change that paved the way for margin trading and short selling in early 2010 in 90 large "pilot programme" stocks. This move came at a time when financial regulators in many

[37] The raw data shows that just over 50% of the short selling activity is concentrated in financial sector stocks during the day 0 to 5 window of short selling implementation.

markets of the world enforcing new rules to constrain short sales. We study the impact of the announcement and implementation of this regulation on stock returns and trading volume.

We find that pilot programme stocks have statistically significant negative CARs following the announcement and introduction of the regulation. Moreover, these CARs are lower than the CARs of both matched non-pilot A-shares and cross-listed H-shares. The negative announcement CARs are consistent with the literature that suggests investors will anticipate a negative price response to the implementation of short selling regulation. The significant negative abnormal returns following the regulation implementation is consistent with the Miller's (1977) overvaluation hypothesis. We suggest our finding that the negative returns impact of short selling offsets any positive impact from allowing margin trading is unsurprising given cash-constrained investors with a positive view on stocks could have borrowed against property prior to the regulation change.

Pilot firms experience a statistically significant decline in trading activity following the announcement and implementation of short selling and margin trading. This is consistent with the theoretical model of Ausubel (1990), which implies that less informed and uninformed investors avoid trading due to the risk of trading against better informed counterparts.

Pilot firms in the finance industry have lower announcement and implementation CARs than firms in other industries. This is consistent with investors' perceiving such firms to be more vulnerable to short selling following the global financial crisis. Firms with higher relative valuation decline less than less overvalued

firms, which is consistent with Wang's (2012) finding that relatively overvalued firms have high idiosyncratic risk which deters pessimistic investors from short selling.

CHAPTER FOUR

ESSAY THREE

This chapter presents the final essay of this thesis which investigates the effect of short selling and margin buying on measures of price efficiency, characteristics of stock returns distributions, and price clustering in the Chinese capital market. Two major events are considered in this essay to examine the aforesaid relationships. First, the introduction of pilot short selling and margin trading programme containing 90 A-shares on March 31, 2010, and second, the conversion of pilot programme to normal operations by including next batch of 190 A-shares and 7 Exchange Traded Funds (ETFs) on December 5, 2011.

Chang, Cheng, and Yu (2007) examine the distributional characteristics of stock returns in the Hong Kong market and employ univariate tests to document the changes in skewness and extreme negative returns of stocks before and after their addition to the shortable stocks list. Whereas, this chapter examines the stock return distributions in an emerging market of China, following the implementation of both short selling and margin trading. We analyse skewness, kurtosis and both positive and negative extreme returns. Further, we also use multivariate tests to assess which variables influence the changes in stock return distributions.

An overview of the impact of short-sale constraints on efficiency, return distributions, and cultural number preferences is provided in Section 4.1 of the chapter. Section 4.2 provides literature review and development of hypotheses. Section 4.3 provides data and sample selection based on two events. Section 4.4 and 4.5 outlines the

test methodologies and results respectively, while Section 4.6 concludes this essay. The essay's appendix and reference list is presented in the last section of this thesis.

The Impact of Short Selling and Margin Trading Regulation on Price Efficiency in China

Abstract

We investigate the impact of short selling and margin trading on measures of price efficiency, characteristics of stock returns distributions, and price clustering in the Chinese equity market. Short selling and margin trading was permitted on selected stocks from March 31, 2010 and was subsequently extended to further securities in December 5, 2011. First, we find that the regulation change does not have a consistent impact on various price efficiency measures. Second, lifting short-sales constraints significantly reduces skewness. Third, the avoidance of numbers ending in 4, which is considered as unlucky, has marginally been reduced following the regulation change.

Key words: *Short selling, Margin trading, Price efficiency, Stock returns distributions, Price Clustering.*

JEL classification: G10, G12, G14, G18

4.1 Introduction

It is generally accepted that allowing short selling makes prices more efficient.[38] As Li (2008, p. 88) notes in regards to the Chinese equity market, "In stock markets where informational asymmetry and investors' irrationalities seem to be inevitable, short sales are, therefore, indispensable for improving market inefficiency."

The China Securities Regulatory Commission (CSRC) allowed pilot short selling and margin trading programme in 90 A-shares effective from March 31, 2010 (Bryan, TieCheng and Phua, 2010). Subsequently, effective from December 5, 2011, short selling and margin trading was permitted in a further 197 securities (referred to as the affected securities in the essay) and more securities brokers were allowed to participate in the securities lending business.[39,40] These initiatives occurred at a time when financial regulators around the world were devising new rules to curb short selling to deal with the aftershocks of GFC (e.g., Gruenewald, Wagner, and Weber, 2010), and the euro-zone debt crisis (e.g., O'Sullivan and Kinsella, 2012).

We examine the impact of the introduction and expansion of China's short sales and margin trading on price efficiency. The role of short sellers in the price discovery process is relevant to academics, financial market regulators, and practitioners. Secondly, we investigate how the practices of short sales and margin trading influence the characteristics of stock returns distributions of affected securities. These characteristics include skewness, kurtosis, and occurrence of extreme negative and positive returns. Hong and Stein's (2003) model suggests severe price drops when unrevealed information due to shorting restrictions becomes public in the down

[38] See, for example, Bris, Goetzmann and Zhu (2007) and Saffi and Sigurdsson (2011).
[39] See, for example, http://us.practicallaw.com/5-517-6421?source=relatedcontent#a454418 .
[40] A total of 287 securities eligible for margin trading and short selling from December 2011 consist of Shanghai Stock Exchange SSE-180 index stocks, Shenzhen Stock Exchange SZSE-100 index stocks, and 7 Exchange Traded Funds (ETFs); 4 listed on SSE and 3 on SZSE.

markets. The theoretical model of Xu (2007) predicts that differences in investor opinion and short-sale constraints increase skewness of stock returns. Therefore, it is interesting to investigate the theoretical implications of Hong and Stein (2003) and Xu (2007) models in an emerging market.

Previous studies, such as Brown and Mitchell (2008), show that Chinese investors view the number 8 as "lucky" and the number 4 as "unlucky", and this manifests itself in more prices ending in 8 than 4. Our third contribution is examining whether cultural price clustering decreases following the introduction of regulation that is intended to improve the price discovery process. Our analysis benefits from the regulatory feature of the Chinese market where short selling and margin trading is partially allowed in two phases for a large group of securities.[41]

A number of studies examine the introduction of short selling and margin trading in China from different perspectives. Sharif, Anderson and Marshall (2013, 2013) and Wang (2012) find a decline in the prices or returns of stocks subject to the regulation change relative to matched firms. Sharif, Anderson and Marshall (2013, 2013) also show that there are liquidity declines in affected stocks. Wang (2011) also finds a similar result and shows there is an increase in informed trading.[42]

Our paper contributes to the important work of Bris, Goetzmann and Zhu (2007) and Saffi and Sigurdsson (2011). Bris, Goetzmann and Zhu (2007) analyse the effects of short-sale constraints on market efficiency in 46 countries and find that stocks are more efficiently priced in countries where short selling is practicable and less

[41] As a robustness test, we use matched sample of 35 cross-listed H-shares to investigate the effect of short sales and margin borrowing on pricing efficiency and stock returns distributions.
[42] We have recently become aware of Chang, Luo and Ren (2012) who examine the impact of relaxation of short selling and margin trading constraints on pricing efficiency and stock returns distributions in China. They also find no improvement in price efficiency following the practice of short selling and margin trading.

constrained. Saffi and Sigurdsson (2011) also conclude, based on a sample of firms from 26 countries, that stock prices are more efficient where short-sales constraints are low. Our single country analysis differs from these studies as we use actual short sales and margin buying data to directly examine the impact of short-sales on price efficiency measures.[43] Prior to short-sales legality and its subsequent expansion, put options were non-existent in China, which suggests that negative information cannot be incorporated easily into stock prices before the change in regulation. Bris, Goetzmann and Zhu (2007) use country-level short-sales constraints data, whereas, Saffi and Sigurdsson (2011) use short-sales constraint proxies to examine their impact on prices.

There is no consistent change in price efficiency across the different measures we employ following the commencement of short selling and margin trading. We find a significant increase in R^2s, suggesting that efficiency has deteriorated for affected securities with higher short-sales.[44] However, we find mixed results for another efficiency measure i.e., cross-autocorrelation (ρ). We also estimate two measures of price delay proposed by Hou and Moskowitz (2005) from market model regressions. The first delay measure (*D1*) compares the fraction of changes in stock returns arising from lagged market returns. The second delay measure (*D2*) tests the size of the lagged market returns betas relative to the contemporaneous market return beta. Lower values of *D1* and *D2* suggest that the speed of price adjustment is faster. Both delay measures are insignificantly different from zero following the inception of short selling and margin trading.

[43] Cheng, Yan, Zhao and Chang (2012) also examine the effects of short selling on IPO price efficiency in Taiwan six months before and after the relaxation of short-sale constraints using actual short-sales data.
[44] There are several applications and interpretations of R-square in the finance literature. In this chapter we are using Roll's (1988) R^2 measure and interpretation. This is a decrease in R^2 suggests an improvement in price efficiency. An example of an alternative interpretation of R^2 is Dasgupta et al (2010) who suggest an increase in R^2 can indicate an improvement in price efficiency

We find a significant decline in the positive skewness of affected securities' abnormal returns following the removal of short sales and margin trading constraints This reduction in skewness is observed for firms with higher short-sales activity, which is consistent with the theoretical model proposed by Xu (2007). The occurrence of extreme positive returns increases significantly in the post-period for securities with higher short sales and margin trading activity. This result, however, suggests that lifting of short-sales restrictions does not cause extreme negative returns. Lastly, we find a significant increase in daily closing prices ending with digit 4 as compared to digit 8 following short sales and margin trading practice. Further, the variation in the frequency of stock prices ending in 0 through to 9 declined substantially following the introduction of short selling and margin trading. This suggests that the regulation change has resulted in some reduction of the influence of cultural superstition on prices and price clustering in general.

The remainder of the paper is organised as follows. Section 4.2 presents the literature review and develops the hypotheses. Section 4.3 describes the data and sample. Section 4.4 explains the methodology used. Section 4.5 presents our results, while section 4.6 concludes the study.

4.2 Literature review and hypotheses development

The majority of studies find that prices are more efficient when short sales are allowed. Bris, Goetzmann, and Zhu (2007) conclude this after studying short-sales regulations in 46 countries and Saffi and Sigurdsson (2011) reach a similar conclusion based on their study of 26 countries. Recently, Cheng, Yan, Zhao, and Chang (2012) find a positive relation between price efficiency and short sales activity for newly listed

Taiwanese stocks. Moreover, Seguin (1990) examines the introduction of margin buying for OTC stocks in the U.S. and finds lower volatility and improvement in price informativeness in margin eligible stocks. Hence, based on the literature discussed above, our first Hypothesis is:

Hypothesis 1: The speed of adjustment and efficiency of security prices improves following the lifting of short selling and margin trading constraints.

There is no consensus in the literature on the relation between short-sale constraints and the positive or negative skewness of stock returns. The theoretical model of Xu (2007) predicts that divergence in investor opinion and short-sale constraints increases the skewness of stock returns. Consistent with this proposition, Chang, Cheng and Yu (2007) find decline in positive skewness of raw and abnormal returns in Hong Kong market following the lifting of short-sales restrictions. Saffi and Sigurdsson (2011) also find an overall decline in skewness of returns when short selling constraints are relaxed. However, Bris, Goetzmann, and Zhu's (2007) evidence is inconsistent with the implication of Xu's (2007) analysis. They find less negative skewness in markets where short selling is not practicable. Bris, Goetzmann, and Zhu (2007) also find marginal increase in negative skewness of market returns in five countries following regulatory changes allowing short sales during their sample period. Charoenrook and Daouk (2005) find no evidence of short-sale constraints affecting the level of market return skewness. Further, the individual stock returns are generally positively skewed (Xu, 2007). Hence, given the above literature, we base our second Hypothesis on the research that following the lifting of short-sale restrictions in China, the security prices incorporate adverse information faster and thus the probability of observing extreme negative (positive) returns increase (decrease); that is:

Hypothesis 2: The negative skewness of security returns increase and/or positive skewness of security returns decrease following the lifting of short selling and margin trading constraints.

