Pre-Market Trading and IPO Pricing

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Abstract

By studying the only mandatory pre-IPO market in the world – Taiwan's Emerging Stock Market (ESM), we document that pre-market prices are very informative about post-market prices and that the pre-market price efficiency increases with trading liquidity of the stock. Pre-market prices are utilized in IPO pricing. The ESM price-earnings ratio shortly before the IPO explains about 90% of the variation in the offer price-earnings ratio. Moreover, the more informative the pre-market price is, the higher the offer price (i.e., the lower the underpricing). However, the average IPO underpricing level remains high despite the pre-market (with an average first-day return of 55%). Our evidence suggests that agency problems between underwriters and issuers can lead to high levels of underpricing even when there is little information asymmetry or valuation uncertainty about the stock.

JEL codes: G14, G15, G18, G24, G32

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1. Introduction

The most important issue as well as the biggest challenge in an initial public offering (IPO) is the pricing of the stock. It has been well documented that IPOs tend to be underpriced (relative to aftermarket prices), and that the underpricing phenomenon is persistent over time and across countries.[1] The associated money left on the table, defined as the first-day price increase multiplied by the number of shares issued, is a measure of foregone proceeds and constitutes a substantial opportunity cost of going public for issuing firms. Whether such underpricing is fair compensation for investors to compensate them for risk-bearing or providing information, or is excessive and is driven by agency problems between issuers and underwriters is the most important debate in the IPO literature (see Ljungqvist (2007) and Ritter (2011) for surveys on the topic). Using data from a quasi-natural experiment in Taiwan, we are able to provide evidence that agency problems can result in extreme underpricing.

Underwriters are paid large amounts for pricing and allocating the IPO shares. How do they arrive at the offer price for an IPO? Under the U.S. bookbuilding method, underwriters, with the acquiescence of the issuer, first come up with a suggested price range partly using benchmark pricing, which is based on the firm's accounting measures and comparable firms' price multiples. The method often leads to wide possible price ranges (e.g., depending on what firms are picked as the comparables) and may not adequately account for the uniqueness of the issuing firm. Kim and Ritter (1999) and Purananandam and Swaminathan (2004) show that implied offer prices based on this method are far from being accurate, in terms of predicting the offer price or the after-market price.

[1] Jay Ritter's website provides a table with the average level of underpricing in each of 52 countries.

After setting the file price range, underwriters then collect investors' indications of interest during the bookbuilding process and determine a final offer price. Bookbuilding mechanism design (asymmetric information) theory argues that value-relevant information is collected during the process and underwriters allocate underpriced shares to induce investors to truthfully reveal information (Benveniste and Spindt, 1989). The information obtained this way is thus costly to the issuer. In addition, self-interested underwriters have strong incentives to bias the price down so that they can allocate underpriced shares to their favored clients in exchange for side payments (Loughran and Ritter, 2002; Reuter, 2006; Nimalendran, Ritter and Zhang, 2007; Liu and Ritter, 2010 and 2011; Goldstein, Irvine and Puckett 2011).

In recent years, a new phenomenon has emerged that may potentially provide a solution to the IPO pricing problem – trading platforms or markets for pre-IPO firms (hereafter pre-IPO markets or simply pre-markets). These pre-markets are in various forms. For example, in the U.S., online sites such as SecondMarket and SharesPost started around 2009, partly due to strong demand for private company stocks such as Facebook. These sites hold auctions for private company stocks from time to time. In the UK, firms can choose to get listed and trade on the Alternative Stock Market before an IPO (Derrien and Kecskés, 2007). In Europe, "grey market" trading exists for many IPOs (Aussenegg, Pichler and Stomper, 2006; Cornelli, Goldreich and Ljungqvist, 2006). In Taiwan, since 2005 firms are actually required to be listed on a so-called "emerging stock market" and trade there for at least six months before applying for an IPO.

It is reasonable to think that a pre-market would reduce the uncertainty about a firm's valuation, achieving the goal of price discovery, and therefore leading to high pricing efficiency during an IPO. Existing studies of European grey markets and the AIM in London indicate that pre-market prices are informative about post-market prices (Löffler, Panther and Theissen 2005;

Aussenegg, et al., 2006; Derrien and Kecskés, 2007). However, given the small amount of evidence, it is not clear whether this conclusion is limited to these specific markets. More importantly, whether these pre-market prices enhance IPO price efficiency is an open question. For example, Aussenegg et al. (p. 860) conclude that "we cannot determine from our data whether when-issued trading enhances the efficiency of IPO pricing" due to the possible interference between the trading and the IPO process (a grey market starts after an IPO price range is determined and coincides with the bookbuilding period). Therefore the benefits of pre-market trading are still unclear. Meanwhile, there are concerns about such markets, including low liquidity of the market and potential fraud. Questions therefore arise in the U.S. regarding whether pre-markets should be allowed, encouraged, and regulated. The U.S. Securities and Exchange Commission (SEC) has shown concerns about related issues (see Stone (2011) and Smith and Eaglesham (2012)), although the Jumpstart Our Business Startups (JOBS) Act of 2012 relaxed a number of regulatory constraints on pre-markets.

This study contributes to the debate by investigating the only mandatory pre-IPO market in the world – Taiwan's Emerging Stock Market (ESM). Since 2005, private firms in Taiwan have been required to trade on the ESM for at least six months before they can apply for an IPO. The mandatory feature of the market frees our study from self-selection issues, and the relatively long trading period prior to an IPO enables us to observe how trading evolves as the IPO approaches.

In the first portion of the paper, we examine how useful the pre-market is in terms of price discovery and what factor determines the accuracy of the pre-market price. Consistent with previous studies, we find that as the time approaches to the IPO, the pre-market prices become very informative, measured against the after-IPO market price. The ratio of the pre-market price to the offer price explains 77% of the variation in the initial return, i.e., the aftermarket price to the

offer price. Controlling for other variables, including the price revision following the bookbuilding period and the lagged market return, does not improve the regression R-squared much, raising it to just 79%.

We hypothesize that the pre-market price should be more informative if the trading is more liquid. We find supporting evidence for the hypothesis using three measures of (il)liquidity. A one standard-deviation increase in each of the illiquidity measures increases price inaccuracy by 2-3 percentage points, which is 15-20% of the mean of the price inaccuracy.

In the second portion of the analysis, we examine whether and to what degree the pre-market price is utilized in setting the IPO offer price. Given the informativeness of the pre-market price, asymmetric information based theories predict that (a) the offer price should largely depend on the pre-market price; and (b) the more accurate the pre-market price is in predicting the aftermarket price, the closer the offer price should be set to the pre-market price, i.e., the lower the price discount (i.e., one minus the offer price relative to the pre-market price). We find evidence consistent with both predictions. The pre-market price-earnings ratio alone explains more than 90% of the variation in the price-earnings ratio calculated using the offer price. After taking into account the issuer's pre-market price, peer firms' pricing ratios have little explanatory power for the offer price. Moreover, the price discount increases with price inaccuracy and volatility, and decreases with firm size. The results suggest that underwriters not only understand the usefulness of the pre-market price, but also understand when the pre-market price is more informative.

In the third and final portion of the paper, we investigate the fascinating question of why underpricing remains high despite the pre-market. In our sample, the average offer price is set at 67% of the pre-market price and the average initial return is 55%. Such a high level of underpricing is hard to explain with the asymmetric information theories of IPO underpricing. Our evidence

suggests that underwriters deliberately underprice shares for their own benefit. We show that the investment banks receive higher fees from underwriting IPOs as underpricing increases. Their brokerage revenues also increase with the money left on table from the IPOs they underwrite, consistent with the hypothesis that they allocate underpriced shares to their favored clients in exchange for brokerage business. In addition, the underpricing level increases with the lead underwriter's incentive and bargaining power to underprice.

Our paper contributes to the IPO literature in several ways. Although the paper is not the first to document that pre-market prices are informative, we add to the limited evidence on this topic. Cornelli, Goldreich, and Ljungqvist (2006) and Dorn (2009) also study grey-markets but focus on different research questions. Both use pre-market prices as a proxy for investor sentiment, and find that high pre-market prices are associated with high first-day returns but poor long-run returns.

Second, we extend the analysis of pre-market trading by shedding light on what factors make pre-market prices more informative and more useful in IPO pricing. Third, we demonstrate two aspects of how the pre-market price is used in IPO pricing. On the one hand, it largely determines the offer prices, as it should. On the other hand, we document that underpricing levels remain high even when there is little asymmetric information or valuation uncertainty about the IPO stock. Underwriters have strong monetary incentives to underprice the stock, and the bookbuilding IPO method gives them a lot of power to do so. With the advantage of our setting, we provide clean evidence that agency problems can cause high levels of underpricing. We thus offer new insights for the important debate on the causes for underpricing and the choice of the IPO method.

2. Institutional Features

2.1 Taiwan's Emerging Stock Market

Taiwan has one of the most active stock markets in the world, with two major stock exchanges: the Taiwan Stock Exchange (TWSE) and the Gre Tai Securities Market (GTSM).[2] The Emerging Stock Market (ESM) was established in January 2002 and is operated by the GTSM, although this market is separate from the GTSM. By providing a trading platform for unlisted stocks, the ESM is intended to prepare firms for getting listed by improving information transparency and increasing firm visibility. The pre-IPO trading is also expected to achieve price discovery for the security. Since 2005, it is mandatory for unlisted firms to trade on the ESM for at least 6 months before they can apply for an IPO and get listed on either the TWSE or GTSM.

