TWO ESSAYS ON THE ROLE OF INSTITUTIONAL INVESTORS IN IPO

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Two Essays on the Role of Institutional Investors in IPO

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Certificate of Originality

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(Signed)

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“Two Essays on the Role of Institutional Investors in IPO”

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Abstract:

My thesis consists of two essays that investigate the roles of institutional investors in Initial Public Offerings (IPO). By adopting a “two-stage” framework that considers the pre-market (bookbuilding) and aftermarket (trading) stages, I aim to provide explanations to how investor sentiment and total allocation to institutional investors influence IPO pricing and price discovery.

My first essay examines how underwriters price an IPO in the presence of investor sentiment especially when pre-market sentiment may deteriorate in aftermarket stage. Ljungqvist et al. (2006) show that underwriters cooperate with institutional investors in adopting a “staggered sale” strategy to exploit sentiment investors who arrive to the IPO market over time. Their study predicts that underwriters leave money on the table to compensate institutional investors for bearing the risk of sentiment deterioration. However, their prediction has not been empirically examined. My study fills such a void by utilizing a unique IPO mechanism in Hong Kong: The separate retail tranche where pre-market sentiment can be directly measured by retail oversubscription. I find that underwriters adjust offer price to take advantage of pre-market investor sentiment but the adjustment is only partially done. More importantly, the money left on the table is positively related to the deterioration of investor sentiment in the aftermarket. Overall,

my result is consistent with the re-distributing role of institutional investors in the aftermarket and establishes a relation between their compensation and the reversal of investor sentiment.

My second essay investigates how total allocation for institutional investors affects their choice of aftermarket trading as an alternative to participating in pre-market bookbuilding. Busaba and Chang (2010) show that if institutional investors anticipate unfavorable allocation, they may strategically choose to withhold their private information in the bookbuilding and trade on it subsequently in the aftermarket. However, little research so far has explored informed aftermarket trading by institutional investors. My study fills this gap by taking advantage of the "Clawback" arrangement in Hong Kong, which exogenously generates a wide but anticipated variation in the total institutional allocation by linking share allocation to pre-market retail demand. I find that insufficient allocation encourages institutional investors to choose strategic aftermarket trading, resulting in less (more) private information being incorporated into share price during the pre-market bookbuilding (the aftermarket trading). I document that aftermarket trading by institutional investors earns excess returns in both short and long horizons. Overall, my findings confirm the prediction by Busaba and Chang (2010) and suggest that institutional investors can enhance price efficiency through either their participation in pre-market bookbuilding or aftermarket trading.

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Chapter 1

Overview

1.1 Introduction

My thesis is constituted of two essays that investigate the role of institutional investors in IPO process from two different but related perspectives. Before going any further, I will give an overview of my thesis in this chapter. In following sections I will briefly discuss the motivations, research questions, research design and my main findings for the two essays respectively. The detailed discussions are provided in following chapters (Chapters 2 and 3).

The roles of institutional investors are addressed in a uniform "two-stage" framework but from two different angles. In my first essay, I explore the role of institutional investors by studying the IPO pricing in a market where pre-market (primary market) sentiment may deteriorate in aftermarket (secondary market) stage. In my second essay, I investigate the role of institutional investors in enhancing IPO pricing discovery by looking into their choice of aftermarket (secondary market) trading as an alternative to participating in pre-market (primary market) bookbuilding.

Specifically, essay one investigates the re-distributing role of institutional investors, that is, purchasing shares from the underwriter in pre-market and reselling them to sentiment investors in the aftermarket. In addition, essay one examines their compensation in a situation where pre-market sentiment demand may deteriorate in aftermarket. Using a sample of 293 IPOs in Hong Kong, I confirm the empirical predictions of Ljungqvist et al. (2006) that underwriters partially adjust to investor sentiment in pre-market as a fair compensation to institutional

investors for the expected inventory losses due to sentiment swing in the aftermarket. Essay two examines the aftermarket trading of institutional investors and its implications on price discovery in pre- and aftermarket stages. I find when institutional investors receive unfavorable allocation in the pre-market, they tend to withhold private information and trade on it subsequently in the aftermarket. Furthermore, their aftermarket trading generates both short- and long-run excess returns. My evidence supports the "strategic aftermarket trading" theory proposed by Busaba and Chang (2010), and shows that institutional investors contribute to price discovery through either pre-market bookbuilding or aftermarket trading.

1.2 Motivation and Research Questions

Essay one is motivated by the recent development in the studies on investor sentiment and IPO pricing. Empirical studies so far (Cornelli et al., 2006; Derrien, 2005; Dorn, 2009) document that overoptimistic investor sentiment may boost up both the offer price as well as the first-day trading price (initial return) of an IPO. While investor sentiment fades in aftermarket, IPO share price converges towards the mean valuation from the market and demonstrates a price reversal. However, an unsolved question in this explanation is why underwriters are less aggressive in setting the offer price and thus leave money on table in the presence of investor sentiment. In a theory paper, Ljungqvist et al. (2006) argue that sentiment investors may arrive to the market sequentially over time. In that case, underwriter could maximize the proceeds of an IPO by employing a "staggered sale" strategy, in which he first sells the IPO to cooperative regular (institutional) investors as inventory, and then lets them resell the issue to sentiment investors arriving in the aftermarket. (Ljungqvist et al., 2006) As investor sentiment may end prematurely, the underwriter sets the offer price less aggressively to compensate institutional investors for the expected loss in holding inventory. Thus, the money left on the table is to

compensate for bearing the risk of sentiment deterioration in the aftermarket. Another theoretical work by Chen and Wilhelm (2008) models the intermediating role of institutional investors over the transition between pre-market and aftermarket stages. However, both of their predictions lack empirical examination. In Chapter 2, I fill the gap by separately measuring the investor sentiment in pre- and aftermarket stages and studying the relationship between the IPO pricing and the deterioration of investor sentiment.

Thus, the research questions for the first essay are as follows: First, does the underwriter take advantage of the pre-market investor sentiment in pricing IPO? Second, if indeed the underwriter capitalizes pre-market sentiment in pricing IPO, whether and to what extent he will under-adjust offer price in relation to the risk of sentiment swing? Answering these two questions helps us to understand the "staggered sale" strategy and the compensation for the re-distributing role of institutional investors.

Essay two sheds light on the aftermarket trading by institutional investors as well as its implications on IPO pricing efficiency. After the seminal work of Benveniste and Spindt (1989), numerous studies show underwriters extract private information from institutional investors by rewarding them favorable IPO share allocations over the bookbuilding. (Benveniste and Wilhelm, 1990; Ljungqvist and Wilhelm, 2002; Sherman, 2000). However, recent studies suggest institutional investors may also have an incentive to withhold their private information from underwriters. First, studies on aftermarket show that considerable information asymmetry and profit potential exist immediately after the listing (Chen and Wilhelm, 2008; Falconieri, 2009; Bradley et al., 2009). Second, empirical findings show institutional investors possess private information and profit from it after the listing (Boehmer et al, 2006; Chemmanur et al., 2010). Third, in a theoretical study, Busaba and Chang (2010) show that institutional investors may

strategically choose to trade on their private information in the aftermarket if they anticipate unfavorable allocation. In essay two, I take advantage of the unique "Clawback" provision in Hong Kong, which stipulates the total institutional allocation in IPO according to retail demand, to investigate the strategic aftermarket trading by institutional investors and its implications on the IPO price discovery in the pre- and aftermarket stages.

In essay two, I aim to provide answers to following questions. First, whether insufficient allocation encourages institutional investors, as a whole, to trade in early aftermarket? Second, whether and how the demand for aftermarket trading by institutional investors will influence the price discovery over the pre- (after-) market stages? Third, whether the actual aftermarket trading by institutional investors can generate excess returns in short and long terms? Answering the first two questions help us identify the role of institutional investors in enhancing price discovery over the pre- and aftermarket stages, while investigating the third one allows us to examine whether institutional investors are informed in IPO valuation.

1.3 Research Design and Main Findings

To answer the research questions proposed in my two essays, a two-stage framework that simultaneously incorporates the IPO pre- and aftermarket stages is required. In my first essay, I divide the "initial return" into two components, offer-to-open and open-to-close, in order to precisely capture the under-adjustment in offer price in pre-market stage and the price run-up in aftermarket stage. Correspondingly, I measure the firm-level investor sentiment in each stage taking advantage of the unique data available in Hong Kong: I use the retail subscription rate of IPO to proxy investor sentiment in the pre-market stage, while using small trade imbalance (Lee and Ready, 1991) to gauge the sentiment in aftermarket stage. By monitoring the change of

investor sentiment from pre-market and aftermarket, I test whether the possibility of deterioration in investor sentiment leads to an under-adjustment in offer price, as implied in Ljungqvist et al., (2006).

The main findings of essay one are as follows. I find that the underwriter incorporates pre-market investor sentiment to offer price, while partial adjustment to sentiment exists in pricing of IPO. Interestingly, I find ceteris paribus, the under-adjustment in offer price is higher when the offering enjoys a higher sentiment in pre-market but suffers a lower one in aftermarket. Simply put, the "money left on the table" of IPO serves as a compensation for the deterioration of investor sentiment in aftermarket. In addition, sentiment persisting in aftermarket boosts up IPO share price further after listing and subsumes pre-market sentiment in explaining the long-run price underperformance. Overall, my evidence suggests that "money left on the table" in hot IPOs is a way to compensate institutional investors who bear the risk of sentiment deterioration in the aftermarket.

In essay two, I adopt a similar two-stage framework assuming that the choice of aftermarket trading by institutional investors is induced from insufficient allocation in the pre-market. In this essay, I use total institutional allocation data in Hong Kong IPO, which is publicly available under the "Claw back" provision, to proxy the demand for aftermarket trading. I then explore whether and how the institutional allocation (institutional trading) will influence the price discovery over the pre- (after-) market stages. Specifically, at the pre-market stage, I examine whether the pattern of "partial adjustment" aligns with the prediction of bookbuilding theories (Benenviste and Spindt, 1989; Hanley, 1993) under different levels of institutional allocation. At the aftermarket stage, I compute the probability of informed trading (PIN) proposed by Easley and O'Hara (1992) to measure the amount of private information impounded

in share price, and test how the institutional trading affects the PIN in the aftermarket. By taking both of the pre- and aftermarket stages into account, I identify the role of institutional investors in enhancing price discovery over the IPO process.

The essay two presents following findings. Firstly, I show that under the "Claw back" provision, insufficient total allocation to institutional investors encourages institutional investors to trade in aftermarket. Second, I find higher (lower) total institutional allocation leads to more (less) the private information revealed over bookbuilding process. In particular, higher total institutional allocation results in "partial adjustment" to private information, which is consistent with the "information extraction" theory (Benenviste and Spindt, 1989; Hanley, 1993). While lower institutional allocation leads to "partial adjustment to public information" in line with the sentiment explanations (Derrien, 2005; Ljungqvist et al., 2006). Third, I find aftermarket trading by institutional investors increases the probability of informed trading (PIN) in aftermarket, suggesting institutional investors enhance IPO price efficiency through aftermarket trading. Finally, I show that institutional trading in aftermarket could predict both short- and long-term post-IPO performances. This result implies institutional investors choosing aftermarket trading could circumvent the offering constraints (flipping, lock-up provisions) set by underwriters and exploit short-term profit. Overall, my results suggest aftermarket trading by institutional investors serves as an alternative to participating in pre-market bookbuilding. As a result, they can enhance price discovery through either their participation in pre-market bookbuilding or aftermarket trading.

1.4 Organization of the Thesis

The remainder of the thesis is structured into three chapters. Chapter 2 presents the first essay on the role of institutional investors in re-distributing IPO shares in aftermarket. Chapter 3 contains the second essay on the role of strategically aftermarket trading by institutional investors and its implications on IPO price efficiency. Finally, concluding remarks are drawn in Chapter 4.

Chapter 2

The Investor Sentiment and IPO Pricing during the Pre- and Aftermarket Stages

2.1 Introduction

The pricing of initial public offering (IPO) is one the most puzzling phenomena in finance. So far, it seems that underwriters take advantage of investor sentiment around the IPO by setting an offer price above its intrinsic value (Derrien, 2005; Cornelli et al., 2006; Cook et al., 2006; and Dorn, 2009). In this chapter, I show when examining the relationship between investor sentiment and IPO pricing, it is important to take the role of institutional investors into consideration.

Institutional investors may play a re-distributing role in the IPO when sentiment investors come to market sequentially. Ljungqvist et al. (2006) argue that in a market where "irrational exuberance" exists about the prospectus of specific IPO firms, the "value to the issuer is maximized if underwriters allocate IPO shares to their regular (institutional) investors for gradual sale to sentiment investors who arrive in the market over time"(Ljungqvist et al., 2006; p1669). This "staggered sale" strategy lets underwriter price investor sentiment into the offer price, and employs institutional investors to hold and re-distribute the IPO share in a way that maintains the stock prices. In another theoretical work, Chen and Wilhelm (2008) show institutional investors may play a similar role in the transition between pre-market and aftermarket where substantial new information arrives gradually. They suggest institutional investors hold and control the supply of IPO shares in respond to the arrival of informed investors in secondary market.

However, institutional investors who re-distribute the shares in aftermarket bear the risk that sentiment may deteriorate prematurely and such risk may result in an inventory loss. Consequently, in pricing the IPO, underwriters need to lower the offer price to some level as a fair compensation to institutional investors for expected inventory loss, which is, by definition, positively related to the possibility of sentiment deterioration (Ljungqvist et al., 2006). Unfortunately, the fact that most of prior IPO pricing studies only looks into the relationship between sentiment and initial return (i.e., offer-to-close return) implies that the compensation arrangement between the underwriter and institutional investors has not been properly considered.

In this chapter, I fill this gap by measuring investor sentiment separately in pre-market and aftermarket, and examining its impact on IPO pricing in a two-stage framework. I address following research questions: First, does the underwriter take advantage of the pre-market investor sentiment in pricing IPO? Second, if indeed the underwriter capitalizes pre-market sentiment in pricing IPO, whether and to what extent he will under-adjust offer price in relation to the risk of sentiment deterioration? Ljungqvist et al. (2006) propose that sentiment deterioration in aftermarket results in an inventory loss for institutional investors. Following this line, the greater is the risk of sentiment swing, the larger should be the level of under-adjustments in setting the IPO price. By partitioning the IPO process into pre-market and aftermarket stages and monitoring the development of investor sentiment, I empirically test this relationship and suggest institutional investors may play a re-distributing role over the IPO process.

Hong Kong provides a unique institutional setting to study investor sentiment and its impact on IPO pricing. First, Hong Kong IPOs have a Dual Tranche system with Public tranche

for retail investors and Placing tranche for institutional investors. The retail demand for public tranche is presumably driven by investor sentiment. Thus, the availability of subscription rate for public tranche allows us to have an effective proxy for pre-market sentiment. The fact that retail investors have a prominent presence also makes Hong Kong an ideal place to study the impact of investor sentiment on IPO pricing[1]. Second, Clawback Provision in Hong Kong implies that the allocation to institutional investors is inversely related to retail demand (or pre-market investor sentiment). Clawback Provision generates a greater variation in the fractional allocation to regular investors in Hong Kong, as compared with a more stable allocation of 70% in the US. This allows us to examine how regular investors are compensated in the presence of fluctuating sentiment.

My study presents following findings. First, I find that underwriters revise offer price up in relation to the retail oversubscription level in pre-market. However, offer-to-open return remains positively associated pre-market sentiment, suggesting underwriters intentionally leave some money on the table. Second, I posit that institutional investors play a role in re-distributing new shares in secondary market and such role is compensated by the money on the table. I show that offer-to-open return is positively related to deterioration of investor sentiment from pre-market to aftermarket periods. In this sense, my findings provide an explanation for the observed partial adjustment phenomenon and shed light on the re-distributing role of institutional investors. Further, using small trade order imbalance and turnover as proxies for aftermarket sentiment, I find that aftermarket sentiment pushes stock price even higher in aftermarket and subsumes pre-market sentiment in explaining IPO long-run performances. Overall, my findings suggest as pre-market investor sentiment will not necessarily persist in the aftermarket, the risk of its

[1] Huang et. al (2011) suggests that Asian markets are more prone to investor overconfidence.

deterioration is compensated by the under-adjustment to pre-market sentiment when underwriters set the offer price.

My study contributes to the literature on institutional investors and IPO pricing in the following ways: First, by documenting the relationship between underpricing and sentiment deterioration in hot issues, I study the re-distributing role played by institutional investors over the pre- and aftermarkets. My results thus lend direct support to Ljungqvist et al. (2006). Second, by establishing a relationship between compensation for institutional investors and the risk of sentiment reversal, this research adds a new perspective in explaining the partial adjustment phenomenon in IPO pricing literature. In sum, this chapter sheds lights on an important re-distributing role played by institutional investors in selling IPO to sequentially-coming sentiment investors.

This essay proceeds as follows. Section 2 offers literature review on IPO pricing and the role of institutional investors. In Section 3 I develop my hypotheses. Section 4 descries the measurement of pre- and aftermarket investor sentiment. Section 5 introduces the institutional background for Hong Kong IPOs. Section 6 summarizes the sample and data sources. Section 7 presents empirical results. Section 8 conducts further analysis. Section 9 offers concluding remarks.

2.2 Literature Review

2.2.1 IPO pricing

There is a substantial amount of research focusing on the IPO pricing puzzle since Ibbotson (1975) documented a positive “initial return” in the first day of IPOs and suggested new issues were underpriced systematically. The most popular strand of the literature, starting with

the Rock (1986), relates the underpricing to the information asymmetry among participants of IPO process. Rock (1986) models the offering process as a "lemon problem", and argues underpricing is a way to avoid "winner's curse" when information asymmetry exists among investors. In another seminal paper, Benveniste and Spindt (1989) discuss the prevailing bookbuilding method and propose that underwriter uses underpricing to extract information from informed investors. In a following research, Hanley (1993) finds the "partial adjustment" phenomenon in initial returns, which strongly supports the "information extraction" theory. Sherman and Titman (2002) model an offering where the choice of becoming "informed" is costly and endogenous and they claim that the equilibrium level of underpricing can be reached. Many researches in this vein (Chemmanur, 1993; Ljungqvist and Wilhelm, 2002) present similar view that underpricing is a way to inducing information production and revelation when information asymmetry exists.

In another strand of literature, researchers try to explain the "underpricing" phenomena by focusing on the agency problem between the issuer and the underwriter. Loughran and Ritter (2002) argue that the underwriter uses his discretion in share allocation to make "quid pro quo" agreements with favored buy-side clients. However, Loughran and Ritter use prospect theory (Kahneman and Tversky, 1979) to justify issuer's tolerance. Their theory claims that the sluggish price adjustment (partial adjustment) in premarket is associated not only private, but also public information. Several empirical studies provide evidence consistent with such prediction (Bradley and Jordan, 2002; Lowry and Schwert, 2004).

In a third strand of literature, researchers examine the IPO pricing from the vantage of a longer horizon or with matched seasoned samples. Ritter (1991) documents that IPOs during 1975 to 1984 underperform a sample of matching firms in a three-year post-IPO window.

Similarly, Purnanandam and Swaminathan (2004) investigate an IPO sample from 1980 to 1997 and find the median IPO is significantly overvalued at the offering compared to its industry peers. These empirical results imply that compared to the "underpricing" theory, an "overpricing" explanation in IPO pricing may better reconcile with the coexistence of short-run initial return and long-run underperformance. Along this line, a number of researchers consider the irrational investor sentiment among investors as one determinant of IPO pricing.

2.2.2 Investor Sentiment and IPO pricing

After Ritter (1984) firstly charactizes a "hot" market with extreme initial returns and IPO volumes betwee 1980 to 1981, there are numerous papers studying the effect of investor sentiment on IPO. Baker and Wurgler (2000) argue firms "time" their IPO to take advantage of opstimistic investor sentiment. Lowry (2003) finds the number and the proceeds of IPO during 1960 to 1996 can be explained by investor optimism to a large extent. These findings suggest the periodic optimism among sentiment investors may contribute to the clustering pattern of offerings.

More papers explore the effect of investor sentiment on IPO pricing. Empirical studies show irrational over-optimism around IPO drives up the offer price (Derrien, 2005) as well as first-day performance. (Corneli, et al, 2006; Dorn et al, 2009). However, as the investor sentiment fades away in long run, the share price reverses back to its intrinsic value and underperformances market benchmarks. Specifically, Derrien (2005) shows the sentiment explanation reconciles with the existence of partial adjustment phenomenon from a sample of French IPOs between 1999 to 2001.Cornelli et al. (2006) and Dorn (2009) uses direct bids from retail investors in grey market to show that the overvaluation among sentiment investors results

in short-term price run-up and long-run reversal. Furthermore, Cornelli et al. (2006) document that the impact of the investor sentiment is asymmetric on IPO aftermarket price. Only over-optimistic sentiment is reflected into IPO aftermarket price immediately after the listing.

In another perspective, researchers step further to identify the source of investor sentiment around IPO. Cook et al. (2006) argues that underwriter may have the power to induce optimistic investor sentiment through promoting and marketing activities. They study the US IPOs from 1993 to 2000 and find higher promotional efforts associate with higher valuation of IPO and initial returns. Kaustia and Knupfer (2008) study the retail subscription of a sample of Finnish IPO during 1995 to 2000. They find past experience in subscripting IPO help account for the future subscription behavior for individual investors. In another word, one has a higher tendency to repeat his or her behavior if he or she experienced a good stock performance from past subscribing. In a recent study, Da et al. (2011) provides another explanation. They use the Google search number to measure the investor attention and find it is positively associated with investor sentiment in the context of IPO. Specifically, they suggest public attention on IPO generates investor sentiment toward the issues.

2.2.3 The Re-distributing Role of Institutional Investors in aftermarket

In major IPO markets, institutional investors have an essential role in determining the price and allocation of an IPO. For example, in US market, institutional investors obtain around 70% of shares offered in the premarket market. (Aggarwal, 2003; Aggarwal et al., 2002; Ljungqvist and Wilhelm, 2002). Several researches thus investigate the how the institutional investors re-distribute IPO shares to ultimate IPO investors in secondary market.

In a theoretical paper, Ljungqvist et al. (2006) investigate the re-distributing role of institutional investors in a market where sentiment investors may arrive sequentially. They argue that underwriters and institutional investors cooperate to take advantage of developing sentiment demand. Underwriters and institutional investors use a "staggered sale" strategy to capitalize the investor sentiment in pre-market and maintain the IPO price in aftermarket. Specifically, the institutional investors re-distribute IPO inventory to sentiment investors in the aftermarket and control the share supply. However, as sentiment may deteriorate prematurely in the aftermarket, underwriters partially adjust offer price to compensate institutional investors for the expected inventory losses. Their study predicts the under-adjustment in offer price is positively related to sentiment swing over the pre- and aftermarket.

A similar theory is proposed by Chen and Wilhelm (2008), who investigate the re-selling role of institutional investors in a market where significant information may arrive immediately after the aftermarket trading starts. They postulate that institutional investors hold the issue over the transition between pre-market to aftermarket and influence the rate at which their excess holding are sold in aftermarket. This strategy enables underwriter and institutional investors to practice inter-temporal price discrimination in early aftermarket where considerable information asymmetry exists.

2.3 Hypothesis Development

In this study, I aim to consider the re-distributing role of institutional investors as well as their compensation in relation to the risk of sentiment deterioration from pre-market to aftermarket. Following this line, I develop three hypotheses that study both the level and the change of investor sentiment over IPO process.

2.3.1 IPO offer price and pre-market sentiment

As proposed by Ljungqvist et al. (2006), the underwriter collaborates with institutional investors to adopt a "staggered sale" strategy as a way to circumvent the uniform-price rule in exploiting sequentially arrived sentiment investors. In particular, the underwriter sets an offer price above IPO intrinsic value by incorporating pre-market sentiment and sells the issue to institutional investors in pre-market. By doing this, the underwriter could reap a profit from sentiment investors coming over time under the uniform-price rule which otherwise he could gain using a price discrimination strategy.

If institutional investors engage in "staggered sale" and help the underwriter successfully take advantage of presented investor sentiment, then one could observe a positive relationship between the pre-market investor sentiment and the IPO offer price. In this essay, I thus follow previous research (Cornelli et al., 2006; Derrien, 2005; Dorn, 2009) to hypothesize that the firm-level investor sentiment over the pre-market stage increases the offer price of the IPO.

