The Role of the Underwriter in the IPO Aftermarket

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Classification: G24, G32

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Abstract

IPO underwriters dominate aftermarket trading but often follow rather than lead in price discovery. This suggests that the underwriter shares a certification, external monitoring and signaling role with aftermarket brokers, venture capitalists and founder-owners retaining equity. In this paper we investigate the cross-sectional determinants of the role of the underwriter in aftermarket price discovery. Not surprisingly, the underwriters' role expands with greater issue uncertainty and diminishes with venture capitalist involvement and greater retention of founder-owner equity. Our novel result is that verifiable facts are not a substitute for, but a complement to, underwriter certification and advice. Specifically, the underwriter's contribution to price discovery increases with the magnitude and complexity of the supplier and customer contracts reported in the prospectus. It declines when the IPO is first in a technology or product space, suggesting that verification processes (not de novo information production) are the key function of the underwriter.

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1. Introduction

Underwriters dominate aftermarket trading of IPOs (Ellis, Michaely, and O'Hara 2000), but follow rather than lead other brokers in Nasdaq pre-opening quotations (Aggarwal and Conroy 2000). This suggests that underwriters play a secondary role in after-market price discovery. Since an execution channel with access to the largest segments of order flow would normally attract stealth trading by the most informed participants (whose transactions establish new permanent price trends), the contradictory pre-opening role of the underwriter in the IPO aftermarket requires explanation.

One explanation is that dealers, obligated to provide price support for issues they underwrite, would rationally await pre-opening quotations to diagnose the state of the market before committing their own capital in proprietary trades. However, we document below that in many cases this secondary role in aftermarket price discovery continues throughout the day and extends to all trading executed by the underwriter. We find that in some IPOs informed traders regularly emerge in execution channels different from the underwriters, and the underwriter channel then follows. In other IPOs, the underwriter channel leads the price discovery. To understand why, we examine a large sample of issue documents and corporate finance characteristics of the issuing firms to identify the cross-sectional determinants of price discovery in the IPO aftermarket.

Using common factor component techniques from the error correction literature, we first estimate directly a market microstructure metric on the contribution to price discovery of trades executed by underwriters versus other brokers. For six months of post-IPO trade-to-trade data, we find that the underwriter is the sole source of statistically significant price discovery in only 20% of the IPOs, even though the underwriter's share of the trading volume normally exceeds 60%. Unlike in seasoned issues, the certification, external monitoring, and signaling roles are widely dispersed in IPOs. We hypothesize that this induces informed traders to execute outside the dominant, underwriter trading channel. Specifically, underwriters appear to share an on-going certification, external monitoring, and signaling role with other aftermarket brokers, venture capitalists, and founder-owners retaining large amounts of equity.

Cross-sectional analysis of the underwriter's common factor weight in the pricing of actively-traded IPOs shows that the underwriter's contribution to price discovery is positively related to

several traditional measures of issue uncertainty--namely, the time delay from announcement to issue and the number and complexity of risk factors listed in the prospectus. Two ownership characteristics, external monitoring by VCs and equity retention by owner-founders, both of which substitute for the reputational effects of the underwriter in certifying IPOs, are negatively related to the underwriter's contribution to price discovery.

One novel finding is that the complexity of the web of supply chain and forward sales contracts that are listed in the prospectus and need to be verified is positively related to underwriter price discovery. In other words, verifiable facts about the new venture's business model prove to be a complement to rather than a substitute for underwriter certification and advice. Despite the prominence of fact-oriented verification activity in our findings, underwriter reputation effects can be demonstrated in the model in that prior successful IPOs increase the price discovery role of underwriters in current IPOs. Finally, controlling for all the above determinants and their interaction terms, our second novel finding is that the role of the underwriter in price discovery *diminishes* when the issuer is the first IPO in its technology or product market space. In such circumstances, investors appear to cast a wider net in an attempt to garner insights about the untested fit among the components of the issuer's new business model. Again, this dispersion of roles (especially in first IPOs in a product or technology space) leads informed traders to execute outside the dominant, underwriter trading channel.

2. Australian IPOs

Our sample comprises the most actively-traded non-privitization IPOs underwritten during 1996-99 in Australia. Examination of Australian IPOs allows a much more continuous analysis of the role of the underwriter in information flows and price discovery because Australia does not impose a post-issue quiet period. Australian underwriters are not prohibited from giving opinions about value at any time.

2.1. The Australian Float Process

All IPOs in Australia are intertwined with the policies and procedures for listing on the Australian Stock Exchange (ASX), a screen-based order-driven electronic trading system since 1987. Unlike NASDAQ dealers who have an affirmative obligation to make markets in stocks they underwrite, there are no official market makers on the ASX for either seasoned or initial public offerings. Nevertheless, like their NASDAQ counterparts, Australian broker underwriters do facilitate large bloc trading, advise on institutional execution strategy, and provide liquidity themselves in "house stocks."[1] For example, Australian broker underwriters are often consulted for several months post-issue about expressions of interest regarding lines of allocated stock to buy or sell.[2] This facilitation of institutional trades serves to attract future capital raising/corporate finance business from IPO clients and related issuers. Analogous incentives influence NASDAQ dealer underwriters.