To register its stock for ESM trading, a firm mainly needs to satisfy two conditions. First, it needs to make public disclosure of its financials and important corporate events. In particular, it has to disclose audited annual and semi-annual financial statements. In contrast, a public firm traded on the TWSE or GTSM is required to publish quarterly financial statements. Second, the firm needs written recommendations by two or more securities firms, one of which is designated as the lead advisory/recommending securities firm, which typically will also act as the lead underwriter in its later IPO.[3] In contrast, both the TWSE and GTSM markets have listing requirements on firm age, size, profitability, and the number of shareholders, with the TWSE generally having more rigorous listing requirements than the GTSM.

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[2] At the end of 2010, there were 758 companies listed on the TWSE with a total market capitalization of US$784 billion, ranked number 21 in the world according to the World Federation of Exchanges web site. The total trading volume of TWSE in 2010 was US$895 billion, ranked number 14 in the world. In addition, GTSM listed 564 companies with a total market capitalization of US$66.15 billion and had a total trading volume of US$187.78 billion in 2010.

[3] Firms traded on ESM are also subject to additional regulations: (1) they have an additional regulator – the Financial Supervisory Commission (FSC). Otherwise a private firm only needs to register with the Economics Department Business Bureau; and (2) they are subject to additional laws such as Securities Trading Law. Otherwise a private firm just needs to comply with Company Law.

When registering on the ESM, a firm needs to prepare a prospectus that makes disclosures about the firm's background and history, top management and board of directors, stock ownership, and firm financials. When applying for an IPO later, the firm has to file a new prospectus that makes similar disclosures, and in addition includes underwriters' opinions of the firm and the IPO including the valuation of the stock.

The ESM is a dealers' market. The recommending securities firms act as dealers or market-makers for the recommended stock, and are each required to start with an inventory of at least 100,000 shares, acquired from the firm. Furthermore, dealers as a group are required to start with an initial inventory equal to the maximum of 1.5 million shares or 3% of shares outstanding.[4] Thus, the public float for ESM trading is at least 3% of shares outstanding. The dealers assume the responsibility to continuously offer bid and ask quotes during normal trading hours through the Emerging Stock Computerized Price Negotiation and Click System (the Click System). The quoted spread cannot exceed five percent of the ask price. The recommending securities firms are obligated to trade at the quoted prices as long as the order does not exceed 2,000 shares. Investors can submit orders to the Click System through their brokers. For orders of 10,000 shares and more, the investor can directly negotiate with a dealer via other methods (e.g. by letter, telephone, or face-to-face talk). All trades are recorded in the Click System. In contrast, both TWSE and GTSM operate through fully automated electronic trading systems where only limit orders are accepted and orders are executed in strict price and time priorities. Shorting is prohibited on the ESM.

Both individual and institutional investors can trade on the ESM, although mutual funds were prohibited from participating during our sample period. However, based on interviews with

[4] Most of the stocks have a market price of $NT10-50 (less than US$2), so even a small firm frequently has more than 50 million shares outstanding. Other securities firms can become a dealer for the stock later, with a required initial inventory of at least 30,000 shares. While trading on the ESM, firms can do private placements.

staff members of the ESM and practitioners in various institutions, we learned that insurance companies, pension funds, and foreign institutional investors tend to refrain from investing in ESM stocks since they are viewed as highly risky securities. So ESM trading is typically dominated by retail investors. Once the company applies for an IPO, the following group of insiders is restricted from selling: directors, supervisors[5], and shareholders who hold at least 10% of the firm.

Compared to the other pre-markets in the world—that of the Alternative Investment Market (AIM) on London Stock Exchange (LSE), discussed by Derrien and Kecskés (2007), and the when-issued markets (aka "grey markets") in European countries, Taiwan's ESM has two distinctive features: (1) it is mandatory for pre-IPO firms, and hence there is no concern for selection bias; (2) the pre-IPO market for each stock lasts for a relatively long period (by regulation, at least 6 months), which enables us to make observations about the dynamic development of pre-IPO trading and helps us understand what factors might affect the usefulness of such trading and the related pre-IPO prices.

2.2 The IPO process in Taiwan

Taiwan had experimented with various IPO methods in the past including fixed-price offering (FPO hereafter), auction, bookbuilding, hybrid auction (auction plus FPO), and hybrid bookbuilding (bookbuilding plus FPO). Since 2005, the hybrid bookbuilding method has become the dominant method. In our sample of 218 IPOs, most IPOs use hybrid bookbuilding, with 14 firms using pure bookbuilding. During our sample period of October 25, 2005 through March 1,

[5]According to Article 216 of Company Law of Taiwan, a firm subject to public disclosure requirements should have at least two supervisors, who are elected at shareholder meetings. A supervisor shall not concurrently be a director, manager, or employee of the company. Supervisors in Taiwan are responsible for monitoring directors and management. Supervisors function similarly to the audit committee of firms in the United States, fulfilling their duties by providing an independent and objective review of the financial reporting process, internal controls, and the audit function.

2011, only two IPOs use non-bookbuilding methods (one uses a hybrid auction and the other uses a fixed-price offering). Both are excluded from the sample.

As a normal practice worldwide, the bookbuilding tranche is open to institutional and large individual investors. The FPO tranche, on the other hand, is open to the general public. Bookbuilding investors give indications of interest (nonbinding bids with price-quantity combinations). Allocation to bookbuilding investors is at the discretion of underwriters. In the FPO, each investor can only submit an order of one lot (i.e., one thousand shares) and allocation is determined by a lottery if there is oversubscription. FPO investors do not submit price suggestions, with the understanding that they will receive the same offer price as bookbuilding investors. Institutional investors are prohibited from participating in the FPO.[6] Except for the overallotment, only primary shares are sold in the IPOs during our sample period. That is, all of the shares offered are from the issuing firm rather than selling shareholders. Typically 70-90% of total shares offered in the IPO are sold through the bookbuilding tranche.

For most hybrid bookbuilding IPOs in our sample, the bookbuilding and FPO tranches run simultaneously.[7] The bookbuilding period typically lasts for four business days during which investors submit nonbinding orders. The FPO process often starts one day later than the bookbuilding but ends at the same time. An announcement is made on the first day of bookbuilding that, among other things, gives a suggested price range. On the business day after bookbuilding ends, the offer price is determined before noon (we call this day the pricing day and the last

[6]As argued in Chiang, Qian and Sherman (2010), although a hybrid IPO consists of two stages, they are essentially independent sales from the investors' point of view. They state, "Due to the one-lot size constraint and frequent oversubscription in the fixed-price tranche, any investor who wishes to make a large investment will not rely on the second-stage sale. More important, there is little room for strategic interaction between the two stages." (p1210). Their comments are for hybrid auctions during 1995-2000, during which the fixed-price offer is run after the auction tranche, hence referred as "second-stage sale". The same argument, however, applies to the hybrid bookbuilding method in our sample.

[7] Out of the 218 IPOs, 14 of them use pure bookbuilding, and another 32 firms use sequential hybrid bookbuilding, i.e., the fixed-price tranche follows the bookbuilding tranche. The rest are simultaneous hybrid bookbuilding IPOs.

bookbuilding day the pre-pricing day). In the next few days, allocation is determined and proceeds are collected. In most cases, the stock starts trading on the TWSE or GTSM on the 5th business day after the pricing day. ESM trading continues after the pricing, ending the day before TWSE or GTSM trading commences. A figure in the internet appendix shows the time line of the IPO process.

3. The Sample and Data

Our sample includes 218 firms that went public between October 25, 2005 and March 1, 2011.[8] All sample firms are subject to a regulation effective in January 2005 that firms must be traded on the Emerging Stock Market for at least 6 months before they apply for an IPO. Three types of firms are exempt from this requirement: firms spun off from listed parents, privatization of public enterprises, and foreign companies. Although some of these exempted firms chose to trade on the ESM before an IPO, we exclude all of them from our sample.[9]

We obtain daily trading data for ESM stocks including price, return, trading volume, and shares outstanding from Taiwan Economic Journal (TEJ). TEJ also provides daily trading data for listed firms after the IPO. Firm information such as firm age, assets, whether it is backed by venture capital, and accounting information is collected from the ESM or IPO prospectus. IPO characteristics such as fees, offer price, and the number of shares issued in each tranche are

[8] Our sample starts with the first IPO that is subject to the mandatory ESM trading. The IPOs after our sample period are subject to a new regulation that the offer price may not be less than 70 percent of the average ESM trading price during the 10 business days before the bookbuilding agreement has been registered with the Taiwan Securities Association (TSA). The new rule also says that if there is a difference of 50 percent between the offer price and the closing price on the pre-price day, a concrete explanation needs to be provided.

[9] During our sample period, there are 8 IPOs that are spin-off firms and 32 that are foreign companies (including those that issue Taiwan Depository Receipts). Two IPOs are privatizations of public enterprises. One of them uses the hybrid auction IPO method and the other uses pure fixed-price offering. There is also one firm that went IPO during our sample period (in November 2005) but its IPO application was before 2005 and hence was not subject to the new regulation. These firms are excluded from our sample.

collected from three sources: the IPO prospectus, the bookbuilding and FPO announcement, and the underwriting announcement that is made after the bookbuilding and FPO processes are completed.