H2.1: Offer price revision is positively related to firm-level pre-market investor sentiment.

2.3.2 "Partial adjustment" and compensation to institutional investors

Partial adjustment of offer price is a well-known phenomenon and there are a number of explanations. Benveniste and Spindt (1989) propose the underwriter reward informed investors for reporting their private information by partially incorporating private information into offer price. Hanley (1993) confirms this "information extraction" hypothesis by documenting a positive correlation between offer price revision and initial return. However, recent studies show apart from private information, the underwriter also partially adjusts to public information in

setting offer price[2]. Derrien (2005) studies a hot IPO market and argues that the underwriter only partially adjusts to the investor sentiment in consideration of costly stabilization activities in aftermarket. In this study, I postulate that to the extent institutional investors play a re-distributing role over the IPO pre-market and aftermarket stages, underwriter partially may adjust the offer price as a compensation for such role. Further, I hypothesize that the magnitude of such under-adjustment is positively associated with the possibility of investor sentiment deterioration in aftermarket. Since the open-to-close return itself is influenced by the aftermarket sentiment and subject to the risk of reversal, I expect underwriters could predict only opening price by observing the pre-market sentiment. Therefore, underwriters adjust the offer price partially to pre-market sentiment and use the offer-to-open return to compensate institutional investors. I thus expect 1) offer-to-open is positively related to firm-level pre-market investor sentiment, and more importantly, 2) offer-to-open is positively related to the possibility of sentiment deterioration from pre-market to the aftermarket.

H2.2: Offer-to-open return is positively related to firm-level pre-market investor sentiment.

H2.3: Offer-to-open return is positively related to the possibility of deterioration in investor sentiment during pre-market to aftermarket.

2.4 Measurement of Key Research Variables

2.4.1 Measuring pre-market investor sentiment

Since there is no trading before listing, a main challenge for studying pre-market investor sentiment is to find an appropriate proxy. Lowry (2003) use IPO volume to proxy market-wide

[2] Bradley and Jordan (2002) and Lowry and Schert (2004) find public information is not fully incorporated into offer price. Loughran and Ritter (2002) explains partial adjustment using prospect theory. Edelen and Kadlec (2005) links partial adjustment to the issuer's trade-off between offering price and the completion possibility of IPO.

investor sentiment and find higher volume results in lower post-IPO returns. Recently, researchers tend to measure the investor sentiment in firm-level. For example, Derrien (2005) and Kaustia and Knupfer (2008) use the oversubscription rate from retail investors as a proxy for pre-market investors sentiment and find it has predictive power on offer price. Da et al., (2010) argue that investor attention on individual stocks could develop into firm-level sentiment. They retrieve the Google Search Volume Index (SVI) as an estimate of investor sentiment and show that this measure can explain both the short-term price run-up and long-run price reversal for an IPO sample from 2004 to 2007. Other proxies for firm-level investor sentiment include the grey market price, (Cornelli et al., 2006; Dorn, 2009) and number of news headlines in media concerning the offer before its listing (Cook et al., 2006).

In this essay, I use two proxies to measure the pre-market investor sentiment. First, due to the availability of retail subscription rate in Hong Kong market, I directly use this measure as a proxy of pre-market sentiment.[3] Second, I follow Da et al. (2011) to calculate the Abnormal Google Search Volume Index (ASVI) within the two weeks before the listing day. Google tracks each searching key word the volume of its search frequency from 2004 and computes them into a standardized weekly index (SVI). One can easily see the change of online searching frequency over time by comparing the figure of SVI in each week. To compute my alternative sentiment proxy, I first obtain the weekly search volume index (SVI) from Google Insights[4] for the Chinese ticker name of each IPO company in my sample. Then, I calculate the ASVI by taking the percentage difference between SVI in one week before the listing day and the median SVI during

[3] The retail subscription data can be accessed under the item of "listed companies" in HKEx annual factbook: (e.g, 2009) http://www.hkex.com.hk/eng/stat/statrpt/factbook/factbook2009/Documents/09.pdf
[4] http://www.google.com/trends/

eight weeks earlier. However, because Google only covers the volume data from 2004, and some search returns invalid results, I only obtain ASVI for a total of 158 companies in my sample.

2.4.2 Measuring aftermarket investor sentiment

Researchers use various proxies to measure the investor sentiment in secondary market. Baker and Stein (2004) argue that market liquidity is an indicator of investor sentiment since sentiment investors tend to underestimate the adverse information contained in opposite quotes. Kumar and Lee (2006) use buy-sell order imbalance (BSI) from a set of retail quotes as a sentiment proxy and find it has incremental power of explaining return comovement. However, when trading data from specific investor group is unavailable, researchers (Bradley et al., 2009; Chan, 2010; Krigman et al., 1999) use categorizing rules to infer trades from small and large investors. For example, based on a dollar-value cut-off, Chan (2010) subdivides buyer- and seller-initiated trades into small investors and large investor initiated trades. He finds order imbalance from small investor group can predict both the short-term underpricing and long-run underperformance for IPO.

I use two proxies to capture the aftermarket sentiment. First, I follow Lee and Ready (1991) to construct a buy-sell order imbalance proxy. I flag each trade in the aftermarket as buyer- or seller-initiated using the algorithm of Lee and Ready (1991), and further classify the trades into small, medium, and large trade group based on the dollar-value cut-offs of HK$50,000 and HK$500,000. Under the small trade group, I calculate the sentiment measure by making the difference between buyer's volume and seller's volume.

To construct my second sentiment proxy for aftermarket, I calculate the turnover ratio on early trading days. Baker and Stein (2004) propose that liquidity measure indicates the presence

of sentiment investors since over-optimism leads to more aggressive trading behavior. Moreover, Miller (1977) indicates that higher volume implies larger divergence of opinions between informed and sentiment investors. I divide the first day or 5-day trading volume by the total number of shares issued to construct an alternative proxy for the aftermarket sentiment.

2.5 Unique Institutional Features in Hong Kong IPO Market

2.5.1 The Dual-Tranche offering mechanism and retail subscription

Before 1993, the majority of new listings in Hong Kong were aimed to local investors and conducted through fixed price subscription. Beginning with the listing of first batch of H shares[5] on Hong Kong Stock Exchange (SEHK) from July 1993, global equity offerings which involve raising fund from both domestic and international investors became more common. In November 1994, the Securities and Futures Committee (SFC) and SEHK introduced a "Double Tranche" offering mechanism, which simultaneously contains a "Public Tranche" for retail (local) subscription and a "Placing Tranche" for international institutional investors using bookbuilding methods. This hybrid system increases flexibility for underwriter in determining the offer structure and selecting the potential shareholders, while retains a channel for retail investors to participate in IPO investments. (Jagannathan and Sherman, 2005) SFC and SEHK leave the new share allocation between the two tranches under the discretion of underwriter and issuer. But a minimum 10% floor is set for the Public Tranche as the total shares offered in an IPO. Generally, the initial allocation to Placing Tranche is 90% of total number of shares offered, as set by most underwriters under the Dual-Tranche mechanism.

[5] Refers to shares of companies incorporated in mainland China and traded on the Hong Kong Stock Exchange

In addition to dividing the total shares into two tranches, underwriters should further divide shares for public subscription into two pools, A and B. Pool A are allocated to investors who apply for HK$ 5 million or less, while shares for Pool B are designated to investors who apply for more than HK$ 5 million. Multiple applications for different pools are prohibited. And in each IPO, the subscription information for Pool A, Pool B, and total Public Tranche is disclosed on the allocation announcement as one of the filing one or two trading days prior to the listing. Thus, the subscription rate, calculated as subscription for the total Public tranche over the initial shares designated into this tranche, serves as a clean proxy for the overall sentiment towards specific IPO during the pre-market.

2.5.2 Oversubscription and Clawback provision

Hong Kong IPO market is featured with extremely high demands from retail investors. To protect the interest of retail investors, in June 1998, The SEHK (The Stock Exchange of Hong Kong Limited) issues the Practice Note 18, in which the Rule 4.2 introduces a “Clawback” provision. Under this rule, a minimum 10% of overall offer should be allotted to retail tranche as initial allocation. When the total demand for shares in the retail tranche reaches some prescribed thresholds, different proportions of the shares originally allocated to placing tranche should be transferred to the retail tranche. Specifically, Clawback formula regulates that the fractional shares allocated to retail tranche increases to 30%, 40% and 50%, respectively, when the shares in retail tranche are at least 15 times, 50 times or 100 times oversubscribed. However, if total offer size exceeds HK$10 billion, the SEHK may grant a waiver to reduce the minimum allocation to public tranche under Clawback arrangement. The objective of Clawback Provision is to ensure a sufficiently large allocation to retail investors when pre-market retail demand is high.

Clawback Provision has the following implications: On the one hand, Clawback Provision may restrict discretionary allocation to regular investors, not only reducing the risk for holding the inventory by regular investors but also discouraging the revelation of private information during book-building process. On the other hand, Clawback Provision provides extra incentives for retail investors to participate in an IPO and to reveal their information and/or sentiment.

2.5.3 Listing requirements for Hong Kong Stock Exchange (SEHK)

The SEHK has two listing boards: the Main Board and GEM (Growth Enterprises Market was introduced in 1999). Applicant for the Main Board listing must have a trading record of not less than three financial years and meet one of three criteria on profit, market capitalization, revenue and cash flow[6]. The SEHK also attracts a significant number of China-affiliated IPOs. A firm with business in mainland China (or PRC) can be listed by offering either H-shares or red-chip shares. An H-share listing is for a company incorporated in mainland China, whereas a red-chip listing is for a company incorporated outside of mainland China but having most of its business in mainland China[7].

[6] The three listing criteria include (1) Profit Test: At least HK$50 million in the last 3 financial years with profits of at least HK$20 million in the most recent year, aggregate profits of at least HK$30 million in the 2 years before that, and at least HK$200 million at the time of listing. (2) Market Cap/Revenue Test: At least HK$4 billion at the time of listing and at least HK$500 million for the most recent audited financial year. (3) Market Cap/Cash flow Test: At least HK$2 billion at the time of listing, at least HK$500 million for the most recent audited financial year and a positive cash flow from operation of at least HK$100 million for the three preceding financial years.

[7] Chapter 19A of the Listing Rules deals with H-share listing with additional requirements: (1) PRC issuers are expected to present their annual accounts in accordance with Hong Kong or international financial reporting standards; (2) the articles of association of PRC issuers must contain provisions which will reflect the different nature of domestic shares and H shares and the different rights of their respective holders; and (3) disputes involving holders of H shares and arising from a PRC issuer's articles of association, or from any rights or obligations conferred or imposed by the Company Law and any other relevant laws and regulations concerning the affairs of the PRC issuer, are to be settled by arbitration in either Hong Kong or the PRC at the election of the claimant.

The Listing Rules require companies to have a public float of at least 25% of an issuer's total issued share capital. Where an issuer has more than one class of securities or more (for example, a firm may have A shares listed on the stock exchanges in mainland China and H shares listed on the SEHK), total stocks held by the public at the time of listing must be at least 25% of the issuer's total issued share capital. Moreover, companies usually grants an over-allotment option to underwriters for issuing additional shares up to 15% of the number of shares initially available for the IPO. The allocation of these additional shares is at the discretion of underwriters but generally to Placing Tranche.

2.5.4 Price stabilization activities

Price stabilization activities in Hong Kong are only permitted for IPOs with an offer value of HK$100 million or more. Issuers normally appoint a stabilizing manager to stabilize share price after listing by undertaking primary stabilizing actions (e.g., purchasing shares in the secondary market to minimize any reduction in share price below offer price) and ancillary stabilizing actions. Primary stabilizing action is carried out during the period from the commencement of trading on the SEHK and the 30th day after the end of an offer. Purchases in the secondary market to close out a prior short position are viewed as primary stabilizing actions. In order to qualify under the Price Stabilization Rules (PS Rules), prior short position should be created in order to carry out primary stabilization. A stabilizing manager may also carry out ancillary stabilizing actions which include: over allocation of securities; exercise of over-allotment options; and liquidations of net long positions created through primary stabilizing purchases.

The PS rules require prior, interim and post stabilization disclosure. For example, stabilizing manager is required to disclose any exercise of over-allotment options. More importantly, the PS Rules require that the maximum price for any primary stabilizing action is offer price**.** Thus, stabilizing actions can only be taken when share price falls below offer price. If underwriters set offer price too high and hot market ends prematurely, price stabilization actions would be costly (Derrien, 2005).

2.6 Data and Sample

2.6.1 Sample

The sample of IPO studied in this essay is retrieved from the HKEx online factbook, which lists the issuances in Hong Kong after 1999.[8] Since Hong Kong Securities and Future Ordinance came into force on April 1, 2003, which substantially change the regulation and disclosure requirements on price stabilization activities, I restrict my sample between April 2003 and Dec 2009. By the definition of SEHK, there are 484 ordinary companies listed on the Main Board of SEHK from April 2003 to Dec 2009. To trim the raw sample, I limit my sample to IPOs using Dual-Tranche mechanism and bookbuilding method with a price range explicitly disclosed in prospectus. And since retail subscription rate is my key proxy for pre-market sentiment, I exclude offerings without subscription information. Further, I exclude IPOs of close-end funds, unit offering, REIT, companies switching from growth enterprise market (GEM) to the Main Board.[9] After this filtering process, my final sample comprises 293 IPOs from April 2003 to Dec 2009.

[8] This list of listed companies can be accessed through the factbook of HKEx website http://www.hkex.com.hk/eng/stat/statrpt/factbook/factbook.htm

[9] Empirical studies normally exclude IPOs with offer price below $5. However, such a filter is not practical in Hong Kong since stocks with a price below $5 have a significant presence.

The subscription rate, offer price, and proceeds raised of each IPO are retrieved from the factbook. The price range, share allocation for placing and public tranche, and disclosure for aftermarket price stabilization for each offering are hand-collected from prospectus from the HKEx website.[10] Daily prices and volumes are downloaded from Datastream. For intraday transactions and quotations information, I obtain the trade-by-trade and bid-ask quotes data from HKEx. Following Lee and Ready (1991) and Chan (2010), I calculate the intraday buy-sell order imbalance by small investors. Meanwhile, I use intraday transaction data to determine the daily open price and daily price volatility. Under my two-stage framework, offer-to-open is calculated as the percentage difference between the opening price (first trade in the listing day) and the IPO offer price, while open-to-close is defined as the percentage difference between the closing price and the first trade price of listing day. I also obtain the annual market share of underwriters from Bloomberg to measure the reputation of lead underwriter. Lastly, I construct the abnormal Google Search Volume Index (ASVI) as discussed in Section 2.4. As the search volume index starts from 2004 and searching some Chinese ticker return zero or contaminating results, only 158 out of 293 IPOs in my sample have appropriate ASVI measure. A detailed description for the variable computations and definitions are provided in Appendix A.1

2.6.2 Descriptive statistics

Descriptive statistics of variables are provided in Table 2.1. IPOs in my sample have an average offer price of HK$3.89, indicating a significant presence of "penny" offerings in Hong Kong. However, the average funds raised from an IPO are about HK$4145 million. More than half of firms (55%) listed on the Main board use prestigious investment bank as their underwriter

[10]HKEx (Hong Kong Exchanges and Clearing Limited) is the owner of SEHK
Website:http://www.hkexnews.hk/listedco/listconews/advancedsearch/search_active_main.aspx

(*UWREP*=1) and about 20% of IPOs in my sample are from companies incorporate in mainland China (*HSHARE*=1). Underwriters tend to allocate majority of shares (approximately 69% of total shares offered) to Placing Tranche. However, this number varies in respond to the Clawback Provision: In my sample, 218 IPOs trigger this mechanism and re-allocate up to 50% of the total shares offered to Public Tranche. And the allocation to institutional investors ranges from 50% to 99%.

As reflected by the re-allocation data, the IPO markets in Hong Kong appears to be highly influenced by investor sentiment. My main variable of interest in gauging the pre-market sentiment, the subscription rate (*SUBRATE*), has an average of 171 times to the number of shares originally assigned to public subscription, which is high enough to re-allocate 50% of total shares offered to public investors. Although this result indicates that oversubscription is common in Hong Kong, some IPOs are undersubscribed to a large extent: the lowest subscription rate is merely 7% of shares assigned. Offer price revision has a mean of 3.66%, suggesting that underwriters typically increase offer price after gathering information during the book-building process. About 42% of IPOs in my sample have an offer price reaching the upper bound of the price range (*TOP=1*).

The indicated price range on prospectus (*RANGE*) has a significant variation, ranging from 7% to 67% of the mid-point price. The average price range is 25%. This is in contrast to the price range in US, which is normally set US$2 (Kutsuna et al., 2009). The average initial returns (ADJIR, offer-to-close) on the first day is 14.34%, lower than 20.29% in 1990s as documented by previous study on Hong Kong (Agarwal et al., 2008).Interestingly, if I decompose the initial return into pre-market (offer-to-open) return and aftermarket (open-to-close) return, offer-to-open return dominates initial return at 13.39% and open-to-close has a mean of 0.77%. However,

the large variations within 1-day or 5-day open-to-close return imply there may be some factors valuable to determine immediate aftermarket performance.

(INSERT TABLE 2.1 ABOUT HERE)

The correlation matrix of variables is presented in Table 2.2. Offer price revision (*REVISION*) is positively correlated with both pre-market sentiment measures: subscription rate (*SUBRATE*) and abnormal *Google Search Volume Index* (*ASVI*), suggesting that underwriters taking into account pre-market investor sentiment when setting offer price. However, both *SUBRATE* and *ASVI* are positively correlated with offer-to-open returns (*OTO*), suggesting that offer price revision is only partial and offer price does not fully reflect pre-market investor sentiment. Small trade order imbalance (*SMALLNET_1D*) is positively correlated with aftermarket trading volume (*TURNOVER*), confirming that two aftermarket sentiment measures are likely to capture something in common. However, aftermarket trading volume (*TURNOVER*) is positively correlated with either *ASVI* or *SUBRATE*, small trade order imbalance (*SMALLNET_1D*) is only weakly correlated with pre-market sentiment measures. This suggests that two aftermarket sentiment measures differ from each other. Market-adjusted open-to-close return on the first day of trading is significantly and positively correlated with aftermarket sentiment measures (either *SMALLNET_1D* or *TURNOVER*), suggesting that aftermarket sentiment leads to a significant secondary market return. One-year market-adjusted return is negatively correlated with pre-market sentiment and aftermarket sentiment measures.

(INSERT TABLE 2.2 ABOUT HERE)

2.6.3 Change in investor sentiment during pre- and aftermarket stages

One of my main objectives in this essay is to investigate whether and to what extent the pre-market sentiment persists (or reverses) during the aftermarket period. Therefore, I classify my full sample into "high" and "low" subgroups according to the pre- and aftermarket sentiment measures (*SUBRATE* and *SMALLNET_1D*) respectively, and present their frequencies in each subgroup in a two-way contingency table.

Table 2.3 presents the two-by-two contingency table for pre-market and aftermarket sentiments. An interesting pattern emerges. Out of 146 IPOs with high pre-market sentiment, 74 IPOs (or a relative frequency of 25.26%) continue to enjoy high sentiment in aftermarket, whereas other 72 (or a relative frequency of 24.57%) end up with a low one in contrast. In another word, IPOs with high pre-market sentiment are evenly split between high and low aftermarket sentiment. In the cases of high pre-market sentiment turning into low aftermarket sentiment (denoted as *H_L*), underwriters are likely to carry out costly price stabilization actions and institutional investors are likely to face the risk of a lower resale price[11]. However, the influence of the deteriorated investor sentiment on IPO pricing will be discussed in later part of this essay.

(INSERT TABLE 2.3 ABOUT HERE)

2.7 Empirical Results

In this part, I empirically test the hypothesized relationships between investor sentiment and IPO pricing proposed in Section 2.3. I first focus on the pre-market sentiment: whether pre-market sentiment could positively affect offer price revision, as stated in H2.1. And whether underwriter incorporates such sentiment in full extent? (H2.2) After documenting the offer price

[11] In Hong Kong, primary stabilization actions take place only when share price falls below the offer price.

is only partially adjusted to pre-market sentiment, I turn to investigate whether the money left on the table can be explained by an deterioration in investor sentiment in the aftermarket period. (H2.3)

2.7.1 Pre-market sentiment and offer price revision

Hypothesis 2.1 predicts that underwriter will revise offer price upward as a way to take advantage of existing sentiment investor in IPO pre-market. As subscription rate (*SUBRATE*) and abnormal Google search volume index (*ASVI*) are selected as the proxies of pre-market sentiment in my study, I hereby examine their impact, after controlling for other variables, on offer price revision in regression analyses. Specifically, I estimate the following regression model to test H2.1:

$$\begin{aligned} REVISION = {} & \alpha_0 + \beta_1 PRES + \beta_2 PRE\_IPO\_RTN \\ & + \beta_3 RANGE + \beta_4 SIZE + \beta_5 UWREP \\ & + \beta_6 H\_SHARE + \varepsilon \end{aligned} \tag{2.1}$$

where *REVISION* is the dependant variable, calculated as the offer price divided by midpoint of initial price range minus one. *PRES* represents the pre-market sentiment. In equation 2.1, I use two proxies for the pre-market sentiment: 1) *SUBRATE*, which is the number of shares subscribed by retail investors divided by the number of shares assigned to Public tranche. And 2) *ASVI*, which is abnormal *Google Search Volume Index*, defined as search volume index during book-building week minus median of search volume index in previous eight weeks. I further include five control variables that are known to influence the cross-sectional variations of IPO offer price. That is: average initial returns of previous IPO (*PRE_IPO_RTN*); price range in prospectus (*RANGE*); firm size (*SIZE*); underwriter reputation (*UWREP*); and H share flag

(*H_SHARE*). A detail definition for variables in equation 2.1 is available in the Appendix A.1 of this thesis.

To estimate equation 2.1 using the *ASVI* proxy, I use a subsample consisting 158 IPOs for which Google Search Volume Index is available. Table 2.4 presents regressions results with offer price revision as the dependent variable. The two pre-market sentiment measures, my variables of interest, both show significant effects in determining IPO offer price. In particular, both the coefficients of subscription rate (*SUBRATE*) and abnormal Google search volume index (*ASVI*) are positive and significant both statistically and economically, suggesting that underwriters do incorporate pre-market investor sentiment into IPO offer price. This finding not only echoes previous researches on investor sentiment (Agarwal et al, 2008), but also lends support to investor attention hypothesis (Barber and Odean, 2008) in explaining the pricing of Hong Kong IPO.

I also control for market-wide investor sentiment and ex-ante value uncertainty. Since investor sentiment towards an IPO is affected by market condition (Derrien, 2005), I include market-wide pre-market sentiment (*PRE_IPO_RTN*) in the regression. The coefficients of *PRE_IPO_RTN* are positive and significant at the 1% level, consistent with the fact that market-wide sentiment positively affects offer price revision. As value uncertainty negatively influences offer price (Kutsuna et al., 2009), I include price range in the regression to proxy for ex-ante value uncertainty. The coefficients of price range (*RANGE*) are negative and significant at the 5% or 1% level. Economically, increasing price range by one standard deviation will cause offer price to drop by 1.42% - 1.79%.

Overall, results in Table 2.4 confirm that underwriters take into consideration of pre-market investor sentiment, as measured by subscription rate or abnormal Google search volume index. Both firm-specific and market-wide pre-market sentiments cause underwriters to revise offer price upward.

(INSERT TABLE 2.4 ABOUT HERE)

2.7.2 "Money on the table" and the investors sentiment over pre- and aftermarket

In this section, I first test whether underwriters adjust offer price fully to incorporate pre-market investor sentiment (H2.2). To test this hypothesis, I estimate a baseline regression model where the offer-to-open return is the dependent variable and pre-market sentiment is the main explanatory variable.

Specifically, following regression analysis is performed:

$$\begin{aligned} OTO = {} & \alpha_0 + \beta_1 SUBRATE + \beta_2 PRE\_IPO\_RTN \\ & + \beta_3 RANGE + \beta_4 SIZE + \beta_5 UWREP + \beta_6 H\_SHARE \\ & + \beta_7 REVISION + \beta_n Year\_Dummies + \varepsilon \end{aligned} \tag{2.2a}$$

where the dependant variable, *OTO*, is defined as open price on the first day of trading divided by offer price minus one. This measure differs from prior studies such as Hanley (1993) where initial return (offer-to-closing return) is used to test partial adjustment of offer price since open-to-close return is subject to aftermarket sentiment. In this baseline model, I test whether *SUBRATE*, the primary measure for pre-market sentiment, could predict the price movement beyond the offer price. Similar to equation 2.1, this specification also incorporates six additional variables as control: average initial returns of previous IPO (*PRE_IPO_RTN*); price range in

prospectus (*RANGE*); firm size (*SIZE*); underwriter reputation (*UWREP*); H share flag (*H_SHARE*) and offer price revision (*REVISION*).