The higher magnitude and probability of observing extreme price movements following the short sales and margin borrowing activity can be gauged from the kurtosis of returns and extreme positive and negative returns. There is no consensus in the literature on the relationship between short-sale constraints and the occurence of extreme returns. Thicker tails in the distribution of returns indicate high kurtosis, which would imply higher frequency of extreme returns. Saffi and Sigurdsson (2011) find smaller kurtosis and lower frequency of extreme positive returns for individual stocks with less short-sale restrictions. This finding is consistent with the implication of Hong and Stein's (2003) model that suggests more extreme negative returns in the presence of short-sale constraints. Hong and Stein's model argue that in the presence of short selling constraints, the unrevealed adverse information possessed by short sellers becomes noticeable in the declining markets and this further intensify the market declines. However, Bris, Goetzmann, and Zhu (2007) find that allowing short-sales increases the likelihood of crashes, which is in accordance with the general opinion of financial regulators that restricting short selling decreases the frequency of extreme negative returns. Similarly, Chang, Cheng and Yu (2007) find an increase in the occurrence of extreme negative stock returns following the relaxation of short-sale constraints in Hong Kong. On the other hand, Charoenrook and Daouk (2005) find no evidence that short selling affect the probability of extreme negative market returns. Hence due to the conflicting empirical evidence on the direction of kurtosis and probability of extreme negative or positive returns, we do not form a prior opinion on the direction of kurtosis

and the frequency of extreme negative or positive returns. As such our null Hypotheses are:

Hypothesis 3: The kurtosis of security returns does not change following the lifting of short selling and margin trading constraints.

Hypothesis 4: The occurrence of extreme negative and positive returns does not change following the lifting of short selling and margin trading constraints.

Ball, Torous and Tschoegl (1985) hypothesise that price clustering is a function of uncertainity about the value of an asset. The price clustering is high when the price of an asset is not fully known. Chinese investors prefer the number 8 which is considered "lucky", and avoid the number 4 which is considered unlucky in their investment decisions (Brown & Mitchell, 2008). Aitken, Brown, Buckland, Izan and Walter (1996) suggest that price clustering decreases when the price discovery process improves through options trading and short selling. Hence, based on the literature discussed above, our fifth Hypothesis is:

Hypothesis 5: The price clustering based on cultural bias for certain numbers in equity prices reduces following the lifting of short selling and margin trading constraints.

4.3 Data and Sample

Stock returns, prices, trading volumes, shares outstanding, and value-weighted indices return data are obtained from Thomson Reuters Datastream (TRD) database. The daily short sales and margin trading data are obtained from the China Securities Market and Accounting Research database (CSMAR). The sample covers the period from June 1, 2009 to June 30, 2012. During the sample period, there are 285 A-shares and 7 Exchange Traded Funds (ETFs) commencing short sales and margin trading on

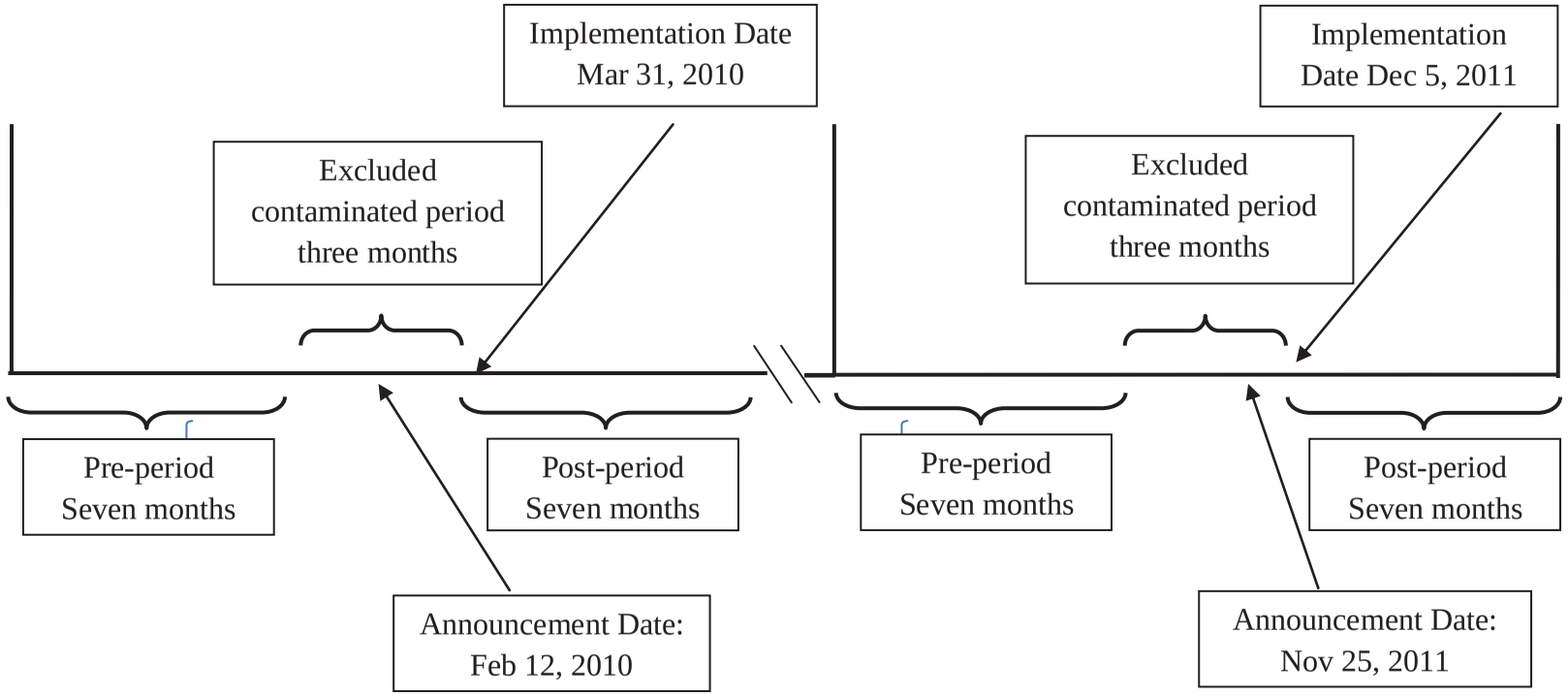
the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE). Under the pilot programme, short selling and margin buying was allowed in 90 stocks from March 31, 2010. Following the reconstitution of SSE-50 and SZSE-40 indices, 5 more stocks became eligible for short selling and margin trading from July 1, 2010. Finally, from December 5, 2011 when the pilot programme is converted to normal operations, 190 additional stocks and 7 ETFs were included in the list.

We use daily data to examine the price efficiency measures, the characteristics of stock returns distributions, and the price clustering. We apply a filter of a minimum of 100 daily observations, before and after the introduction of short sales and margin trading, which reduces our final sample down to 277 A-shares and 7 ETFs. Out of the total sample, 180 A-shares and 4 ETFs are listed on the SSE, whereas 97 A-shares and 3 ETFs are listed on the SZSE. The pre-period is seven-months before the commencement of short selling and margin trading for each stock,[45] whereas the post-period is seven-months immediately following the start of short sales and margin trading for each stock. Figure 4.1 exhibits the timeline of pre- and post-periods.

For robustness, we also examine the short sale and margin tradable Chinese A-shares that have cross-listed equivalent stocks in the Hong Kong and U.S. markets. Of the 277 A-shares, 40 have cross-listings. After applying the filtering criteria of a minimum of 100 daily observations in the pre- and post-periods, we have a control sample of 35 cross-listed H-shares.[46]

[45] In order to avoid any contaminating effect of announcement of stocks eligible for short sales and margin trading, we take a seven-month period that is three months prior to the commencement of short selling and margin trading as our pre-period. For example, if the sample stock is eligible for short selling and margin trading from December 5, 2011, then the pre-period is from Feb 1, 2011 to Aug 31, 2011.
[46] All 35 stocks are cross-listed in the Hong Kong Stock Exchange following the screening criteria.

Figure 4.1: Pre- and Post-period timelines for Short Selling and Margin Trading[47]



[47] Five A-shares allowed for short selling and margin buying from July 1, 2010 due to reconstitution of SSE-50 Index and SZSE Component (40) Index. The pre-period for those stocks is from September 1, 2009 to March 31, 2010; and post period is between July 1, 2010 and January 31, 2011.

4.4 Methodology

4.4.1 Measures of Price Efficiency

First we employ R^2 to examine whether the incorporation of firm-specific information in prices increases following the relaxation of short-sales and margin buying constraints. Roll (1988) suggests that if investors' trading is linked with more firm related information this leads to higher stock return variation and hence lowers the security's R^2. Secondly, we employ cross auto-correlation (ρ); lower cross auto-correlation indicates greater speed of price adjustment. Thirdly, we employ two price delay measures, *D1* and *D2*; lower delay measures suggest higher efficiency.

To measure the pricing efficiency, we follow Bris, Goetzmann and Zhu (2007) to calculate the R^2, upside R^2, and downside R^2 from the following three regressions:

$$r_{it} = \alpha_i + \beta_i^M * r_{mt} + \varepsilon_{it} \quad (1)$$

where we regress daily stock returns on the value-weighted market return for firm *i* on day *t*.

$$r_{it} = \alpha_i + \beta_i^M * r_{mt}^+ + \varepsilon_{it} \quad (2)$$

where r_{mt}^+ equal to 1, when the market return is either positive or zero.

$$r_{it} = \alpha_i + \beta_i^M * r_{mt}^- + \varepsilon_{it} \quad (3)$$

where r_{mt}^- equal to 1, when the market return is negative. Following Bris, Goetzmann and Zhu (2007), we measure relative co-movement of stock returns with the market, based on the sign of the market return by computing the difference between downside and upside R^2.

Next, we estimate price efficiency using cross-autocorrelations between market returns lagged 1 day and individual stock returns. Following Bris, Goetzmann and Zhu (2007) we also calculate $\rho_{it}^{+} = corr(r_{it}, r_{mt-1}^{+})$ and $\rho_{it}^{-} = corr(r_{it}, r_{mt-1}^{-})$ for eligible securities using daily observations. We then average the cross-autocorrelations across stocks and calculate the difference:

$$\rho_i^{Diff} = \rho_{it}^{-} - \rho_{it}^{+} \tag{4}$$

To examine the changes in price efficiency measures following the introduction of short sales and margin trading activity, we use *t*-test and Wilcoxon rank sum test between the pre- and post-period paired samples.

To further measure the speed of information diffusion in prices, we use two stock price adjustment delay measures developed by Hou and Moskowitz (2005). The market return is utilised as a proxy for new information to which individual stock prices react:

$$r_{i,t} = \alpha_i + \beta_i^0 R_{m,t} + \varepsilon_{i,t} \qquad \text{(Base market model)} \tag{5}$$

$$r_{i,t} = \alpha_i + \beta_i^0 R_{m,t} + \sum_{n=1}^{4} \beta_i^n R_{m,t-n} + \varepsilon_{it} \quad \text{(Extended market model)} \tag{6}$$

where $r_{i,t}$ is the return of stock *i* on day *t*, $R_{m,t}$ ($R_{m,t-n}$) is the market return on day *t* (*n* days prior to day *t*). In equation (6), if the stock reacts immediately to new information, β_i^0 will be significantly different from zero, but the β_i^n coefficients will not differ significantly from zero. Alternatively if the reaction is delayed, β_i^0 will be less significant or insignificant and some or all of the β_i^ns will be significantly different from zero.

We also use two delay measures consistent with Hou and Moskowitz (2005) and Saffi and Sigurdsson (2011). The first R^2 ratio, measures the proportional difference

between the explanatory power of contemporaneous versus lagged market returns to predict stock returns.

$$D1_i = 1 - \frac{R^2_{base}}{R^2_{extended}} \quad (7)$$

where R^2s are obtained from equations (5) and (6) of the base and extended market models respectively. The larger the D1, the higher the variation in stock returns captured by the lagged market returns, which implies that security price takes longer to respond to new market information. However, D1 does not take the magnitude of the coefficients of lagged market returns into account. Therefore, another delay measure is:

$$D2_i = \frac{\sum_{n=1}^{5} abs(\beta_i^n(-n))}{abs(\beta_i^0) + \sum_{n=1}^{5} abs(\beta_i^n(-n))} \quad (8)$$

This measure captures the magnitude of the lagged coefficients relative to the magnitude of all market-return coefficients.