Table 1 presents the summary statistics of firm characteristics at two points of time: when firms start to trade on the ESM (Panel A) and when they apply for an IPO (Panel B). The median firm is 9 years old. When firms first trade on the ESM, with an average asset value of NT$2.1 billion (about U.S.$70 million) and an average annual revenue of NT$1.6 billion (about U.S. $53 million).[10] The average debt ratio (total liabilities relative to assets) is 41.3%. The average return on assets (ROA) is 9.2%. Forty-five percent of firms are backed by venture capital.

At the time of the IPO application, Panel B reports that on average firms are 1.7 years older, with increased assets, revenues, and ROA, and a decreased debt ratio relative to when ESM trading started. Panel C compares the differences in means and medians of these variables between the two time points, with all differences being significant at the 1% level.[11] In addition, the fraction of firms that are backed by venture capital has increased from 45% at the time of ESM listing to 56% at the time of the IPO application.

Table 2 shows the IPO characteristics. In the average IPO, the number of shares issued is 10.4% of the shares outstanding before the IPO. The average proceeds raised is $NT 495.3 million (U.S.$15 million). Both of these numbers are considerably lower than the corresponding numbers for U.S. IPOs, where the average IPO during 2005-2011 issued close to 50% of the pre-IPO shares outstanding and raised more than 15 times as much money, according to numbers listed on Jay

[10] All NT$ values in the paper are deflated to constant year 2011 NT$ based on Taiwan's CPI index. At the end of 2011, the exchange rate is US$1 =NT$30.29.

[11] We use paired t-tests for differences in means and Wilcoxon signed rank tests for differences in medians, assuming independence across IPOs. We do not test the significance of the change in firm age since the value of this variable increases by construction.

Ritter's website. Thirty percent of the firms are listed on the TWSE, and 70% are listed on the GTSM. The median P/E ratio (i.e., offer price relative to the annual earnings per share before the IPO) is 11.7. After excluding three outliers, the average P/E ratio is 18.4.[12] Price revision, computed as the offer price relative to the midpoint of the price range announced shortly before the bookbuilding process, minus 1, has a mean of 0.13%, a median of 0, and a standard deviation of 4.6%. None of the issues in our sample is priced outside of its price range.

We calculate the price discount as one minus the ratio of the offer price over the ESM closing price on the day before IPO pricing, multiplied by 100%. The average price discount is 33.0%. Alternatively, the ratio of the ESM closing price on the day before IPO pricing over the offer price minus one, multiplied by 100% (which we call expected initial return), has an average of 58.4%. In comparison, the initial return of IPO investors (i.e., the closing price on the first-trading day on TWSE/GTSM relative to the offer price minus one) has an average of 55.3%. Only 6.4% of IPOs drop in price on the first day of trading, and even then by no more than 10%.

With an average discount of 33% and an issue size of 10% of the pre-IPO shares outstanding, the money left on the table is approximately 3% of firm value, which is smaller than that in the United States, where the comparable numbers for 2005-11 are 10% (for the discount) and 50% (for the issue size), resulting in foregone proceeds of 5% of pre-IPO firm value. Furthermore, the investment banking fees in the U.S. are larger than in Taiwan (which will be discussed later), accentuating the difference in foregone proceeds.

We note that not all ESM firms have IPOs. There are 299 firms that have traded on the ESM during our sample period but haven't had an IPO by January 2014. Among them, 166 firms

[12] When applying for an IPO, firms in general are required to have positive earnings. However, a firm can be exempted from the requirement if it is deemed as advancing important innovations or participates in major national public construction projects. In our sample, two firms have negative earnings when applying for an IPO. Another firm has a tiny EPS and hence a P/E ratio larger than 1000. We exclude these three firms when the P/E ratio is used in our analysis.

stopped trading on ESM, mostly due to poor performance but sometimes because of mergers and acquisitions. We compare the 299 no-IPO firms with our sample firms in Table IA-1 of the internet appendix (http://bear.warrington.ufl.edu/ritter/ritterwp.htm). These no-IPO firms tend to be less profitable than our sample firms, and they suffer lower liquidity and lower returns during the first 6 months of ESM trading. Although more successful firms tend to have an IPO, the resulting selection does not affect the validity of our study, which focuses on the informativeness of ESM prices for those that do go public and to what extent such prices are incorporated into the offer price.

4. The Informativeness of ESM Prices

We focus on the ESM price shortly before IPOs. In the internet appendix, however, we report how trading and prices evolve for ESM stocks. Specifically, we examine its liquidity, returns, and volatility for three event periods: the six-month after its ESM trading starts, the six months prior to IPO application, and the three months prior to IPO pricing. For comparison, we also investigate the six-month period of trading on the TWSE or GTSM after the IPO. The general trend is that when a firm moves towards its IPO, its stock trading on the ESM becomes more liquid and less volatile; and it tends to have a large price run-up prior to the IPO. It is likely that these patterns are due to both the sample selection bias associated with successful IPOs, and greater liquidity in anticipation of the greater post-IPO liquidity to come.

4.1 Price accuracy on ESM

We examine the informativeness of the pre-market price in reflecting the fundamental value of a stock. To do that, we assume the after-IPO market price is efficient and use it as the benchmark.

Specifically, we define price error for stock *i* on day *t* as:

$$\text{Price Error}_{i,t} = \frac{P_{i,t} - P_{i,FTD}}{P_{i,FTD}},$$

where $P_{i,t}$ is the closing price on day t (t belongs to the pre-IPO period), and $P_{i,FTD}$ is the closing price on the first trading day on the TWSE or GTSM. We define the absolute value of price error as price inaccuracy, i.e.,

$$\text{Price Inaccuracy}_{i,t} = \left| \frac{P_{i,t} - P_{i,FTD}}{P_{i,FTD}} \right|.$$

We observe a clear decreasing trend for price inaccuracy as the time approaches to IPO. Table 3 reports the summary statistics of this variables on the days of 6, 3, 2, and 1months before, 1 day before and 4th day after IPO pricing.[13] At six months before the pricing (and after IPO application), the mean (median) price inaccuracy is 50.8% (35.1%). On the day before the pricing date, the mean (median) price inaccuracy is 14.8% (13.0%). The standard deviation also steadily decreases from 50.4% to 11.4%. It is clear that the pre-market price shortly before the IPO is close to and hence very informative about the aftermarket price.

Several reasons may contribute to the disparity between the ESM price on the pre-pricing day and the after-market price: (1) there might be information resolution over the 5-day period. This applies to firms on TWSE and GTSM as well, except that our sample firms have an important type of information resolution in common—the culmination of the IPO; (2) the trading environment changes. Now officially listed on the TWSE or GTSM, these stocks may gain more attention and attract more investors; their trading becomes more liquid, and hence prices more

[13] In the internet appendix, we also display a figure for the daily mean and median price inaccuracy for the period around IPO pricing, i.e., from six months before pricing or the IPO application date, whichever is later, to four business days after IPO pricing.

efficient; and (3) last but not least, there might be clientele changes of investors. As discussed before, institutional investors are either restricted or self-restricted from participating in the ESM market. Hence there may be more institutional investors investing in or trading the stock once it is listed on the TWSE or GTSM.

Table 3 also reports summary statistics for price error. It shows that mean and median price errors are mostly not significantly different from zero on the days of 6, 3, 2 and 1 month(s) before IPO pricing. However, on the day before pricing, the average pricing error is 6.0% and the median is 6.5%; both are statistically significant. This positive pricing error is consistent with the finding of Cornelli, Goldreich and Ljungqvist (2006) for European grey markets.

To further test the informativeness of the pre-market price, we explore the predictability of the initial return based on the pre-market price. Specifically, we use the expected initial return based on the pre-market price (i.e., pre-market price over the offer price, minus one) to predict the post-market first-day return. Table 4 shows the results. Column (1) displays the univariate regression result. The regression coefficient is 1.23 and is highly significant. The R-squared is a high 77%. In contrast, multivariate regressions predicting initial returns using U.S. data (without the pre-market) typically have R-squared's around 20% (e.g., see Hanley 1993; Lowry and Schwert 2004; Liu and Ritter, 2011). Although the regression coefficient of 1.23 is significantly different from 0, it is not significantly different from 1.00 (t-statistic = 1.49).

We are also interested to see, given the pre-market, whether bookbuilding still provides useful information for IPO pricing. For that purpose, in model (2) of Table 4 we look at the explanatory power of a well-known initial-return predictor—price revision (Hanley, 1993). Because studies using U.S. data (Table 5 of Loughran and Ritter, 2002 and Table 4 of Lowry and Schwert, 2004) have reported an asymmetric relation of initial returns to upward and downward

revisions, we include the price revision and the interaction of the price revision and a dummy variable for a positive price revision. Consistent with the literature, the initial return is positively related to price revision for downward revisions. But, unlike the U.S. pattern, there is not a stronger relation for positive revisions. Indeed, the sum of the two coefficients of 2.44 and -2.56—the marginal effect of positive price revision—is essentially zero in model 2. Furthermore, the coefficient on the lagged 3-week market return is significantly positive, suggesting that the underwriters ignore public information in revising the offer price. This is consistent with agency problems showing up in bookbuilding (Loughran and Ritter, 2002).