Hypothesis 2.3 predicts that money left on the table (offer-to-open return) is associated with the sentiment deterioration over pre- to aftermarket stages. As Table 2.3 illustrates that a portion of IPOs with high pre-market sentiment turn cold during the aftermarket stage, I thus use the subsample with "high" pre-market sentiment (IPOs with *SUBRATE* higher than the sample median) in testing H2.3.

To test H2.3, I augment the baseline model (2.2a) into the following equation:

$$\begin{aligned} OTO = {} & \alpha_0 + \beta_1 SUBRATE + \beta_2 R\_SMALLNET + \beta_3 PRE\_IPO\_RTN \\ & + \beta_4 RANGE + \beta_5 SIZE + \beta_6 UWREP + \beta_7 H\_SHARE \\ & + \beta_8 REVISION + \beta_9 VOLATILITY + \beta_n Year\_Dummies + \varepsilon \end{aligned} \tag{2.2b}$$

Compared to baseline model, the augmented model (2.2b) adds two variables capturing aftermarket condition. First, I include a ranking variable, *R_SMALLNET*, to measure the level of aftermarket sentiment. This is a standardized proxy constructed from small order imbalance in aftermarket (Lee and Ready, 1991). I firstly compute the small trade order imbalance (*SMALLNET*) over 1 day or 5 days using the algorithm similar to Lee and Ready (1991) and Chan (2010). Then, I rank this measure from low to high and use its percentile ranking (*R_SMALLNET*) as a new standardized measure for aftermarket sentiment. As a result, a higher value of *R_SMALLNET* indicates a lower aftermarket sentiment level and vice versa. (That is, the lowest *SMALLNET* is assigned to 1 for *R_SMALLNET*, while the highest assigned to 0). I also compute the aftermarket volatility (*VOLATILITY)* as a further control for aftermarket uncertainty (Falconieri et al., 2009) using intraday trade records.

By regressing offer-to-open return on reverse percentile ranking of aftermarket sentiment, one can conclude whether the deterioration of investor sentiment affects IPO price under-adjustment. A positive and significant effect from *R_SMALLNET* will evidence the theoretical prediction by Ljungqvist et al. (2006) that the compensation to institutional investors causes an under-adjustment to pre-market sentiment positively related to the risk of sentiment swing over the pre- and aftermarket stages.

Table 2.5 presents estimation results for the baseline as well as the subsample regressions. In Model 1, the coefficient of subscription rate (SUBRATE) is positive and significant at the 1% level, suggesting that underwriters only partially respond to pre-market sentiment when setting the offer price. However, the coefficient of *PRE_IPO_RTN* loses its significance, implying that offer price has already fully incorporated market-wide investor sentiment. Other variables, except price revision (*REVISION*), exhibit no power in predicting the "money on the table". Overall, findings in the baseline regression are consistent with partial adjustment to investor sentiment in prior studies (e.g., Derrien, 2005; Cornelli et al., 2006).

Model 2 to Model 5 are estimated using equation 2.2b among IPOs with high pre-market sentiment (*SUBRATE).* Consistent with the factor loading in Model 1, the coefficients of subscription rate (*SUBRATE*) remain positive and significant at the 1% level. However, the most interesting finding emerges with my proxy for aftermarket sentiment: The coefficients of *R_SMALLNET* are positive and significant at the 1% or 5% level thorough Model 2 and Model 5. To the extent that the *R_SMALLNET* reflects the deterioration in investor sentiment when secondary market starts, this evidence supports the view of Ljungqvist et al. (2006) that "money on the table" serves as a compensation for institutional investors who hold IPO inventory in aftermarket.

As to control variables, I use price range (*RANGE*) to proxy uncertainty in pre-market and use the intraday volatility (*VOLATILITY*) to proxy that in aftermarket. While the coefficient of *RANGE* is positive but insignificant, the coefficients of *VOLATILITY* are positive and significant at the 1% level across 1-day to 5-day windows. Overall, Table 2.5 provides empirical evidence supporting my Hypotheses 2.2 and 2.3. To the extent that underwriters are capable of anticipating a reversal in investor sentiment, my results suggest that underwriters tend to compensate regular investors for bearing the risk of deteriorating sentiment over the transition from pre-market to aftermarket market.

(INSERT TABLE 2.5 ABOUT HERE)

2.8 Further Analyses

In this section, I conduct some further analyses on investor sentiment and its effect on IPO pricing. Specifically, I investigate whether aftermarket sentiment further pushes up the IPO prices after the listing? As a supplementary test, the source of retail demand in IPO market is also examined. Finally, I compare the effects of pre- and aftermarket sentiment in explaining the IPO long-run underperformances.

2.8.1 Aftermarket sentiment and secondary market returns

In this section, I investigate whether aftermarket sentiment further drives IPO price up in the secondary market. Under my two-stage framework, I use open-to-close instead of offer-to-close return to measure the aftermarket price movement. If sentiment investors continue to arrive after listing, the share price should be pushed up further due to the price discrimination implemented by the institutional investors. To test this prediction, I use the aftermarket data to perform following regression:

$$
\begin{aligned}
ADJOTC = {} & \alpha_0 + \beta_1 AFTS + \beta_2 VOLATILITY + \beta_3 LARGENET \\
& + \beta_4 SUBRATE + \beta_5 PRE\_IPO\_RTN + \beta_6 RANGE \\
& + \beta_7 SIZE + \beta_8 UWREP + \beta_9 H\_SHARE + \beta_{10} REVISION \\
& + \beta_{11} TOP + \beta_{12} OTO + \beta_n Year\_Dummies + \varepsilon
\end{aligned}
\tag{2.3}
$$

On the left hand side is the market-adjusted open-to-close returns measured within 1-day and 5-day trading window, respectively. On the right hand side, *AFTS* (aftermarket sentiment), my main variable of interest, is gauged by small order imbalance (*SMALLNET*) and turnover ratio (*TURNOVER*), respectively. For other control variables, *LARGENET* controls the trading from large investors. *OTO* controls the momentum from the pre-market price movement. Other control variables are similar to equations 2.2a and 2.2b. To control the fixed effect, I also add the year dummies in regression.

Regressions results for equation 2.3 are presented in Table 2.6 based on two trading windows: 1-day (Model 1 to Model 3) and 5-day (Model 4 to Model 6).In the first row, the coefficients of *SMALLNET* in both 1-day and 5-day intervals are positive and significant at the 1% level, suggesting that optimistic and overconfident small traders are likely to drive the secondary market return. The coefficients of *TURNOVER* in Model 2 and Model 5 demonstrate similar effects. As *TURNOVER* is likely to be driven by divergence of opinions among traders and the presence of sentiment investors, this result echoes that for *SMALLNET* in explaining secondary market return. In my test, although aftermarket return on average is much lower than pre-market price movement, the impact from sentiment on secondary market performance is quite significant in economic level: A one standard deviation increase in small trade order imbalance leads to a positive 4.44% intraday return, while a same increase in turnover ratio generates a 5.75% price run-up in the same period.

Turning to other variables, an interesting result is that pre-market sentiment (*SUBRATE*) loses its power in predicting open-to-close return. This is in contrast to previous studies using offer-to-close return as the dependant variable. (Agarwal et al., 2008) The result suggests that opening price can fully incorporate pre-market sentiment when trading starts in the secondary market. The coefficients of *VOLATILITY* are positive and significant at the 5% or 1% level, suggesting that aftermarket uncertainty contributes to the secondary market return. The finding is consistent with Falconieri et al. (2009). The coefficients of offer-to-open return are negative and significant at the 5% or 1% level, suggesting IPOs with low open-to-close return appear to have high offer-to-open return, after controlling for aftermarket sentiment and other factors. This evidence is consistent with the explanation of Ljungqvist et al. (2006) on partial adjustment.

To understand how institutional investors trade in the aftermarket period, I also incorporate large trade order imbalance (*LARGENET*) into the regressions. Chan (2010) finds that medium and large trades explain aftermarket price movement in cold or neutral market, while small trades can only predict share price in hot market. As shown in Columns 3 and 6 of Table 2.6, the coefficients of *LARGENET* are positive and significant at the 1% level.

My further analysis in Table 2.7 reveals that the correlation coefficients between *SMALLNET* and *LARGENET* for the first day of trading are positive and significant for *H_H* sub-sample, and negative but insignificant for *H_L* sub-sample. This indicates that retail and institutional investors trade in the same direction with both high pre-market sentiment and high aftermarket sentiment (*H_H*), but in the opposite direction with high pre-market sentiment and low aftermarket sentiment (*H_L*). These results are in contrast to the US finding in Chan (2010) that *SMALLNET* and *LARGENET* work in the opposite direction for their impact on open-to-close return. The fact that Clawback Provision reduces institutional allocation in presence of

investor sentiment implies that if institutional investors anticipate a continuation of pre-market sentiment into the aftermarket period, they are more likely to purchase shares in the secondary market along with retail investors.

Overall, results in Table 2.6 show that aftermarket sentiment results in a further price run-up once the secondary market trading starts. In contrast, pre-market sentiment no longer has any impact on open-to-close return in the secondary market. The net buying by large traders also reinforces small trade order imbalance when aftermarket sentiment is high.

(INSERT TABLE 2.6 AND TABLE 2.7 ABOUT HERE)

2.8.2 Does investor attention generate retail demand?

In this part, I explore the potential sources of pre-market retail demand for IPOs. Prior studies suggest that investor attention is a major factor in determining purchase decisions by individual investors (Barber and Odean, 2008; Barber et al., 2009).Kaustia and Knupfer (2008) show that investors overweight their personal experiences in IPOs and the reinforcement learning drives investor sentiment. Da et al. (2011) show that abnormal Google search volume index (*ASVI*) is a direct and timely measure of investor attention. Using it to proxy for individual investor attention, they find increased investor attention leads to high initial return and subsequent long-run underperformance of IPOs. Therefore, I expect that investor attention would drive retail demand and estimate following regression equation:

$$\begin{aligned} SUBRATE = {} & \alpha + \beta_1 ASVI + \beta_2 PRE\_IPO\_RTN + \beta_3 RANGE \\ & + \beta_4 SIZE + \beta_5 UWREP + \beta_6 H\text{–}SHARE \\ & + \beta_7 Year\_\text{Dummies} + \varepsilon \end{aligned} \tag{2.4}$$

where *SUBRATE* is the subscription rate over the public subscription period in retail tranche, and *ASVI* is the abnormal Google search volume index within two weeks before the listing. Other variables are defined as in previous equations.

Table 2.8 presents regression results. Among control variables, the parameter of price range (*RANGE*) is negative and significant at the 5% level, suggesting that *ex-ante* value uncertainty negatively affects retail demand. The coefficient of market capitalization (*SIZE*) is negative and significant at the 5% level. This is probably due to the fact that small-cap IPOs are subject to more speculative trading. H-share IPOs appear to generate greater interests among retail investors, as indicated by a significantly positive coefficient of *H_SHARE* dummy variable.

My key variable of interest is investor attention (*ASVI*). As expected, the coefficient of *ASVI* is positive and significant at the 1% level. This implies that retail investors' attention indeed increases retail demand for IPOs. Similarly, the coefficient of market-wide sentiment (*PRE_IPO_RTN*) is also positive and significant at the 1% level. Overall, these findings confirm that attention-grabbing IPOs are more likely to be in demand by sentiment investors.

(INSERT TABLE 2.8 ABOUT HERE)

2.8.3 Long-run performance

As documented in previous sections, pre-market sentiment drives up the offer and opening prices, while the aftermarket sentiment leads to even higher first-day closing prices. This finding brings up two more questions: first, to the extent that IPOs are overpriced as a result of investor sentiment on and before the listing day, will their valuations go back to their intrinsic

level in medium or long terms, as documented by previous research[12]? And second, which component of investor sentiment is more likely to be related with this price downturn in aftermarket? To answer these two questions, I investigate the long-run performance of IPOs in my sample and their relation to pre-market and aftermarket sentiment.

Table 2.9 presents market-adjusted returns over 6 months, 1 year and 18 months. The average one-year market-adjusted return is -0.74% for the full sample. I am particularly interested in hot IPO subsample during the pre-market stage. An interesting pattern emerges. When hot pre-market sentiment turning cold in the aftermarket period (i.e., *H_L* sub-sample), average one-year market-adjusted return is 0.05%. In contrast, when hot pre-market sentiment persists in the aftermarket period (i.e., *H_H* sub-sample), average one-year market-adjusted return is -11.54%. The sharp contrast between these two subsamples implies that market adjusts strongly and negatively to the sentiment generated and existed in immediate aftermarket.

(INSERT TABLE 2.9 ABOUT HERE)

To further explore whether pre-market and aftermarket sentiment measures can explain long-run underperformance of IPO, I conduct a regression test using following equation:

$$\begin{aligned} ADJRTN = {} & \alpha + \beta_1 AFS + \beta_2 PRES + \beta_3 VOLATITLITY \\ & + \beta_4 SIZE + \beta_5 UWREP + \beta_6 H\_SHARE \\ & + \beta_7 Year\_Dummies + \varepsilon \end{aligned} \tag{2.5}$$

where market-adjusted long-run buy-and-hold returns are the dependent variables. In my study, I compute the Hang Seng Index adjusted buy-and-hold returns for 6-month (*ADJRTN_6M*), 1-year (*ADJRTN_1Y*) and 18 months (*ADJRTN_18M*) from the first-day closing price. On the right

[12] Previous research provides both theoretical argument(Ritter and Welch, 2002; Ljungqvist et al. 2006) and empirical evidences (Derrien, 2005; Cornelli et al., 2006; Agarwal et al., 2008; Dorn, 2009; Da et al., 2011) for IPO long-run underperformance.

hand side, I use subscription rate (*SUBRATE*) to proxy pre-market sentiment (*PRES*) and small order imbalance and turnover ratio (*SMALLNET* and *TURNOVER*) to proxy aftermarket sentiment (*AFS*).

Table 2.10 reports the regression where 1-year market-adjusted return is the dependent variable. Results are similar using returns in other horizons as dependent variables and thus omitted. In this table, parameter estimates are separately presented based on 1-day and 5-day trading window. In Model 1 and Model 3, the coefficients of *SMALLNET* are negative and significant at the 5% level, while in Model 2 and 4, those of *TURNOVER* show similar statistical significance. This result is in line with Barber et al. (2009) that purchases by small investors push up price and result in a subsequent price reversal in the long run. In contrast, the coefficients of pre-market sentiment *SUBRATE* are not significant across all specifications, which differs from the finding of Agarwal et al. (2008) that subscription rate negatively affects long-run performance of Hong Kong IPO. It is likely that when pooled together, my aftermarket sentiment measures subsume the pre-market sentiment proxy. The negatively significant coefficients of *SIZE* suggest sentiment investors are more likely to speculate on small-cap firms, which are more subject to information asymmetry (Kumar and Lee, 2006; Ofek and Richardson, 2003; Ritter and Welch, 2002). Thus, larger IPOs are less likely to underperform in the long run. Overall, Tables 2.9 and 2.10 confirm that aftermarket sentiment contributes to IPO underperformance in the long run.

(INSERT TABLE 2.10 ABOUT HERE)

2.9 Conclusion

In this chapter, I examine the IPO pricing in a market where sentiment investors come sequentially over time. By considering the risk that investor sentiment may deteriorate over the transition from pre-market to aftermarket stages, I shed new lights on whether the money left on the table is explained by the underwriters' compensation to institutional investors for re-distributing shares in aftermarket.

Utilizing the unique Dual-Tranche offering mechanism of Hong Kong, I study a sample of 293 IPOs from 2003 to 2009. My study provides solid evidence that the money left on the table in pre-market is linked to the sentiment deterioration during the transition from pre-market to aftermarket. Specifically, I first confirm that while underwriters take advantage of pre-market investor sentiment in setting IPO price, they do so in a partial way by intentionally leaving some "money on the table". This finding is basically in line with that of previous research by Derrien (2005), Cornelli et al. (2006), and Dorn (2009).

More importantly, I step further to show that the portion of money on the table is greater, ceteris paribus, for IPOs which endure a deterioration of investor sentiment immediately after secondary market starts. I find in a subsample of high pre-market sentiment, the offer-to-open return is larger when sentiment in aftermarket turns out to be lower. This finding confirms Ljungqvist et al.'s (2006) prediction that partial adjustment in offer price is designed to compensate institutional investors for the risk of sentiment swing.

Third, using small order imbalance as proxy, I show that investor sentiment existing in aftermarket further pushes up stock price during and after the listing day. In contrast, pre-market sentiment loses its significance in predicting price movement in secondary market. This finding

suggests that investors who participate in the early stage would benefit from the sequential arrival of sentiment investors.

Last, I find the long-run underperformance of IPO is mainly due to the fade-away of aftermarket sentiment, rather than pre-market sentiment. This finding confirms that over-optimistic sentiment eventually fades away and IPO overpricing is reversed over time. However, the presence of investor sentiment during pre-market and aftermarket stages makes it possible for underwriters to successfully implement a "staggered sale" strategy.

Overall, by separately measuring the investor sentiment and IPO price movement in pre-(primary market) and aftermarket (secondary market) stages of IPO, I study the risk of sentiment deterioration over two stages and its impact on the IPO pricing. Several practical implications can be drawn from this study. My findings imply that as sentiment investors arrive to IPO sequentially, institutional investors may engage in underwriter's "staggered sale" strategy as the share re-distributer in aftermarket (Ljungqvist et al., 2006). Further, my findings indicate the underpricing aimed to compensate institutional investors is positively related to the anticipated sentiment deterioration over the pre-market to aftermarket stages.

By empirically documenting a positive relationship between the risk of sentiment swing in early aftermarket and the amount of "money left on the table", this essay complements current literature in explaining the partial adjustment phenomenon (Bradley and Jordan, 2002; Edelen and Kadlec, 2005; Loughran and Ritter, 2002). And more importantly, this chapter sheds a new light on the role of institutional investors in IPO. As Ljungqvist et al., (2006) theorizes that institutional investors may engage in a "staggered sale" strategy with underwriters when sentiment investors come sequentially to IPO, my empirical work evidences such conjecture that

institutional investors play a redistributing role over this process and receive compensation from underwriters in terms of the “money left on the table”.

However, the study has several limitations. Limited by the observation data from a single market, the results are not necessarily generalized to other markets. In addition, it is worth noted that the measuring for tendency of sentiment swing is based on ex-post, rather than ex-ante, which may suffer from the measurement bias. Future research might usefully extend the present use of two-stage framework to examine the impact of other factors to the IPO pricing. And more extensive research would be necessary to explore the evolvement of investor sentiment over the transition between the pre- and aftermarket stages.

(INSERT APPENDIX A.1 AND A.2 HERE)

Chapter 3

The Strategic Aftermarket Trading by Institutional Investors and the Price Discovery over the Pre- and Aftermarket Stages

3.1 Introduction

It is well documented that institutional investors possess private information prior to the IPO and thus play an important role in improving the price discovery of the issue. Following Benveniste and Spindt (1989), proponents of "information extraction" theory contend that underwriters, under the bookbuilding mechanism, use their discretion over share allocation to favor institutional over retail investors during the bookbuilding process. In return, institutional investors produce and report their private information to underwriters in pre-market to price the IPO at its intrinsic value. (Cornelli and Goldreich, 2001, 2003; Sherman, 2000, 2005; Sherman and Titman, 2002). As a result, any constraints on underwriters' discretion in IPO allocation would lead to diminished information production over the bookbuilding process (Ljungqvist and Wilhelm, 2002). In this study, I show that unfavorable institutional allocation goes beyond a reduction in information production during the bookbuilding stage and induces informed trading, which incorporates private information into IPO share price in aftermarket. Consequently, institutional investors play an important role in enhancing IPO price discovery either in pre-market bookbuilding and aftermarket trading.

Institutional investors have an incentive to engage in informed aftermarket trading if they face unfavorable allocations. First, as institutional investors produce costly private information before the bookbuilding starts, their incentives for producing or revealing such information to the underwriter tend to be adversely affected if they expect to get insufficient IPO allocation.

Specifically, Busaba and Chang (2010) propose that institutional investors have an option to trade strategically in aftermarket on their private information and this acts as an alternative to participating in the bookbuilding. Second, recent empirical findings on early aftermarket echo the aftermarket trading hypothesis: These studies document that IPO prices established immediately after the listing do not reflect the intrinsic value of the firm. Instead, substantial information asymmetry (Chen and Wilhelm 2008; Falconieri *et al.* 2009) and profit potential (Bradley *et al.* 2009) exist in the early aftermarket of IPO, making it a suitable ground for informed trading. However, although there are numerous studies on the trading in early aftermarket, most of them focus on the role of underwriters.[13] This leaves an unexplored issue of aftermarket informed trading by institutional investors and its implication on price discovery.

In this essay, I fill this gap by examining the aftermarket trading by institutional investors in IPO and its implications on price discovery in both pre- and aftermarket stages. I take advantage of the unique "Clawback" provision in Hong Kong, which links the total institutional allocation to retail demand for IPO. This results in a greater variation in the total institutional allocation and generates different demand for aftermarket trading. I focus on following questions in this essay: First, whether insufficient allocation encourages institutional investors, as a whole, to trade in early aftermarket? Since institutional investors may choose between participating bookbuilding and conducting aftermarket trading based on the potential gain from their private information, an unfavorable expectation on institutional allocation may alter their decision of participating in the bookbuilding vis-a-vis aftermarket trading. Second, whether and how the demand for aftermarket trading by institutional investors will influence the

[13] See Aggarwal (2000); Boehmer and Fishe (2004); Krishnan et al. (2006) and Schultz and Zaman (1994) for "price stabilization" explanations; Ellis (2006); Ellis et al. (2000, 2002) for "market making" hypothesis; and Griffin et al. (2007) for "laddering" hypothesis.

price discovery over the pre- (after-) market stages? As unfavorable institutional allocation discourages information revelation in the pre-market stage and induces institutional trading in the aftermarket, it is interesting to empirically examine whether such trading could play a "complementary" role in enhancing price discovery? Third, whether institutional investors who actively participate in the aftermarket trading are informed, such that their trading can predict the post-IPO performances in both short and long terms? While the first two questions explore the existence of aftermarket trading by institutional investors and its implications on price discovery, investigating the third question allows us to examine the economic consequences of aftermarket trading by institutional investors.

My research focuses on Hong Kong IPO market since it is particularly suitable to investigate strategic aftermarket trading by institutional investors. First, compared to the bookbuilding mechanism in other markets, the "hybrid" offering method in Hong Kong restrains the discretionary power of underwriter in extracting information from institutional investors (Sherman, 2000). Second, and more importantly, the existence of the "Clawback" provision in Hong Kong market makes the demand for aftermarket trading easier to identify. The "Clawback" provision automatically stipulates the shares for institutional investors to some prescribed level pertaining to retail demand, which is commonly driven by investor sentiment (Agarwal et al., 2008; Jiang and Li, 2013). Given the volatile nature of retail demand in Hong Kong IPO market, the "Clawback" provision therefore results in an exogenous but anticipatable variation in the total institutional investors and thus varied demands for aftermarket trading. Last, retail investors have a prominent presence in Hong Kong IPO, resulting in a noticeable information asymmetry within the investors after the listing. As retail investors tend to flip their allocations for liquidity

or other reasons, it provides institutional investors a good opportunity to profit by strategic purchasing in aftermarket.

I have a number of interesting findings in this paper. In the first part of my analysis, I show that under the "Clawback" arrangement, institutional investors could infer their share allocation from the overall market condition two weeks before bookbuilding starts. Second, I find the under-allocation to institutional investors leads to less private information revealed in pre-market bookbuilding. In particular, higher total institutional allocation makes "partial adjustment" to private information predicted by the "information extraction" theory (Benveniste and Spindt, 1989; Hanley, 1993). While lower institutional allocation leads to "partial adjustment to public information" in line with the sentiment explanation (Derrien, 2005; Ljungqvist et al., 2006). Third, I report that the aftermarket trading by institutional investors increases the probability of informed trading (PIN) in aftermarket, similar to the effect of total institutional allocation. This result suggests not only aftermarket trading by institutional investors may facilitate private information getting into share price in aftermarket, but also these trading could complement the pre-market bookbuilding in enhancing the price discovery. Last, I extend the findings of Boehmer et al. (2006) and Chemmanur et al. (2010) to show that institutional trading in aftermarket could predict short-run post-IPO performance in addition to long-run. This finding indicates institutional investors choosing to strategic trading in the aftermarket can circumvent the allocation restrictions set by underwriter and therefore generate short-term excess returns.