One feature of the trading regulations subsequent to the ASX float process (depicted in Figure 1) remains quite distinct from the U.S. experience. In contrast to the 25-day quiet period post-issue in the U.S., there are no restrictions whatsoever on the timing of analysts' forecasts and recommendations regarding an Australian IPO. After establishing eligibility and selecting syndicate members, the issuing firm and its underwriter prepare road show documents that include an indicative range of issue prices. For the ensuing ten days to two weeks, the underwriter markets the issue to securities firms and institutional clients who offer informal guidance about the potential demand and sometimes about the draft prospectus itself. During a three-five day typical exposure period, the final prospectus is examined and registered by the Australian Securities Investment Commission (ASIC), and then the offer period begins. Formal marketing of the IPO, acceptance, and subsequent processing of applications typically take 2-4 weeks. Once the offer period ends, the underwriter in consultation with the issuing firm allocates and distributes the shares. Listing and quotation then ensue within several days. Again, throughout the pre-issue and post-issue events, analysts' recommendations emanate from all quarters, including the underwriter firm.

[1] See Aitken, Garvey and Swan (1995).

[2] Underwriters are consulted first because other syndicate members are seldom told the location of the stock allocations.

Australia's adoption of this fixed price method is a result of the historical influence of the British Commonwealth. As recently as 1996-99, only 6% (just 13) of the 214 IPOs in Australia employed the full-blown book building method so prevalent in the U.S. In cross-national comparative studies, Loughran, Ritter and Rydqvist (1994) and Ljungqvist, Jenkinson and Wilhelm (2003) document that fixed price methods lead to a greater probability of the issue failing than the book building method. The greater failure rates are attributed to increased uncertainty during the time delay between offer and issuance. In the U.S., the time delay when prices are fixed is 36 hours or less. Because the time delay is at least 2-4 weeks in Australia, indicative price range mechanisms (rather than fixed prices) have emerged such that Australian capital raising begins to resemble U.S. book building.

In any case, the allocation outcomes of the Australian underwriter process remain quite close to those in the U.S. Table 1, Panel A shows that Australian underwriters allocate only 68% of IPO shares to the top twenty shareholders (all but a few of whom purchase over 100,000 shares), slightly less than 20% to large individual and institutional investors purchasing 5,000 to 100,00 shares, and the remaining 12% to retail investors purchasing less than 5,000 shares. European and Japanese underwriters, in contrast, allocate almost the entire float in large block sales to a few financial institutions.

Table 1, Panel B displays the commonalities between U.S. and Australian IPO fees and offer statistics. We divide the 214 IPOs June 1996-December 1999 into 176 underwritten versus 38 non-underwritten cases. In general, underwriting fees are 4%, which is reduced to 3% for issues over $100 million AUD and rises to 5% for issues under $20 million AUD. Beyond the underwriting fee, a 1% management fee also applies in most cases (in 140 out of the 176 underwritten IPOs). An additional 1% handling fee arises in one-third of all IPOs (in 10 of the Top 30, 55 of the 176 underwritten, and 65 of the 214 total IPOs). Overall, then, an Australian IPO often incurs 6% underwriting + management + handling fees relative to the "7% solution" reported by Chen and Ritter (2000) for U.S. IPOs. In the next section, we show that the percentage aftermarket trading by Australian underwriters and the percentage underpricing at issue in Australia also approximate well-known patterns in U.S. IPOs.

2.2 Sample selection and descriptive statistics

We obtain information concerning all 214 IPOs issued between July 1996 and December 1999. Our data come primarily from the Securities Data Corporation New Issues Database, the Australian Stock Exchange IPO reports, and individual firm prospectuses. In addition, the Australian Stock Exchange provided proprietary broker identifications from their audit trail data. Intraday price and trade data for the first 180 days are extracted from the Stock Exchange Automated Trading System database obtained from the Securities Industry Research Centre of Asia Pacific (SIRCA). An important advantage of our study is that we can view the entire order and trade schedule for each IPO. This allows us to track orders and trades such that we can identify two execution channels: the underwriter channel and the execution channel of all the other brokers.