In column (3) of Table 4, we include the expected initial return, (asymmetric) price revision, the lagged 3-week market return, and a set of control variables. Specifically, we include firm size measured by log(assets), return on assets, a VC dummy that equals one if the firm is backed by venture capital, and return volatility during the 3 months prior to the pricing. We also include year and industry dummies. The coefficient on the expected initial return is similar to that in the univariate regression. The coefficients on price revision and its interaction with a positive revision dummy remain similar to the column (2) values. Among the control variables, stock volatility has a significantly positive coefficient, suggesting that riskier firms are underpriced more, which is consistent with information-based theories. The coefficient on the lagged market return becomes non-significant, suggesting that the ESM price reflects market returns. The R-squared is 79% for the multivariate regression, which is not much of an improvement from the univariate regression value of 77% in column (1) that uses expected initial return as the only explanatory variable.

4.2 Price accuracy and stock liquidity on ESM

We hypothesize that the informativeness of pre-market prices should depend on the

liquidity of the stock. The more liquid the stock trading, the more information may be incorporated into the stock price and hence the more efficient the price. We use three measures of illiquidity: the percentage of zero trading days (Rabinovitch, Silva and Susmel, 2003), the percentage of zero return days (Bekaert, Harvey and Lundblad, 2007; Chen, Lesmond and Wei, 2007), and the Amihud ratio (Amihud 2002).[14] The larger each of these measures, the less liquid the stock is. In regressions presented in the tables, we measure the illiquidity variables during the three months prior to the pricing day. We include the same control variables as in Table 4.

Table 5 reports results of both univariate and multiple regressions of pre-pricing day price inaccuracy on illiquidity. Consistent with our hypothesis, price inaccuracy increases with all measures of illiquidity (i.e., price accuracy increases with liquidity). In terms of economic significance, a one-standard-deviation increase in *% of zero-trading days* (16.76%) increases price inaccuracy by 2.48 percentage points (using the multiple-regression regression result); a one-standard-deviation increase in *%of zero-return days* (21.10%) increases price inaccuracy by 2.58 percentage points; and a one-standard-deviation increase in the *Amihud ratio* (10.66%) increases price inaccuracy by 2.46 percentage points. In comparison, the mean price inaccuracy is 14.78 percentage points. The coefficients on the control variables are not significant, although their signs are consistent with the notion that larger firms, less profitable firms, and less volatile firms tend to have higher price accuracy (i.e., lower price inaccuracy).

In unreported robustness checks, we run the same regressions using the turnover ratio or log(dollar volume) as a measure for liquidity. The coefficients on turnover and log(dollar volume)

[14] The Amihud ratio for firm *i* is defined as $A_i = \frac{1}{T}\sum_{t=1}^{T}\frac{|r_{i,t}|}{dvol_{i,t}}$, where $r_{i,t}$ is the daily stock return (in percentage points) and $dvol_{i,t}$ is daily dollar volume (in millions of NT$). It measures the price impact (i.e., the absolute value of the return) per unit of dollar volume. If the dollar trading volume was calculated using US dollars, the Amihud ratio would be approximately 30 times larger.

are all negative, and those on log(dollar volume) are significant at the 10% level. So the evidence is weaker but still consistent with the notion that price accuracy is positively related to liquidity. We also use the closing price 5 trading days after the first after-market trading day as the benchmark to compute price accuracy. We reach the same conclusion that liquidity increases price accuracy.

We also examine how price error depends on firm characteristics including liquidity (results not tabulated). Interestingly, we find that price error increases with illiquidity. In other words, the more illiquid the pre-market is, the more positively biased the pre-pricing day price is. There is weak evidence that price error decreases with volatility. The coefficients on the other variables that are included in Table 5 are not significant.

5. IPO Offer Price and Pre-Market Price

The previous section shows that as time approaches to the IPO, the pre-market price gets very informative about the fundamental value of the stock, measured by the after-market price. The pre-market price therefore should be useful in setting the IPO offer price. More specifically, the bookbuilding theories based on asymmetric information posit that underpricing is used to compensate regular investors for providing information that is not readily available from public sources (e.g., Benveniste and Spindt (1989) (with endowed costly information), and Sherman (2000) and Sherman and Titman (2002) (with costly information)). This framework generates predictions that the IPO offer price should exhibit the following features: (1) the offer price should largely depend on the pre-market price but not peers' pricing; (2) the more informative the pre-market price is, the closer and higher the offer price will be relative to the pre-market price; and (3) there should be little underpricing. We test the first two predictions in this section and explore

the third in the next section.

To test the first prediction, we run a horse-race between the stock's own pre-market price and its peer companies' prices in determining the IPO offer price. Specifically, we regress the (standardized) offer price on the stock's own pre-market price and its peer firms' market price. We are interested to see which variable explains more of the variation in the offer price. We standardize prices using two variables – earnings per share (EPS) and book value of equity per share, i.e., we use two price ratios: the P/E ratio and the M/B (market-to-book) ratio. For brevity, we present results using the P/E ratio and note that results are similar when the M/B ratio is used. For each sample firm, peer companies are identified in two alternative ways: (1) we include all firms in the same industry that are listed on either the TWSE or GTSM, and use the median price ratio; (2) we identify a matching firm in the same industry that is traded on the TWSE or GTSM and has the closest asset value as the IPO firm.

Panel A of Table 6 reports the summary statistics of P/E ratios. The regression results in Column (1) of Panel B show that the ESM P/E ratio explains 91.4% of the variation in offer price P/E ratios. In Column 2, the only explanatory variable is the industry median P/E. The regression coefficient is also positive and significant but the R-squared is only 1.9%. When we include both variables in the regression in Column (3), both the value and the t-statistic of the coefficient on the pre-market P/E remain similar to those in Column (1), but the coefficient on the industry median P/E becomes significantly negative. In addition, the R-squared is close to that in Column (1) (91.7% vs. 91.4%), suggesting that adding the industry median P/E in the regression does little to improve the fit of the model. Interestingly, given the high R^2, the slope coefficient for the pre-market P/E is approximately 0.6, rather than the 1.0 that might be expected. This, together with the small intercept (1.2), suggests that although the offer price largely depends on the pre-market

price, it is a sizable discount off the pre-market price. In other words, the offer price is on average set at approximately 60% of the pre-market price, consistent with the average price discount of 33.0% that we reported in Table 2.

Column (4) uses the matching firm's P/E ratio as the only explanatory variable and Column (5) includes both the matching firm's and the issuing firm's pre-market P/E ratios. In both regressions, the coefficient on the matching firm's P/E is not significant.

The results in Table 6 support the notion that the pre-market price is highly relevant in setting the IPO price. The information contained in the pre-market price is not captured by peer firms' price information, reflecting the effects of noise and outliers.

We now examine what determines the cross-sectional difference in the offer price relative to the pre-market price, i.e., the price discount. Asymmetric information-based theories of IPO underpricing hypothesize that the less risky the stock is and the more informative the pre-market price is, the less is the discount that should be taken when setting the IPO offer price

Table 7 reports the results of a regression of *price discount* on the stock and firm characteristics. Columns (1)-(5) present univariate regressions of the price discount on, respectively, pre-market *price inaccuracy*, pre-market stock *volatility*, a *VC dummy*, *ROA*, and *log(assets)*, and Column (6) presents a multiple regression including all of the variables as well as year and industry dummies. Consistent with the asymmetric information hypothesis, the coefficients on *price inaccuracy* and *volatility* are both significantly positive, and the coefficient on log(assets) is significantly negative. The coefficients on VC dummy and ROA are negative, as predicted by the hypothesis as well, although neither is statistically significant. In terms of economic significance, a one-standard-deviation increase in *price inaccuracy* (11.4 percentage point) increases the *price discount* by 2.0 percentage points; a one-standard-deviation increase in

volatility (1.5 percentage point) increases the *price discount* by 3.6 percentage points; and a one-standard-deviation increase in *log(asset)* (0.9) decreases the *price discount* by 3.4 percentage points.

One concern associated with using *price inaccuracy* in the previous regression is that it is not known at the time of IPO pricing. Alternatively, we use instrumental-variable regression method to test the impact of price inaccuracy on price discount, using pre-market liquidity as the instrument. Specifically, we model the first-stage regression as the multiple regressions in Table 5. In unreported results, we find significantly positive coefficients for price inaccuracy, which supports the notion that price discount decreases with the informativeness of the pre-market price.

6. IPO Underpricing and Underwriter Incentives

The evidence in the previous section suggests that underwriters do recognize the usefulness of the scaled pre-market price and largely rely on the information in setting the IPO offer price, in that it explains over 90% of the variation of the offer price, whereas the scaled multiple of peer firms explains little of the variation. Given that the existence of the pre-market price reduces valuation uncertainty of the stock and also the information asymmetry between different clienteles of investors, the information-based theory predicts that little underpricing is needed to compensate investors for providing private information.

In contrast to this prediction, we observe a substantial amount of underpricing in our sample: the average *price discount* is 33.0% and the average *expected initial return* is 58.4%. Similarly, the actual *initial return* of IPO investors averages 55.3%.[15] Such a high level of

[15] The high level of underpricing does not mean that the pre-market price is overlooked in setting the offer price. In fact, if the price cut is always 33% for all IPOs, then the pre-market price is the only variable considered. The results in Section 5 show that the pre-market price explains most of the variations in the IPO price.

underpricing is difficult to justify by information/risk reasons given the informativeness of the pre-market prices. Neither can it be explained by the lack of understanding of the information because the offer price does largely depend on the pre-market price.