This essay contributes to several strands of literature. First, by linking the pre-market allocation to the aftermarket trading by institutional investors, I confirm Busaba and Chang (2010) that anticipating unfavorable allocation, institutional investors may strategically choose to trade in the aftermarket instead of participating bookbuilding. Therefore, my study suggests the

consideration of strategic aftermarket trading may be a reason for the favoritism towards institutional investors in IPO. Second, this research sheds new lights on the role of institutional investors in IPO price discovery. By documenting that both the bookbuilding and aftermarket trading may facilitate private information getting into the IPO price, this essay suggests institutional investors could enhance the price discovery either in pre- or aftermarket stages. Third, this research extends the literature on institutional investors' information production by linking the pre-market share allocation to aftermarket trading by institutional investors. As Ljungqvist and Wilhelm (2002) suggest that reduced institutional allocation gives rise to diminished information production in pre-market, my research takes a further step to illustrate institutional investors not necessarily cut such production but may strategically withhold their private information in pre-market and trade on it when the aftermarket begins.

Last, my research contributes to the debate on the efficacy of Clawback provision, which is currently under question by Hong Kong IPO practitioners. By offering direct evidence that Clawback policy hinders information revelation in bookbuilding process, this study provides consistent results to show this fairness-oriented arrangement may undermine the price discovery in pre-market and induce informed trading over early IPO aftermarket. Such trading may benefit institutional investors in both short and long runs at the expense of uninformed investors.

The rest of this chapter is organized as follows. Section 3.2 reviews the literature. Section 3.3 develops testable hypotheses. Section 3.4 provides a brief introduction to the unique institutional settings for Hong Kong IPOs, especially on the "Clawback" arrangement. Section 3.5 and 3.6 discuss the data and measure used in this study. In Section 3.7 I report the empirical results. In Section 3.8 I conduct further analysis to cope with the selection bias. And finally Section 3.9 concludes this chapter.

3.2 Literature Review

3.2.1 Bookbuilding and information extraction

In a seminal paper, Benveniste and Spindt (1989) propose an "information extraction" theory under the recently dominated bookbuilding method. This theory states that the bookbuilding allows the underwriter to extract private information from institutional investors by using its discretion over pricing and allocation. Specifically, underwriter underprices the offering and gives favorable allocations to institutions who truthfully surrender their private information. Subsequent studies provide consistent empirical evidences in both pricing and allocation. For example, Hanley (1993) documents the "partial-adjustment" phenomenon in IPO pricing. Cornelli and Goldreich (2001) and Aggarwal et al. (2002) show that underwriter allocates more shares to institutional investors in "hot" IPOs. Boehmer et al. (2006) report institutional investors also obtain preferential allocations in IPOs with better long-term performance. Ljungqvist and Wilhelm (2002) examine the global IPO markets and find constraints on banker's allocation discretion result in diminished production of private information in pre-market. Bubna and Prabhala (2011) investigate the order books in India IPO markets and find a regime change in allocation rules results in different information content among the bids of bookbuilding investors. Theoretical extensions are also made in this stream of research. Benveniste and Wilhelm (1990) propose that the underpricing is higher if underwriter's discretional power in share allocating is constrained. Sherman (2000) models the bookbuilding as a "repeated game" and argues that underwriter can reduce the average underpricing by influencing allocation in future IPOs. Sherman and Titman (2002) and Sherman (2005) further demonstrate the discretional allocation in bookbuilding reduces the spending on information acquisition when information production is costly.

3.2.2 Aftermarket trading

The trading volume generally booms immediately after the IPO and drops substantially later. This phenomenon attracts extensive empirical studies. Aggarwal (2003) shows that, although first-day traders are generally perceived as flippers, flipping only accounts for 19% of trading volume in first two days. Numerous researchers then focus on the role of lead underwriter in determining the aftermarket trading. Started from Shultz and Zaman (1994), Aggarwal (2000) and Boehmer and Fishe (2004) report that the price stabilization activities conducted by lead underwriter, especially the covering of naked-short position, lead to substantial volume in early aftermarket. Ellis (2000) et al. find the lead underwriter commonly takes large inventory positions in aftermarket and directs most the trading activity. Ellis (2006) investigates the Nasdaq IPOs and attributes the high initial trading volume to the inventory adjustment behaviors between market dealers. Griffin et al. (2007) examine the stylized fact from 1997 to 2002 that purchases from underwriter's clients exceeds sales substantially, and find this imbalance in aftermarket trading stems from the "quid pro quo" arrangement between underwriter and his institutional clients.

3.2.3 The role of institutional investors in IPO

As an essential participant of the IPO process, the institutional investors play an important role in producing information and enhancing the price efficiency. So far, research suggests that institutional investors perform such role by participating in the bookbuilding process in pre-market. This stream of research is discussed in Section 3.2.1.

Another strand of literature studies institutional investors in their intermediating role over the transition between pre- and aftermarket stages. In this vein, institutional investors collaborate

with the underwriters in implementing staged selling strategy that extracts greater buyer surplus. Chen and Wilhelm (2008) claim that the institutional investors intermediate as a re-seller in early aftermarket where considerable new information may come in. Ljungqvist et al. (2006) justify a similar role of institutional investors in hot market conditions, where they re-distribute the shares to sentiment investors arriving sequentially in aftermarket.

A third strand of literature focuses on the role of institutional investors in trading in aftermarket. Busaba and Chang (2010) point out institutional investors may withhold their private information in pre-market in order to exploit the mispricing in immediate aftermarket. Empirical findings from the transaction-level data show the institutional investors may retain valuable information in offering and their trade in early aftermarket can predict long-run post-IPO performances. (Boehmer et al., 2006; Chemmanur, et al., 2010)

3.3 Hypotheses Development

In this essay, I adopt a two-stage framework which relates the aftermarket trading by institutional investors to total institutional allocations in the pre-market. Under this framework, I investigate the impact of the aftermarket trading by institutional investors on IPO price discovery over the pre- and aftermarkets. Several testable predictions are thus formulated.

3.3.1 Institutional allocation and IPO price discovery in the pre-market

I first examine the impact of the demand for aftermarket trading on IPO price discovery in pre-market stage. I use the proportion of share allocation to institutional investors in the pre-market to proxy their demand for aftermarket trading. According to the information extraction theory, institutional investors participate in the bookbuilding and report their private information to underwriters in exchange for allocation of underpriced shares (Benveniste and Spindt, 1989;

Benveniste and Wilhelm, 1990). Along this line, if institutional investors anticipate unfavorable allocations in ahead of bookbuilding, they are less incentivized to reveal their private information to underwriters during the pre-market. Therefore, consistent with previous studies, I predict that if more (fewer) shares are allocated to institutional investors, private information is more(less) likely to be incorporated into the offer price during the bookbuilding.

H3.1.a: Private information is more likely to be incorporated in IPO offer price if more shares are allocated to institutional investors.

H3.1.b: Private information is less likely to be incorporated into IPO offer price if fewer shares are allocated to institutional investors.

3.3.2 Trading by institutional investors and IPO price discovery in the aftermarket

This section explores the effects of trading by institutional investors on enhancing price discovery in early aftermarket stages. The behavior of withholding private information during the bookbuilding process renders institutional investors an information advantage in early aftermarket, where considerable uncertainty and information asymmetry exists. (Boehmer et al., 2006; Chemmanur et al., 2010; Chen and Wilhelm, 2008; Falconieri et al., 2010) As institutional investors trade on their superior information for profits, their private information will be revealed to other market participants through their order flows disclosed as secondary market trading goes, increasing the amount of private information contained in IPO share price. This constructs my H3.2.

In addition, as suggested by H3.1, higher institutional allocation leads to more private information being incorporated into the offer price before the aftermarket starts. I thus postulate that ceteris paribus, a greater allocation to institutional investors results in an IPO market price

containing larger amount of private information. More importantly, by exploring the relationship in my H3.3, one could test whether the pre-market bookbuilding and aftermarket institutional trading play a "complementary" role to each other in the IPO price discovery. H3.2 and H3.3 are stated as follows.

H3.2: If more shares are allocated to institutional investors, the amount of private information incorporated into the secondary market price is higher.

H3.3: Trading by institutional investors during the early aftermarket increases the amount of private information incorporated into the secondary market price.

3.3.3 Trading by institutional investors and post-IPO performances

I further examine the predictive power of aftermarket trading by institutional investors. Previous studies show institutional trading in early aftermarket could predict the post-IPO performance in long-run. (Boehmer et al., 2006; Chemmanur et al., 2010). In this study, I extend this prediction in the consideration of strategic aftermarket trading. Since institutional investors could bypass the bookbuilding and trade directly in aftermarket, they are not subject to the offering restrictions (flipping, lock-ups, etc.) set by underwriters in the pre-market and thus able to chase short-term profits. Therefore, I expect institutional trading in early aftermarket could predict both short- and long-run post-IPO performances.

H3.4: Trading by institutional investors in early aftermarket is positively related to short- and long-term post-IPO performances.

3.4 Institutional Background in Hong Kong

In this section, I provide a brief introduction to the institutional details of IPOs in Hong Kong market. I mainly focus on the dominated "Dual-tranche" offering structure and the

"Clawback" mechanism established since 2000s to discuss that these institutional features render Hong Kong an ideal testing ground to examine the aftermarket trading by institutional investors.

3.4.1 The Dual-Tranche offering structure

In Hong Kong, shares are publicly traded in The Stock Exchange of Hong Kong (SEHK)[14]. SEHK has two listing boards: The Main Board and the Growth Enterprise Market (GEM). To list in SEHK, a majority of IPOs adopt a "Dual-Tranche" method since early 2000s. It is a "hybrid" method that combines both bookbuilding and public offer compared to pure bookbuilding method (Sherman, 2000). Shares issued in IPOs are divided into two tranches: Placing Tranche (PT) and Public Subscription Tranche (or Retail Tranche, RT). Typically, the Placing Tranche is initially allocated with 90% of the issued shares and restricted for demand from institutional investors. After the hearing, the issuer and underwriter set an initial price range and start the "roadshow" to promote the offering. During the roadshow, the lead underwriter interacts with potential institutional investors worldwide and collects their indications to estimate the market demand for the new shares, which is known as "bookbuilding". On the other hand, the retail tranche initially reserves 10% of the issued shares and runs like a fixed-price open subscription among smaller investors[15]. It starts from the date that underwriter discloses the prospectus, and normally goes parallel to the last few days of the bookbuilding process in placing tranche. Unlike institutional investors, retail investors have to pay the maximum price of the price range and transfer corresponding amount of money into the accounts of the underwriter in advance. When both of the bookbuilding and subscription end at a same day, the underwriter will

[14] The Stock Exchange of Hong Kong (SEHK) is a wholly-owned subsidy of Hong Kong Exchange and Clearing Company (HKEx).

[15] Shares in Subscription tranche is further equally divided into two "Pools". Pool A are allocated to investors who apply for HK$5 million or less, while shares for Pool B are allocated to investors who apply for more than HK$5 million. Multiple applications for different pools are prohibited

determine the final offer price generally on the basis of demand from the Placing Tranche one day after. The subscription rate is simultaneously disclosed. If the issue is oversubscribed, shares for retail tranche will be rationed in each subscription layer in lotteries.

3.4.2 The "Clawback" provision

Unlike the offer price, which is decided by the underwriter, the final fractional allocation between the Placing and Retail tranches is mechanically determined by the retail demand due to a unique "Clawback" arrangement. In June 1998, The SEHK (The Stock Exchange of Hong Kong Limited) issues the Practice Note 18, in which the Rule 4.2 stipulates the way to allocate shares between the placing tranche and retail tranche. Under this rule, a minimum 10% of overall offer should be allotted to retail tranche as initial allocation. Moreover, when the total demand for shares in the retail tranche reaches some prescribed thresholds, specific proportion of the shares firstly allocated to placing tranche should be transferred from placing tranche to retail tranche. Specifically, Clawback formula established in 1998 regulates that the fractional shares allocated to retail tranche increases to 30%, 40% and 50%, respectively, when the shares in retail tranche are at least 15 times, 50 times or 100 times oversubscribed.

As most of the IPO firms in Hong Kong adopt the dual-tranche offering mechanism since June 1998, Clawback becomes a routinely practice existing in Hong Kong market. In my sample period, about 64% of IPOs over 2003 to 2010 trigger the Clawback and increase the retail tranche at least to 30% of the total offer. However, a waiver applies to offering with a size more

than HK10 billion. In this case, the initial, and the reallocated fraction of shares assigned to retail tranche may reduce to 5%, 7.5%, 10%, and 20%, respectively.[16]

In this part, I will illustrate the effects of the "Clawback" provision using a mini case. On 24 January 2005, the Xinyi Glass Holding Limited (Stock Code: 00868) filed its IPO on Hong Kong Stock Exchange (SEHK). On the prospectus disclosed to prospective investors, a total number of 375,000,000 shares are offered in Xinyi's IPO. Specifically, 90% of the shares (337,500,000 shares) are allocated to the placing tranche, while 37,500,000 shares, representing 10% of total shares offered, are assigned to the public tranche. As this allocation is made before the public subscription starts, the prospectus mentions that shares in each tranche are subject to reallocation caused by the "Clawback" rules, whose reallocation formula is fully disclosed in the prospectus.

On 2 February 2005, Xinyi Glass Holding Limited announced its offer price and the share allotment results one day after both the public subscription and international placing end. The company receives 4,145 valid applications in public subscription for a total of 2,121,176,000 shares, equivalent to approximately 56.6 times of the total number of shares available for the retail tranche. As a result of this over-subscription, the Clawback disclosed in the prospectus applies. According to the uniform reallocation formula, a total of 112,500, 000 shares initially available for placing tranche have been reallocated to the retail tranche, making the total shares available for retail tranche 150, 000, 000 shares, which represents about 40% of the shares in this

[16] This paper does not consider the waiver since applying for waiver is a costly process. It normally takes at least 6 months, and tedious consultation papers need to be drafted and circulated to get the response of market participants before its publish. After the publishment of consultation papers, the HKEx's board and SFC has the final discretion to approve or not the waiver to an IPO.

offering. The shares allocated to the placing tranche, have thus been reduced to 225,000, 000 shares, representing 60% of the total number of the offering.

The Clawback mechanism has the following implications on strategic trading: On one hand, this provision may reduce allocation to institutional investors, discouraging the revelation of private information during the bookbuilding process. On the other hand, the Clawback provision mechanically ties up the fractional allocation to institutional investors with the retail demand. If institutional investors could by some means infer the retail demand *ex ante*, they can anticipate the share allocations and identify their demand for aftermarket trading well before the bookbuilding starts.

Recently, doubts arise among market practitioners towards the "Clawback" rule. Opponents of this rule claim that its mechanical reallocating formula and the overly retail-oriented mindset infringe the discretional power of underwriters and issuers to allocate shares to proper investors. In most cases, retail investors are generally not long-term investors: their flipping activity usually brings significant volatility and downward pressure to early aftermarket trading. An article reviewing Hong Kong's Clawback provision has following comments:

"*No doubt originally drafted with fairness in mind, those rules are pretty arbitrary and do not take into account the profile of a deal, or whether an IPO is particularly suited to significant investment by the general public*."

-----*Dow Jones Investment Banker, 2011*[17]

[17] This quotation is extracted from an article by Philip Espinasse. A detailed discuss from this author can be accessed at http://www.ipo-book.com/blog/2011/09/20/scrapping-the-claw-back-rules/

In response to the criticism from underwriters, the government advisory body in Hong Kong has begun to review the Clawback mechanism and rethink the suitability of the "overly retail-oriented regulatory mindset". However, the reform of current Clawback arrangement will no doubt face stiff opposition on the part of receiving banks and retail brokers, who earn interest on IPO application money and through margin loans and trade commissions.[18]

3.4.3 Cornerstone investors

Another unique market practice in Hong Kong IPO market is the existence of "cornerstone investors". Cornerstone investors are typically large institutions and well-known individuals such as sovereign wealth funds and Hong Kong tycoons. They voluntarily commit to invest a specific amount of money before the IPO as a way to signal their confidence in the issuer. Their investment, although classified into the Placing Tranche, are treated as guaranteed allocations not subject to the Clawback arrangement.

This cornerstone investor arrangement may further stimulate strategic aftermarket trading by institutional investors for two reasons: First, as empirical evidence suggests that cornerstone investors often play a "branding" role in Hong Kong IPOs (McGuinness, 2012), their presence tends to stir up the investor sentiment and boost the retail demand above the Clawback triggers. Second, since the guaranteed placing of cornerstone investors may occupy the institutional allocation, the existence of cornerstone investors itself could further squeeze the shares available to potential bookbuilding investors.

3.5 Data and Measures

3.5.1 Sample

[18] http://orientaldaily.on.cc/cnt/finance/20131125/00202_001.html

My sample of IPOs sources from the website of Hong Kong Exchange and Clearing Limited (HKEx)[19], the holding company of Hong Kong Stock Exchange (SEHK). Since shares in GEM are usually illiquid and not conducted in "Dual-tranche" offering structure, I focus on IPOs listed on the Main Board. There are 578 offerings classified as "Ordinary Companies" listed during 2003 to 2010 on the Main Board in SEHK. I exclude offerings not priced by bookbuilding method, REITs, unit offerings, close-end funds, and transfers from Growth Enterprises Market (GEM)[20]. This filter reduces my sample to 373 companies ranging from April 2003 to December 2010.

I retrieve most of the data from the online "Listed Company Information Advanced Search" from the website of HKEx[21]. In particular, the offering characteristics, including initial price range, offer price, share allocation to placing tranche and subscription tranche, cornerstone investors and issuer and underwriter information are hand-collected from the IPO prospectus. The information for the underwriter's price stabilization activity is obtained from the compulsory disclosure after the listing. Aftermarket raw returns and annually market-to-book value are acquired from Datastream. The ranking of underwriters is obtained from Bloomberg.

3.5.2 Measure of aftermarket trading

In some recent studies (Boehmer et al., 2006; Ellis, 2006; Krigman et al., 1999), researchers use large order imbalance to account for institutional trading in aftermarket. I follow their method in this study. Specifically, I acquire trade-by-trade transaction prices and quotations from the HKEx. And then I divide all the trade into three groups based on their dollar-value size

[19] http://www.hkex.com.hk/eng/stat/statrpt/factbook/factbook.htm
[20] This contains 1) transfers of listing to Main Board as a newly listed company after withdrawal of listing from GEM, and 2)transfers of listing from GEM to Main Board pursuant to the revised Rule 9.24 of the GEM Listing Rules and to the new Chapter 9A of the Main Board Listing Rules, as quoted from the HKEx.
[21] http://www.hkexnews.hk/listedco/listconews/advancedsearch/search_active_main.aspx

using the value cut-offs for HK$50,000 and HK$500,000[22]. Trades with a dollar value larger than HK$500,000 are classified as large trades. Then, I use Lee and Ready (1991) algorithm to flag each trade as either buyer- or seller-initiated. Finally, I compute the buy-minus-sell order imbalance of large trades as my proxy for the net aftermarket trading of institutional investors.

3.5.3 Measure of the amount of private information in secondary market price

Easley and O'Hara (1992) propose the probability of informed trading (PIN) as a measure of information-based trading. The PIN is constructed by monitoring the abnormal order flows in market. Its underlying assumption is that while public information automatically comes into the quotes and orders (and thus prices) of an asset, private information is reflected in excess buying or selling pressure through the order flow. Recently, a large body of research (Brockman and Yan, 2009; Chen et al., 2007; Ferreira et al., 2011; Vega, 2006) employ PIN as a measure of the price informativeness. I follow their research to use PIN to gauge the amount of private information that being incorporated in the IPO share price. Essentially, a more informative price will reflect private information more quickly and therefore suggest higher information content.

The PIN is a measure of information-based trading which models a market consisting of three kinds of risk-neutral players: liquidity traders, informed traders, and a market maker. The market has zero transaction costs and discount. The buying and selling orders of liquidity traders are exogenous to the model and follow a Poisson distribution with a daily arrival rate equal to ε. The probability of an "information event" occurring is α, in which case the probability of bad news is δ while the good news $(1-\delta)$. If an information event occurs, the informed traders will also arrive at a rate of μ. Specifically, they will buy one share of the asset if receiving good news,

[22] For a robust check, we also use lower value cut-offs for HK$20,000 and HK$200,000 to classify sizes of trade and obtain similar results.

whilst selling one share if receiving the bad. The market maker observes the abnormal flow in selling and buying orders and thus infers the occurring information event.

When information event does not occur, the daily transaction is 2ε with selling orders approximately equal to buying orders. However, on a day with good (bad) information event, the arrival rate of buy (sell) orders is ε+μ and that of sell(buy) orders ε. The probability of a good and bad information event day is α(1-δ) and αδ, respectively.

Easley and O'Hara (1992) define the PIN as the estimated arrival rate of informed traders divide by the estimated arrival rate of all trades during a pre-specified period of time.

$$PIN = \frac{\hat{\alpha}\hat{\mu}}{\hat{\alpha}\hat{\mu} + 2\varepsilon} \tag{3.1}$$

We estimate all four parameters, θ={ε, μ, α, δ}, by maximizing the likelihood function

$$L(\theta \mid \mathrm{M}) = \prod_{t=1}^{T} L(\theta \mid \mathrm{B}_t, S_t), \tag{3.2}$$

Where Bt is the number of buyer-initiated trades and St is the number of seller-initiated trades on day t. Detailed discussions of the structure of the model are available in Easley and O'Hara (1992) and Vega (2006).

I retrieve the intraday trades and quotes data over the first month after IPO to estimate the PIN. Lee and Ready (1991) algorithm is used to identify the buyer- and seller-initiated trades respectively and calculate the frequencies of each trade on daily basis. For each IPO, I obtain the parameter estimates by maximizing the equation (3.2). Finally the PIN measure is calculated from the formula specified in equation (3.1).

3.6 Descriptive Statistics

In this section, I first show the descriptive statistics of the IPO characteristics in my sample. And then I divide my sample into four groups based on the total institutional allocation levels stipulated by the "Clawback" provision, in which way I compare the pre-market allocation and aftermarket trading across different IPOs.

3.6.1 IPO characteristics

Table 3.1 illustrates the descriptive statistics of my sample issues. The average offer price of IPOs in my sample is HK$4.04. At the offering, IPO firms averagely have a total asset of HK$10.7 billion when they go public, and raise about HK$4,392 millions in their offerings. Hong Kong IPO markets are highly dominated by prestigious underwriters. About 55% of IPOs in my sample are underwritten by the "Top 10" investment banks in the league table (*U_REP=1*). Two unique features in Hong Kong markets are the H-share offerings and the "cornerstone investors". In my sample, 17% of the issues are designed in the H-share framework (*H_SHARE=1*) and 29% of the total issues attract at least one cornerstone investor before the roadshow starts (*CSI=1*).

My summary statistics in Table 3.1 show that the institutional allocation appears to be influenced in a large extent by the subscription behavior of retail investors. The average and median subscription rate (*SUBRATE*) are 173 and 58, suggesting a high probability that the "Clawback" mechanism kicks in. However, the level of *SUBRATE* varies significantly from 0.07 and about 1700, resulting considerable cross-sectional variation in institutional allocations. The price revision (*REVISION*) has a mean of 2.73% as compared to a market return of 1.16% (*WINDOW_RTN*), which indicates that underwriters typically increase offer price after not only reflecting contemporaneous public information, but also gathering private information from the book-building process.

In the aftermarket, the turnover as percentage of shares offered is 46% in first day (*TO_D1*), while this number increases to 111% and 178% over the first week (*TO_W1*) and first month (*TO_M1*). Price stabilization activities play an important role in aftermarket. 39% of IPOs in my sample conduct direct price support (*PS*) over the 1-month stabilization period, and 67% of IPOs choose to exercise the "green shoe" option (*GS*) and offer an additional portion of shares (normally 15% of shares total offered) to secondary market.