4.4.2 Price Clustering

To test Hypothesis 5 of cultural influences on stock price clustering, we measure the frequencies of all prices ending with digits 0 to 9 observed during the pre- and post-period, i.e., 2nd decimal place of daily opening, high, low, and closing prices. Following Brown and Mitchell (2008), we compare the daily frequencies of (i) 2 with 8; (ii) 4 with 6 (all are even numbers and equi-distant from 0 to 5); and (iii) 4 with 8. The third comparison of frequency of 4 with 8 specifically predict the Chinese cultural effects (4 is less prevalent than 8), which is in contrast to the first two comparisons. In the absence of price clustering, the above ratios would be close to 1. We test clustering effects using seven-month daily data in each pre- and post-period for all affected securities.

4.5 Empirical Results

4.5.1. Efficiency Measures

To observe how the lifting of short sales and margin buying restrictions impact the pricing efficiency measures, we first look at the univariate results.

4.5.1.1 Univariate Analysis

The cross-sectional averages are reported in Panel A of Table 4.1. We find that R^2 increases significantly following the inception of short-sales and margin buying, suggesting that price efficiency deteriorates in the post-period.[48] When we decompose the R^2 into downside R^2 and upside R^2, depending on the negative and positive market return respectively, the downside R^2 does not change, whereas, the upside R^2 increases significantly, indicating lower firm-related return variation during the post period. Next, our second efficiency measure, the cross auto-correlation (ρ) exhibits a significant decline in price delay. Similarly, the decline is significant for downside cross-autocorrelation (ρ_{it}^{-}) in the post-period.[49] The lower value of ρ_{it}^{-} measure suggests that individual stock returns adjust faster in the falling market following regulation change. However, the upside ρ increases in the post-period, suggesting less price efficiency in bullish market. Further, when short selling and margin trading is allowed in the post period, we find significantly lower downside-minus-upside R^2 and downside-minus-upside ρ. This evidence is consistent with the argument that relaxing short-sale constraints facilitates price discovery process during down markets.

[48] We also transform R^2 into a continuous variable ranges between -∞ to +∞ as applied by Bris et al. (2007) but the significance level of our univariate and multivariate results does not change if we apply the transformation.

[49] Similarly, we transform ρ to take the values between -∞ to +∞ as applied by Bris et al. (2007) but the results are similar after the transformation.

In addition, the two delay measures D1 and D2 show lower values in the post-period, but those are not significantly different from zero. The lower values of D1 and D2 imply less time delay for affected securities in incorporating new market information. The results are similar in Panel B for domestic stocks without cross listing, except downside cross-autocorrelation shows no change in the post period. Again, in Panel C for domestic stocks with cross-listing, we find similar results to Panel A, except R^2 does not change in the post period. Hence, based on univariate results, we do not find support that firms that cross-list their shares in overseas markets is associated with more efficient price discovery process. Overall, the results from the three panels suggest that there is no consistent pattern of changes in efficiency across the different measures following the inception of short-sales and margin trading. In sum, the findings based on univariate analysis are inconsistent with our first Hypothesis and prior literature.

For robustness, we re-run the univariate analysis to check the difference in efficiency measures between pre- and post-period for the subsample of 35 affected A-shares minus their cross-listed H-shares. The results are reported in Appendix C.1 for affected minus cross-listed shares. Overall, we observe significant change in only two of the efficiency measures following the short selling and margin trading activity. The downside-minus-upside ρ significantly declined, whereas upside ρ increased significantly when short selling and margin trading constraints are removed. Overall, the univariate results suggest no consistent change in price efficiency for the sub-sample of affected A-shares after controlling for cross-listed H-shares, which is inconsistent with Hypothesis 1.

4.5.1.2 Multivariate Analysis

To test Hypothesis 1, we estimate a number of regression models to examine

Table 4.1: Univariate Analysis - Changes in Price Efficiency Measures

This table reports the cross-sectional average of estimated measures of price efficiency. The columns labelled with 'Pre' show the cross-sectional mean and median of each measure for the seven-months before the inception of short selling and margin trading. The columns labelled with 'Post' show the average of variables during the seven-months following the introduction. A minimum of 100 trading days is required for both the pre- and post-period. A paired *t*-test and the Wilcoxon non-parametric test are used to analyse the difference between two periods. Also reported are 'Diff' of Post minus Pre and associated p-value. Panel A shows all securities eligible for margin trading and short selling. Panel B shows the domestic securities not listed in other world markets. Panel C shows analysis of Chinese A-shares that have cross-listing in other equity markets.

	Mean				*Median*			
Panel A:	All Securities (N = 284)							
	Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
R-Squared	0.4307	0.5029	0.0722	0.0001	0.4250	0.5111	0.0861	0.0001
Downside-minus-Upside R^2	0.1019	-0.0401	-0.1420	0.0001	0.0879	-0.0417	-0.1295	0.0001
Upside *R*-Squared	0.2146	0.3617	0.1472	0.0001	0.1797	0.3513	0.1716	0.0001
Downside *R*-Squared	0.3165	0.3217	0.0052	0.7253	0.2904	0.3076	0.0172	0.4221
Cross Auto-correlation	0.0208	0.0057	-0.0151	0.0245	0.0206	0.0172	-0.0034	0.1295
Downside-minus-Upside ρ	0.1203	0.0574	-0.0629	0.0001	0.1138	0.0587	-0.0550	0.0001
Upside ρ	-0.0584	-0.0308	0.0276	0.0112	-0.0637	-0.0347	0.0289	0.0194
Downside ρ	0.0620	0.0266	-0.0354	0.0022	0.0619	0.0296	-0.0323	0.0031
D1	0.0501	0.0467	-0.0035	0.4744	0.0317	0.0318	0.0001	0.3970
D2	0.2458	0.2365	-0.0093	0.2723	0.2337	0.2281	-0.0056	0.3426
Panel B:	Stocks with no Cross Listing (N=244)							
R-Squared	0.4134	0.4949	0.0816	0.0001	0.4097	0.4971	0.0874	0.0001
Downside-minus-Upside R^2	0.0918	-0.0526	-0.1443	0.0001	0.0807	-0.0442	-0.1249	0.0001
Upside *R*-Squared	0.2055	0.3621	0.1566	0.0001	0.1667	0.3475	0.1808	0.0001
Downside *R*-Squared	0.2973	0.3095	0.0123	0.4291	0.2717	0.2938	0.0221	0.1893

Table 4.1 – Panel B (Continued)

	Mean				*Median*			
	Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
Cross Auto-correlation	0.0229	0.0130	-0.0099	0.1651	0.0259	0.0223	-0.0037	0.3742
Downside-minus-Upside ρ	0.1108	0.0797	-0.0311	0.0588	0.1010	0.0715	-0.0295	0.0560
Upside ρ	-0.0569	-0.0363	0.0207	0.0802	-0.0632	-0.0366	0.0267	0.0971
Downside ρ	0.0539	0.0434	-0.0105	0.3885	0.0531	0.0367	-0.0164	0.3641
D1	0.0520	0.0478	-0.0042	0.4248	0.0337	0.0318	-0.0019	0.2026
D2	0.2527	0.2386	-0.0141	0.1375	0.2387	0.2286	-0.0102	0.1603
Panel C:	Stocks with Cross Listing (N=40)							
	Mean				*Median*			
	Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
R-Squared	0.5290	0.5556	0.0266	0.3935	0.5304	0.5669	0.0365	0.4216
Downside-minus-Upside R^2	0.1563	0.0310	-0.1253	0.0004	0.1678	0.0230	-0.1448	0.0010
Upside *R*-Squared	0.2667	0.3671	0.1003	0.0003	0.2629	0.3697	0.1068	0.0010
Downside *R*-Squared	0.4230	0.3981	-0.0249	0.5242	0.4217	0.3637	-0.0580	0.5878
Cross Auto-correlation	0.0117	-0.0358	-0.0476	0.0078	0.0016	-0.0273	-0.0288	0.0246
Downside-minus-Upside ρ	0.1665	-0.0599	-0.2264	0.0001	0.2217	-0.0516	-0.2734	0.0001
Upside ρ	-0.0612	-0.0080	0.0532	0.0591	-0.0632	-0.0255	0.0377	0.0992
Downside ρ	0.1054	-0.0679	-0.1733	0.0001	0.1243	-0.0443	-0.1686	0.0001
D1	0.0397	0.0380	-0.0017	0.8918	0.0241	0.0304	0.0063	0.6607
D2	0.2083	0.2167	0.0085	0.6126	0.2082	0.2099	0.0017	0.7113

how the dependent variables of efficiency change following the relaxation of constraints on short sales and margin borrowing. The regression results for R^2 are reported in Table 4.2.[50] Consistent with our univariate results we observe a significant positive coefficient on SS_Ratio (daily short sales volume divided by total volume), implying that it takes longer to incorporate firm specific information into the stock prices when there is higher short-sales activity. The control variable of cross-listed dummy shows positive significance which indicates that the returns of domestic securities with cross-listings tend to be less efficient. The increase in R^2 measure following regulation change is counter to the evidence of Bris, Goetzmann and Zhu (2007). Following Bris, Goetzmann and Zhu (2007), we decompose R^2 into upside and downside market movements. Downside R^2 show significantly positive coefficient with SS_Ratio and significantly negative coefficient with MT_Ratio (daily margin buying volume divided by total volume). Similarly, upside R^2 show positively significant coefficient with SS_Ratio. However, the effect of short selling and margin trading on the downside-minus-upside R^2 is negative and statistically significant at 1% level suggesting that price discovery process relatively improves when the market is going down.[51] Overall, the results of R^2 are inconsistent with Hypothesis 1 and broad literature such as Bris, Goetzmann and Zhu's (2007) finding that allowing short sales facilitates market efficiency.

The next dependent variable is our second measure of price efficiency, i.e., cross-autocorrelation (ρ) between 1-day lagged market return and individual stock return, we use to examine Hypothesis 1. The explanatory variables are SS_Ratio, MT_Ratio, cross-list dummy, and percentage of zero-return days. In Table 4.3, the first

[50] We rule out potential biases in the regression results due to multicollinearity problem as none of the explanatory variables are strongly correlated with others as shown in Table C.3 in Appendix-C.
[51] Although the coefficient on SS_Ratio is significantly positive for both downside and upside R^2 but the magnitude and t-value of downside R^2 is much smaller than upside R^2.

Table 4.2: Cross-Sectional Regressions of R-Square

For each security in our sample, we calculate the R^2 from regressions of individual stock returns on the domestic market index returns. We use either negative or positive market returns to calculate downside R^2 or upside R^2. We also compute the downside-minus-upside R^2. SS_Ratio is the average of daily short sales volume divided by daily trading volume. MT_Ratio is the average of daily margin volume divided by daily trading volume. Cross-List equals 1 if the stock is dual-listed, 0 otherwise. The percent of zero returns is the number of days a stock has a zero return, divided by the total number of days in the seven-month post-period with available return data; t-statistics are reported in brackets.

	Exp. Sign	*R*-Squared	Downside Minus Upside R^2	Downside *R*-Squared	Upside *R*-Squared
		(I)	(II)	(III)	(IV)
SS_Ratio	-	0.0070***	-0.0074***	0.0049***	0.0123***
		(3.96)	(-4.69)	(2.71)	(6.62)
MT_Ratio	-/+	-0.0002	-0.0010***	-0.0007***	0.0003
		(-0.97)	(-4.20)	(-2.70)	(0.97)
Cross List	-/+	0.0767***	0.0450*	0.0883***	0.0433
		(2.98)	(1.92)	(3.33)	(1.58)
Days with zero return (%)	-	-0.4415***	-0.0912	-0.2863*	-0.1951
		(-2.69)	(-0.61)	(-1.70)	(-1.12)
Constant		0.4937***	0.0273*	0.3285***	0.3012***
		(27.23)	(1.66)	(17.62)	(15.61)
Obs.		284	284	284	284
Adj. R^2		0.0829	0.1776	0.0682	0.1517

column shows the result for cross-autocorrelation, the second column shows results for the downside-minus-upside cross-autocorrelation, and the last two columns present the results for the downside and the upside cross-autocorrelation separately. The speed of price adjustment measured by the cross-autocorrelation is not associated with short selling or margin trading (column I). When we decompose the cross-autocorrelation based on the direction of the market movements, surprisingly, we find that short sales is related with a reduction in the upside cross-autocorrelation (column IV). This suggests that speed of price adjustment is faster in up market for securities with higher short-sales. In addition, we find significant increase in downside cross-autocorrelation for

firms with higher margin trading volume (column III). The cross-list dummy variable shows significantly negative coefficients in downside ρ and downside-minus-upside ρ, which suggest that price discovery process improves in the down market for Chinese firms with cross-listings. Overall, the multivariate results for our second measure of efficiency are inconsistent with Hypothesis 1 and broad literature such as Saffi and Sigurdsson (2011) that less short-sale constraints allow faster incorporation of bad news into prices.