The evidence therefore points to the possibility that agency problems play an important role in setting the IPO price. Loughran and Ritter (2002) and Liu and Ritter (2011), among others, argue that underwriters have incentives to underprice IPO shares more than necessary and allocate these underpriced securities to their favored clients in exchange for side payments. In the U.S., such side payments include future investment banking businesses (Liu and Ritter, 2010) and brokerage trading commissions (Reuter, 2006; Nimalendran, Ritter and Zhang, 2007; Goldstein, Irvine and Puckett, 2011).

In our setting, we explore the agency hypothesis with three tests: first, we examine whether underwriting-related income increases with underpricing. If yes, the underwriters will have direct monetary incentives to underprice IPO shares. Second, if these Taiwanese underwriters also trade underpriced shares for brokerage business, we expect that their brokerage revenues increase with the money left on the table of the IPOs they underwrite. Third, we explore the cross-sectional differences in underwriters' incentives and power to underprice. Under the agency hypothesis, the higher the incentives or bargaining power, the more the underpricing.

6.1 Underwriting income and IPO underpricing

In Taiwan, underwriters earn a sizable fraction of their fees from IPO investors in addition to a fixed fee (typically NT$5 million) they charge to the issuer (see Chen, Fok, and Wang (2006)). The fee structure is such that underwriters can earn more when investors are more enthusiastic about the security.[16] This provides a unique opportunity to directly test the agency theory.

[16] Chowdhry and Sherman (1996) argue that if the issuer (or the underwriter) collects interest float on investors' advance payment, then there is an additional incentive to underprice the offering. This does not apply to our sample

Specifically, we examine whether underwriter fee income increases with the underpricing level.

Underwriters receive variable investor fees across IPO issues. Fees are from both bookbuilding and FPO investors. Each FPO subscriber pays a fixed fee of NT$20, of which NT$8.5 goes to underwriters (the rest is paid to brokers and the TWSE for handling the orders). FPO fees are paid regardless of the allocation. Hence the higher the subscription ratio, the more fees the underwriters earn. We calculate the FPO fee as 8.5 times the number of subscribers, relative to the FPO proceeds (which is equivalent as 8.5 times the FPO subscription ratio, relative to the offer price). Since the subscription ratio has a large variation (a mean of 90 times and a standard deviation of 169), the FPO fee also varies considerably (with a mean of 2.0% and a standard deviation of 1.9%). When examining the relationship between the underpricing level and the FPO fee, we focus on the subscription ratio, which is the variable component of the FPO fee. Using FPO fees yield similar results.

For the bookbuilding tranche, underwriters have discretion on how much fee to charge on a per share basis. The bookbuilding fee as a percentage of the proceeds varies from 0 to 8.7%, with a mean of 1.7%. We calculate the total investor fee as the weighted average of the FPO fees and the bookbuilding fee, where the weighting variable is the proceeds raised in the two tranches.[17]

For the underpricing level, we use an ex ante price discount measure based on the price range specified in the bookbuilding announcement, instead of an ex post measure based on the offer price. This is because investor demand and fees are fixed before the offer price is finally set, so they must depend on the expected price discount level. Specifically, we define *intended price discount* as the midpoint of the price range relative to the closing pre-market price on the day

since investors only pay at the end of the bookbuilding or FPO submission period.

[17] For the 14 pure bookbuilding IPOs in our sample, the total investor fee equals the bookbuilding fee. Because of these 14 IPOs, the average total investor fee is not a number between the average FPO fee and the average bookbuilding fee (see Table 10 Panel A).

before the bookbuilding starts. The *intended price discount* turns out to be close to the actual *price discount* (the mean is 32.0% vs. 33.0%, the median is 30.5% vs. 31.4%, and the correlation is 0.89). Recall that the variable *price revision* has a standard deviation of only 4.6%.

Table 8 reports the results of regressions of underwriter fee income on *intended price discount*, with and without controlling for other firm and stock characteristics. The dependent variables in Panels B, C, and D are the FPO subscription ratio, the bookbuilding fee, and the total investor fee, respectively. For all six regressions, the coefficient on *intended price discount* is positive and with one exception, significant at the 5% level. Take the multivariate regression with the FPO subscription ratio as the dependent variable, for example, for which the coefficient is 4.13. This coefficient suggests that a one-standard-deviation increase in *intended price discount* (14.8%) increases the subscription ratio by 61.1 (4.13×14.8), which is economically significant given an average subscription ratio of 90. In the multivariate regression with the total investor fee as the dependent variable, a one-standard-deviation increase in *intended price discount* increases the total investor fee by 0.38 percentage point (=0.026×14.8). It is also economically significant given an average total investor fee of 1.67 percentage point. Given the average proceeds of NT$495.3 million, a total investor fee of 0.38% translates into NT$1.9 million. In comparison, the fixed fee the issuer pays to the underwriter is typically NT$5 million. Importantly, unlike the U.S., where gross spreads are usually negotiated as a percentage of the offer price, if the offer price is lowered, underwriter compensation from issuers does not decrease, and thus there are greater incentives to underprice in Taiwan than in the U.S.

The results in Table 8 show that fees increase with the intended price discount (i.e., the expected underpricing level). Hence underwriters have direct monetary incentives to underprice IPO shares to increase their own income from fees.

6.2 Underwriters' brokerage revenues and money left on the table from IPOs

Existing studies report that US underwriters have significant incentives to allocate underpriced shares to institutional investors who give them brokerage businesses. We explore this possibility in our sample by examining the relationship between an underwriter's brokerage revenues and the money left on the table from IPOs underwritten by the firm. A positive relationship is consistent with the notion that underwriters trade underpriced shares for brokerage business.

We hand-collect lead underwriters' brokerage revenues from their annual reports. There are 18 unique lead underwriters in our sample. For each IPO, we compute money left on the table as the shares issued times the difference between the pre-market price on the day before IPO pricing and the offer price. For each underwriter-year, we sum up the total money left on the table from the IPOs the firm lead underwrites.

We regress the underwriters' brokerage revenues (in the current and next year, respectively) on the total money left on the table. The agency hypothesis predicts that the more money that is left on the table, investors, as a *quid pro quo* in order to receive preferential allocations of shares, will overpay on commissions on other trades, increase the underwriter's overall brokerage revenues. Because each underwriter has a different normal level of revenues (some are bigger than others), in our empirical work we control for underwriter fixed effects. By doing so, we capture the within-firm changes in brokerage revenues due to changes in money left on the table.

Table 9 reports the regression results. The dependent variable is the current year's brokerage revenues (in millions) in Column 1 and the next year's brokerage revenues in Column 2. The main variable of interest is the total money left on the table during the year (in millions). Column 1 shows a significantly positive coefficient on the variable, suggesting that more money left on the table from IPOs are associated with an underwriter's brokerage revenues. Specifically, the coefficient of 0.34 suggests that for each dollar left on table from the IPOs it underwriters, the

underwriter receives 34 cents from the same year's brokerage revenues. Column 2 reports a positive coefficient of 0.23 which is statistically non-significant. These numbers are comparable to Liu and Ritter's (2010) estimate for US IPOs that 35% of money left on the table flows back to underwriters in the form of increased brokerage commissions (page 2052, footnote 30).

In unreported results, we find that after controlling for underwriter fixed effects, *money left on the table* has no positive relation with an underwriter's brokerage revenues in the previous year. In fact, the coefficient is negative. This indicates that the positive relations between IPO underpricing and the current and next year's brokerage revenues are unlikely due to spurious correlations. If anything, the negative coefficient in Column 6 is consistent with the notion that an underwriter has less incentive to underprice if their brokerage revenues are high in the previous year.

In a robustness check, we take natural logarithm of both brokerage revenues and total money left on the table as a method to control for effects of outliers, and re-estimate the regressions. We find significantly positive regression coefficients when the dependent variable is both this year's and next year' brokerage revenues. As before, we find a negative coefficient when the dependent variable is the previous year's brokerage revenues.

In summary, the results in Table 9 show that underwriters' brokerage revenues increase if they leave more money on the table for IPO investors. This is consistent with the hypothesis that they trade underpriced shares for brokerage business.

The above two subsections show that underwriters income increase with IPO underpricing, either directly through fees from IPO investors, or indirectly through increased brokerage business. Our analysis may still grossly underestimate the compensation underwriters receives from allocating IPO shares. For example, we suspect they will have similar incentives as their US counterparties to trade IPO shares for future investment-banking businesses, although we do not

have data and evidence on this. These direct and indirect compensation for allocating underpriced shares provides an explanation why the underpricing level remains high even though underwriters recognize that the pre-market price is informative and they set the offer price largely according to it.

The sensitivity of underwriter revenue to underpricing does not, however, explain why issuers do not agree to pay higher fees in return for less underpricing, with a net effect of higher net proceeds. For the U.S., Liu and Ritter (2011) posit that underwriters with influential analysts have bargaining power, and are able to maintain excessive underpricing in equilibrium. They, nor we, do not explain why underwriters with bargaining power extract rents via excessive underpricing, rather than through charging higher gross spreads.