(INSERT TABLE 3.1 ABOUT HERE)

3.6.2 Pre-market allocation

Table 3.2 describes the allocation results for institutional investors from 2003 to 2010 on a yearly basis. In Panel A, I show the distribution of the fractional allocation to Placing Tranche among each year's IPOs. I classify the Placing Tranche allocations into four groups according to the prescribed levels in the "Clawback" provision, and compute the frequency of each group in every calendar year. I find about 64% of the IPOs in my sample trigger the "Clawback" provision and reallocate part of the shares from Placing Tranche to Retail Tranche. Meanwhile, the reallocation effect of Clawback provision is more significant when market condition is good. For instance, when investors are generally optimistic in years like 2006 and 2007, more than two thirds of IPOs trigger this provision. In contrast, when market condition is poor in years like 2008, only less than 30% of IPOs are affected by the Clawback provision due to weak retail demand.

In Panel B, I further show the allocation ultimately available for bookbuilding investors by subtracting the shares purchased by "cornerstone" investors from shares in the Placing Tranche. As cornerstone investments are irrevocably made before the release of prospectus, their

existence may further squeeze the shares available to institutional investors who receive allocation through participating in the bookbuilding. Results in Panel B show "cornerstone" investments averagely reduce the percentage of shares to institutional investors from 69% to 63%. However, in years with excess pre-issue "cornerstone" investments like 2007 and 2010, such investments crowd out the shares available for institutional investors in a much larger extent.

(INSERT TABLE 3.2 ABOUT HERE)

3.6.3 Aftermarket trading

In this study, I measure the aftermarket trading by large (institutional) and small (retail) investors using the buy-sell order imbalance (Lee and Ready, 1991). I retrieve the transaction data over the first month after listing, and do a two-way sorting as follows: I classify the trades into buyer- or seller-initiated using the Lee and Ready (1991) algorithm, while flagging each trade by size (small, mid, and large) according to the aforementioned dollar cut-offs (HK50,000 and HK500,000). Panel A of Table 3.3 shows the weekly dollar volume for four trading "subgroups" (large-buy, large-sell, small-buy, and small-sell) generated by this two-way sorting. Consistent with previous research, my results show the trading in the first week after the IPO occupies more than 70% of the volume in the first month, and the volume gradually decreases as aftermarket runs. However, an interesting finding in my results is that over the first week, order imbalance (calculated as buy volume less sell volume) is only significant for large trade group. This result indicates large (institutional) investors, compared to small (retail) ones, tend to act as net buyers of IPO shares in early aftermarket. Figure 3.1 illustrates the weekly proportion of order imbalance as total trading volume for both large and small trade groups within the first month after IPO.

The Panel B of Table 3.3 describes the order imbalance over the first month under different share allocation levels. The third column of Panel B.1 shows the large order imbalance occupies 7.32% of the total volume in the first week. In contrast, small order imbalance is only 0.23% of total volume. Moreover, the proportion of large order imbalance increases as the total institutional allocation level decreases from around 70%, suggesting that under-allocation to institutional investors stimulates the aftermarket buying by institutional investors.

(INSERT TABLE 3.3 AND FIGURE 3.1 ABOUT HERE)

3.7 Empirical Results

In this section, I first show institutional investors could infer their allocation before IPO starts. Then I focus on my main test to examine how the demand for aftermarket trading among institutional investors influences the IPO price discovery over pre- and aftermarkets. Further, I investigate whether such aftermarket trading could predict IPO performance in both short and long terms.

3.7.1 Pre-issue market conditions and institutional allocation

Before going to test the hypotheses proposed in Section 3.3, I firstly examine an empirical question: whether institutional investors as a whole could know their share allocation before the bookbuilding starts. Given that the Clawback provision mechanically stipulates most Hong Kong IPOs (except a small portion of IPOs getting a waiver) into only four types of allocation scheme, and that the retail demand in Hong Kong IPOs is subject to sentiment and market noise, it is likely that institutional investors could infer the subscription level (and

therefore, the final total institutional allocation) by using public information available in market in ahead of bookbuilding.

To test this predictive relationship, I follow Cen Ling (2009) to define the two weeks right before the prospectus release as the "pre-issue" period. A timeline of my IPO process is illustrated in Figure 3.2. I thus compute the Hang Seng index return (*Pre_IDX_RTN*) and average IPO initial return (*Pre_IPO_RTN*) as two measures for the overall market condition in pre-issue period and study their relationships with the subsequent allocations results.

Table 3.4 presents the pre-issue market conditions under different institutional allocation levels. Panel A shows the average index return (*Pre_IDX_RTN*) in the highest institutional allocation group (0.46%) is significantly lower than that in the lowest institutional allocation group (1.93%). Panel B compares the average initial returns of IPOs in pre-issue period among four allocation groups and obtains similar results: the average initial return of the highest institutional allocation group is significantly lower (5.38%) than that in the lowest institutional allocation group (17.28%).

In Panel C, the Pearson Correlation tests between the institutional allocation (*PT_ALLO*) and pre-issue market condition echoes results presented above. Overall, tests suggest one could predict institutional share allocation using public information before the bookbuilding starts.

(INSERT TABLE 3.4 AND FIGURE 3.2 ABOUT HERE)

To clarify the relative contribution of these two market condition variables in predicting the share allocation, I conduct multiple regressions where the dependent variables are gauges for

retail demand and institutional allocations. Specifically, I estimate the following regression model:

$$\begin{aligned} IA = {} & \alpha_0 + \beta_1 Pre\_IDX\_RTN + \beta_2 Pre\_IPO\_RTN \\ & + \beta_3 CSI + \beta_4 PROCEEDS + \beta_5 AGE + \beta_6 U\_REP \\ & + \beta_7 VC + \beta_8 H\_SHARE + \beta_9 CRISIS + \varepsilon \end{aligned} \tag{3.3}$$

where *IA* is 1)retail subscription rate (*SUBRATE*), 2)proportion of shares allocated to placing tranche (*PT_ALLO*), and 3)proportion of shares available to bookbuilding investors (*BB_ALLO*), respectively. Market return (*Pre_IDX_RTN*) and IPO initial returns (*Pre_IPO_RTN*) are included to measure pre-issue market condition. I further include seven variables that are known to influence the retail sentiment as control: a dummy variable indicating cornerstone investment (*CSI*); logarithm of proceeds raised (*PROCEEDS*); logarithm of firm age (*AGE*); dummy variable indicating the reputation of lead underwriters (*U_REP*); dummy variable indicating the venture capital backed IPO (*VC*); dummy variable indicating the H-share from mainland (*H_SHARE*); a dummy variable indicating the period of subprime crisis (CRISIS). A detail definition for variables in equation (3.3) is provided in the Appendix B.1.

Table 3.5 presents the regression results for equation 3.3. In column 1, the market return (*Pre_IDX_RTN*) and IPO initial returns (*Pre_IPO_RTN*) in the pre-issue periods exhibit significant effects in inducing the retail demand. In addition, the cornerstone investment dummy (*CSI*) has a factor loading that is positive and significant at 10%, suggesting its branding effect in generating retail demand.

In column 2 and column 3, I use two proxies for institutional allocation (shares to Placing Tranche (*PT_ALLO*); and shares to bookbuilding investors (*BB_ALLO*)) as dependent variables.

Generally, both of these allocation measures are significantly influenced by pre-issue market condition and IPO initial return: On average, a one-standard-deviation increase in pre-issue index return (average IPO initial return) leads to a percentage decrease of 36% (130%）and 34% (105%) respectively, in allocation to Placing Tranche and to bookbuilding investors. Moreover, the negative and significant coefficient of *CSI* in column 3 suggests that the presence of cornerstone investors reduces the shares to bookbuilding investors. Overall, empirical results indicate that due to the predictable feature of retail demand, institutional investors can at least partly infer their share allocation from the market before bookbuilding starts. This ability enlarges the space for institutional investors to consider whether aftermarket trading versus bookbuilding serves as best strategy to profit from their private information.

(INSERT TABLE 3.5 ABOUT HERE)

3.7.2 Institutional allocation and price discovery in pre-market

In this part I test Hypothesis 3.1, which predicts that higher (lower) institutional allocation leads to better (worse) price discovery in bookbuilding stage. I test this prediction by examining how the patterns of the "partial adjustment" display under different levels of institutional allocation. According to the "information extraction" theory by Benveniste and Spindt (1989), underwriter rewards the institutional investors who surrender private information by leaving them some profit margins in setting the offer price. Hanley (1993) empirically documents a positive relationship between the offer price revision (*REVISION*) and underpricing level (offer-to-close) and names it as the "partial adjustments". However, recent studies (Bradley and Jordan, 2002; Derrien, 2005; Ljungqvist et al., 2006; Loughran and Ritter, 2002) show that partial adjustment may also associate with public information especially when investor

sentiment plays a role in pricing IPO. By observing the patterns of partial adjustment under different institutional allocation levels, one can identify whether "information extraction" occurs during the bookbuilding and thus enhances price discovery.

Following Lowry and Schwert (2004), I employ market return (here Hang Seng index return) over the subscription window (*WINDOW_RTN*) as the proxy for public information. And correspondingly, I use the price revision (*REVISION*) to measure the amount of private information released by institutional investors due to the fact that both the midpoint of filing range and offer price are determined by negotiation between underwriters and institutional investors. Given that price revision (*REVISION*) may also reflect public information and noise in market, (such as investor sentiment and contemporaneous index return) I follow Lowry and Schwert (2004) to estimate both the *WINDOW_RTN* and *REVISION* into one regression. To the extent that *WINDOW_RTN* captures the influence from public information on the underpricing, the coefficient of *REVISON* should isolate the effects of private information.[23] To strictly differentiate the pre- and aftermarket, I follow Bradley et al. (2009) to use the offer-to-open (*OTO*) return as my proxy for underpricing. Overall, my estimation is as follows:

$$\begin{aligned} OTO = {} & \alpha_0 + \beta_1 REVISION + \beta_2 REVISION\_P + \beta_3 WINDOW\_RTN \\ & + \beta_4 RANGE + \beta_5 SUBRATE + \beta_6 PROCEEDS \\ & + \beta_7 AGE + \beta_8 U\_REP + \beta_9 VC + \beta_{10} H\_SHARE + \varepsilon \end{aligned} \tag{3.4}$$

where *OTO* measures the return between the offer price and open price. *REVISION* is the price update between the midpoint of filing range and offer price. *REVISION_P* is a dummy variable flagging positive price updates. *WINDOW_RTN* is the contemporaneous return of Hang Seng

[23] As a robustness check, I also regress the price revision (*REVISON*) on market return (*WINDOW_RTN*) and get its residual as proxy for revision caused by private information (*PRI_RTN*). However, replacing *REVISION* with this proxy in equation 3.4 generates similar results.

Index over the bookbuilding period. I also include seven more variables as control variables: the width of filing range (*RANGE*); the subscription rate in retail tranche (*SUBRATE*); logarithm of proceeds raised (*PROCEEDS*); logarithm of total asset the year before IPO (*SIZE*); logarithm of firm age (*AGE*); dummy variable indicating the reputed lead underwriters (*U_REP*); venture-capital backed IPO (*VC*); H_SHARE dummy (*H_SHARE*).

To test whether IPOs with different levels of institutional allocations have different patterns of "partial adjustment", I use two groups of IPOs in my sample where institutional allocations are significantly different: IPOs with Placing Tranche equals to 90% (50%) of total shares offered. Table 3.6 presents the regression results. In column 1, the parameter estimation for equation 3.4 using pooled sample shows averagely both the price revision (*REVISION*) and market return (*WINDOW_RTN*) are positively related to offer-to-open return. In column 2, I augment equation 3.4 by introducing a dummy variable, *PT_HIGH*, into the regression. This dummy variable takes value of one if the size of the Placing Tranche in IPO equals to 90% and zero if it equals 50%. In addition, I multiply *PT_HIGH* with my main variable of interests: *REVISION*, *REVISION_P*, and *WINDOW_RTN*, respectively, to get interaction terms: *REVISION_H*, *REVISION_P_H*, and *WINDOW_R_H*. By doing this, I separate the effect of high and low institutional allocation on shaping the pattern of partial adjustment. The results show compared to low (50%) placing, high institutional placing in IPO has the size of "money left on the table" more in line with the price movement in the pre-market (*REVISION*). In contrast, IPOs with high institutional allocation responses little to contemporaneous market return compared to issues with low institutional allocation. Overall, the pooled results suggests "money left on the table" of IPOs with higher institutional allocation responses more to price revision in pre-market, while that of IPOs with lower institutional allocation is more likely to be influenced by market

condition.

In rest columns, I report subsample results to show partial adjustment exhibits different patterns between high and low institutional allocations. Specifically, in the subsample where Placing Tranche allocation is high (90%), the coefficient of price revision (*REVISION*) is positive and significant at 1% in predicting underpricing, consistent with the prediction in "information extraction" theory. In column 4, I follow Lowry and Schwert (2002) to add a dummy capturing positive price revision (*REVISION_P*) in regression. The positive and significant coefficient of *REVISION_P* is in line with the view that underwriter underprices the IPO to reward institutional investors reporting positive information (Lowry and Schwert, 2002).

However, IPOs with lower total institutional allocation (Placing Tranche equals 50%) exhibit "partial adjustment" only to public information. In column 5 and column 6, the coefficients of market return are both positive and significant at 1%. However, both the price revision (*REVISION*) and the positive-revision dummy (*REVISION_P*) show little impact on determining the offer price. This pattern is not in line with the prediction of "information extraction" the theory but that of Derrien (2005) and Ljungqvist et al.,(2006), which argue that underwriter capitalizes over-optimistic investor sentiment in pricing IPO but only do so partially in consideration of aftermarket performance.

Filing range width (*RANGE*) also exerts asymmetry effect in influencing the underpricing level, with its coefficients only positive and significant in column 3 and 4. As the width of filing range is commonly considered as a proxy for the ex ante valuation uncertainty (Aggarwal et al., 2002; Kutsuna et al., 2009), this result indicates that private information is more valuable and (profitable) in bookbuilding when the offering is harder to value.

In conclusion, results in Table 3.6 are in line with hypothesis 3.1.a and 3.1.b. In particular, IPO offer price partial adjusts to price revision when institutional allocation is high, while to index returns when institutional allocation is low. This difference in the patterns of partial adjustment suggests that when institutional investors receive greater allocation, private information is more likely to be incorporated into offer price, and vice versa.

(INSERT TABLE 3.6 ABOUT HERE)

3.7.3 Institutional trading and price discovery in aftermarket market

In previous section, I explore the price discovery in IPO pre-market by studying the patterns of "partial adjustment" under different levels of institutional allocations. In this section, I investigate the aftermarket price discovery using PIN (probability of informed trading) to measure the amount of private information in IPO share price. In another word, I test the Hypothesis 3.2, which predicts that aftermarket trading by institutional investors facilitates private information getting into share price. Meanwhile, I test H3.3, which conjectures higher institutional allocation leads to larger amount of private information in IPO aftermarket price. To test these two hypotheses, I regress the PIN value calculated from the first-month trading of IPO on contemporaneous large order imbalance (*LARGENNET_W1*) and allocation to Placing Tranche (*PT_ALLO*) after controlling other characteristics. The model is as follows.

$$\begin{aligned} PIN\_M1 = {} & \alpha_0 + \beta_1 PT\_ALLO + \beta_2 LARGENET\_W1 \\ & + \beta_3 SMALLNET\_W1 + \beta_4 PROCEEDS + \beta_5 AGE \\ & + \beta_6 U\_REP + \beta_7 VC + \beta_8 H\_SHARE + \beta_9 TO\_M1 + \varepsilon \end{aligned} \tag{3.5}$$

where *PIN_M1* is the PIN value estimated using the series of daily trade numbers over the first month after listing. *PT_ALLO* is the proportion of shares allocated to Placing Tranche,

LARGENET_W1 is the large order imbalance as percentage of total volume over the first week. I also include the small order imbalance as percentage of total volume (*SMALLNET_W1*) as a control. Other control variables include: logarithm of proceeds raised (*PROCEEDS*); logarithm of firm age (*AGE*); underwriter reputation (*U_REP*); venture capital backed (*VC*); H share offering (*H_SHARE*); the turnover of first month (*TO_M1*).

Table 3.7 presents the regression results. Column 1 shows the institutional allocation (*PI_ALLO*) in pre-market is positively related to PIN in aftermarket. This evidence echoes my findings in Table 3.6, which argues that higher (lower) institutional allocation enhances (reduces) price discovery. In column 2, I exclusively test the effect of large order imbalance over the first week (*LARGENET_W1*). Large order imbalance exerts a positive impact on the PIN at the significance level of 5%, implying institutional investors do incorporate their private information into market price over their trading. Furthermore, after including both the institutional allocation (*PT_ALLO*) and aftermarket trading (*LARGENET_W1*) simultaneously in one model, I find both of their significances are unchanged. This unanimity suggests that the effects of pre-market allocation and aftermarket trading may complement each other in incorporating private information into IPO price over the IPO price discovery process. However, the small order imbalance (*SMALLNET_W1*) has little impact on PIN as reported in column 4.

I retain most explanatory variables in Table 3.6 to control their influence on PIN. Consistent with previous literature, IPO size (*SIZE*) is positively related to PIN, showing larger firms have more informative share prices. Moreover, I follow Brockman and Yan (2009) to add turnover (*TO_M1*) as a further control in my regression models. The significant negative coefficients of *TO_M1* indicate the liquidity or noise trading dominates in the IPO early aftermarket.

Overall, results in Table 3.7 support Hypotheses 3.2 and 3.3. Pre-market share allocation and aftermarket trading by institutional investors tend to be complementary to each other in determining the amount of private information in the IPO share price in early aftermarket. This leads to an implication that institutional investors could participate in and enhance the price discovery of IPO during either pre- or aftermarket stages.

(INSERT TABLE 3.7 ABOUT HERE)

3.7.4 Institutional trading and IPO future performance

In this section, I test whether the aftermarket trading by institutional investors could predict IPO future returns. Trading in early aftermarket is usually constrained by underwriters from flipping or chasing short-term profits. And under such constraints, previous studies show institutional trading could predict long-run post-IPO performances up to two years (Boehmer et al., 2006; Chemmanur et al., 2010). In my framework, as institutional investors choosing strategic trading may not participate in the primary offering and therefore, not subject to offering constraint by underwriters, they could chase shorter-term profits freely in aftermarket. Thus, I hypothesize in H3.4 that the institutional trading in early aftermarket can also predict short-term excess return in addition to long-term ones. To test H3.4, I estimate regression equations where the dependent variables are the post-IPO excess returns from 1 month to 18 months

$$\begin{aligned} ExRTN = {} & \alpha_0 + \beta_1 LARGENET\_W1 + \beta_2 SMALLNET\_W1 \\ & + \beta_3 PT\_ALLO + \beta_4 SIZE + \beta_5 MTB + \beta_6 AGE + \beta_7 U\_REP \\ & + \beta_8 VC + \beta_9 H\_SHARE + \beta_{10} OTO + \beta_{11} OTC + \varepsilon \end{aligned} \tag{3.6}$$

where *ExRTN* is the 1-month, 6-month, 1-year, and 18-month buy-and-hold returns started from the sixth trading day, respectively. Large order imbalance over the first week (*LARGENET_W1*)

is my main variable of interest. I also include 10 variables as control. That is: small order imbalance over the first week (*SMALLNET_W1*); percentage of shares allocated to placing tranche (*PT_ALLO*); logarithm of total assets (*SIZE*); market-to-book ratio (*MTB*); logarithm of firm age (*AGE*); dummy variable of underwriter reputation (*U_REP*); dummy for venture-capital investment (*VC*); dummy for H-share listing (*H_SHARE*); offer-to-open return (*OTO*); open-to-close-return in first trading day (*OTC*).

The regression results in Table 3.8 show large order imbalance in early aftermarket (*LARGENET_W1*) could predict the post-IPO excess returns for all four holding periods (1-month, 6-month, 1-year and 18-month) after controlling other characteristics. These results are more interesting if I compare the coefficients of variables between different holding periods. In longer runs (1-year and 18-month), the post-IPO excess return is also co-determined by some common risk factors such as market-to-book ratio (*MTB*) and firm size (*SIZE*), as showed in column 3 and 4. However, in shorter run (1-month), the aftermarket trading becomes the only significant variable in predicting the excess return. Overall, the result suggests that aftermarket trading by institutional investors is informed in the sense that it could generate them excess returns in both short- and long-runs.

(INSERT TABLE 3.8 ABOUT HERE)

3.8 Further Analyses

In this section, I examine the potential selection bias in institutional investors' choice of aftermarket trading. Meanwhile, I consider several alternatives explanations for the aftermarket trading and show they are unlikely to be the cause of my findings.

3.8.1 Selection bias and Heckman' two-stage method

Firstly, I examine the possibility of selection bias existed in my framework. Since to trade in the aftermarket relies on the trade-off among institutional investors, their choice to conduct trading activity is not random, but rather a strategic decision made by institutional investors. The self-selecting process thereby creates a selection bias problem. I solve this problem by using the two-step method of Heckman (1978). Specifically, I construct a dichotomous variable (AFT_BUY) which assigns value one (zero) to each IPO if its large order balance in aftermarket is greater (not greater) than zero. In the first step, I regress this dichotomous variable (AFT_BUY) on IPO characteristics using a probit model. After obtaining the "inverse Mills ratio" from the first stage regression, I then insert it into the outcome equations as the second step to estimate the selection-bias-free results. The two-stage method is conducted by estimating the following regressions

First stage:

$$\begin{aligned} AFTER\_BUY = {} & \alpha_0 + \beta_1 PT\_ALLO + \beta_2 PROCEEDS + \beta_3 AGE \\ & + \beta_4 U\_REP + \beta_5 VC + \beta_6 RANGE + \beta_7 P\_USE + \beta_8 REVISION \\ & + \beta_9 OTO + \beta_{10} OTC + \beta_{11} PS + \beta_{12} GS + \beta_{13} TO\_W1 + \varepsilon \end{aligned} \tag{3.7}$$

Second Stage:

$$\begin{aligned} ExRTN = {} & \alpha_0 + \beta_1 LARGENET\_W1 + \beta_2 SMALLNET\_W1 \\ & + \beta_3 PT\_ALLO + \beta_4 SIZE + \beta_5 MTB + \beta_6 AGE \\ & + \beta_7 U\_REP + \beta_8 VC + \beta_9 H\_SHARE + \beta_{10} OTO \\ & + \beta_{11} OTC + \beta_{12} InverseMillsratio + \varepsilon \end{aligned}$$

(3.8.1)

$$
\begin{aligned}
PIN\_M1 = {} & \alpha_0 + \beta_1 PT\_ALLO + \beta_2 LARGENET\_W1 \\
& + \beta_3 SMALLNET\_W1 + \beta_4 PROCEEDS + \beta_5 AGE \\
& + \beta_6 U\_REP + \beta_7 VC + \beta_8 H\_SHARE + \beta_9 TO\_M1 \\
& + \beta_{10} InverseMillsratio + \varepsilon
\end{aligned}
\tag{3.8.2}
$$

In the first stage, I estimate a probit model as specified in equation (3.7). The dependent variable is *AFTER_BUY*, which equals one if the large order imbalance over the first week is positive and zero otherwise, I include five proxies to measure the information asymmetry: firm age (*AGE*), underwriter reputation (*U_REP*), venture-capital backed (*VC*), filing range (*RANGE*), and use of proceeds disclosed on prospectus (*P_USE*). [24] Other control variables include: price update (*REVISION*), offer-to-open return (*OTO*), first-day open-to-close return (*OTC*), dummy for primary stabilization (*PS*), dummy for exercise of "green shoe" option (*GS*), and first-week turnover (*TO_W1*). In the second stage, I augment the equation (3.5) and equation (3.6) by adding the "inverse Mills ratio" estimated from equation (3.7) into the regressions. Other controlling variables are in consistence with equation (3.5) and (3.6).

The column 1 of Table 3.9 presents the results of the probit model. Some interesting findings are worth noting. First, consistent with my intuition, I find larger offerings (*PROCEEDS*) with less shares allocated to institutional investors (*PT_ALLO*) increase the probability of trading in aftermarket. Second, I include five proxies for uncertainty and information asymmetry in my tests. Results show generally, institutional investors are more likely to trade in aftermarket if an IPO is associated with higher uncertainty and information asymmetry. By trading on these

[24] Carter and Manaster (1990); Lowry et al. (2010) propose firms with younger age (*AGE*) have higher ex-ante uncertainty and information asymmetry; The "certificate hypothesis" of Shiller (1989) claims underwriter reputation (*U_REP*) is negatively associated with uncertainty and information asymmtery; Beatty and Ritter (1986) argue the use of proceeds disclosed on prospectus (*P_USE*) implies the ex ante uncertainty, while McGuinness (1992) use this measure in his Hong Kong study. Aggarwal et al. (2002) use the filing range (*RANGE*) to measure the demand uncertainty; Brav and Gompers (1997) argue that venture-capital backed firms (*VC*) are better monitored and thus less associated with severe information asymmetry. I include all the five proxies above-mentioned into my probit regression model.

shares, institutional investors exploit from their private information and reap excess returns in both short- and long-term.