Finally, we use the two price delay measures, D1 and D2 following Hou and Moskowitz (2005) methodology, as dependent variables to test the effect of short sales and margin buying on pricing efficiency. The higher values of D1 and D2 suggest less efficiency and greater delay in price adjustment. In columns I and II of Table 4.4, we observe negative but insignificant coefficients for short sales and margin trading ratios, suggesting that D1 and D2 are not associated with short selling and margin trading activity. Consistent with prior literature, we observe positive coefficient for less liquid stocks (column I). Further, we find a significantly positive relationship between D1 and turnover, which is somewhat puzzling. Taken together, the evidence with different measures of efficiency is inconsistent with Hypothesis 1 and prior literature, suggesting that relaxing the short sales and margin trading constraints do not make markets more efficient. These results are more likely to imply that the distributions of daily returns do not closely follow a random walk following the permissibility of short selling and margin buying that is examined in the next section.

Table 4.3: Cross-Sectional Regressions of Cross-Autocorrelation
For each security, we calculate cross-autocorrelations between 1-day lagged market returns and individual stock returns. Downside cross-autocorrelation equals the market return when it is negative using daily observations in each seven-month period and Upside cross-autocorrelation equals the market return when it is positive. We then calculate the downside-minus-upside cross-autocorrelation. SS_Ratio is the average of daily short sales volume divided by daily trading volume. MT_Ratio is the average of daily margin volume divided by daily trading volume. Cross-List equals 1 if the stock is dual-listed, 0 otherwise. The percent of zero returns is the number of days a stock has a zero return, divided by the total number of days in the seven-month post-period with available return data; t-statistics are reported in brackets.

	Exp. Sign	ρ	Downside Minus Upside ρ	Downside ρ	Upside ρ
		(I)	(II)	(III)	(IV)
SS_Ratio	-	-0.0011	0.0038*	0.0004	-0.0035**
		(-1.10)	(1.90)	(0.24)	(-2.13)
MT_Ratio	-/+	0.0002	0.0014***	0.0012***	-0.0002
		(1.25)	(4.77)	(5.64)	(-0.70)
Cross List	-/+	-0.0472	-0.1140***	-0.0907***	0.0233
		(-3.20)	(-3.83)	(-4.09)	(0.97)
Weeks with zero return (%)	-/+	-0.0868	0.0689	0.0185	-0.0504
		(-0.92)	(0.36)	(0.13)	(-0.33)
Constant		0.0158	0.0017	-0.0082	-0.0100
		(1.52)	(0.08)	(-0.53)	(-0.59)
Obs.		284	284	284	284
Adj. R^2		0.0350	0.1615	0.1687	0.0154

4.5.2 Characteristics of Stock Returns Distributions

4.5.2.1 Univariate Analysis

We now investigate how short selling and margin trading activity affects the distributional characteristics of stock returns. The results are reported in Table 4.5. Following the removal of short-sales and margin trading constraints, there is a significant decline in mean raw returns and volatility of abnormal returns, a reduction in positive skewness of abnormal returns, and an increase in extreme positive stock returns. Lower volatility is consistent with the findings of Charoenrook and Daouk (2005) and Saffi and Sigurdsson (2011). Likewise, a decrease in positive skewness is

Table 4.4: Cross-Sectional Regressions of Price Delay Measures

For each security, we calculate D1 and D2. D1 and D2 proxy for price delay, as in Hou and Moskowitz (2005). SS_Ratio is the average of daily short sales volume divided by daily trading volume. MT_Ratio is the average of daily margin volume divided by daily trading volume. Cross-List equals 1 if the stock is dual-listed, 0 otherwise. The percent of zero returns is the number of days a stock has a zero return, divided by the total number of days in the seven-month period with available return data. Market Cap is market capitalization. Turnover is total volume traded to shares outstanding. Bid-Ask is the closing spread scaled by price; t-statistics are reported in brackets.

	Exp. Sign	*D1*	*D2*
		(I)	(II)
SS_Ratio	-	-0.0007	-0.0018
		(-1.12)	(-1.59)
MT_Ratio	-/+	-0.0002	-0.0002
		(-1.47)	(-1.20)
Cross List	-/+	-0.0076	-0.0187
		(-0.78)	(-1.06)
Market Cap	-	-0.0000	-0.0000
		(-0.29)	(-0.53)
Turnover	-	1.3353***	0.9774
		(3.62)	(1.46)
Days with zero return (%)	-/+	0.1303**	0.1433
		(2.25)	(1.36)
Bid-Ask	-/+	3.1020	4.5174
		(0.81)	(0.65)
Constant		0.0324***	0.2339***
		(3.75)	(14.90)
Obs.		284	284
Adj. R^2		0.0621	0.0151

consistent with the evidence of Chang, Cheng and Yu (2007) and Xu (2007). Kurtosis show marginal decline only in security's raw returns. The greater frequency of extreme positive returns is inconsistent with our Hypothesis 4. However, this result suggests that relaxing short-sale restrictions does not increase the possibility of frequent extreme negative returns.

For robustness, we re-run the univariate analysis to test the changes in the characteristics of stock return distributions following the regulation change by

Table 4.5: Univariate Analysis - Changes in the Characteristics of Stock Returns Distributions

This table reports the characteristics of stock returns distributions. The columns labelled with 'Pre' show the cross-sectional mean and median of each characteristic for the seven-months before the inception of short selling and margin trading. The columns labelled with 'Post' show the average of variables during the seven-months following the introduction. A minimum of 100 trading days is required for both the pre- and post-period. A paired *t*-test and the Wilcoxon non-parametric test are used to analyse the difference between two periods. Also reported are 'Diff' of Post minus Pre and associated p-value.

All Stocks (N=284)		*Mean*				*Median*			
		Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
Mean	Raw Returns	0.0000	-0.0006	-0.0006	0.0001	-0.0001	-0.0006	-0.0005	0.0001
Standard Deviation	Raw Returns	0.0242	0.0234	-0.0009	0.0717	0.0234	0.0235	0.0001	0.3372
	Abnormal Returns	1.0470	0.9490	-0.0980	0.0001	1.0556	0.9552	-0.1004	0.0001
Skewness	Raw Returns	0.0434	0.0667	0.0232	0.5475	0.0434	0.0494	0.0060	0.3552
	Abnormal Returns	0.7573	0.4376	-0.3196	0.0001	0.7818	0.4560	-0.3258	0.0001
Kurtosis	Raw Returns	1.9074	1.5615	-0.3459	0.0515	1.3704	1.2476	-0.1228	0.3160
	Abnormal Returns	3.4950	3.5084	0.0133	0.9690	2.2680	2.4502	0.1821	0.4626
Extreme Values	Frequency [*Return > M+(2)(SD)*]	0.0270	0.0290	0.0020	0.0370	0.0282	0.0300	0.0018	0.0001
	Frequency [*Return < M-(2)(SD)*]	0.0271	0.0265	-0.0007	0.4399	0.0280	0.0225	-0.0057	0.1681

comparing 35 affected A-shares and their cross-listed H-shares (affected minus cross-listed shares). Appendix C.2 reports no significant change for different characteristics of stock return distributions except one measure, i.e., significant increase in volatility of abnormal returns in the post-period after controlling for cross-listed H-shares. Thus the abnormal returns volatility of A-share decreases less than their H-share counterparts following the relaxation of short sales and margin trading restrictions in China.

4.5.2.2 Multivariate Analysis

In this section, we examine the distribution of stock returns following the change in regulation after controlling for other variables. Our dependent variable is the skeweness of returns, and explanatory variables are SS_Ratio, MT_Ratio, cross-list dummy, size, turnover, percentage of zero-return days, and bid-ask spread. We test Hypothesis 2 by examining the skewness of securities' raw and abnormal returns. Table 4.6 reports the results. We find evidence that short-sales is associated with the decline in skewness of returns (column II) at the 5% level. This finding is consistent with our Hypothesis 2 and the theoretical model of Xu (2007) that propose relaxation of short-sale constraints reduces skewness. Our finding is also consistent with the empirical evidence of Saffi and Sigurdsson (2011). The multivariate results are also consistent with our univaraite results of no relation between skewness of securities' raw returns and short selling and/or margin trading (column I).

Next, we test Hypothesis 3 by using the kurtosis estimated from stock returns and residuals from a market model regression as dependent variables following the relaxation of short sales and margin trading constraints. In columns I and II of Table 4.7, we provide the cross-sectional regression results. We find that higher short sales volume is marginally associated with lower kurtosis at the 10% level. The kurtosis from

Table 4.6: Cross-Sectional Regressions of Skewness

The dependent variable is the skewness of stock returns. The skewness of raw returns is calculated for each stock in seven-month post-period. The skewness of abnormal returns is the skewness of the residual of a regression of stock returns on the market returns, for each firm in the seven-months period following the change in regulation. SS_Ratio is the average of daily short sales volume divided by daily trading volume. MT_Ratio is the average of daily margin volume divided by daily trading volume. Cross-List equals 1 if the stock is dual-listed, 0 otherwise. Market Cap is market capitalization. Turnover is total volume traded to shares outstanding. The percent of zero returns is the number of days a stock has a zero return, divided by the total number of days in the seven-months with available return data. Bid-Ask is the closing spread scaled by price; t-statistics are reported in brackets.

	Exp. Sign	*Dependent Variable: Skewness of Individual Stock Raw Return*	*Dependent Variable: Skewness of Individual Stock Abnormal Return*
		(I)	(II)
SS_Ratio	-	0.0071	-0.0231**
		(1.42)	(-2.44)
MT_Ratio	-/+	-0.0000	-0.0021
		(-0.02)	(-1.27)
Cross List	-/+	-0.1043	-0.2793*
		(-1.30)	(-1.84)
Market Cap	-/+	-0.0000*	-0.0000
		(-1.89)	(-1.01)
Turnover	-/+	0.3845	-0.7057
		(0.13)	(-0.12)
Zero return days (%)	-/+	-0.1525	-0.4415
		(-0.32)	(-0.49)
Bid-Ask	-/+	28.7140	66.3827
		(0.91)	(1.12)
Obs.		284	284
Adj. *R*-Squared		0.0287	0.0208

abnormal returns is not associated with short sales or margin buying volume. In addition, we find that kurtosis increases significantly with a higher frequency of zero-return days, which is consistent with prior empirical literature. Overall, our findings are not consistent with Hypothesis 3, but consistent with Saffi and Sigurdsson's (2011) evidence that relaxation in short-sales constraints reduces kurtosis of returns. Again, our regression analysis results are consistent with univariate analysis, where we find marginal decline in kurtosis of affected securities' raw returns

Table 4.7: Cross-Sectional Regressions of Kurtosis

The dependent variable is the Kurtosis of stock returns. The kurtosis of abnormal returns is based on the residuals of a local market model regression for each firm in the seven-months period following the change in regulation. SS_Ratio is the average of daily short sales volume divided by daily trading volume. MT_Ratio is the average of daily margin volume divided by daily trading volume. Cross-List equals 1 if the stock is dual-listed, 0 otherwise. Market Cap is market capitalization. Turnover is total volume traded to shares outstanding. The percent of zero returns is the number of days a stock has a zero return, divided by the total number of days in the seven-months with available return data. Bid-Ask is the closing spread scaled by price; t-statistics are reported in brackets.

	Exp. Sign	*Dependent Variable: kurtosis of Individual Stock Raw Return*	*Dependent Variable: Kurtosis of Individual Stock Abnormal Return*
		(II)	(I)
SS_Ratio	-	-0.0745*	-0.0140
		(-1.89)	(-1.12)
MT_Ratio	-/+	0.0071	-0.0009
		(1.02)	(-0.41)
Cross List	-	-0.4069	-0.0921
		(-0.64)	(-0.46)
Market Cap.	-	-0.0000	-0.0000
		(-0.88)	(-1.24)
Turnover	-	-30.1436	-0.8608
		(-1.26)	(-0.11)
Zero return days (%)	-/+	12.4752***	9.1847***
		(3.32)	(7.67)
Bid-Ask	-/+	266.9471	93.2130
		(1.08)	(1.18)
Obs.		284	284
Adj. *R*-Squared		0.0579	0.1817

Finally, we test Hypothesis 4 by estimating the relationship between short sales and margin borrowing volume and extreme returns. The results are reported in Table 4.8, Columns I and II. For the extreme negative returns, we do not find any explanatory power for short sales and margin trading volume. However, extreme positive returns are postively associated with higher short-sales and margin trading at the 5% and 10% levels respectively. These results are inconsistent with our Hypothesis 4, but indicate that lifting of short-selling ban is not associated with market crashes. Further, the analysis of other controls present a mixed picture; affected securities with higher

Table 4.8: Cross-Sectional Regressions of Extreme Returns

The dependent variable is the fraction of returns two standard deviations below or above the seven-months post-period average. SS_Ratio is the average of daily short sales volume divided by daily trading volume. MT_Ratio is the average of daily margin volume divided by daily trading volume. Cross-List equals 1 if the stock is dual-listed, 0 otherwise. Market Cap is market capitalization. Turnover is total volume traded to shares outstanding. The percent of zero returns is the number of days a stock has a zero return, divided by the total number of days in the seven-months with available return data. Bid-Ask is the closing spread scaled by price; t-statistics are reported in brackets.