6.3 Underwriters' impact on underpricing

Cross-sectionally, the agency hypothesis predicts higher underpricing when the underwriter has higher incentives or higher bargaining power to do so. We design three tests to explore the cross-sectional differences in underwriters' incentives or bargaining power. First, we measure a lead underwriter's monetary incentive to underprice based on the percentage of shares sold/allocated by the lead. The lead underwriter has all the pricing power whereas the other syndicate members help sell the shares. Whereas the lead receives most of the fixed fees from the issuer, the dollar investor fees an underwriter receives proportionally depends on the number of shares it sells, for both the bookbuilding and FPO tranches. As discussed in Section 6.1, the percentage investors fees increases with the underpricing level. Therefore the higher the percentage of shares sold by the lead, the higher incentives for it to underprice the stock.

Second, more generally, if underwriters' intrinsic incentives and bargaining power do influence the underpricing level, we expect to see a persistent underwriter effect on underpricing. In other

words, we expect an IPO's *price discount* is positively related to the price discount levels of previous IPOs lead underwritten by the same bank. Specifically, we regress an IPO's price discount on the average price discount of the lead's IPOs in the previous three year.

Third, we conjecture that if an issuer has more cash needs and is more likely to come back to the financial market in the near future, then the underwriter may have more bargaining power to induce the issuer to leave more money on the table. We use the ex post occurrence of a firm's security issuance after IPO as a proxy for its ex ante likelihood.

Table 10 reports the results of the three tests. Panel A presents the univariate subsample t-tests, and Panel B presents the regression results. In Panel A, we divide the sample into subsamples based on three variables respectively, to capture the tree ideas described above. The variables are: *lead percentage—the* percentage of shares sold by the lead, *previous price discount*—the average price discount in the previous year, and *issue again—a* dummy variable equal to one if the firm issues any public securities (seasoned equity offerings or corporate bonds) again in the next two years. Alternatively, we define *issue again* equal to one if the firm issues seasoned equity offerings in the next two years. The results are similar. We categorize an IPO observation as having high underwriter incentive/power to underprice if it has above-median *lead percentage or* above-median *previous price discount,* or its value of *issue again* equal to one. The other IPOs are categorized into low incentive/power subsamples. The agency hypothesis predicts that IPO with high underwriter incentive/power should exhibit higher underpricing.

Panel A reports the mean price discount for each subsample. Consistent with the agency hypothesis, each high incentive/power subsample exhibits a higher average price discount than its low incentive/power counterparty. The average price discount is 35.1 vs. 30.9 percentage points for subsamples with above- vs. below-median *lead percentage,* 35.4 vs. 31.3 percentage points for

subsamples with above- vs. below-median *previous price discount*, and 36.4 vs. 30.9 percentage points for subsamples with and without further security issuance. All differences are significant at the 5% level.

We then estimate multivariate regressions. The dependent variable is *price discount*. The variables of interest are the three variables that measure the lead underwriter's incentive to underprice. We control for firm characteristics and industry and year fixed effects.

Panel B reports the regression results. Consistent with the results in Panel A, each of the three main variables—*lead percentage*, *previous price discount*, and *issuer again* has a significant and positive coefficient. That is, the higher the lead underwriter's incentive and power to underprice, the higher the underpricing level.

Another measure that has been used in the literature for underwriter power is a bank's market share in the IPO market. However, market share is also a measure for underwriter reputation. Therefore its impact on underpricing is conceptually unclear: on the one hand, rent-seeking underwriters with higher bargaining power will want to increase underpricing; on the other hand, underwriters who care about their reputation capital will want to lower underpricing (e.g., Beatty and Ritter, 1986). In addition, prestigious underwriters provide higher certification value and hence investors may demand lower underpricing (e.g., Carter and Manaster, 1990). The empirical evidence for the relationship between underwriter market share and underpricing in the US varies with the sample period (e.g., Megginson and Weiss, 1991; Beatty and Welch, 1996).

In our sample, we find an underwriter's market share has no significant impact on price discount (not tabulated). This is consistent with the opposing effects of underwriter reputation and power as described above. Another possibility is that the matching between the underwriter and the issuer is endogenous (Fernando, Gatchev and Spindt, 2005). That is, although underwriters

with higher market shares tend to have higher bargaining powers, all else equal, the issuers they serve may have different characteristics compared to those served by underwriters with lower market shares. Consistent with this conjecture, we find positive correlations between issuer size and underwriter market share. Therefore these issuers may very well also have higher bargaining power compared to their peers. The net bargaining outcome between the issuer and the underwriter therefore can't be directionally predicted.

6.4 Impact of regulation changes

Acting upon complaints of excessive underpricing, the Taiwan Securities Association (TSA), under the guidance of Financial Supervisory Commission (FSC), imposed a new rule in 2011 that the IPO offer price must not be lower than 70% of the average ESM trading price during the 10 days before the bookbuilding announcement is submitted to the TSA (which typically is two business days before the bookbuilding starts). The rule applies to IPOs after our sample period.

We examine how this rule affects ESM trading and the IPO offer price. For this purpose, we impose the same sample criteria as before and collect data for 172 bookbuilding IPOs during March 2011 – December 2014. We repeat all the analysis in the paper and in most cases find qualitatively similar results. That is, the following results hold in the new period: (a) pre-market prices are informative with a mean price inaccuracy of 12.7% on the day before IPO pricing. (b) The higher liquidity of the ESM stock trading, the more informative the pre-market price is. (c) The scaled pre-market price alone explains more than 90% of the variation in offer price.

The striking difference for the new period, however, is that the average underpricing level is roughly halved! The average initial return decreases to 27% (vs. 55% in our sample period). Using the same definition of price discount as before (i.e., benchmarked against the ESM closing price before IPO pricing), the average price discount is 23% (vs. 33% in our sample period). If we calculate price discount against the regulatory benchmark, i.e., the average ESM trading price

during 10 days before the bookbuilding announcement is submitted to TSA, the average price discount is 21%, with the 25th, 50th, and 75th percentiles equal to 19%, 23% and 27% respectively. Therefore a substantial portion of IPOs have their offer prices set close to the minimum values set by the regulation.

Despite the similar pre-market and similar IPO institutions, the average underpricing level changes drastically due to the regulation change. This is consistent with the notion that agency problems is a main cause of underpricing, and the underpricing level decreases when the regulation constrains the underwriters' bargaining power.

Overall, the results we present in this section are consistent with the agency hypothesis, and explain why underpricing can remain high in a setting with little valuation uncertainty and information asymmetry.

7. Conclusions

We study a unique pre-IPO market that has an organized trading platform and is mandatory for firms aiming for an IPO – the Emerging Stock Market in Taiwan. We find that the pre-market trading achieves price discovery to a large degree—as the date of an IPO is approached, the price gets very informative about the stock's after-IPO value. The pre-market price therefore should be very useful in setting the IPO offer price, thus making the biggest challenge in the IPO process less of a challenge.

We indeed find that the IPO offer price largely depends on the pre-market price. The pre-market price-multiple alone explains about 90% of the variation in the offer price-multiple. After taking into account the issuer's own pre-market price, peers' prices are no longer important in determining the offer price. Moreover, the more volatile or riskier the stock is, and the less

informative the pre-market price is, the greater is the discount taken in setting the offer price relative to the pre-market price (and similarly, the higher the first day return). These results are consistent with the prediction of asymmetric information bookbuilding theory.

Despite the informative pre-market price, however, IPO underpricing remains at high levels, an average of 55.3%, which is in contrast to the prediction of asymmetric information bookbuilding theories. We provide evidence that underwriters have monetary incentives to underprice shares—both their fees from underwriting IPOs and their brokerage revenues increase when they underprice the shares more. We also find that the stronger the underwriter' incentives and bargaining powers to do so, the higher the underpricing. Our results therefore suggest that agency problems can lead to high levels of IPO underpricing even when there is little information asymmetry or valuation uncertainty about the stock.

Our study has several policy implications. We demonstrate the usefulness of a pre-IPO market in terms of price discovery. We show that liquidity is a key factor in determining the price efficiency on such a market. Consequently, the current restrictions on institutional participation in ESM trading may have the effect of making the ESM less liquid and informative than it could be. We also observe that the liquidity of the ESM trading remains low before the firm applies for an IPO, and that liquidity does not necessarily increase with the number of days the stock is traded. These facts therefore raise a question regarding the usefulness of prolonged trading before IPO application when there is little attention to, and a lot of uncertainty about, the firm. ESM trading does, however, allow for greater risk-sharing for pre-IPO shareholders than if it did not occur.

In spite of the information acquired about market demand through ESM trading, the 1underpricing reported for 90 IPO auctions in Taiwan during 1995-2007 by Chiang, Qian, and Sherman (2010). Since underwriters enjoy the most flexibility and discretion over the pricing and

allocating of the shares under the bookbuilding IPO method (as opposed to the auction or fixed-price offering method), it is the method that is most vulnerable to agency problems. Our study therefore casts doubts on the benefit of the bookbuilding method, especially in the presence of a pre-IPO market from which price discovery is largely achieved.