The column 2 and column 6 in Table 3.9 present the estimation results of the outcomes equations where the dependent variables are post-IPO performance and PIN. Two points are worth noting here. First, the inverse Mills ratio turns out to be significant in estimates over 1-month and 6-month horizons, implying that there exits selection bias among my institutional trading sample. Second, my main variable of interest, the large order imbalance (*LARGENET_W1*) remains significant, after corrected from the selection bias, in predicting both the post-IPO performance and the PIN. This result reaffirms Hypotheses 3.4 and 3.3 that institutional investors possess private information to profit in aftermarket and they incorporate such information into share price through aftermarket trading.

3.8.2 Alternative explanations

The aftermarket trading by institutional investors may be due to two alternative explanations: underwriter-directed price stabilization and laddering. Several previous researches (Aggarwal, 2000; Boehmer and Fishe, 2004; Lewellen, 2006) discuss that underwriter engages in aftermarket trading in particular the IPO price is under downward pressure. In that case, stabilizing and supporting orders directed by underwriter will largely boost up the volume artificially over the first month after the listing. Another explanation is the "laddering" agreement between underwriter and institutional investors, where the underwriter requires the institutional investors to buy additional shares in aftermarket as a condition to pre-market allocation. Griffin et al. (2007) reports that the net buying from the clients of lead underwriters equals to 8.79% of the total shares issued. Hao (2007) argues laddering raises both of the offer

price and money left on the table. I test these two alternative explanations in Table 3.9.

3.8.3 Estimation results

Column 1 of Table 3.9 shows these alternative explanations are less likely to be the cause of my results. I introduce two dummy variables, *PS* and *GS*, to control for the primary stabilizing (refers to direct purchase in secondary market) and ancillary stabilizing (refers to overallotment through Greenshoe option) activities in Hong Kong IPO market. The negative coefficient (significant at 1% level) of direct purchasing activity (*PS*) shows price stabilization is not likely the cause of aftermarket trading. In fact, its negative effect can be explained according to Chemmanur et al. (2010), who claim the direct price support (that is, place an extremely large buy limit order at a specific price under the offer price) is identified as seller-initiated in Lee and Ready (1991) algorithm.

If laddering is the main cause of aftermarket trading, two conclusions can be drawn: First, as allocation is the reward for aftermarket purchasing, one should see a positive relationship between pre-market allocation and the selection of aftermarket trading. Second, since reputed underwriters have more power in pitching and allocating hot issues, one should expect issues underwritten by more reputed investment banks are more likely to be associated with such trading. However, neither of these predictions is supported by my results in Column 1 of Table 3.9. Both of the pre-market allocation and underwriter reputation exhibit negative effect on the dichotomous variable of aftermarket trading. Overall, my results imply the more likely explanation for aftermarket institutional trading may be the strategic trading behavior.

I also shed light on several characteristic that may influence the cost of aftermarket trading. For instance, Busaba and Chang (2010) theorize that larger offerings and more liquid

aftermarkets lower the cost of implementing strategic trading. I therefore include the proceeds raised (*PROCEEDS*) and aftermarket turnover (*TO_M1*) as proxies for trading cost in column 1. The results show that larger and more liquid issues tend to attract more trading from institutional investors. This result is congruent with my expectation that institutional investors trade more when cost of aftermarket trading is lower.

Overall, Table 3.9 presents results with the "correction" of sample selection bias using Heckman (1978) two-stage method. Incorporating the inverse Mills ratio into regression corrects the potential sample selection bias. The results show consistently that large net buying increases the amount of private information contained in share price, and predicts the post-IPO performance. Meanwhile, results show institutional investors are more likely to trade in IPOs with higher information asymmetry and uncertainty, lower trading cost, and lower share allocation. Last, my findings exclude alternative explanations such as "price stabilization" and "laddering".

(INSERT TABLE 3.9 ABOUT HERE)

3.9 Conclusion

In this chapter, I examine how the total allocation to institutional investors influences their choice of aftermarket trading as alternative to participating in pre-market bookbuilding. By employing the unique "Clawback" provision in Hong Kong, I explore the strategic trading hypothesis proposed by Busaba and Chang (2010) and its implications on IPO price discovery over the pre- and aftermarket stages.

Several interesting findings are worth summarizing in this chapter: I find under-allocation to institutional investors results in trading by institutional investors in early aftermarket, which is consistent with the theoretical prediction of Busaba and Chang (2010). Meanwhile, I find while price discovery is hindered by under-allocation in bookbuilding stage, it is enhanced by institutional trading in early aftermarket. Therefore, my findings suggest that bookbuilding and aftermarket trading may play a complementary role in incorporating private information into IPO share price. Furthermore, my results show institutional trading in early aftermarket could predict both of the short-term and long-term IPO future performance. This finding extends previous findings on the relationship between institutional trading and IPO long-run performance (Boehmer et al., 2006; Chemmanur et al., 2010; Krigman et al., 1999). Last, further analysis shows that institutional trading is more likely to occur in IPOs with higher uncertainty and information asymmetry and more liquid aftermarket. However, it is less like the result of price stabilization and "laddering".

My essay contributes to literature in following aspects. First, my findings confirm the theoretical prediction of Busaba and Chang (2010) by documenting the relationship between the pre-market institutional allocation and the aftermarket trading by institutional investors. More importantly, by shedding light on the implications of such trading behavior, I show that institutional investors may have the ability to improve IPO price discovery through either pre-market bookbuilding or aftermarket trading. I thus suggest pre-market bookbuilding and aftermarket trading work as complement to each other and a better understanding of IPO price discovery could be drawn by jointly considering both stages. Last, my research contributes to the recent debate on the efficacy of Clawback provision. As Hong Kong IPO practitioners are casting doubt on this fairness-oriented arrangement for its overly retailed-favored mindset, this

study offers direct evidence to show that this policy hinders information revelation in bookbuilding but induces informed trading in aftermarket. Such trading may benefit institutional investors in both short- and long-runs at the expense of uninformed investors.

(INSERT APPENDIX B.1 AND B.2 HERE)

Chapter 4

Conclusion and Future Research Opportunities

This thesis has investigated the role of institutional investors in IPO from two different but related angles. Using a "two-stage" framework which considers both the pre- and aftermarket stages of IPO, I investigate how investor sentiment affects the IPO pricing in my first essay, and how the total institutional allocation influences aftermarket trading by institutional investors in my second essay.

In essay one, I examine the pricing of IPO in a context where sentiment investors arrive sequentially with a possibility that pre-market sentiment deteriorates in aftermarket. Following Ljungqvist et al., (2006), I postulate that institutional investors may play a "re-distributing" role in helping underwriter takes advantage of sentiment investors over time. The main findings can be summarized as follows: I find that as the underwriter adjusts the IPO price upward to incorporate pre-market investor sentiment, it may only do so partially if the investor sentiment tends to deteriorate in aftermarket stage. Moreover, my empirical tests show the amount of "money on the table" is related to the likelihood of sentiment deterioration. My results are consistent with the theoretical argument of by Ljungqvist et al. (2006), which proposes the "re-distributing" role of institutional investors in hot IPOs and explains the money on the table as a fair compensation to institutional investors for bearing the risk of sentiment swing.

In essay two, I explore how the total institutional allocation affects their choice of aftermarket trading as an alternative to participating in the bookbuilding. I find institutional investors may choose to strategically trade in aftermarket if they anticipate unfavorable allocation. Consequently, their choice of aftermarket trading leads to price discovery primarily

conducted in aftermarket instead of pre-market. In particular, under-allocation results in less (more) private information being incorporated into IPO price through bookbuilding (aftermarket trading). Furthermore, aftermarket trading of institutional investors predict post-IPO performances in both short- and long-terms. These findings support the theoretical analysis of Busaba and Chang (2010) and suggest institutional investors enhance price discovery in either pre-market and aftermarket stage.

My two essays shed light on different perspectives of the roles played by institutional investors in IPO: The first essay investigate institutional investors' re-distributing role in collaborating with the underwriter in a "staggered sale" strategy. In contrast, the second essay looks into their role in price discovery over the pre- and aftermarket stages. Thus, my findings extend the knowledge and research in the field studying how institutional investors exert their influences over IPO process.

My research can be extended in following directions. First, an important question related to the first essay is what causes the sentiment swing between the pre- and aftermarket stages. Results in my essay one suggest pre-market sentiment can be induced by investor attention, while according to Miller (1977), sentiment in aftermarket arises from divergence of options in valuing with asymmetric constraints. As my findings suggest a sentiment swing is likely to occur over the transition from pre-market to aftermarket, it is interesting to see whether sentiment investors shift their attention to other IPOs once the aftermarket trading starts.

Second, my second essay can be extended in the areas of the strategic behavior of institutional investors. As my results show that institutional investors can reveal their private information either in pre-market or aftermarket, an interesting question to be explored is that

whether the strategic behavior of institutional investors could explain the uncertainty and information asymmetry in early aftermarket.

Third, the two-stage framework can be used in other issues about the IPO. This approach separates the initial return into a pre-market part and an aftermarket part and studies the transition process from primary offering to secondary trading. Ljungqvist et al. (2006) and Chen and Wilhelm (2008) apply similar framework in their theoretical analysis. I use the two-stage model to better monitor the evolvement of investor sentiment and gauge the private information contained in IPO share price. It is intriguing to apply this model to other topics where we need to consider both pre-market and aftermarket stages. However, I would like to leave these issues for future research.

Appendices

Appendix A.1

Variable Definition

Pre-market Sentiment is defined as the investor sentiment during the pre-market of an IPO offering, in my study, during the last week before the listing.

Aftermarket Sentiment is defined as the investor sentiment during the immediate listing of an IPO, in my study, over the first trading week after the listing.

OFFER is the final offer price of IPO in HK dollar.

SUBRATE is the number of shares subscribed by individual investors during the public subscription window (normally the last three to five days in bookbuilding period) divided by the number of shares primarily assigned to Public tranche before Clawback mechanism.

RETAIL is the proportion of shares finally allocated to Retail tranche after Clawback mechanism, as documented on the allocation announcement one or two trading days before listing.

PLACING is the proportion of shares finally allocated to Placing tranche after Clawback mechanism, as documented on the allocation announcement one or two trading days before listing.

PRE_IPO_RTN is the average first-day return of five prior IPOs, calculated as the arithmetic mean of first day offer-to-close returns from five prior IPOs before the IPO.

RANGE is price range announced in its prospectus, calculated as

$Range=(P_{High}-P_{Low})*2/(P_{High}+P_{Low})$

SIZE is the logarithm of total assets in millions of Hong Kong dollars in the year before IPO.

PROCEEDS is the logarithm of the amount of money raised in millions of Hong Kong dollars in the IPO.

REVISION is offer price divided by the midpoint of initial price range minus one, calculates as $Revison=(P_{offer}-\frac{1}{2}(P_{high}+P_{low}))/\frac{1}{2}(P_{high}+P_{low})$

UWREP is a binary variable which equals one if at least one of lead managers is among the top ten underwriters based on underwriting market share in the IPO year, and zero otherwise.

H_SHARE is a binary variable equals one if the IPO is an H-share offering, and zero otherwise.

TOP is a binary variable that equals one when offer price is set at the upper bound of price range and zero otherwrise.

ADJIR is market-adjusted offer-to-close return on the first day of trading, calculated as

$$ADJIR=(P_{close}-P_{offer})/P_{offer}*100-(PI_{close}-PI_{offer})/PI_{offer}*100$$

OTO is offer-to-open return, which equals to the open price on the first day of trading divided by offer price minus one.

SMALLNET_1D is buyer-initiated small trades less seller-initiated small trades divided by total dollar trading volume on the first day of trading.

SMALLNET_5D is buyer-initiated small trades less seller-initiated small trades divided by total dollar trading volume on the first five days of trading.

TURNOVER_1D is total trading volume divided by the number of shares offered on the first day of trading.

TURNOVER_5D is total trading volume divided by the number of shares offered on the first five days of trading.

LARGENET_1D is buyer-initiated large trades less seller-initiated large trades divided by total dollar trading volume on the first day of trading.

LARGENET_5D is buyer-initiated large trades less seller-initiated large trades divided by total dollar trading volume on the first five days of trading.

ADJOTC_1D is market-adjusted open-to-close return during the first day of trading, calculated as

$$ADJOTC\_1D=(P_{first\text{-}day\text{-}close}-P_{first\text{-}day\text{-}open}/P_{first\text{-}day\text{-}open}*100-(PI_{first\text{-}day\text{-}close}-PI_{first\text{-}day\text{-}open})/PI_{first\text{-}day\text{-}open}*100$$

ADJOTC_5D is market-adjusted open-to-close return during the first five days of trading, calculated as

$$ADJOTC\_5D=(P_{fifthday\text{-}close}-P_{first\text{-}day\text{-}open}/P_{first\text{-}day\text{-}open}*100-(PI_{fifthday\text{-}close}-PI_{first\text{-}day\text{-}open})/PI_{first\text{-}day\text{-}open}*100$$

VOLATILITY is standard deviation of intraday returns on first day of trading normalized by offer price, calculated as

VOLATILITY=STD.Dev(first-day trading price)/Offer_price

ASVI is abnormal *Google Search Volume Index*, defined as search volume index during book-building week minus median of search volume index in previous eight weeks. This measure is calculated as

$$ASVI=(SVI_{week0}-median(SVI_{week-1},SVI_{week-2}, \ldots, SVI_{week-8}))/median(SVI_{week-1},SVI_{week-2}, \ldots, SVI_{week-8})*100,$$

Where "week 0" specifies IPO week and "week –n" specifies n weeks prior to the IPO.

ADJRTN_6M is the buy-and-hold return less the corresponding Hang Seng Index return within the 6-month trading day window (+1, +125) after IPO.

ADJRTN_1Y is the buy-and-hold return less the corresponding Hang Seng Index return within the 1-year trading day window (+1, +250) after IPO.

ADJRTN_18M is the buy-and-hold return less the corresponding Hang Seng Index return within the 18-month trading day window (+1, +375) after IPO.

Appendix B.1

Variable Definition

ADJRTNW1_6M is the buy-and-hold return less the corresponding Hang Seng Index return within the 6-month trading day window (+6, +125) after IPO.

ADJRTNW1_1Y is the buy-and-hold return less the corresponding Hang Seng Index return within the 1-year trading day window (+6, +250) after IPO.

ADJRTNW1_18M is the buy-and-hold return less the corresponding Hang Seng Index return within the 18-month trading day window (+6, +375) after IPO.

AFT_BUY is binary variable which equals one if the large net buying (LARGENET_W1) is positive and zero otherwise.

AGE is the logarithm of firm age from its incorporation to listing.

BB_ALLO is the percentage proportion of allocation to the Placing Tranche less the percentage portion of allocation to "Cornerstone investors".

CRISIS is a binary variable equals one if the IPO is listed between Aug 2007 and Nov 2008 and zero otherwise.

CSI is a binary variable which equals one if "Cornerstone" investment agreements are made before the bookbuilding starts and zero otherwise.

GS is a binary variable which equals one if "green shoe" option is exercised within the stabilization period.

H_SHARE is a binary variable equals one if the IPO is an H-share offering, and zero otherwise.

Inverse Mills Ratio is conditional expectation of the residual in first stage probit model given the selection variable *AFT_BUY*.

IR is the initial return (offer-to-close return) on the first day of trading.

LARGENET_W1 is buyer-initiated large trades minus the seller-initiated divided by total dollar trading volume during first week of trading, defined as

*LARGENET_W1=(LARGEBUY_W1-LARGESELL_W1)/TURNOVER_W1*100*

MTB is market-to-book ratio calculated at the time of IPO.

OFFER_PRICE is the final offer price in HK dollar

OTC is the open-to-close return in the first trading day.

OTO is offer-to-open return, that is, open price on the first day of trading divided by offer price minus one.

P_USE is the logarithm of usage of proceeds disclosed on the prospectus.

PIN(probability of informed trading) is proposed by Easley and O'Hara (1992) and is defined

$$PIN = \frac{\hat{\alpha}\hat{\mu}}{\hat{\alpha}\hat{\mu} + 2\varepsilon}$$

A detailed variable definition is available in Section 3.4.3.

Pre_IDX_RTN is the Hang Seng Index return over the two weeks before the bookbuilding starts.

Pre_IPO_RTN is the average IPO initial return over the two weeks before the bookbuilding starts.

PROCEEDS is the logarithm of the amount of money raised in millions of Hong Kong dollars in the IPO.

PS is a binary variable which equals one if primary stabilization activities are conducted in aftermarket and zero otherwise.

PT_ALLO is the percentage proportion of allocation to the Placing Tranche at the offering.

RANGE is price range announced on the prospectus, calculated as

$RANGE=(P_{High}-P_{Low})*2/(P_{High}+P_{Low})$

REVISION is offer price divided by the midpoint of initial price range minus one, calculates as $REVISION=(P_{offer} - \frac{1}{2}(P_{high} + P_{low}))/\frac{1}{2}(P_{high} + P_{low})$

REVISION_P is a binary variable which equals one if the price revision is positive, and zero otherwise

SIZE is the logarithm of total assets in millions of Hong Kong dollars in the year before IPO.

SMALLNET_W1 is buyer-initiated small trades minus the seller-initiated divided by total dollar trading volume in the first week of trading.

*SMALLNET_W1=(SMALLBUY_W1-SMALLSELL_W1)/TURNOVER_W1*100*

SUBRATE is the number of shares subscribed by individual investors during the public subscription window (normally the last three to five days in bookbuilding period) divided by the number of shares primarily assigned to Public tranche before Clawback mechanism.

TO_W1 is total trading volume in the first week of trading divided by the number of total shares offered.

TO_M1 is total trading volume in the first month of trading divided by the number of total shares offered.

U_REP is a binary variable which equals one if at least one of lead managers is among the top ten based on underwriting market share and zero otherwise.

VC is the binary variable which equals to one if the issuing firm is venture-capital backed and zero otherwise.

WINDOW_RTN is the Hang Seng Index return over the bookbuilding periods.

Appendix B.2

The Clawback Arrangement

The Practice Note 18 of the Main Board Listing Rules in Hong Kong Stock Exchange (HKEX) states that, In an Main Board IPO which includes both a placing tranche (PT) and a retail tranche (RT), the minimum allocation of shares to the retail tranche (RT) shall be as follows:

An initial allocation of 10% of the shares offered in the IPO;

Allocation increases to 30% of the shares offered in the IPO when the total demand for shares in the retail tranche is 15 times but less than 50 times the initial allocation;

Allocation increases to 40% of the shares offered in the IPO when the total demand for shares in the retail tranche is 50 times but less than 100 times the initial allocation

Allocation increases to 50% of the shares offered in the IPO when the total demand for shares in the retail tranche is 100 times or more the initial allocation.

Shares may be transferred from the retail tranche to the placing tranche where there is insufficient demand in the retail tranche to take up the initial allocation.

In the case of granting Practice Note 18 Waiver (PN18 Waiver), the allocation of shares to the retail tranche (RT) shall be as follows:

An initial allocation of 5% of the shares offered in the IPO;

Allocation increases to 7.5% of the shares offered in the IPO when the total demand for shares in the retail tranche is 15 times but less than 50 times the initial allocation;

Allocation increases to 10% of the shares offered in the IPO when the total demand for shares in the retail tranche is 50 times but less than 100 times the initial allocation;

Allocation increases to 20% of the shares offered in the IPO when the total demand for shares in the retail tranche is 100 times or more the initial allocation.

Listing Decision HKEx-LD60-1 published in May 2008 describes certain typical parameters underlying a grant of PN 18 Waiver (‘Typical PN 18 Waiver’). A key factor the Exchange will

consider in reaching such a determination is the size of the offering. The size of an issuer's total offering (including any over-allotment option or sale of existing shares by shareholders) should be big. It was noted that the majority of the previous applications for PN 18 Waivers had been for offerings with a size of over HK$10 billion.

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Tables and Figures

Table 2.1 Descriptive statistics

The final sample consists of 293 IPOs in Hong Kong from April 2003 to December 2009. *OFFER* is the final offer price in HK dollar. *PLACING* is the proportion of shares finally allocated to Placing tranche in an IPO. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Public tranche. *PRE_IPO_RTN* is the average first-day return of five prior IPOs before the IPO. *RANGE* is price range announced in its prospectus scaled by midpoint price. *SIZE* is the logarithm of total assets. *PROCEEDS* is the logarithm of the amount of money raised in millions of HK dollars. *UWREP* is a binary variable which equals one if one of lead managers is among the top ten based on underwriting market share. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. *REVISION* is offer price divided by the midpoint of initial price range minus one. *TOP* is a binary variable that equals one when offer price is set at the upper bound of price range. *ADJIR* is market-adjusted offer-to-close return on the first day of trading. *OTO* is offer to open return, that is, open price on the first day of trading divided by offer price minus one. *SMALLNET_1D, SMALLNET_5D* is buyer-initiated small trades less seller-initiated small trades divided by total dollar trading volume on the first day and the first five days of trading. *TURNOVER_1D and TURNOVER_5D* are total trading volume divided by the number of shares offered on the first day and the first five days of trading, respectively. *LARGENET_1D and LARGENET_5D* are buyer-initiated large trades less seller-initiated large trades divided by total dollar trading volume on the first day and the first five days of trading, respectively. *ADJOTC_1D* and *ADJOTC_5D* are market-adjusted open-to-close return during the first day and the first five days of trading, respectively. *VOLATILITY* is standard deviation of intraday returns on first day of trading normalized by offer price. *ASVI* is abnormal *Google Search Volume Index*, defined as search volume index during book-building week minus median of search volume index in previous eight weeks. *ADJRTN_6M, ADJRTN_1Y,* and *ADJRTN_18M* are 6-month, 1-year and 18-month buy-and-hold market-adjusted returns from closing price on the first day of trading.