	Exp. Sign	*Dependent Variable: Frequency of Extreme Negative Stock Returns*	*Dependent Variable: Frequency of Extreme Positive Stock Returns*
		(I)	(II)
SS_Ratio	-	-0.0001	0.0003**
		(-0.83)	(2.09)
MT_Ratio	-/+	0.0000	0.0000*
		(0.29)	(1.84)
Cross List	-/+	0.0005	0.0001
		(0.27)	(0.03)
Market Cap	-/+	0.0000	-0.0000
		(0.86)	(-0.48)
Turnover	+	0.1229*	0.1906**
		(1.63)	(2.54)
Bid-Ask	+	-0.89175	-0.8220
		(-1.14)	(-1.06)
Zero return days (%)	-	0.0118	0.0272**
		(0.99)	(2.31)
Obs.		284	284
Adj. *R*-Squared		0.0052	0.0547

turnover and greater proportion of zero return days (i.e. lower liquidity) increase the occurence of extreme positive returns. The increase in the frequency of extreme positive raw returns is consistent to our earlier univariate results. Next, we test the changes in price clustering when price discovery process is likely to improve following the lifting of short-sales restrictions.

4.5.3 Price Clustering

We test the clustering effect in final digits of the daily closing, opening, high and low prices. Following Brown and Mitchell (2008), in the presence of cultural effects in Chinese market where 8 (4) is considered a lucky (unlucky) number, A-shares prices are likely to reveal (i) lower occurences of 2 relative to 8; (ii) lower occurences of 4 relative to 6; and (iii) lower occurences of 4 relative to 8. Therefore, we want to test whether the intensity of Chinese cultural influence on price clustering is reduced following the relaxation of short sales and margin borrowing constraints. The results of the relative frequencies are mentioned in Table 4.9. Firstly, consistent with prior literature, we find higher relative frequencies for numbers ending in 0 and 5 for both pre- and post-periods. Secondly, the relative frequency of digit 0 has significantly declined following the regulation change and is consistent across all the daily price types. Thirdly, the variation in price clustering has substantially reduced across all final digit stock price types i.e., standard deviation in the post period is reduced in (a) closing prices by 16.03%; (b) opening prices by 17.26%; (c) high prices by 27.77%; and (d) low prices by 23.69%. The above findings are consistent with Ball, Torous and Tschoegl's (1985) evidence that price clustering is a function of uncertainity about the asset's value. If value is not well known, prices are more likely cluster, and if the value is well known, clustering is likely to decline.

Fourthly, the relative frequency of digit 4 has increased for all the daily price types following the removal of short selling and margin buying restrictions. However, the increase in relative frequency is significant for daily closing and low prices. On the other hand, relative frequency of prices ending in digit 8 show mixed picture, with no change in the daily closing and high prices, but significant increase in the daily opening

Table 4.9: Relative Frequencies of Clustering Digit for Daily Closing, Opening, High, and Low Prices

This table provides the relative frequencies (in percentage) to which prices with the relevant ending digits (0-9) are observed for affected securities seven months before and seven months after the short sales and margin trading regulation change. Clustering behaviour is examined for closing, opening, high, and low prices for each day. The p-value of differences between post- and pre-period is also reported. All prices clustering are on the second decimal place.

	Closing			Opening			High			Low		
Digit	Pre	Post	p-value	Pre	Post	p-value	Pre	Post	p-value	Pre	Post	p-value
0	14.49	13.85	0.0109	21.72	19.72	0.0001	17.60	15.45	0.0001	21.23	18.59	0.0001
1	9.07	9.51	0.0336	8.53	8.54	0.9767	6.26	7.13	0.0001	10.19	10.27	0.7050
2	9.36	9.25	0.5952	8.18	8.47	0.1496	8.29	8.72	0.0001	8.91	9.24	0.1021
3	9.16	9.13	0.8617	8.02	8.32	0.1247	8.38	8.67	0.1548	8.66	8.80	0.5104
4	8.81	9.31	0.0141	7.01	7.28	0.1455	8.65	8.81	0.4248	6.46	7.21	0.0001
5	9.98	10.45	0.0318	12.72	12.41	0.1884	12.78	12.75	0.8807	11.54	11.72	0.4170
6	9.21	9.28	0.7540	7.73	8.39	0.0007	8.06	8.98	0.0001	8.20	8.69	0.0139
7	8.74	8.78	0.8622	7.81	7.93	0.5126	9.18	9.29	0.5769	7.71	7.95	0.1995
8	10.41	10.23	0.4118	9.71	10.39	0.0016	10.85	10.77	0.7035	9.69	10.10	0.0567
9	10.68	10.19	0.0270	8.50	8.53	0.9001	9.85	9.41	0.0378	7.36	7.39	0.8753
0-9	100.00	100.00		100.00	100.00		100.00	100.00		100.00	100.00	
	Pre	Post	% Diff.	Pre	Post	% Diff.	Pre	Post	% Diff.	Pre	Post	% Diff.
Std. Dev.	1.71	1.46	-16.03	4.41	3.71	-17.26	3.19	2.42	-27.77	4.21	3.32	-23.69
Ratios:	Pre	Post	p-value	Pre	Post	p-value	Pre	Post	p-value	Pre	Post	p-value
4 *v* 6	0.96	1.00	0.0000	0.91	0.87	0.0000	1.07	0.98	0.0000	0.79	0.83	0.0000
2 *v* 8	0.90	0.90	0.4585	0.84	0.82	0.0011	0.76	0.81	0.0000	0.92	0.91	0.5482
4 *v* 8	0.85	0.91	0.0000	0.72	0.70	0.0362	0.80	0.82	0.0134	0.67	0.71	0.0000

Table 4.10: Univariate Analysis for the Distribution of the Daily Ratios
This table provides summary statistics and difference in means and medians using *t*-test and Wilcoxon rank sum test of the distribution of daily ratios for all affected securities. The ratios are based on daily closing prices. The ratios presented are: 2 *v.* 8, 4 *v.* 6 and 4 *v.* 8. These daily ratios are calculated by determining the number of observations each day that data is available for each of the respective digits. The summary statistics are then the aggregate ratios computed across all the days for the pre- and post-period of the entire sample. For the 2 *v.* 8 comparisons the expectation is that the frequency of the occurrence of 2 would increase relative to 8 in the post period. For the 4 *v.* 6 comparisons the expectation is that the frequency of the occurrence of 4 would increase relative to 6 in the post period. Similarly, for the 4 *v.* 8 comparisons the expectation is that the frequency of occurrence of 4 would increase relative to 8 in the post period. Thus we expect mean and median ratios to increase following the inception of short sales and margin trading in the post-period. The p-value of differences is also reported. All prices clustering are on the second decimal place.

	2 *v.* 8			4 *v.* 6			4 *v.* 8		
	Pre	Post	Diff. p-value	Pre	Post	Diff. p-value	Pre	Post	Diff. p-value
Predicted ratio (#1/#2)									
Average daily ratio	1.01	1.05	0.4039	1.06	1.14	0.1181	0.94	1.04	0.0515
Median daily ratio	0.90	0.90	0.6794	0.95	1.00	0.4061	0.86	0.90	0.0727
Proportion of daily ratios <1	0.58	0.56	0.6532	0.51	0.49	0.5485	0.63	0.56	0.0837

and low prices. Overall, the results suggest that avoidance of prices ending in 4, which is considered as undesirable, is reduced following the inception of margin trading and short selling, whereas digit 8 is still favoured by Chinese investors. It seems the introduction of short-sales activity has somewhat weakened the influence of cultural effects in Chinese market consistent with Aitken, Brown, Buckland, Izan and Walter (1996). Therefore, we observe less clustering at all final digits including digits 4 and 8. Previously, daily prices ending with digits 8 (4) were higher (lower) in the Chinese markets.

Table 4.10 indicates the average of daily ratios in the pre- and post-period for 2 *v.* 8, 4 *v.* 6, and 4 *v.* 8. The results reveal that the ratio of closing prices ending with digit

4's versus 8's increased significantly in the post period. Further, the proportion of 4 *v.* 8 daily ratios of less than one significantly decline (at 10% level) from 63% in the pre-period to 56% in the post-period, suggesting increase in frequency of unlucky final digit 4 than lucky 8 in closing prices following the lifting of short-sales constraints. However, the comparisons of daily ratios in ending numbers 2 *v.* 8 and 4 *v.* 6 show no significant change in the post period. On balance, the evidence is consistent with the argument put forward by Aitken, Brown, Buckland, Izan and Walter (1996).

4.6 Conclusion

The China Securities Regulatory Commission (CSRC) allowed short sales and margin buying initially for 90 A-shares from March 31, 2010 as a pilot programme and subsequently converted this into normal operations by increasing the number of securities to 197 from December 5, 2011. Both these regulatory events happened at a critical time, i.e., the pilot programme and subsequent conversion to regular business was initiated when financial regulators around the world were devising new rules to restrain short selling activity to deal with the aftershocks of GFC and euro debt crisis respectively. We investigate the impact of removal of short sales and margin trading restrictions on price efficiency measures, stock returns distributions, and price clustering.

On average, we find there is not a consistent change in pricing efficiency across the various measures we test following the commencement of short sales and margin trading in China. The first measure of efficiency, i.e., R^2 shows significant increase in the post period, suggesting decline in pricing efficiency following the removal of short-sales ban. The second measure of efficiency, that is, cross-autocorrelation declines significantly in the post period, suggesting faster incorporation of information into

prices following the regulation change. In addition, another two price delay measures i.e., D1 and D2 depict no changes following the relaxation of short sales and margin borrowing constraints. Thus the evidence is inconsistent with the prior literature that suggests that security prices adjust faster in such environments where short-sales constraints are minimal.

The abnormal returns of the affected securities experience a statistically significant decline in positive skewness following the inception of short sales activity. This is consistent with the theoretical model of Xu (2007), and empirical finding of Chang, Cheng and Yu (2007), suggesting that greater divergence of investors views along with short-sales restrictions increases skewness of stock returns. Moreover, we find no change in kurtosis of abnormal returns and significant increase in the occurrence of extreme positive raw returns for affected securities with higher short selling and margin trading. The higher frequency of extreme positive raw returns for affected securities with greater short selling activity suggest that removal of short-sale constraints is not linked with extreme negative returns.

Finally, we investigate the relationship between price clustering and removal of short selling and margin trading restrictions. Under Chinese culture, any numbers ending in digit 8 are considered attractive and lucky, while numbers ending in 4 are considered unfavourable and unlucky. The previous literature finds prevalence of price clustering in the final digits due to the influence of uninformed investment decisions and superstitious beliefs. We find a significant increase in the relative frequency of daily closing prices ending with digit 4 following the change in regulation. Similarly, this increasing trend is also observed in daily low prices. Further, the daily average proportion of 4 *v.* 8 ratios of less than one is significantly declined in the post-period.

However, the relative frequency of number 8 in daily price types show mixed evidence. Overall, these results provide some support for the hypothesis that cultural influences are less pronounced following the regulation change.

CHAPTER FIVE

CONCLUSION

This chapter concludes the thesis by providing a brief summary of the key findings from each of the three essays as well as suggesting potential areas for further research.