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Table 1
Firm characteristics

The sample includes 218 Taiwanese firms that conducted IPOs during 10/2005-02/2011. NT$ refers to New Taiwan Dollars. All NT$ values are deflated to constant year 2011 NT$ based on Taiwan's CPI index. The exchange rate at the end of year 2011 is US$1 = NT$30.29. *Debt ratio* is total liabilities over assets. *Return on assets* is annual net earnings relative to assets. We use paired *t*-test for differences in means, and Wilcoxon signed rank test for differences in medians. We do not test the significance of the change in firm age since the value of this variable increases by construction. ***, **, and * denote the difference is significant at the 1%, 5%, and 10% levels, respectively.

Panel A: When starting trading on the Emerging Stock Market.

Variables	*N*	Mean	Median	Std. Dev	Min.	Max.
Firm Age (years)	218	12.14	9.06	8.71	1.37	45.59
Assets (millions of NT$)	218	2,101.32	882.57	5,810.45	135.58	73,343.20
Annual revenues (millions of NT$)	218	1,640.62	652.83	3,115.62	4.45	33,696.54
Debt ratio (%)	218	41.33	41.86	17.36	0.00	87.62
Return on Assets (%)	218	9.22	8.93	10.76	-22.48	63.14
% of firms with VC backing	218	44.95				

Panel B: At the time of IPO application

Variables	*N*	Mean	Median	Std. Dev	Min.	Max.
Firm Age (years)	218	13.87	11.26	8.81	1.93	46.20
Assets (millions of NT$)	218	2,932.63	1,261.53	7,591.07	252.28	76,963.73
Revenues (millions of NT$)	218	2,845.89	1,126.74	7,111.01	59.60	81,786.18
Debt ratio (%)	218	36.19	35.03	15.62	4.00	85.89
Return on Assets (%)	218	14.31	11.96	11.06	-7.10	75.17
% of firms with VC backing	218	56.42				

Panel C: Difference (Panel B – Panel A)

		Mean	Median
Firm Age (years)	218	1.74	2.20
Assets (millions of NT$)	218	831.31***	378.96***
Revenues (millions of NT$)	218	1,205.27***	473.91***
Debt ratio (%)	218	-5.14***	-6.83***
Return on assets (%)	218	5.09***	3.03***

Table 2
IPO characteristics

The sample includes 218 firms that issued IPOs during 10/2005-02/2011. *% of shares issued* is the shares offered in the IPO relative to the number of shares outstanding before the IPO. *P/E* is the IPO offer price relative to the last annual earnings per share by the time of IPO. *Price revision* is the offer price relative to the midpoint of the initial price range, minus one, expressed as a percentage. *Price discount* is one minus the ratio of the offer price over the closing price on the pre-pricing day on the ESM. *Expected initial return* is the ratio of the closing price on the pre-pricing day on the ESM over the IPO offer price minus one, expressed as a percentage. *Initial return* is the ratio of first trading day closing price over the IPO offer price minus one, expressed as a percentage. In Panel B, the 2005 and 2011 number of IPOs are part-year totals. TWSE is the Taiwan Stock Exchange, and GTSM is the Gre Tai Securities Market. The mean initial returns are equally weighted. *Post-issue market cap* equals shares outstanding after the issuance times either the offer price or the closing price on the first trading day on TWSE or GTSM. All NT$ values are deflated to constant year 2011 NT$ based on Taiwan's CPI index.

Panel A: IPO characteristics

Variables	*N*	Mean	Median	Std. Dev	Min.	Max.
IPO Proceeds (NT$, millions)	218	495.33	210.89	1,445.85	18.63	18,186.18
% of shares issued	218	10.42	10.53	2.19	2.26	24.06
% of IPOs on TWSE	218	30.73				
P/E	218	119.15	11.69	1,495.86	-51.55	22,100
P/E after excluding 3 outliers	215	18.40				
Price revision (%)	218	0.13	0	4.64	-14.29	11.11
Price discount (%)	218	33.03	31.42	14.14	2.78	82.03
Expected initial return (%)	218	58.44	45.82	48.35	2.86	456.52
Initial return (%)	218	55.32	36.74	68.06	-10.00	726.09
Percentage with negative initial returns (%)	218	6.42				
Post-issue market cap (NT$, millions)						
at offer price	218	5,955.26	2,383.98	16,989.74	234.73	160,547.82
at first closing market price	218	8,292.82	3,451.73	21,670.92	324.78	231,188.86

Panel B: Initial returns by year

	All		TWSE		GTSM	
	N	IR, %	*N*	IR, %	*N*	IR, %
2005	8	59.45	3	52.77	5	63.46
2006	42	55.97	8	39.31	34	59.89
2007	51	60.03	16	34.52	35	71.69
2008	33	29.80	11	32.71	22	28.35
2009	37	79.50	17	85.17	20	74.68
2010	35	49.70	10	22.46	25	60.60
2011	12	42.28	2	25.51	10	45.63
All	218	55.32	67	46.39	151	59.28

Table 3
Price accuracy

Price error is the ratio of the pre-IPO price on ESM over the closing price on the first trading day on TWSE or GTSM, minus one. *Price inaccuracy* is the absolute value of price error. For the row "6 months before pricing (after apply IPO)", we restrict the sample to those for which the hiatus between IPO application and pricing is at least 6 months. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Variables	*N*	Mean	Median	Std Dev	Min.	Max.
Price inaccuracy (%):						
6 months before pricing	218	45.76***	34.48***	42.86	1.49	243.91
6 months before pricing (after apply IPO)	86	50.80***	35.10***	50.44	2.33	243.91
3 months before pricing	218	34.97***	27.88***	31.92	0.00	215.32
2 months before pricing	218	29.47***	24.90***	25.37	0.00	168.15
1 month before pricing	218	21.58***	18.82***	16.88	0.52	93.55
the day before pricing	218	14.78***	12.96***	11.43	0.46	56.91
4^{th} day after pricing	215	11.96***	10.73***	8.81	0.00	53.40
Price error (%):						
6 months before pricing	218	3.65	-12.95	62.66	-90.14	243.91
6 months before pricing (after apply IPO)	86	11.51	-2.86	70.86	-85.79	243.91
3 months before pricing	218	5.84*	-2.83	47.04	-83.42	215.32
2 months before pricing	218	4.07	-0.13	38.73	-78.84	168.15
1 month before pricing	218	1.85	0.32	27.38	-58.42	93.55
the day before pricing	218	6.04***	6.50***	17.71	-40.87	56.91
4^{th} day after pricing	215	6.56***	7.43***	13.35	-32.17	53.40

Table 4
Predictability of Initial Returns

The dependent variable is *Initial return*, which is the ratio of first trading day closing price over the IPO offer price minus one. *Expected initial return* is the ratio of the closing price on the pre-pricing day on the ESM over the offer price minus one. *Price revision* is the offer price relative to the midpoint of the initial price range, minus one. *Positive price revision* equals price revision if it is positive and zero otherwise. *Market return* is the three-week value-weighted return of all stocks on TWSE and GTSM prior to the IPO pricing. *Volatility* is the standard deviation of daily stock returns during the 3 months prior to IPO pricing. *VC dummy* equals to 1 if the firm is backed by venture capital and zero otherwise. *Return on assets* is annual earnings relative to assets. *t*-statistics are adjusted for heteroskedasticity. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

Model	(1)		(2)		(3)	
Variables	Estimates	t-value	Estimates	t-value	Estimates	t-value
Expected initial return	1.231	(7.98)***			1.213	(7.25)***
Price revision			2.443	(1.78)*	1.706	(2.44)**
Positive Price revision			-2.562	(-0.84)	-1.794	(-1.23)
Market return			2.844	(3.47)***	0.312	(0.81)
Volatility					3.106	(2.14)**
VC dummy					4.079	(0.89)
Return on assets					0.214	(1.12)
Log(assets)					0.721	(0.31)
Intercept	-16.647	(-2.07)**	56.765	(7.05)***	-37.31	(-1.74)*
Industry dummies					yes	
Year dummies					yes	
R^2	0.765		0.0749		0.794	
N	218		218		216	

Table 5
Determinants of Pre-Market Price Accuracy

The dependent variable is the percentage price inaccuracy on the pre-pricing day, i.e., the absolute value of the ratio of the closing price on the pre-pricing day on the ESM over the closing price on the first trading day on the TWSE or GTSM, minus one, multiplied by 100. *%Zero trading* is the percentage of trading days with no trading during the 3 months prior to IPO pricing. *%Zero return* is the percentage of trading days with zero stock return or no trading during the 3 months prior to IPO pricing. *Amihud ratio* is daily average of the absolute value of stock return over dollar trading volume during the 3 months prior to IPO pricing. *Volatility* is the standard deviation of daily stock returns during the 3 months prior to IPO pricing. *VC dummy* equals to 1 if the firm is backed by venture capital and zero otherwise. *Return on assets* is annual earnings relative to assets. *t*-statistics are adjusted for heteroskedasticity. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