Variables	N	Mean	Median	Max	Min	Std Dev
OFFER	293	3.89	2.73	37.00	0.43	3.97
PLACING	293	68.82	70.00	99.34	50.00	17.15
SUBRATE	293	171.55	68.00	1703.00	0.07	247.71
PRE_IPO_RTN	293	13.58	9.65	61.92	-13.59	14.31
RANGE	293	25.00	24.93	66.67	7.00	8.30
SIZE	293	21.95	21.72	29.65	18.01	1.94
PROCEEDS	293	7.05	7.10	11.74	1.01	1.63
UWREP	293	0.55	1	1	0	0.50
H_SHARE	293	0.20	0	1	0	0.40
REVISION	293	3.66	6.94	20.42	-33.33	10.10
TOP	293	0.42	0	1	0	0.49
ADJIR	293	14.34	6.29	190.87	-23.06	25.77
OTO	293	13.39	6.77	122.22	-27.62	21.13
SMALLNET_1D	293	-0.26	-0.15	15.66	-51.58	4.93
SMALLNET_5D	293	-0.34	-0.11	20.42	-20.05	3.60
TURNOVER_1D	293	0.58	0.44	3.53	0.02	0.49
TURNOVER_5D	293	0.21	0.15	2.81	0.01	0.22
LARGENET_1D	293	-2.10	-0.13	51.75	-61.85	12.14
LARGENET_5D	293	-1.23	0.00	16.86	-37.85	8.12
ADJOTC_1D	293	0.77	-0.12	76.02	-25.05	10.72
ADJOTC_5D	293	1.02	-0.61	108.46	-29.06	15.25
VOLA_1D	293	3.31	2.41	23.45	0.35	2.87
VOLA_5D	293	2.55	1.92	18.72	0.35	2.31
ASVI	158	75.02	41.67	900.00	-52.84	116.55

Table 2.2 Correlation matrix

PLACING is the proportion of shares finally allocated to Placing tranche in an IPO. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Public tranche. *PRE_IPO_RTN* is average first-day return of five latest IPOs before the IPO. *RANGE* is price range announced in its prospectus scaled by midpoint price. *SIZE* is the logarithm of total assets. *PROCEEDS* is the logarithm of the amount raised in millions of HK dollars. *UWREP* is a binary variable which equals one if one of lead managers is among the top ten based on underwriting market share. *H_SHARE* is a binary variable that equals one if an IPO is an H-share offering, and zero otherwise. *REVISION* is offer price divided by midpoint of initial price range minus one. *TOP* is a binary variable that equals one when offer price is set at the upper bound of price range. *ADJIR* is market-adjusted offer-to-close return on the first day of trading. *OTO* is offer to open return, that is, open price on the first day of trading divided by offer price minus one. *SMALLNET* is buyer-initiated small trades minus seller-initiated small trades divided by total dollar trading volume on the first day of trading. *TURNOVER* is total trading volume divided by the number of shares outstanding on the first day of trading. *LARGENET* is buyer-initiated large trades minus seller-initiated large trades divided by total dollar trading volume on the first day of trading. *ADJOTC* is market-adjusted open-to-close return on the first day of trading. *VOLATILITY* is standard deviation of intraday returns on the first day of trading. *ASVI* is abnormal *Google Search Volume Index*, defined as search volume index during book-building week minus median of search volume index in previous eight weeks. *ADJRTN_1Y* is 1-year buy-and-hold market-adjusted returns from closing price on the first day of trading.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
PLACING	(1)	1														
SUBRATE	(2)	-0.5778	1													
PRE_IPO_RTN	(3)	-0.3249	0.2741	1												
RANGE	(4)	0.0963	-0.1240	-0.1183	1											
SIZE	(5)	0.1551	0.0489	0.1355	-0.2452	1										
PROCEEDS	(6)	0.0171	0.1324	0.1656	-0.2151	0.8494	1									
REVISION	(7)	-0.6497	0.4350	0.3369	-0.2131	0.1022	0.1881	1								
OTO	(8)	-0.4338	0.5709	0.3255	-0.0043	0.0337	0.1229	0.3785	1							
SMALLNET_1D	(9)	-0.0582	0.0022	-0.0121	-0.0104	0.0524	0.0532	0.1187	0.0514	1						
TURNOVER	(10)	-0.4858	0.4646	0.1217	0.0343	-0.1258	0.0740	0.3085	0.5665	0.2318	1					
LARGENET	(11)	-0.2406	0.1444	0.0162	0.0109	-0.1159	-0.0792	0.1436	0.1659	0.1749	0.2925	1				
ADJOTC	(12)	0.0035	-0.0261	-0.0821	-0.0183	-0.0448	-0.0537	-0.0268	0.0207	0.4641	0.3758	0.3610	1			
VOLATILITY	(13)	-0.1851	0.1723	0.1678	0.0737	-0.2180	-0.1483	0.1082	0.5107	0.1583	0.5270	0.2468	0.3427	1		
ASVI	(14)	-0.3035	0.3685	0.0450	0.1471	0.0192	0.0182	0.2951	0.2540	0.0435	0.0796	0.0839	-0.0087	0.0003	1	
ADJRTN_1Y	(15)	0.1692	-0.1020	-0.1224	-0.0419	0.1235	0.0567	-0.1087	-0.0711	-0.0663	-0.1812	-0.1364	-0.0591	-0.0834	-0.1253	1

Table 2.3 Pre-market sentiment and aftermarket sentiment

This table reports two-by-two contingency table and relative frequency (%) are shown in parenthesis. The full sample is sorted by subscription rate (*SUBRATE*) as pre-market sentiment measure. IPOs with *SUBRATE* above (below) its sample median are classified as IPOs of "High" ("Low") pre-market sentiment. The full sample is then sorted by small trade order imbalance *(SMALLNET_1D)* as aftermarket sentiment measure. IPOs with *SMALLNET_1D* above (below) with median are classified as IPOs of "High" ("Low") aftermarket sentiment.

	Aftermarket Sentiment		
Pre-market Sentiment	High	Low	Total
High	74	72	146
	(25.26%)	(24.57%)	(49.83%)
Low	73	74	147
	(24.91%)	(25.26%)	(50.17%)
Total	147	146	293
	(49.83%)	(50.17%)	(100.00%)

Table 2.4 Pre-market sentiment and offer price revision

The dependant variable, *REVISION* is offer price divided by midpoint of initial price range minus one. *SUBRATE* is the number of shares subscribed by retail investors divided by the number of shares assigned to Public tranche. *ASVI* is abnormal *Google Search Volume Index*, defined as search volume index during book-building week minus median of search volume index in previous eight weeks. *PRE_IPO_RTN* is average first-day return of five latest IPOs before the IPO. *RANGE* is price range announced in its prospectus divided by midpoint price. *SIZE* is the logarithm of total asset. *UWREP* is a binary variable which equals one if one of lead managers is among the top ten based on underwriting market share. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Dependent Variable: *REVISION*		
Variables	Model 1	Model 2
SUBRATE	0.014***	
	(6.58)	
ASVI		0.028***
		(4.24)
PRE_IPO_RTN	0.159***	0.202***
	(4.22)	(3.88)
RANGE	-0.171***	-0.216**
	(-2.66)	(-2.35)
SIZE	-0.128	-0.503
	(-0.33)	(-0.94)
UWREP	1.396	0.830
	(1.10)	(0.43)
H_SHARE	0.185	1.001
	(0.12)	(0.45)
Constant	5.299	15.052
	(0.64)	(1.28)
Observations	293	158
R-square	0.265	0.207

Table 2.5 Pre-market sentiment, sentiment deterioration and offer-to-open return

The dependant variable, *OTO*, is defined as open price on the first day of trading divided by offer price minus one. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Public tranche. *R_SMALLNET* is the standardized ranking of buyer-initiated small trades less seller-initiated small trades divided by total dollar trading volume during the immediate market trading windows. *PRE_IPO_RTN* is average first-day return of five latest IPOs before the IPO. *RANGE* is price range announced in its prospectus divided by midpoint price. *VOLATILITY* is standard deviation of intraday returns during immediate market trading windows. *SIZE* is the logarithm of total asset. *UWREP* is a binary variable which equals one if one of lead managers is among the top ten based on underwriting market share. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. *REVISION* is offer price divided by the midpoint of initial price range minus one. Year dummies are included but omitted in the report. In Model 1, I present the result of full sample. In Model 2 to Model 5, I present the results of high pre-market sentiment subsample, which has a higher *SUBRATE* than the sample median. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Dependant Variable: *OTO*					
	Full Sample	Subsample with High Pre-market Sentiment			
		1-Day		5-Day	
Variables	Model 1	Model 2	Model 3	Model 4	Model 5
SUBRATE	0.040***	0.034***	0.028***	0.034***	0.028***
	(5.78)	(4.15)	(3.50)	(4.15)	(3.47)
R_SMALLNET		12.668**	15.440***	12.760**	15.593***
		(2.03)	(3.23)	(2.25)	(3.25)
PRE_IPO_RTN	0.147	0.082	-0.007	0.094	0.002
	(1.59)	(0.62)	(-0.06)	(0.71)	(0.02)
RANGE	0.125	0.167		0.218	
	(0.96)	(0.66)		(0.85)	
VOLATILITY			3.190***		3.219***
			(3.95)		(4.10)
SIZE	-0.859	-0.970	0.229	-0.958	0.185
	(-1.29)	(-0.93)	(0.24)	(-0.93)	(0.20)
UWREP	1.931	0.208	-0.682	0.981	0.134
	(0.81)	(0.05)	(-0.21)	(0.26)	(0.04)
H_SHARE	3.488	7.191	6.858	7.667	7.521
	(0.91)	(1.15)	(1.26)	(1.24)	(1.39)
REVISION	0.240**	0.059	0.174	0.085	0.256
	(1.97)	(0.18)	(0.68)	(0.25)	(0.96)
Constant	19.283	21.240	-14.033	18.908	-14.694
	(1.37)	(0.90)	(-0.72)	(0.80)	(-0.76)
Observations	293	147	147	147	147
R-squared	0.387	0.355	0.531	0.356	0.533

Table 2.6 Aftermarket sentiment and open-to-close return

The dependant variable, *ADJOTC*, is market-adjusted open-to-close return. *SMALLNET* is buyer-initiated small trades minus seller-initiated small trades divided by total dollar trading volume on the first trading day. *TURNOVER* is total trading volume divided by the number of shares outstanding on the first day of trading. *VOLATILITY* is standard deviation of intraday returns on first day of trading. *LARGENET* is buyer-initiated large trades minus seller-initiated large trades divided by total dollar trading volume on the first day of trading. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Public tranche. *PRE_IPO_RTN* is average first-day return of five latest IPOs before the IPO. *RANGE* is price range announced in its prospectus divided by its midpoint price. *SIZE* is the logarithm of total asset. *UWREP* is a binary variable which equals one if one of lead managers is among the top ten based on underwriting market share. *H_SHARE* is a binary variable that equals one if an IPO is an H-share offering, and zero otherwise. *REVISION* is offer price divided by midpoint of initial price range minus one. *TOP* is a binary variable that equals one when offer price is set at the upper bound of price range. *OTO* is offer to open return, that is, open price on the first day of trading divided by offer price minus one. Year dummies are included but omitted in report. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Dependant Variable: *ADJOTC*						
	1-Day			5-Day		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SMALLNET	0.901***		0.826***	1.657***		1.456***
	(8.30)		(7.85)	(5.67)		(5.44)
TURNOVER		11.744***			20.795***	
		(4.04)			(5.06)	
VOLATILITY	1.452***	0.960**	1.276***	3.715***	3.229***	3.580***
	(6.35)	(2.40)	(5.74)	(6.94)	(5.32)	(6.76)
LARGENET			0.216***			0.390***
			(4.95)			(5.28)
SUBRATE	0.002	-0.005	0.001	0.005	0.000	0.004
	(0.62)	(-1.59)	(0.31)	(1.52)	(0.03)	(1.29)
PRE_IPO_RTN	-0.139***	-0.142***	-0.125**	-0.254***	-0.277***	-0.231***
	(-3.00)	(-2.83)	(-2.80)	(-4.91)	(-4.69)	(-4.74)
RANGE	-0.081	-0.074	-0.080	-0.041	-0.086	-0.027
	(-1.20)	(-1.00)	(-1.24)	(-0.55)	(-1.02)	(-0.37)
SIZE	-0.227	0.403	-0.036	0.759*	1.196**	0.955**
	(-0.57)	(0.91)	(-0.09)	(1.76)	(2.55)	(2.32)
UWREP	0.771	1.266	0.381	-0.364	0.534	-0.833
	(0.58)	(0.89)	(0.30)	(-0.23)	(0.30)	(-0.54)
H_SHARE	1.620	1.475	1.542	2.494	2.462	2.336
	(0.95)	(0.89)	(0.94)	(1.36)	(1.11)	(1.34)
REVISION	-0.113	-0.096	-0.121*	-0.116	-0.043	-0.130
	(-1.53)	(-1.08)	(-1.71)	(-1.35)	(-0.46)	(-1.56)
TOP	1.817	1.091	1.282	3.636**	3.040	3.313*
	(1.13)	(0.65)	(0.83)	(2.02)	(1.46)	(1.94)
OTO	-0.111**	-0.175***	-0.108**	-0.177***	-0.213***	-0.187***
	(-3.07)	(-3.64)	(-3.10)	(-3.53)	(-4.64)	(-3.83)
Constant	5.308	-11.170	1.958	-19.200**	-28.802***	-23.305**
	(0.60)	(-1.06)	(0.23)	(-1.97)	(-2.84)	(-2.54)
Observations	293	293	293	293	293	293
R-square	0.366	0.326	0.418	0.582	0.490	0.619

Table 2.7 Trading of small and large investors

This table reports small and large order imbalance. *SMALLNET* is buyer-initiated small trades minus seller-initiated small trades divided by total dollar trading volume on the first trading day. *LARGENET* is buyer-initiated large trades minus seller-initiated large trades divided by total dollar trading volume on the first day of trading. *H_H* represents IPOs with high pre-market sentiment and high aftermarket sentiment. *H_L* represents IPOs with high pre-market sentiment and low aftermarket sentiment. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

1-Day Period	*H_L* (Obs=73)	*H_H* (Obs=74)	All (Obs=293)
Mean of *SMALLNET*	-3.24	3.18	-0.27
Mean of *LARGENET*	-4.07	4.52	-2.10
Correlation between *SMALLNET* and *LARGENET*	-0.0038	0.3105***	0.1749***

5-Day Period	*H_L* (Obs=68)	*H_H* (Obs=79)	All (Obs=293)
Mean of *SMALLNET*	-2.99	1.99	-0.34
Mean of *LARGENET*	-2.71	3.31	-1.23
Correlation between *SMALLNET* and *LARGENET*	0.1162	0.1763	0.2539***

Table 2.8 Investor attention and retail demand

This is regression with subscription rate as the dependant variable. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Public tranche. *ASVI* is abnormal *Google Search Volume Index*, defined as search volume index during book-building week minus the median of search volume index in previous eight weeks. *PRE_IPO_RTN* is average initial return of five latest IPOs before the IPO. *RANGE* is price range announced in its prospectus divided by its midpoint price. *SIZE* is the logarithm of total assets. *UWREP* is a binary variable that equals one if one of lead managers is among the top ten based on underwriting market share. *H_SHARE* is a binary variable that equals one if an IPO is an H-share offering, and zero otherwise. Year dummies are included but omitted in report. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Dependant Variable: *SUBRATE*	
Variables	Model 1
ASVI	0.784***
	(3.50)
PRE_IPO_RTN	5.438***
	(2.94)
RANGE	-3.805**
	(-2.48)
SIZE	-24.86**
	(-2.15)
UWREP	11.94
	(0.26)
H_SHARE	121.2**
	(2.23)
Constant	659.5***
	(2.71)
Observations	158
R-square	0.335

Table 2.9 IPO long-run underperformance

H_H subsample includes IPOs with high pre-market sentiment and high aftermarket sentiment. *H_L* subsample includes IPOs with high pre-market sentiment and low aftermarket sentiment. *ADJOTC_1D* and *ADJOTC_5D* are market-adjusted open-to-close return in one-day and five-day periods, respectively. *ADJRTN_6M, ADJRTN_1Y,* and *ADJRTN_18M* are 6-month, 1-year and 18-month buy-and-hold market-adjusted returns from closing price on the first day of trading.

Panel A: Market-adjusted returns for full sample				Obs:293
Returns	Mean	Median	Min	Max
ADJOTC_1D	0.77	-0.12	-25.05	76.02
ADJOTC_5D	1.02	-0.61	-29.06	108.46
ADJRTN_6M	-1.56	-6.27	-100.15	182.94
ADJRTN_1Y	-0.74	-16.28	-108.91	243.45
ADJRTN_18M	2.87	-19.22	-132.33	531.65
Panel B: Market-adjusted returns for *H_L* subsample				Obs:74
	Mean	Median	Min	Max
ADJOTC_1D	-6.33	-4.35	-25.05	4.52
ADJOTC_5D	-7.50	-7.84	-25.31	12.40
ADJRTN_6M	0.24	-5.26	-81.81	182.94
ADJRTN_1Y	0.05	-22.34	-108.91	243.45
ADJRTN_18M	-2.57	-21.48	-107.98	352.94
Panel C: Market-adjusted returns for *H_H* subsample				Obs:73
Returns	Mean	Median	Min	Max
ADJOTC_1D	7.40	5.75	-16.84	29.95
ADJOTC_5D	11.13	6.66	-9.32	60.37
ADJRTN_6M	-7.00	-11.55	-74.66	91.03
ADJRTN_1Y	-11.54	-21.76	-105.30	197.10
ADJRTN_18M	-4.65	-30.19	-104.28	531.65

Table 2.10 Investor sentiment and long-run underperformance

This table examines determinants of long-run IPO underperformance. The dependant variable, *AJDRTN_1Y*, is 1-year and buy-and-hold market-adjusted returns from close price on the first day of trading. *SMALLNET* is buyer-initiated small trades minus seller-initiated small trades divided by total dollar trading volume. *TURNOVER* is total trading volume divided by the number of shares offered. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Public tranche. *VOLATILITY* is standard deviation of intraday returns. *SIZE* is the logarithm of total asset. *UWREP* is a binary variable that equals one if one of lead managers is among the top ten based on underwriting market share. *H_SHARE* is a binary variable that equals one if an IPO is an H-share offering, and zero otherwise. Year dummies are included but omitted in report. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Dependant Variable: *ADJRTN_1Y*				
	1-Day		5-Day	
Variables	Model 1	Model 2	Model 3	Model 4
SMALLNET	-2.355**		-2.225**	
	(-2.31)		(-2.34)	
TURNOVER		-19.912**		-46.996**
		(-2.12)		(-2.12)
SUBRATE	-0.016	-0.001	-0.017	-0.005
	(-0.87)	(-0.08)	(-0.89)	(-0.26)
VOLATILITY	0.819	2.463	3.295	5.236**
	(0.51)	(1.42)	(1.61)	(2.06)
SIZE	7.793***	7.197**	8.545***	7.854***
	(2.62)	(2.43)	(2.92)	(2.66)
UWREP	-8.054	-8.280	-5.766	-6.720
	(-0.83)	(-0.87)	(-0.61)	(-0.71)
H_SHARE	-8.854	-9.538	-11.485	-11.914
	(-0.68)	(-0.77)	(-0.87)	(-0.89)
Constant	-159.225**	-140.043**	-180.301***	-156.728**
	(-2.50)	(-2.22)	(-2.86)	(-2.49)
Observations	293	293	293	293
R-square	0.133	0.131	0.150	0.149

Table 3.1 Descriptive statistics of sample issues

The final sample consists of 373 IPOs in Hong Kong from April 2003 to December 2010. *OFFER_PRICE* is the final offer price in HK dollar. *PT_ALLO* is the proportion of shares finally allocated to Placing Tranche in an IPO. *BB_ALLO* is the proportion of shares allocated to the Placing Tranche less the proportion of shares purchased by "Cornerstone investors". *SIZE* is the logarithm of total assets in millions of Hong Kong dollars in the year before IPO. *PROCEEDS* is the logarithm of the amount of money raised in millions of HK dollars. *AGE* is the logarithm of firm age from its incorporation to listing. *U_REP* is a binary variable which equals one if at least one of lead managers is among the top ten based on underwriting market share and zero otherwise. *VC* is the binary variable which equals to one if the issuing firm is venture-capital backed and zero otherwise. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. *CSI* is a binary variable which equals one if "Cornerstone" investment agreements are made before the bookbuilding starts and zero otherwise. *CRISIS* is a binary variable equals one if the IPO is listed between Aug 2007 and Nov 2008 and zero otherwise. *RANGE* is price range announced in its prospectus scaled by midpoint price. *P_USE* is the logarithm of the usage of proceeds disclosed on the prospectus. *Pre_IPO_RTN* is the average IPO initial return over the two weeks before the bookbuilding starts. *Pre_IDX_RTN* is the Hang Seng Index return over the two weeks before the bookbuilding starts. *WINDOW_RTN* is the Hang Seng Index return over the bookbuilding periods. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Retail Tranche. *REVISION* is offer price divided by the midpoint of initial price range minus one. *IR* is offer-to-close return on the first day of trading. *OTO* is offer-to-open return, that is, open price on the first day of trading divided by offer price minus one. *OTC* is the open-to-close return in the first trading day. *TO_D1*, *TO_W1* and *TO_M1* are total trading volume divided by the number of shares offered on the first day, first week, and the first month of trading, respectively. *PS* is a binary variable which equals one if primary stabilization activities are conducted in aftermarket and zero otherwise. *GS* is a binary variable which equals one if "green shoe" option is exercised within the stabilization period and zero otherwise.

Variables	N	Mean	Median	Max	Min	Std Dev
OFFER_PRICE	373	4.04	2.75	44.68	0.43	4.42
PT_ALLO	373	69.22	70.00	99.34	50.00	17.58
BB_ALLO	373	63.44	60.00	98.70	10.43	19.82
SIZE	373	21.93	21.65	30.04	18.01	1.90
PROCEEDS	373	7.10	7.14	11.97	3.93	1.53
AGE	373	2.24	2.40	4.66	0.16	0.86
U_REP	373	0.55	1	1	0	0.49
VC	373	0.07	0	1	0	0.25
H_SHARE	373	0.17	0	1	0	0.38
CSI	373	0.29	0	1	0	0.46
CRISIS	373	0.15	0	1	0	0.36
RANGE	373	25.47	25.24	66.67	6.83	8.10
P_USE	373	1.75	1.79	2.94	0	0.40
Pre_IPO_RTN	373	10.66	4.98	61.92	-13.59	13.85
Pre_IDX_RTN	373	1.18	1.59	11.37	-11.75	3.71
WINDOW_RTN	373	1.16	1.29	14.59	-12.63	4.43
SUBRATE	373	173.43	58	1703	0.07	254.84
REVISION	373	2.73	5.90	20.42	-36.67	11.00
IR	373	12.81	5.60	192.59	-23.33	24.67
OTO	373	11.77	5.35	122.22	-27.62	19.62
OTC	373	0.86	-0.52	75.00	-24.30	11.09
TO_D1	373	0.46	0.33	3.53	0.01	0.50
TO_W1	373	1.11	0.83	14.22	0.03	1.17
TO_M1	373	1.78	1.31	18.72	0.06	1.74
PS	373	0.39	0	1	0	0.49
GS	373	0.67	1	1	0	0.47

Table 3.2 Institutional allocation in pre-market during 2003 to 2010

This table summarizes institutional allocation between the years 2003 to 2010. *PT_ALLO* is the percentage of shares allocated to Placing Tranche. *BB_ALLO* is the percentage of shares allocated to bookbuilding investors, calculated as percentage of shares allocated to Placing Tranche minus percentage of shares allocated to Cornerstone Investors.

Panel A: The Distribution of Share Allocated to Placing Tranche

	2003	2004	2005	2006	2007	2008	2009	2010	Total
Allocation to Placing Tranche(PT_ALLO)									
90%(Highest)	6	12	26	13	13	16	16	34	136
	30.00%	40.00%	57.78%	27.66%	18.06%	72.73%	28.07%	42.50%	36.46%
70%	5	5	7	7	13	3	15	10	65
	25.00%	16.67%	15.56%	14.89%	18.06%	13.64%	26.32%	12.50%	17.43%
60%	2	4	4	4	7	2	7	4	34
	10.00%	13.33%	8.89%	8.51%	9.72%	9.09%	12.28%	5.00%	9.12%
50%(Lowest)	7	9	8	23	39	1	19	32	138
	35.00%	30.00%	17.78%	48.94%	54.17%	4.55%	33.33%	40.00%	37.00%
Total	20	30	45	47	72	22	57	80	373

Panel B: Percentage of Shares allocated to Placing Tranche (PT) and Bookbuilding Investors (BB)

		2003	2004	2005	2006	2007	2008	2009	2010	Total
Allocation to Placing Tranche(PT_ALLO)										
90%(Highest)	*PT_ALLO*	90.00%	88.11%	90.12%	88.82%	88.92%	91.16%	89.03%	91.34%	90.00%
	BB_ALLO	89.44%	86.86%	86.00%	80.97%	77.34%	87.51%	81.56%	77.53%	82.46%
70%	*PT_ALLO*	72.00%	71.00%	71.43%	71.43%	71.92%	71.67%	70.83%	70.86%	71.32%
	BB_ALLO	68.65%	71.00%	66.71%	69.31%	68.08%	65.26%	69.10%	58.57%	66.97%
60%	*PT_ALLO*	60.00%	59.13%	60.00%	60.00%	60.00%	60.00%	60.71%	60.00%	60.00%
	BB_ALLO	60.00%	59.13%	60.00%	60.00%	57.87%	60.00%	54.28%	55.60%	57.76%
50%(Lowest)	*PT_ALLO*	50.00%	50.27%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%
	BB_ALLO	50.00%	44.01%	50.00%	44.29%	39.63%	50.00%	47.30%	46.07%	44.44%
Total	*PT_ALLO*	68.49%	70.04%	77.40%	64.77%	61.95%	83.80%	67.76%	70.68%	69.22%
	BB_ALLO	67.50%	67.67%	74.29%	59.50%	53.34%	80.27%	63.51%	61.48%	63.44%

Table 3.3 Trading in early IPO aftermarket

This table summarizes the weekly trading volume and percentage over the first month after IPO. Small and large trades are classified using the cut-offs of HK$50,000 and HK$500,000, respectively. Buyer- and seller-initiated trades are identified using the Lee and Ready (1991) algorithm.