5.1 Major Findings and Implications

5.1.1 Essay One

The first essay examines the effect of regulation removing margin trading and short-sales ban on prices, trading value, bid-ask spreads and price volatility by using a dataset which covers the period from October 1, 2009 through June 30, 2010. The results from univariate and multivariate statistical analysis indicate that the A-stock premium declines by 6.1% and 8.8% compared to a sample of matched Chinese A-shares and identical firm H-shares respectively, following the regulation change. This implies that allowing short sales result in a decrease in the prices of pilot firms relative to the matched and cross-listed firms, which is consistent with the models of Miller (1977) and Chen, Hong and Stein (2002). The significant decrease in prices is more likely due to the fact that optimistic investors can already trade prior to the regulation change by borrowing against their houses and other assets in China. On the other hand, relaxing margin borrowing allows cash-constrained investors with an optimistic opinion to push the prices upward. However, the optimistic investors in China may trade prior to regulation change by borrowing against their house and other assets. Thus, the results show that lifting of short selling ban has the stronger effect compared to lifting of margin borrowing constraints.

The lifting of short-sales ban and reduction in margin requirements allows more investors to trade in the market. During the GFC, markets where short selling was constrained, the evidence suggests that trading volume and bid-ask spreads deteriorated during the ban period. However, the findings of this essay are inconsistent with the broad literature on developed markets. The results indicate that trading value declined and bid-ask spread increased following the eligibility of pilot programme stocks relative

to matched A-stocks and cross-listed H-stocks. The evidence is however, consistent with Ausubel's (1990) model that uninformed investors are reluctant to trade against informed counterparts due to the information asymmetry risk. This finding contributes to the existing literature on the relation between short-sale restrictions and liquidity measures in emerging markets.

Lastly, the impact of removing short selling and margin borrowing constraints on volatility based on the prior literature is mixed. Prior theoretical model and empirical results suggest an increase in volatility when short-sale restrictions are more binding, whereas, some studies find higher volatility when short selling is practiced. The findings of this essay suggest a decline in volatility for pilot stocks relative to Chinese matched stocks and increase in volatility relative to cross-listed Hong Kong H-shares. Thus the evidence is consistent with prior literature that finds the relationship between short selling and / or margin buying and volatility debatable.

5.1.2 Essay Two

The second essay investigates how the announcement and implementation of short sales and margin buying programme affects the returns and volume of Chinese pilot stocks. The event study results show that the abnormal returns of pilot firms significantly decline by 0.41% and 0.23% on the announcement and implementation dates respectively. After controlling for matched A-shares the abnormal returns of pilot A-shares declined by 0.38% and 0.31% on the announcement and implementation days at the 10% level respectively. Similarly, abnormal volumes of pilot firms also decline following the announcement and implementation of pilot programme regulation. The finding of abnormal returns is consistent with prior studies, which argue that short-sale constraints cause overvaluation. In order to test the robustness of the results, the

difference in abnormal returns and volume are also calculated between pilot A-shares and their cross-listed H-shares. Overall, the evidence suggests that announcement and implementation returns and volumes of pilot A-shares are lower than the matched Chinese A-shares and cross-listed H-shares. The decline in trading volume of pilot stocks following the announcement and implementation of regulation, however, suggest that uninformed investors possibly avoid trading against informed counterparts in pilot stocks for fear of risking their investments. Further, to examine what other factors might influence the observed announcement and implementation abnormal returns in a pilot sample, a cross-sectional regression analysis is carried out.

The empirical findings from the regression analysis show that pilot stocks from the finance industry have lower announcement and implementation returns compared to other industries. This is consistent with investors' apprehension that financial institutions are more prone to short selling activity in the wake of the global financial crisis. Pilot firms with higher relative valuation decline less than pilot firms with lower relative valuation. This finding is consistent with Wang's (2012) evidence that indicate higher idiosyncratic risk for relatively overpriced firms which resultantly deters investors / arbitrageurs with adverse information from selling short. The second essay also adds to the body of knowledge on the market reaction to the announcement of the pilot programme allowing short selling and margin buying.

5.1.3 Essay Three

The final essay of this thesis emphasises the crucial role of the short selling activity on price discovery process for a large group of short-sale and margin tradable Chinese firms over the period from June 1, 2009 to June 30, 2012. Compared to developed markets and other emerging markets, the Chinese market is dominated by

unsophisticated investors (Kling and Gao, 2008). Besides, the past performance of the Chinese securities is considered as highly volatile generating larger returns, as compared to the securities listed on other matured markets (Wu, 2011). Different measures of price efficiency are estimated to examine their behaviour following the relaxation of short sales and margin borrowing constraints. This essay finds no evidence of a consistent change in different measures of efficiency, on average, for affected securities eligible for short selling and margin trading. These findings are inconsistent with the broad literature and contribute to the argument that developed markets evidence may not be generalizable to emerging markets.

Moreover, this essay adds to the existing body of knowledge by examining how the practice of short sales and margin buying influence the characteristics of stock return distributions. This essay finds skewness of abnormal returns decline significantly for affected securities with higher short-sales. This evidence is consistent with Xu's (2007) model that proposes higher skewness when divergence of opinion is high and short-sale constraints are binding. The kurtosis of individual stock returns for affected securities also decline, suggesting that price clustering is reduced to a certain extent for affected securities with higher short-sales activity, which is consistent with the findings of Saffi and Sigurdsson (2011). Besides, the occurrence of daily extreme positive stock returns increases following the eligibility of short selling and margin trading in underlying securities, this at least suggests that allowing short sales does not increase the frequency of extreme negative returns.

In addition, the findings contribute to the argument that more informed trading by investors reduces the cultural biases found in Chinese market (Brown and Mitchell, 2008). In Chinese culture, the number 8 is considered lucky; whereas the number 4 is

thought to be unlucky. We find price clustering has weakened following the lifting of short sales and margin trading restrictions. Particularly, daily closing prices ending with digit 4 significantly increase relative to closing prices ending with digit 8 after the inception of short selling and margin buying. Further, the relative frequency of ending digit 4 in daily low prices also increases significantly.

5.2 Future Areas of Research

The first essay findings highlight the possibility that the heightened risk of information asymmetry between informed and uninformed investors causes a decline in liquidity following implementation of short sales and margin trading regulation. The evidence of increases in bid-ask spreads and decrease in trading value suggests an increase in information asymmetry risk. However, other measures of information asymmetry could be used to confirm these results.

Additionally, further analysis could examine the premium, volatility, and liquidity changes by taking a further sample of around 197 securities which were allowed for short sales and margin buying in the second phase of regulation change. For instance, examining the changes in price premiums, volatility, and liquidity proxies following short-sales activity by taking a larger sample over a longer period would be useful.

Essay two finds evidence of decline in abnormal returns and trading volume around the announcement and implementation of pilot short sale and margin trading programme. This essay puts forward some possible explanations for the decline in returns and volume around announcement and implementation, such as investors expecting impending short sales activity and hence mark down the prices prior to

implementation and after the introduction. Moreover, uninformed investors following the announcement and implementation avoid investing in pilot securities due to risk of trading against informed counterparts. However, the question remains as to whether there are other factors besides asymmetric information risk in China that causes the decline in abnormal returns and volume following the announcement and implementation of the pilot programme. Short-sale activity remained subdued after the introduction during the sample period, so perhaps, some psychological factors or other measures of investors' sentiment needs to be included in the model specification of regression analysis to test whether this can help to explain such outcomes. Further, the results of second essay find that financial industry firms are more responsive when there is a change in regulation, mainly due to the aftershocks of GFC. However, an investigation at an industry-level including the affected securities of the second phase of the programme would also provide useful information for investment decisions during the periods of relaxation of short sales and margin borrowing restrictions.

Finally, essay three documents that different measures of price efficiency, on average, do not change consistently following the relaxation of short sales and margin borrowing constraints in China. However, prior literature suggests improvement in price efficiency where short selling is less constrained. The skewness of abnormal returns decline for affected securities with higher short sales, and price clustering is reduced after the inception of short sales and margin borrowing. The decline in skewness and price clustering is consistent with prior literature. This essay relies on daily data to investigate the impact of short selling and margin trading. By using high frequency stock market intraday data, the effects of regulation lifting short selling and margin buying restrictions on efficiency, stock returns distributions and price clustering could be verified. Recently, in order to promote short sales and margin trading activity, the

CSRC is exploring the options whereby brokerages can borrow the funds and securities from financial institutions in China, such as banks, insurance, and fund management companies and re-lend them to their clients / investors. To date, eligible short sellers and margin traders can only borrow shares and funds owned by qualified brokerage houses.[52] Hence, future study could also explore the impact of this major shift in securities re-lending and refinancing business by examining whether further relaxation of short-sales and margin borrowing constraints has a strong predictive power in explaining stock price movements in China.

[52] See, http://www.csrc.gov.cn/pub/csrc_en/laws/rfdm/DepartmentRules/201212/t20121205_217636.htm and http://www.chinadaily.com.cn/business/2012-08/30/content_15721800.htm

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APPENDIX A

FOR ESSAY ONE

Appendix A.1

The implementation rules, among other requirements, set out the margin requirement for margin trading and short selling. Under the rules, the investors must deposit cash and/or stocks in the margin account with the qualified dealers. The value in the margin account must not be less than 50% of the initial funds and/or stocks borrowed by the investors and investors are subject to the margin calls made by the brokerage houses.[53]

Moreover, the criteria stipulate that brokerage firms which are eligible to undertake new business must:

- "*have net assets of at least RMB 5 billion (approx US$720 million) over the previous six months*
- *be rated as A-class*
- *have a relatively high proportion of self-owned funds in their net capitals and a certain level of self-owned securities*
- *have a trading and settlement system in place which meets the requirements for trading and settlement with the stock exchanges, and*
- *have passed the professional assessment by the China Securities Association (CSA)*".

[53] See http://www.mallesons.com/MarketInsights/marketAlerts/2010/Chineseregulatorpermitsmargintradingandshortselling/Pages/default.aspx

Similarly, the CSRC, require the qualified brokerage firms to select their clients (i.e. investors) for margin trading and short selling operations very carefully based on client's financial status, trading experience and risk preference. Among other requirements, the qualified, investors must have opened the securities accounts with their brokers for more than 18 months, with the value of total assets in their securities accounts of above RMB 500,000 (approx US$72,500) and total financial assets above RMB 1 million (approx US$145,000).

Appendix A.2: List of Sample Stocks Eligible for Margin Trading and Short Selling

S. No.	China Code	Name	Exchange	Listed in HKG	SS Allowed in HKG
1	600000	Shanghai Pudong Development Bank Co., Ltd.	Shanghai	No	No
2	600005	Wuhan Iron and Steel Company Limited	Shanghai	No	No
3	600015	Hua Xia Bank Co., Limited	Shanghai	No	No
4	600016	China Minsheng Banking Corp., Ltd.	Shanghai	Yes	Yes
5	600018	Shanghai International Port (Group) Co., Ltd.	Shanghai	No	No
6	600019	Baoshan Iron & Steel Co., Ltd.	Shanghai	No	No
7	600028	China Petroleum & Chemical Corporation	Shanghai	Yes	Yes
8	600029	China Southern Airlines Company Limited	Shanghai	Yes	Yes
9	600030	CITIC Securities Co., Ltd.	Shanghai	No	No
10	600036	China Merchants Bank Co., Limited	Shanghai	Yes	Yes
11	600048	Poly Real Estate Group Co., Ltd.	Shanghai	No	No
12	600050	China United Network Communications Limited	Shanghai	No	No
13	600089	TEBA Co., Ltd.	Shanghai	No	No
14	600104	SAIC Motor Corporation Limited	Shanghai	No	No
15	600320	Shanghai Zhenhua Port Machinery Co., Ltd.	Shanghai	No	No
16	600362	Jiangxi Copper Co., Ltd.	Shanghai	Yes	Yes
17	600383	Gemdale Corporation	Shanghai	No	No
18	600489	Zhongjin Gold Corporation, Limited	Shanghai	No	No
19	600519	Kweichow Moutai Co., Ltd.	Shanghai	No	No
20	600547	Shandong Gold Mining Co., Ltd.	Shanghai	No	No
21	600550	Baoding Tianwei Baobian Electric Co., Ltd.	Shanghai	No	No
22	600598	Heilongjiang Agriculture Company Limited	Shanghai	No	No
23	600739	Liaoning Chengda Co., Ltd.	Shanghai	No	No

Appendix A.2 (Continued)