Model	(1)		(2)		(3)		(4)		(5)		(6)	
Variables	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value
%Zero trading	0.149	(2.73)***	0.148	(2.19)**								
%Zero return					0.113	(2.68)***	0.122	(2.52)**				
Amihud ratio									0.190	(2.04)**	0.231	(2.03)**
Volatility			0.432	(0.75)			0.542	(0.91)			0.276	(0.48)
VC dummy			0.906	(0.53)			1.113	(0.65)			1.105	(0.66)
Return on assets			0.064	(1.02)			0.067	(1.08)			0.090	(1.31)
Log(assets)			-1.077	(-1.49)			-1.043	(-1.44)			-1.137	(-1.56)
Intercept	13.287	(15.84)***	15.375	(1.93)*	11.808	(9.92)***	12.346	(1.51)	13.601	(16.26)***	15.448	(1.97)**
Industry dummies				yes				yes				yes
Year dummies				yes				yes				yes
R^2		0.048		0.135		0.044		0.142		0.033		0.146
N		218		216		218		216		216		216

Table 6

Relative Importance of Pre-Market Price and Peer Firms' Prices in Determining IPO Offer Price

When calculating the P/E ratio, we exclude two issuing firms with negative EPS and one firm with an outlier P/E value. *Offer-price P/E* is the ratio of the IPO offer price relative to the annual EPS prior to the IPO. *Pre-market P/E* is the ratio of the closing price on the pre-pricing day on the ESM relative to the annual EPS. *Industry-median P/E* is the median P/E ratio for firms in the same industry as the issuing firm, where the P/E ratio is based on a peer firm's closing price on the issuing firm's pre-pricing day and the peer firm's annual EPS prior to that day. For each issuing firm, we identify a matching firm that is traded on either TWSE or GTSM, is in the same industry and has the closest asset value. *Matching-firm P/E* is the ratio of the matching firm's closing price on the issuing firm's pre-pricing day relative to the matching firm's annual EPS prior to that day.

Panel A: Summary statistics

Variables	N	Mean	Median	Std. Dev	Minimum	Maximum
Offer-price P/E	215	18.40	11.70	27.75	1.85	257.14
Pre-market P/E	215	29.53	18.04	45.44	2.51	454.29
Industry-median P/E	215	15.83	15.00	5.41	5.20	29.75
Matching-firm P/E	215	29.76	14.95	49.62	5.36	284.09

Panel B: Offer price P/E as the dependent variable

Model	(1)		(2)		(3)		(4)		(5)	
Variables	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value
Pre-market P/E	0.584	(15.40)***			0.591	(15.41)***			0.584	(15.38)***
Industry-median P/E			0.702	(2.76)***	-0.279	(-1.95)*				
Matching-firm P/E							-0.012	(-0.59)	-0.005	(-0.91)
Intercept	1.157	(1.62)	7.290	(1.66)*	5.378	(2.8)***	18.768	(8.39)***	1.313	(1.89)*
R^2	0.914		0.019		0.917		0.001		0.914	
N	215		215		215		215		215	

Table 7
Determinants of Price Discount

The dependent variable is *Price discount*, defined as one minus the ratio of the offer price over the closing price on the pre-pricing day on the ESM. *Volatility* is the standard deviation of daily stock returns during the 3 months prior to IPO pricing. *VC dummy* equals to 1 if the firm is backed by venture capital and zero otherwise. *Return on assets* is annual earnings relative to assets. *t*-statistics are adjusted for heteroskedasticity. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

Model	(1)		(2)		(3)		(4)		(5)		(6)	
Variables	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value	Estimates	t-value
Price inaccuracy	0.233	(3.04)***									0.171	(2.20)**
Volatility			3.132	(3.60)***							2.369	(2.85)***
VC dummy					-0.429	(-0.22)					-1.350	(-0.72)
Return on assets							-0.016	(-0.20)			-0.119	(-1.41)
Log(assets)									-3.373	(-3.35)***	-3.822	(-3.60)***
Intercept	29.578	(19.66)***	21.867	(7.50)***	33.269	(22.00)***	33.248	(22.38)***	57.726	(7.73)***	46.022	(4.50)***
Industry dummies											yes	
Year dummies											yes	
R^2	0.036		0.110		0.000		0.000		0.049		0.332	
N	218		216		218		218		218		216	

Table 8
Underwriting fees and intended price discount

The FPO subscription ratio is the total demand from the fixed-price offering tranche, relative to the shares sold through that tranche. The FPO fee is 8.5 times the FPO subscription ratio, relative to the offer price. The *bookbuilding fee* is the fee bookbuilding investors pay for each share allocated to them, relative to the offer price. The *total investor fee* is the weighted average of the FPO fees and the bookbuilding fee, where the weighting variable is the proceeds raised in the two tranches. *Intended price discount* equals one minus the ratio of the midpoint of the price range over the closing price on the day before bookbuilding starts. *Volatility* is the standard deviation of daily stock returns during the 3 months prior to IPO pricing. *VC dummy* equals to 1 if the firm is backed by venture capital and zero otherwise. *Return on assets* is annual earnings relative to assets. *t*-statistics are adjusted for heteroskedasticity. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

Panel A: Summary statistics

Variables	*N*	Mean	Median	Std. Dev	Min.	Max.
FPO subscription ratio	204	89.82	60.87	168.95	0.43	2,300.95
FPO fee (%)	204	1.98	1.37	1.89	0.01	12.58
Bookbuilding fee (%)	218	1.68	0	2.09	0	8.70
Total investor fee (%)	218	1.67	1.20	1.70	0	8.00
Intended price discount (%)	218	32.08	30.48	14.16	-0.81	82.31

Panel B: The dependent variable is the FPO subscription ratio

Model	(1)		(2)	
Variables	Estimates	t-value	Estimates	t-value
Intended price discount	4.089	(2.43)**	4.126	(2.34)**
Volatility			-3.901	(-1.12)
VC dummy			-31.109	(-1.23)
Return on assets			3.211	(1.89)*
Log(assets)			-27.114	(-2.84)***
Intercept	-42.354	(-0.96)	168.3	(3.56)***
Industry dummies			yes	
Year dummies			yes	
R^2	0.117		0.302	
N	204		202	

Panel C: The dependent variable is the bookbuilding fee.

Model	(1)		(2)	
Variables	Estimates	t-value	Estimates	t-value
Intended price discount	0.029	(2.98)***	0.019	(1.66)*
Volatility			-0.059	(-0.59)
VC dummy			0.768	(2.96)***
Return on assets			-0.006	(-0.67)
Log(assets)			-0.053	(-0.3)
Intercept	0.731	(2.35)**	3.897	(2.42)**
Industry dummies			yes	
Year dummies			yes	
R^2	0.040		0.345	
N	218		216	

Panel D: The dependent variable is the total investor fee.

Model	(1)		(2)	
Variables	Estimates	t-value	Estimates	t-value
Intended price discount	0.039	(5.53)***	0.026	(3.18)***
Volatility			-0.026	(-0.34)
VC dummy			0.436	(2.22)**
Return on assets			-0.014	(-2.14)**
Log(assets)			-0.211	(-1.62)
Intercept	0.407	(1.78)*	4.322	(3.62)***
Industry dummies			yes	
Year dummies			yes	
R^2	0.107		0.424	
N	218		216	

Table 9
Underwriter brokerage revenues and money left on the table from IPOs

The regressions in this table include 78 lead underwriter-years where the lead has underwritten at least one IPO. For each IPO, we compute money left on the table as the shares issued times the difference between the pre-market price on the day before IPO pricing and the offer price. For each underwriter-year, we sum up the *total money left on the table* from the IPOs the bank lead underwriters. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

	Current year's brokerage revenue		Next year's brokerage revenue	
	Estimates	t-value	Estimates	t-value
Total money left on the table	0.342	(2.05)**	0.234	(1.5)
Underwriter dummy	yes		yes	
R^2	0.890		0.884	
N	78		78	

Table 10
Underwriter impact on underpricing

Panel A reports the mean *price discount* for subsamples based on three variables. We categorize an IPO observation as having high underwriter incentive/power to underprice if it has above-median *lead percentage* or above-median *previous price discount*, or its value of *issue again* equal to one. The other IPOs are categorized into low incentive/power subsamples. *Price discount* is one minus the ratio of the offer price over the closing price on the pre-pricing day on the ESM. *Lead percentage is* the percentage of shares sold by the lead underwriter. *Previous price discount* is the average price discount in the previous year. *Issue again* is a dummy variable equal to one if the firm issues any public securities (seasoned equity offerings or corporate bonds) again in the next two years. Panel B estimates regressions with price discount as the dependent variable.

Panel A: price discount by subsamples

	Lead percentage	Previous price discount	Issue again
High underwriter incentive/power	35.093	35.422	36.425
Low underwriter incentive/power	30.920	31.341	30.862
Difference	4.173**	4.081**	5.563***

Panel B: Regression; the dependent variable is price discount

	Price discount					
	(1)		(2)		(3)	
	Estimates	t-value	Estimates	t-value	Estimates	t-value
Lead percentage	13.877	(1.82)*				
Previous price discount			0.267	(1.98)**		
Issue again					4.273	(2.30)**
log(asset)	-3.265	(-3.06)***	-4.932	(-4.63)	-3.687	(-3.57)***
Volatility	2.782	(4.33)***	2.278	(3.50)***	2.557	(4.01)
VC	-0.824	(-0.42)	-1.963	(-1.02)	-1.484	(-0.77)
ROA	-0.124	(-1.45)	-0.174	(-1.95)*	-0.120	(-1.41)
Intercept	33.083	(2.30)**	45.317	(3.91)***	48.673	(4.50)
Industry	yes		yes		yes	
Year	yes		yes		yes	
R^2	0.351		0.352		0.3587	
N	215		195		215	