Panel A: Dollar trading volume over the first month after IPO (in millions of HK$)										
	Week 1		Week 2		Week 3		Week 4		1-Month	
Subgroups	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Large Buy	1162.15	186.49	205.92	117.75	133.48	6.7	122.82	5.97	1624.33	221.04
Large Sell	633.07	138.69	157.35	137.1	102.71	8.53	94.87	5.81	987.36	163.47
Small Buy	203.95	101.21	63.88	26.41	51.32	19.02	50.01	17.02	369.27	174.2
Small Sell	185.46	97.23	59.25	26.37	48.41	20.42	47.59	18.7	341.44	170.13
Total Volume	2741.25	985.14	845.68	207.27	621.36	143.07	593.85	116.46	4802.35	1614.24

Panel B: Trading in early IPO aftermarket under different allocation levels (in percentage of total trading volume)						
	Large Trades			Small Trades		
	Buy	Sell	Buy-sell	Buy	Sell	Buy-sell
Panel B.1 Trading as percentage of total trading volume in first week						
Allocation to Placing Tranche (PT_ALLO)						
90%(Highest)	24.98	18.03	6.96	9.79	9.65	0.14
70%	18.93	12.73	6.20	11.72	11.54	0.18
60%	22.39	14.68	7.71	10.54	10.72	-0.18
50%(Lowest)	19.58	11.81	7.77	12.91	12.45	0.46
Total	21.98	14.67	7.32	11.34	11.11	0.23
Panel B.2: Trading as percentage of total trading volume in second week						
Allocation to Placing Tranche (PT_ALLO)						
90%(Highest)	10.68	11.25	-0.57	13.90	13.60	0.29
70%	7.47	8.08	-0.61	14.65	15.21	-0.56
60%	9.36	9.39	-0.03	15.16	14.39	0.77
50%(Lowest)	7.62	8.17	-0.55	15.16	16.02	-0.87
Total	9.03	9.50	-0.47	14.61	14.85	-0.24
Panel B.3: Trading as percentage of total trading volume in first month						
Allocation to Placing Tranche (PT_ALLO)						
90%(Highest)	18.89	15.42	3.47	11.31	10.83	0.44
70%	14.74	11.24	3.50	12.79	12.81	-0.18
60%	16.49	12.61	3.88	11.82	11.73	0.08
50%(Lowest)	14.91	10.33	4.58	13.66	13.37	0.31
Total	16.62	12.67	3.96	12.48	12.19	0.29

Table 3.4 Pre-issue market conditions and institutional allocation

This table reports the market condition in pre-issue period within different institutional allocation level groups. *_ALLO* is the percentage of shares allocated to Placing Tranche.

Panel A:Pre-issue index returns (*Pre_IDX_RTN*) and institutional allocation				
	Obs	Mean	Median	Std. Dev.
Allocation to Placing Tranche (PT_ALLO)				
90%(Highest)	136	0.46	0.66	3.82
70%	65	0.92	1.21	3.81
60%	34	1.54	2.54	3.83
50%(Lowest)	138	1.93	2.11	3.40
Total	373	1.18	0.19	3.71
Difference			1.47	
		t=3.362		
		(p=0.001)		
Panel B: Pre-issue IPO average initial returns (*Pre_IPO_RTN*) institutional allocation				
	Obs	Mean	Median	Std. Dev.
Allocation to Placing Tranche (PT_ALLO)				
90%(Highest)	136	5.38	2.40	13.30
70%	65	18.54	10.23	24.51
60%	34	17.16	13.88	15.82
50%(Lowest)	138	17.28	12.25	18.00
Total	373	13.15	0.96	18.55
Difference	11.91			
		t =6.218		
		(p=0.000)		
Panel C: Correlations		*Pre_IPO_RTN*		*Pre_IDX_RTN*
Allocation to Placing Tranche		-0.2898***		-0.1780***
(PT_ALLO)		(0.000)		(0.001)

Table 3.5 Pre-issue public information and institutional allocation

This table examines the relationship between pre-issue public information and institutional allocation. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Retail Tranche. *PT_ALLO* is the proportion of shares finally allocated to Placing Tranche in an IPO. *BB_ALLO* is the proportion of shares allocated to the Placing Tranche less the proportion of shares purchased by "Cornerstone investors". *CSI* is a binary variable which equals one if "Cornerstone" investment agreements are made before the bookbuilding starts and zero otherwise. *PROCEEDS* is the logarithm of the amount of money raised in millions of HK dollars. *SIZE* is the logarithm of total assets in millions of Hong Kong dollars in the year before IPO. *AGE* is the logarithm of firm age from its incorporation to listing. *U_REP* is a binary variable which equals one if at least one of lead managers is among the top ten based on underwriting market share and zero otherwise. *VC* is the binary variable which equals to one if the issuing firm is venture-capital backed and zero otherwise. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. *CRISIS* is a dummy variable which equals one if the listing date of an IPO is between Aug 2007 and Nov 2008 and zero otherwise. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Variables	Subscription Rate in Retail Tranche (*SUBRATE*)	Allocation to Placing Tranche (*PT_ALLO*)	Allocation to Bookbuilding Investors (*BB_ALLO*)
Pre_IDX_RTN	6.142**	-0.509**	-0.447*
	(2.01)	(-2.08)	(-1.74)
Pre_IPO_RTN	3.776***	-0.391***	-0.339***
	(3.19)	(-6.60)	(-5.28)
CSI	43.563*	2.015	-18.514***
	(1.66)	(0.98)	(-8.03)
PROCEEDS	67.391***	-5.826***	-5.081***
	(3.66)	(-4.57)	(-3.68)
SIZE	-61.212***	6.175***	5.790***
	(-4.74)	(7.03)	(5.62)
AGE	-15.311	-0.162	0.584
	(-1.00)	(-0.15)	(0.50)
U_REP	-56.976	2.811	3.105
	(-1.21)	(1.24)	(1.25)
VC	-69.931***	2.332	1.987
	(-2.89)	(0.78)	(0.63)
H_SHARE	48.833	-4.287	-3.980
	(1.34)	(-1.54)	(-1.23)
CRISIS	-98.547***	7.872***	7.843***
	(-3.38)	(3.31)	(3.15)
Constant	1056.68***	-22.427*	-21.548
	(5.27)	(-1.67)	(-1.32)
Observations	373	373	373
R-squared	0.201	0.256	0.378

Table 3.6 Institutional allocation and partial adjustment in pre-market

This table presents the test results of the "partial adjustment" in two subsamples with high and low institutional allocation, respectively. IPOs are classified into high and low subsample based on *PT_ALLO*, which is the proportion of shares finally allocated to Placing Tranche in an IPO. *REVISION* is offer price divided by the midpoint of initial price range minus one. *REVISION_P* is a binary variable which equals one if the price revision is positive, and zero otherwise. *WINDOW_RTN* is the Hang Seng Index return over the bookbuilding periods. *RANGE* is price range announced in its prospectus scaled by midpoint price. *SUBRATE* is the number of shares subscribed by individual investors divided by the number of shares assigned to Retail Tranche. *PROCEEDS* is the logarithm of the amount of money raised in millions of HK dollars. *SIZE* is the logarithm of total assets in millions of Hong Kong dollars in the year before IPO. *AGE* is the logarithm of firm age from its incorporation to listing. *U_REP* is a binary variable which equals one if at least one of lead managers is among the top ten based on underwriting market share and zero otherwise. *VC* is the binary variable which equals to one if the issuing firm is venture-capital backed and zero otherwise. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. *PT_HIGH* is the binary variable equals to one if shares allocated to Placing Tranche represents 90% of total issue and zero otherwise. *REVISON_H*, *REVISON_P_H* and *WINDOW_R_H* are interactions terms of *PT_HIGH* and *REVISON*, *REVISON_P*, and *WINDOW_RTN*, respectively. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Dependent Variable: offer-to-open return						
	Pooled Sample for Both High and Low Institutional Allocation		Subsample for High Institutional Allocation (*PT_ALLO*=90%)		Subsample for Low Institutional Allocation (*PT_ALLO*=50%)	
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
REVISION	0.237*	1.430*	0.378***	0.291**	-0.172	0.245
	(1.78)	(1.90)	(2.64)	(2.01)	(-0.55)	(0.93)
REVISION_P	1.277	-1.789*		1.936***		-1.422*
	(1.61)	(-1.93)		(2.89)		(-1.88)
WINDOW_RTN	0.618***	1.062***	0.077	0.116	0.906**	1.056***
	(2.84)	(2.97)	(0.39)	(0.59)	(2.49)	(2.95)
RANGE	0.186	-0.038	0.418***	0.320***	0.033	0.303
	(1.61)	(-0.08)	(2.84)	(2.77)	(0.17)	(1.41)
SUBRATE	0.036***	0.034***	0.049***	0.038***	0.033***	0.036***
	(6.07)	(5.59)	(3.44)	(2.67)	(5.21)	(5.29)
PROCEEDS	1.405	0.571	0.196	-0.148	1.179	0.231
	(1.12)	(0.42)	(0.15)	(-0.11)	(0.58)	(0.11)
SIZE	-0.504	-0.025	0.806	0.889	1.248	2.402
	(-0.52)	(-0.02)	(0.76)	(0.84)	(0.67)	(1.28)
AGE	-0.258	-0.362	0.929	0.998	-0.126	0.355
	(-0.21)	(-0.30)	(0.76)	(0.85)	(-0.05)	(0.14)
U_REP	-1.585	-0.330	0.999	1.737	-3.794	-3.036
	(-0.58)	(-0.12)	(0.41)	(0.68)	(-0.88)	(-0.70)
VC	-2.834	-1.729	-3.701	-3.146	-3.922	-3.343
	(-1.11)	(-0.58)	(-0.92)	(-0.75)	(-1.20)	(-0.93)
H_SHARE	5.476	4.986	-5.456	-5.094	14.768**	14.862**
	(1.47)	(1.31)	(-1.56)	(-1.50)	(2.28)	(2.30)
PT_HIGH		-12.732***				
		(-2.99)				
REVISION_H		1.591**				
		(2.06)				
REVISION_P_H		2.968***				

		(2.76)				
WINDOW_R_H		-0.774*				
		(-1.83)				
Constant	0.057	7.993	-28.232	-28.005	-26.720	-46.571
	(0.00)	(0.52)	(-1.58)	(-1.59)	(-0.78)	(-1.33)
Observations	274	274	136	136	138	138
R-squared	0.442	0.466	0.296	0.312	0.368	0.381

Table 3.7 Institutional trading and the probability of informed trading (PIN) in aftermarket

This table examines the relationship between institutional trading and the amount of private information contained in IPO share price. The dependant variable, probability of informed trading (*PIN)*, is estimated using the maximum likelihood method as proposed by Easley and O'Hara (1992). *PT_ALLO* is the proportion of shares finally allocated to Placing Tranche in an IPO. *LARGENET_W1* is buyer-initiated large trades less seller-initiated large trades divided by total dollar trading volume during the first 5 trading days after IPO. *SMALLNET_W1* is buyer-initiated small trades less seller-initiated small trades divided by total dollar trading volume during the first 5 trading days after IPO. *PROCEEDS* is the logarithm of the amount of money raised in millions of HK dollars. *SIZE* is the logarithm of total assets in millions of Hong Kong dollars in the year before IPO. *AGE* is the logarithm of firm age from its incorporation to listing. *U_REP* is a binary variable which equals one if at least one of lead managers is among the top ten based on underwriting market share and zero otherwise. *VC* is the binary variable which equals to one if the issuing firm is venture-capital backed and zero otherwise. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. *TO_M1* total trading volume over the first month divided by the number of shares offered. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Dependant Variable: *PIN_1-Month*

Variables	Model 1	Model 2	Model 3	Model 4
PT_ALLO	0.002***		0.002***	0.002***
	(6.91)		(6.92)	(7.16)
LARGENET_W1		0.001**	0.001**	0.001**
		(2.00)	(2.09)	(2.19)
SMALLNET_W1				-0.003
				(-1.56)
PROCEEDS	-0.061***	-0.077***	-0.064***	-0.064***
	(-6.87)	(-8.77)	(-7.21)	(-7.28)
SIZE	0.015**	0.020***	0.010*	0.009*
	(1.99)	(3.53)	(1.77)	(1.76)
AGE	-0.003	-0.004	-0.001	-0.002
	(-0.37)	(-0.57)	(-0.22)	(-0.35)
U_REP	-0.009	0.003	-0.006	-0.004
	(-0.76)	(0.25)	(-0.48)	(-0.34)
VC	0.015	0.016	0.014	0.013
	(0.95)	(0.97)	(0.85)	(0.89)
H_SHARE	0.010	0.000	0.009	0.008
	(0.67)	(0.01)	(0.62)	(0.54)
TO_M1	-0.000***	-0.000***	-0.000***	-0.000***
	(-6.13)	(-5.11)	(-5.97)	(-5.98)
Constant	0.232***	0.293***	0.276***	0.271***
	(3.03)	(3.12)	(3.47)	(3.44)
Observations	373	373	373	373
R-squared	0.517	0.452	0.524	0.529

Table 3.8 Institutional trading and post-IPO performance

This table reports the relationship between institutional aftermarket trading and the post-IPO performance in short- and long-terms. Post-IPO excess returns are calculated as buy-and-hold returns starting from the 6th trading day of an IPO and subtracted by contemporaneous Hang Seng index return. *PT_ALLO* is the proportion of shares finally allocated to Placing Tranche in an IPO. *LARGENET_W1* is buyer-initiated large trades less seller-initiated large trades divided by total dollar trading volume during the first 5 trading days after IPO. *SMALLNET_W1* is buyer-initiated small trades less seller-initiated small trades divided by total dollar trading volume during the first 5 trading days after IPO. *SIZE* is the logarithm of total assets in millions of Hong Kong dollars in the year before IPO. *MTB* is market-to-book ratio calculated at the time of IPO. *AGE* is the logarithm of firm age from its incorporation to listing. *U_REP* is a binary variable which equals one if at least one of lead managers is among the top ten based on underwriting market share and zero otherwise. *VC* is the binary variable which equals to one if the issuing firm is venture-capital backed and zero otherwise. *H_SHARE* is a binary variable equals one if an IPO is an H-share offering, and zero otherwise. *OTO* is offer-to-open return, that is, open price on the first day of trading divided by offer price minus one. *OTC* is the open-to-close return in the first trading day. Year Dummies are included but not reported. Robust *t*-statistics are in parentheses. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Variables	1-Month Post-IPO Excess Return	6-Month Post-IPO Excess Return	1-Year Post-IPO Excess Return	18-Month Post-IPO Excess Return
LARGENET_W1	0.263***	0.768***	0.652**	0.817**
	(4.25)	(3.01)	(2.51)	(2.37)
SMALLNET_W1	-0.005	-1.527*	-1.524	0.198
	(-0.02)	(-1.75)	(-1.54)	(0.12)
PT_ALLO	0.036	0.346**	0.377*	0.199
	(0.78)	(2.26)	(1.90)	(0.79)
SIZE	0.091	2.739	6.045**	7.006**
	(0.20)	(1.16)	(2.21)	(2.11)
MTB	0.052	11.427***	10.405**	10.094
	(0.80)	(3.50)	(2.20)	(1.47)
AGE	-0.681	3.869	1.921	3.171
	(-0.85)	(0.75)	(0.32)	(0.44)
U_REP	-1.871	-5.615	-14.534*	-14.680
	(-1.08)	(-1.05)	(-1.92)	(-1.53)
VC	-1.426	19.097**	1.283	3.304
	(-0.73)	(2.11)	(0.12)	(0.23)
H_SHARE	-3.546*	-16.052*	-15.356	-15.352
	(-1.70)	(-1.81)	(-1.29)	(-0.87)
OTO	0.022	0.116	0.000	-0.003
	(0.44)	(0.72)	(0.00)	(-0.01)
OTC	0.005	-0.082	0.014	-0.136
	(0.07)	(-0.63)	(0.07)	(-0.56)
Constant	-1.509	-94.721	-169.165**	-194.409**
	(-0.14)	(-1.62)	(-2.56)	(-2.41)
Observations	373	373	373	373
R-squared	0.112	0.208	0.161	0.141

Table 3.9 The Heckman two-stage estimation

The first stage probit model is to regress a dichotomous selection variable (*AFT_BUY*) on IPO characteristics that may influence the aftermarket buying decision. And inverse Mills ratio is estimated and inserted in second stage estimates. *LARGENET_W1* is buyer-initiated large trades minus the seller-initiated divided by total dollar trading volume during first week of trading. *PT_ALLO* is the proportion of allocation to the Placing Tranche at the offering. *PROCEEDS* is the logarithm of cash amount raised. *AGE* is the logarithm of firm age from its incorporation to listing. *U_REP* is a binary variable which equals one if one of lead managers is among the top ten based on underwriting market share and zero otherwise. *VC* is the binary variable which equals to one if the issuing firm is venture-capital backed and zero otherwise. *P_USE* is the logarithm of the usage of proceeds disclosed on the prospectus. *RANGE* is price range announced in its prospectus divided by its midpoint price. *REVISION* is offer price divided by midpoint of initial price range minus one. *OTO* is offer-to-open return, that is, open price on the first day of trading divided by offer price minus one. *OTC* is the open-to-close return in the first trading day. *PS* is a binary variable which equals one if primary stabilization activities are conducted in aftermarket and zero otherwise. *GS* is a binary variable which equals one if "green shoe" option is exercised within the stabilization period. *TO_W1* is total trading volume in the first week of trading divided by the number of shares outstanding. *SMALLNET_W1* is buyer-initiated small trades minus the seller-initiated divided by total dollar trading volume in the first week of trading. *SIZE* is the logarithm of total assets. . *MTB* is market-to-book ratio calculated at the time of IPO. *H_SHARE* is a binary variable which equals one if the IPO is an H-share offering and zero otherwise. *TO_M1* total trading volume over the first month divided by the number of shares offered. *Inverse Mills Ratio* is conditional expectation of the residual in first stage probit model given the selection variable *AFT_BUY*. Robust *t*-statistics are in parentheses. . *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively.

Variables	*AFT_BUY*	1-month Post-IPO Excess Return	6-month Post-IPO Excess Return	1-year Post-IPO Excess Return	18-month Post-IPO Excess Return	1-month PIN
LARGENET_W1		0.330***	1.036***	0.765**	1.045**	0.001***
		(3.64)	(3.83)	(2.11)	(2.24)	(3.25)
PT_ALLO	-0.017*	0.146**	0.664***	0.832***	0.503	0.002***
	(-1.86)	(2.07)	(3.26)	(3.10)	(1.48)	(6.41)
AGE	-0.178*	-0.568	4.082	1.221	5.378	-0.005
	-(1.69)	(-0.46)	(1.13)	(0.26)	(0.89)	(-0.80)
U_REP	-0.636***	-2.151	-3.763	-17.634**	-15.392	-0.051***
	(-2.60)	(-0.91)	(-0.55)	(-1.98)	(-1.36)	(-4.26)
VC	0.111	-1.714	11.616	-6.707	-3.629	0.002
	(0.31)	(-0.44)	(1.04)	(-0.46)	(-0.19)	(0.10)
P_USE	-0.328**					
	(-2.32)					
RANGE	-0.003					
	(-0.22)					
REVISION	-0.017					
	(-1.68)					
OTO	-0.012*	-0.020	-0.047	-0.001	-0.044	
	(-1.65)	(-0.38)	(-0.31)	(-0.00)	(-0.18)	
OTC	0.014	-0.091	-0.716**	-0.465	-0.016	
	(1.52)	(-0.93)	(-2.28)	(-1.12)	(-0.03)	
PS	-0.750***					
	(-3.70)					
GS	0.221					
	(1.24)					
PROCEEDS	0.621***					-0.052***
	(6.01)					(-9.21)
TO_W1	0.004***					
	(3.55)					
SMALLNET_W1		-0.448	-0.815	-1.232	0.291	0.002
		(-1.17)	(-0.66)	(-0.74)	(0.14)	(1.02)
SIZE		-1.451*	-0.643	4.258	8.248**	
		(-1.94)	(-0.26)	(1.31)	(1.99)	

MTB		0.126**	0.299	0.310	0.326	
		(2.03)	(1.46)	(1.12)	(0.91)	
H_SHARE		-2.210	-8.125	-5.283	-4.383	0.007
		(-0.81)	(-0.93)	(-0.45)	(-0.29)	(0.46)
TO_M1						-0.000**
						(-2.57)
Inverse Mills Ratio		-17.422***	-29.740**	-22.928	-0.392	0.088***
		(-4.35)	(-2.30)	(-1.32)	(-0.02)	(4.04)
Constant	-2.644**	26.869*	-37.986	-145.429**	-232.990***	0.400***
	(-2.49)	(1.65)	(-0.73)	(-2.12)	(-2.67)	(4.10)
Observations	373	373	373	373	373	373

Figure 3.1 Large and small order imbalance as percentage of weekly volume within the first month after IPO

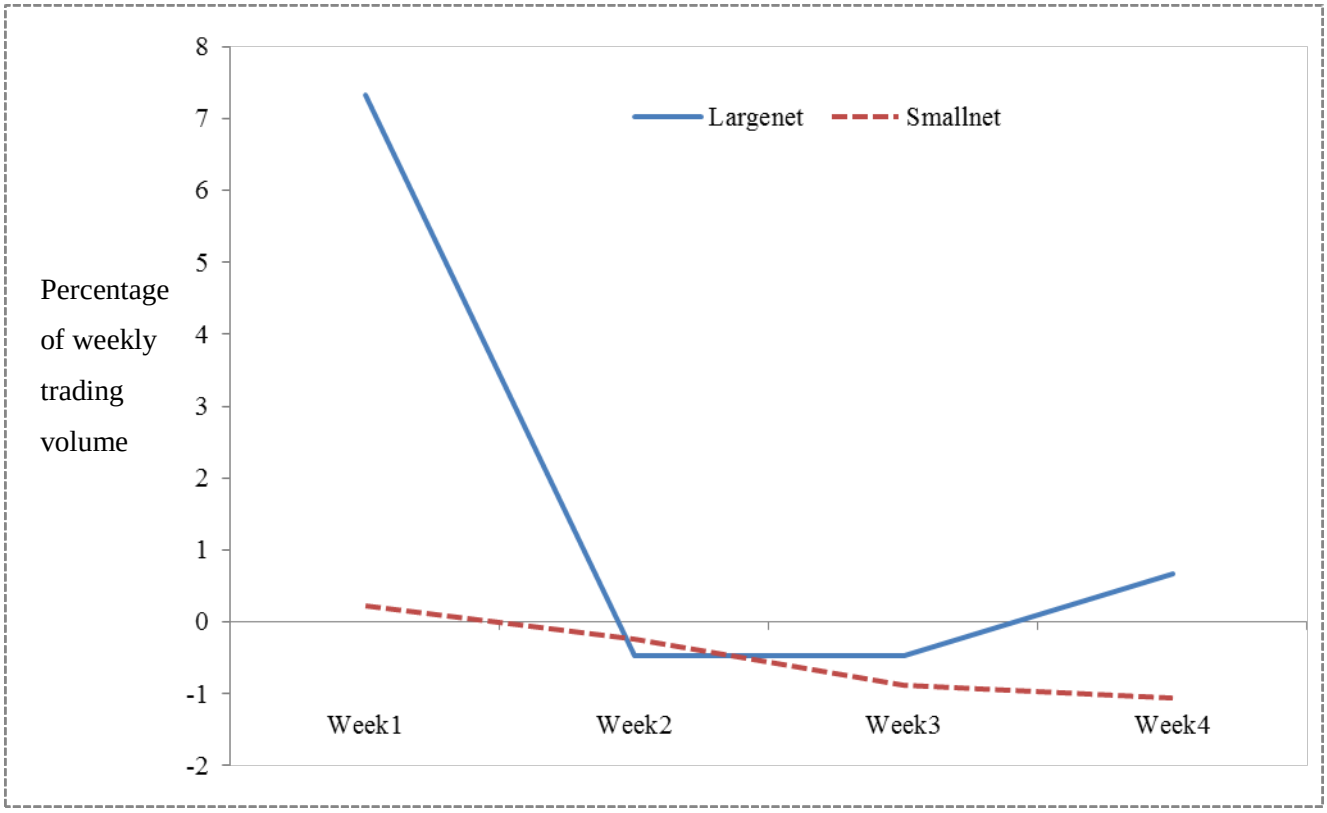

Figure 3.2 Timeline of the IPO process in Hong Kong