S. No.	China Code	Name	Exchange	Listed in HKG	SS Allowed in HKG
24	600795	GD Power Development Co., Ltd.	Shanghai	No	No
25	600837	Haitong Securities Company Limited	Shanghai	No	No
26	600900	China Yangtze Power Co., Ltd.	Shanghai	No	No
27	601006	Daqin Railway Co., Ltd.	Shanghai	No	No
28	601088	China Shenhua Energy Company Limited	Shanghai	Yes	Yes
29	601111	Air China Limited	Shanghai	Yes	Yes
30	601166	Industrial Bank Co., Ltd.	Shanghai	No	No
31	601168	Western Mining Co., Ltd.	Shanghai	No	No
32	601169	Bank of Beijing Co., Ltd.	Shanghai	No	No
33	601186	China Railway Construction Corporation Limited	Shanghai	Yes	Yes
34	601318	Ping An Insurance (Group) Company of China, Ltd.	Shanghai	Yes	Yes
35	601328	Bank of Communications Co., Ltd.	Shanghai	Yes	Yes
36	601390	China Railway Group Limited	Shanghai	Yes	Yes
37	601398	Industrial and Commercial Bank of China Limited	Shanghai	Yes	Yes
38	601600	Aluminium Corporation of China Limited	Shanghai	Yes	Yes
39	601601	China Pacific Insurance (Group) Co., Ltd.	Shanghai	Yes	Yes
40	601628	China Life Insurance Company Limited	Shanghai	Yes	Yes
41	601668	China State Construction Engineering Corporation Limited	Shanghai	Yes	No
42	601727	Shanghai Electric Group Company Limited	Shanghai	Yes	Yes
43	601766	China South Locomotive & Rolling Stock Corporation	Shanghai	Yes	Yes
44	601857	PetroChina Company Limited	Shanghai	Yes	Yes
45	601898	China Coal Energy Company Limited	Shanghai	Yes	Yes
46	601899	Zijin Mining Group Co., Ltd.	Shanghai	Yes	Yes
47	601919	China COSCO Holdings Company Limited	Shanghai	Yes	Yes

Appendix A.2 (Continued)

S. No.	China Code	Name	Exchange	Listed in HKG	SS Allowed in HKG
48	601939	China Construction Bank Corporation	Shanghai	Yes	Yes
49	601958	Jinduicheng Molybdenum Co., Ltd.	Shanghai	No	No
50	601988	Bank of China Limited	Shanghai	Yes	Yes
51	000001	Shenzhen Development Bank Co., Ltd.	Shenzhen	No	No
52	000002	China Vanke Co., Ltd	Shenzhen	No	No
53	000024	China Merchants Property Development Co., Ltd	Shenzhen	No	No
54	000027	Shenzhen Energy Group Co., Ltd.	Shenzhen	No	No
55	000039	China International Marine Containers (Group) Co., Ltd	Shenzhen	No	No
56	000060	Shenzhen Zhongjin Lingnan Nonfemet Co., Ltd.	Shenzhen	No	No
57	000063	ZTE Corporation	Shenzhen	Yes	Yes
58	000069	Shenzhen Overseas Chinese Town Co., Ltd	Shenzhen	No	No
59	000157	Changsha Zoomlion Heavy Industry Science and Technology Co., Ltd.	Shenzhen	No	No
60	000338	Weichai Power Co., Ltd.	Shenzhen	Yes	Yes
61	000402	Financial Street Holding Co., Ltd	Shenzhen	No	No
62	000527	Guangdong Midea Electric Appliances Co., Ltd	Shenzhen	No	No
63	000538	Yunnan Baiyao (Group) Co., Ltd	Shenzhen	No	No
64	000562	Hong Yuan Securities Co., Ltd	Shenzhen	No	No
65	000568	Luzhou Lao Jiao Co., Ltd	Shenzhen	No	No
66	000623	Jilin Aodong Medicine Industry Croup Co., Ltd.	Shenzhen	No	No
67	000630	Tonling Nonferrous Metal Group Stock Co.,Ltd	Shenzhen	No	No
68	000651	Gree Electric Appliances, Inc. of Zhuhai	Shenzhen	No	No
69	000652	Tianjin Teda Co., Ltd	Shenzhen	No	No

Appendix A.2 (Continued)

S. No.	China Code	Name	Exchange	Listed in HKG	SS Allowed in HKG
70	000709	Hebei Iron And Steel Co., Ltd	Shenzhen	No	No
71	000932	Hunan Valin Steel Co., Ltd.	Shenzhen	No	No
72	000729	Beijing Yanjing Brewery Co., Ltd.	Shenzhen	No	No
73	000768	Xi'an Aircraft International Corporation	Shenzhen	No	No
74	000783	Changjiang Securities Co., Ltd.	Shenzhen	No	No
75	000792	Qinghai Salt Lake Potash Co., Ltd.	Shenzhen	No	No
76	000800	Faw Car Co., Ltd	Shenzhen	No	No
77	000825	Shanxi Taigang Stainless Steel Co., Ltd	Shenzhen	No	No
78	000839	Citic Guoan Information Industry Co., Ltd	Shenzhen	No	No
79	000858	Wuliangye Yibin Co., Ltd	Shenzhen	No	No
80	000878	Yunnan Copper Industry Co., Ltd	Shenzhen	No	No
81	000895	Henan Shuanghui Investment & Development Co., Ltd.*	Shenzhen	No	No
82	000898	Angang Steel Company Limited	Shenzhen	Yes	Yes
83	000933	Henan Shen Huo Coal Industry And Electricity Power Co., Ltd	Shenzhen	No	No
84	000937	Jizhong Energy Resources Co., Ltd.	Shenzhen	No	No
85	000960	Yunnan Tin Co., Ltd.	Shenzhen	No	No
86	000983	Shanxi Xishan Coal And Electricity Power Co., Ltd	Shenzhen	No	No
87	002007	Hualan Biological Engineering Inc.	Shenzhen	No	No
88	002024	Suning Appliance Co.,Ltd.	Shenzhen	No	No
89	002142	Bank Of Ningbo Co., Ltd	Shenzhen	No	No
90	002202	Xinjiang Goldwind Science&Technology Co.,Ltd	Shenzhen	No	No

* Due to unavailability of daily data from March 22, 2010 to November 26, 2010 this stock is not included in our sample for Essay one and three, but is included in Essay two for the announcement sample and not in the implementation sample.

APPENDIX B

FOR ESSAY TWO

Discussion on Equal Weighted Returns

This appendix briefly discusses the results around the announcement and implementation of short selling and margin trading pilot programme using market returns based on equal-weighted index.

B.1 Event study results – Announcement Returns

In Table B.1, there is a significant decline in returns of 0.33% on the announcement day for the pilot stocks reported in Panel A. Cumulative Abnormal Returns around the announcement of the pilot programme for $CAR_{0,5}$ and $CAR_{0,25}$ event windows are reported at the bottom of Panel A. Panel B report the significance of the differences in returns between the pilot and matched sample using the means *t*-test and Wilcoxon rank sum test. The difference in the proportion of positive values between the two samples is evaluated using the test for two proportions.

The mean equal-weighted $CAR_{0,5}$ and $CAR_{0,25}$ after the announcement are -3.65% and -6.45% for the pilot sample. During the examined period, the Chinese market decline as a whole, but even after adjusting for both the market and matched sample, the pilot stocks abnormal returns are significantly lower as reported in Panel B. The difference between the CARs of both samples is statistically significant by using means *t*-test, Wilcoxon rank sum test, and proportion test. The negative price reaction following the announcement is consistent with our notion that investors drive the prices of pilot stocks down following the announcement and in anticipation of the short-sales

introduction.

Figure B.1 highlights a clear view of the trend by plotting pilot-matched CARs on the equal-weighted (value-weighted) market model from day -5 through day 5 surrounding the announcement. A post-announcement decreasing trend between the pilot and matched sample suggests higher negative abnormal returns for the pilot stocks.

B.2 Event study results – Implementation Returns

In Table B.2 there is a significant difference in returns of -0.32% between the pilot and matched stocks on the implementation day reported in Panel B. The returns of the pilot firms are lower than the matched firms following the introduction of margin trading and short selling. The evidence is consistent with Miller's (1977) theoretical model that short-sale restrictions push prices upward. In Panel B, the difference in the CARs between the two samples is statistically significant only for shorter window$_{(0,5)}$ by using the means *t*-test, Wilcoxon rank sum test, and proportion test.

Figure B.2 also highlights that the pilot-matched cumulative abnormal returns are lower. Therefore, a post-implementation decreasing trend in pilot-matched CARs can be seen.

Table B.1
Event Study Abnormal Returns and Cumulative Abnormal Returns around Announcement
This table reports abnormal returns and selected CARs surrounding the announcement of the CSRC's pilot short selling and margin trading programme on February 12, 2010. Panel A show equal-weighted abnormal returns for the 90 pilot programme stocks and a control sample of 90 stocks matched on industry, market value of equity, closing stock price, daily turnover, and daily return volatility. We follow Boehmer et al. (1991) and construct standardised cross-sectional test statistics to test mean abnormal returns. The proportion of positive returns and nonparametric sign test are also reported. In Panel B, the pilot-matched difference of returns and tests of significance are presented along with the difference in fraction of positive returns. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Announcement Returns – Equal weighted

Days	Pilot sample		Matched sample	
	Abnormal returns	Positive proportion	Abnormal returns	Positive proportion
-5	-0.0016	0.39	-0.0075**	0.26***
-4	-0.0009	0.40	0.0010	0.57***
-3	0.0054***	0.74***	0.0050***	0.63***
-2	0.0040***	0.58***	0.0002	0.53**
-1	0.0062***	0.71***	0.0036**	0.61***
0	-0.0033**	0.34**	-0.0001	0.42
1	-0.0051***	0.31**	-0.0028*	0.38
2	-0.0174***	0.15***	-0.0098***	0.24***
3	-0.0034*	0.35*	-0.0020*	0.37
4	-0.0015*	0.40	0.0023*	0.51*
5	-0.0064***	0.19***	-0.0055***	0.24***
Announcement $CAR_{0,5}$	-0.0365***	0.20***	-0.0175***	0.27***
Announcement $CAR_{0,25}$	-0.0645***	0.13***	-0.0421***	0.26***

Panel B: Differences between pilot and matched sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	0.0059	2.09**	2.31**	0.12	1.96**
-4	-0.0019	-0.84	-1.61	-0.17	-2.41**
-3	0.0005	0.21	1.41	0.11	1.67*
-2	0.0038	1.85*	1.45	0.04	0.71
-1	0.0026	1.22	1.77*	0.10	1.49
0	-0.0031	-1.48	-0.77	-0.08	-1.16
1	-0.0023	-1.06	-0.58	-0.07	-1.04
2	-0.0077	-2.53**	-2.77***	-0.09	-1.61*
3	-0.0014	-0.70	-1.08	-0.02	-0.29
4	-0.0038	-1.78*	-1.48	-0.10	-1.42
5	-0.0009	-0.46	0.71	-0.05	-0.86
Announcement $CAR_{0,5}$	-0.0189	-2.83***	-2.75***	-0.07	-1.17
Announcement $CAR_{0,25}$	-0.0224	-2.12**	-1.94*	-0.12	-2.32**

Table B.2
Event Study Abnormal Returns and Cumulative Abnormal Returns around Implementation
This table reports abnormal returns and selected CARs surrounding the implementation of the CSRC's pilot short selling and margin trading programme on March 31, 2010. Panel A show equal-weighted abnormal returns for the 89 pilot programme stocks and a control sample of 89 stocks matched on industry, market value of equity, closing stock price, daily turnover, and daily return volatility. We follow Boehmer et al. (1991) and construct standardised cross-sectional test statistics to test mean abnormal returns. The proportion of positive returns and nonparametric sign test are also reported. In Panel B the pilot-matched difference of returns and tests of significance are presented along with the difference in fraction of positive returns. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Implementation Returns – Equal weighted

Days	Pilot sample		Matched sample	
	Abnormal returns	Positive proportion	Abnormal returns	Positive proportion
-5	-0.0053***	0.20***	-0.0035***	0.26***
-4	-0.0048***	0.26***	-0.0016	0.37
-3	0.0030***	0.51*	0.0019*	0.56**
-2	0.0193***	0.97***	0.0105***	0.80***
-1	-0.0036***	0.27***	-0.0033***	0.32**
0	-0.0110***	0.13***	-0.0078***	0.25***
1	0.0009	0.47	0.0016	0.40
2	0.0010	0.48	0.0037*	0.50
3	-0.0050***	0.34**	-0.0071***	0.34**
4	-0.0075***	0.18***	-0.0074***	0.26***
5	-0.0115***	0.15***	-0.0028	0.44
Implementation $CAR_{(0,5)}$	-0.0326***	0.10***	-0.0197***	0.24***
Implementation $CAR_{(0,25)}$	-0.0737***	0.21***	-0.0607***	0.31***

Panel B: Differences between pilot and matched sample

Days	Mean Diff	t-value	Wilcoxon test	Proportion	t-value
-5	-0.0018	-1.15	-0.69	-0.06	-1.04
-4	-0.0032	-1.64*	0.87	-0.11	-1.62*
-3	0.0011	0.58	-0.27	-0.05	-0.64
-2	0.0087	3.85***	4.24***	0.17	3.73***
-1	-0.0003	-0.18	-0.17	-0.05	-0.74
0	-0.0032	-1.68*	-2.14**	-0.13	-2.28**
1	-0.0006	-0.35	-0.84	0.06	0.88
2	-0.0028	-1.10	-0.58	-0.02	-0.24
3	0.0021	0.69	-0.47	-0.00	-0.05
4	-0.0001	-0.04	0.35	-0.07	-1.22
5	-0.0087	-3.15***	-3.75***	-0.29	-4.49***
Implementation $CAR_{(0,5)}$	-0.0130	-2.46**	-2.89***	-0.14	-2.68***
Implementation $CAR_{(0,25)}$	-0.0130	-0.61	0.40	-0.10	-1.56

Table B.3: Correlation Matrix

	Relative_M/B	*Relative_P/E*	*Relative_CFO*	*Relative_Debt*	*Turnover*	$Sigma_{ab}$	*Board_Ind*	*Board_Size*	*State_Dummy*
Relative_M/B	1.0000	0.1539	0.3505	-0.1517	0.2803	0.3363	-0.0677	-0.1811	0.1304
Relative_P/E	0.1539	1.0000	-0.0954	-0.0332	0.3746	0.1117	-0.0384	-0.0200	0.2686
Relative_CFO	0.3505	-0.0954	1.0000	-0.2383	0.0055	0.1911	-0.0362	-0.1544	0.0283
Relative_Debt	-0.1517	-0.0332	-0.2383	1.0000	-0.1535	-0.0950	-0.0012	0.2854	0.0156
Turnover	0.2803	0.3746	0.0055	-0.1535	1.0000	0.4382	0.1860	-0.2654	0.5317
$Sigma_{ab}$	0.3363	0.1117	0.1911	-0.0950	0.4382	1.0000	0.0984	-0.2845	0.1534
Board_Ind	-0.0677	-0.0384	-0.0362	-0.0012	0.1860	0.0984	1.0000	-0.3634	0.2142
Board_Size	-0.1811	-0.0200	-0.1544	0.2854	-0.2654	-0.2845	-0.3634	1.0000	-0.0384
State_Dummy	0.1304	0.2686	0.0283	0.0156	0.5317	0.1534	0.2142	-0.0384	1.0000

Figure B.1: Difference in cumulative abnormal returns around announcement.
This figure reports pilot-matched equal-weighted and value-weighted CARs between pilot and matched sample respectively. The abnormal returns are calculated based on the OLS market model around announcement event. An announcement event is defined as one in which 90 pilot stocks are announced on February 12, 2010 that can be bought on margin or sold short from the implementation date. The announcement day is denoted as day 0. For the market model, the estimation window is (-255, -30).

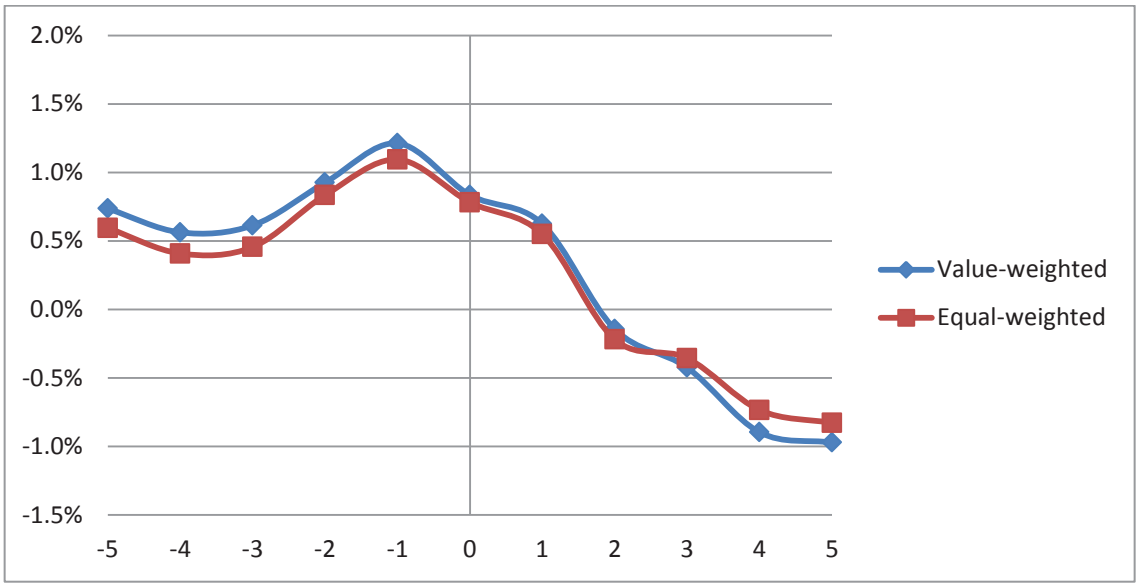
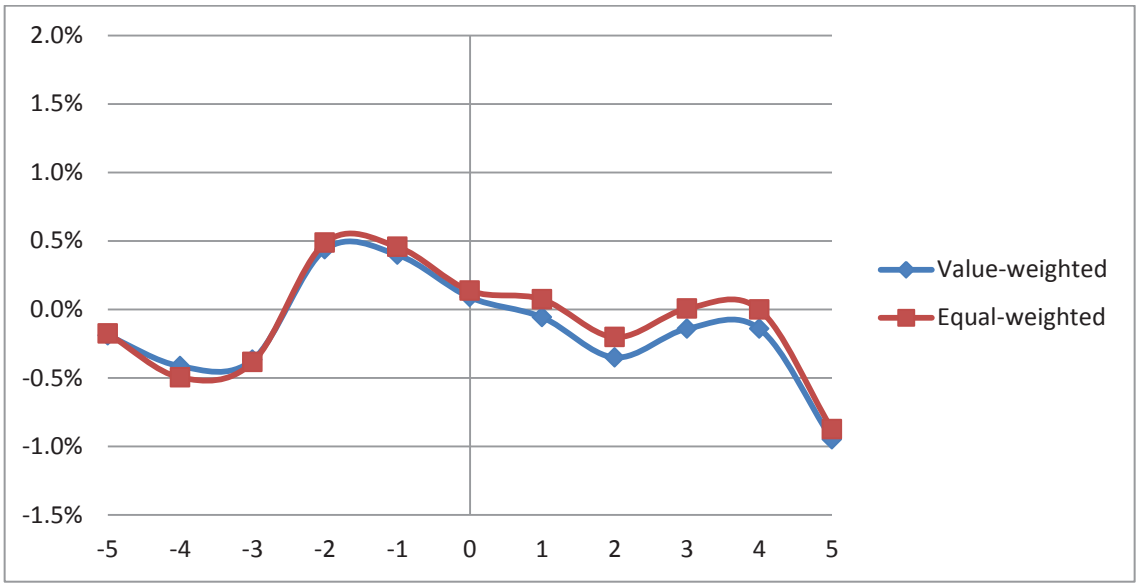


Figure B.2: Difference in cumulative abnormal returns around implementation.
This Figure reports difference in value-weighted and equal-weighted CARs between pilot and matched sample respectively. The abnormal returns are calculated based on the OLS market model around implementation event. An implementation event is defined as one in which 89 pilot stocks can be bought on margin or sold short from March 31, 2010. The implementation day is denoted as day 0. For the market model, the estimation window is (-255, -30).



APPENDIX C

FOR ESSAY THREE

Table C.1: Univariate Analysis - Changes in Price Efficiency Measures – Affected and Cross-listed Samples

This table reports the cross-sectional average of estimated measures of price efficiency. The columns labelled with 'Pre' show the cross-sectional mean and median of each measure for the seven-months before the inception of short selling and margin trading. The columns labelled with 'Post' show the average of variables seven-months following the introduction. A minimum of 100 trading days is required for both the pre- and post-period in cross-listed stocks. This reduces the total sample of 40 cross-listed firms down to 35 H-shares. A paired *t*-test and the Wilcoxon non-parametric test are used to analyse the difference between two periods. Also reported are 'Diff' of Post minus Pre and associated p-value.

Affected minus cross-listed sample (N=35)	*Mean*				*Median*			
	Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
R-Squared	0.0941	0.1098	0.0157	0.7016	0.0626	0.0708	0.0082	0.8150
Downside minus Upside *R*-Sq.	0.0657	0.0302	-0.0355	0.4619	0.0730	-0.0002	-0.0732	0.3877
Upside *R*-Squared	0.0574	0.0945	0.0371	0.3714	0.0737	0.1211	0.0474	0.3159
Downside *R*-Squared	0.1231	0.1248	0.0016	0.9653	0.0990	0.1394	0.0404	0.8607
Cross Auto-correlation	-0.0230	0.0041	0.0271	0.2336	-0.0272	0.0203	0.0475	0.1849
Downside minus Upside C. Auto.	-0.0240	-0.1686	-0.1446	0.0186	0.0358	-0.2235	-0.2593	0.0134
Upside Cross Auto-correlation	-0.0285	0.0980	0.1265	0.0007	-0.0698	0.0685	0.1383	0.0015
Downside Cross Auto-correlation	-0.0526	-0.0706	-0.0181	0.6979	-0.0492	-0.0459	0.0033	0.6995
D1	-0.0624	-0.0191	0.0434	0.1487	-0.0164	-0.0042	0.0122	0.0767
D2	-0.0972	-0.0424	0.0549	0.0978	-0.0636	-0.0298	0.0338	0.1775

Table C.2: Changes in the Characteristics of Stock Returns Distributions – Affected and Cross-listed Samples

This table reports the characteristics of stock return distributions before and after the inception of short selling and margin trading. The columns labelled with 'Pre' show the cross-sectional mean and median of seven-month before the inception of short selling and margin trading. The columns labelled with 'Post' show the time-series average of variables seven-month following the introduction. A minimum of 100 trading days is required for both the pre- and post-period in cross-listed stocks. This reduces the total sample of 40 cross-listed firms down to 35 H-shares. A paired t-test and the Wilcoxon non-parametric test are used to analyse the difference between two periods. Also reported are 'Diff' of Post minus Pre and associated p-value.

Affected minus Cross-listed sample (N=35)		*Mean*				*Median*			
(N=35)		Pre	Post	Diff	p-value	Pre	Post	Diff	p-value
Standard Deviation	Raw Returns	-0.0010	-0.0017	-0.0007	0.7061	-0.0010	-0.0012	-0.0002	0.9347
	Abnormal Returns	0.0882	0.1754	0.0873	0.0088	0.0886	0.2010	0.1125	0.0027
Skewness	Raw Returns	-0.1286	0.0204	0.1491	0.4720	-0.1583	-0.1573	0.0010	0.8332
	Abnormal Returns	0.5462	0.4266	-0.1196	0.7351	0.4228	0.2249	-0.1979	0.3447
Kurtosis	Raw Returns	1.1827	-0.5991	-1.7818	0.1651	1.1998	0.6728	-0.5270	0.2785
	Abnormal Returns	1.8698	0.9397	-0.9301	0.6885	2.1194	1.5605	-0.5589	0.9254
Extreme Values	Frequency [*Return > M+(2)(SD)*]	-0.0017	-0.0015	0.0002	0.9446	-0.0042	-0.0052	-0.0010	0.9347
	Frequency [*Return < M-(2)(SD)*]	0.0056	0.0091	0.0035	0.2696	0.0035	0.0093	0.0058	0.2127

Table C.3: Correlation Matrix

Variable Name	SS_Ratio	MT_Ratio	Market Cap	Turnover	Zero Return Days	Bid_Ask
SS_Ratio	1	0.2689	-0.1650	0.0016	-0.1263	0.0375
MT_Ratio	0.2689	1	-0.1978	-0.0409	-0.1025	0.5222
Market Cap	-0.1650	-0.1978	1	-0.1864	0.1585	-0.0059
Turnover	0.0016	-0.0409	-0.1864	1	-0.0731	-0.2869
Zero Return Days	-0.1263	-0.1025	0.1585	-0.0731	1	0.1036
Bid_Ask	0.0375	0.5222	-0.0059	-0.2869	0.1036	1