Of the 214 initial public offerings, we include in the initial analyses 176 underwritten IPOs of ordinary shares (i.e., that did not involve privatizations or closed-end funds). There were 150 cases of a single underwriter with no other member of the syndicate and 26 cases of single underwriters accompanied by lead managers and/or sponsoring brokers. Nevertheless, because of our access to audit trail data, we were able to distinguish clearly between underwriter executions and all other broker executions. Some of our analyses are limited to the Top 30 most frequently traded new issues in the 176 underwritten IPOs. This occurred because our time series-based price discovery technology requires synchronous trades from the underwriters and other brokers. Thinly-traded IPOs have statistically insignificant price discovery metrics, our dependent variable for the cross-sectional analysis. Thinly-traded IPOs also have smaller capitalizations; hence our results should be understood to apply to larger floats. Finally, most of our IPOs are concentrated in one year as follows: 1996: 10%; 1997: 6%; 1998: 6%; 1999: 78%. Similarly, Morgan-Stanley data show that 79% of the 325 U.S. IPOs 1996-1999 also occurred in 1999 (Lowry and Schwert, 2002).

Offer statistics for the June 1996-December 1999 IPOs in Australia are presented in Table 1, Panel B. All 214 IPOs have a mean offer size of 116.4 million AUD. Removing the largest IPO in Australia (the non-underwritten Telstra privatization at $14.6 billion), the mean offer size is $48.4 million AUD, about one third of the mean offer size of $99 million USD for all U.S. IPOs in this

period.[3] In general, the non-underwritten privatizations are much larger issues than the 176 underwritten IPOs (mean $26.9 million AUD). However, our Top 30 sample of heavily-traded underwritten IPOs have a mean offer size of 59.8 million AUD, and a median offer size of $42.5 million AUD. These Top 30 issues sizes are distributed as follows: $100 to $385 million: 4, $55 to 94 million: 6, $20 to $49 million: 13, $7 to $16 million: 7. Below the Top 30, even the heavily-traded non-privitization IPOs in Australia have issue sizes below $5 million AUD, too small to compare to U.S. IPOs .

Ellis, Michaely, and O'Hara (2000) report that for Nasdaq stocks, the lead underwriter is always the dominant market maker, taking substantial inventory positions and handling as much as 50 percent of the trading volume during the first few months of the aftermarket. Table 1, Panel C, shows that the underwriter's market share in Australia averages 58.1% on the first day of trading and remains as high as 52.1% even forty-five days after issue. For the Top 30 IPOs, Figure 2 displays the 82% first day trading volume declining to no less than 61% after 45 days. Hence, underwriters also dominate aftermarket trading in Australia. Also note that the percentage of the trades is much smaller than the percentage of the volume suggesting underwriters get the medium to larger executions, where one would expect to find informed stealth trading.

Some of the underwriter trading volume in the U.S. is due no doubt to stabilization activities.[4] In Australia, aftermarket price support is seldom authorized and rarely offered. Indeed, prior to 1992, all IPO price stabilization activity by underwriters was prohibited by the ASIC. Exceptions have been granted in recent years primarily for privitizations. Hence, the institutional history in Australia is one in which underwriters have not been expected to offer price support services. Nevertheless, the underwriters dominate the aftermarket trading in Australia, just like in the U.S.

Table 1, Panel D, presents selected Australian issue characteristics, each exhibiting substantial cross-sectional variation. The Top 30 underwritten Australian IPOs have institutional ownership from 10% to 92% (mean 61 %, standard deviation 22%), equity retention from 4% to 83% (mean 53 %, standard deviation 23%), and number of pages of boilerplate plus risk factors from 48 to 155 pages in

[3] The median daily exchange rate in 1999 when most of these IPOs occurred was 0.65 AUD/USD.
[4] Aggarwal (2000) and Lewellen (2004) examine issues related to price stabilization.

the prospectus (mean 98 pages, standard deviation 26 pages).[5] The number of contracts with suppliers and customers announced in the prospectus varies from 1 to 14 (mean 6.7 contracts, standard deviation 4.1 contracts).

The industry breakdown for our Top 30 sample is presented in Figure 3. The most frequently-traded IPOs come from 12 different industries. Telecommunications firms are over-represented, both in Australia and in U.S. data during this time period. The 176 underwritten IPOs are distributed across industries and sectors in a very similar fashion. Non-underwritten privitizations have arisen primarily in banking, transportation, and telecommunications.

Opening trade and opening day return statistics for June 1996-December 1999 are presented in Table 2. The 176 underwritten Australian IPOs experience first-day median price appreciation of 16.1% (offer to open) and mean 32.9%. This compares to first-day median returns in the U.S. 1996-1999 of 16.7% and mean 26.1% (Loughran and Ritter, 2004, Table 1). Of the 176 underwritten Australian IPOs, 139 experienced first-day appreciation. Adjusting for first-day market returns still leaves 132 of the 176 IPOs appreciating on the first day of trading (the median excess return is 12.6%). 1999 first-day returns were much higher than in the previous three years in both Australia and the U.S. Loughran and Ritter (2004) report median first-day returns 1996-1998 of 10.3%, 9.4%, and 9.0% followed by a 1999 first-day return of 37.5%. We too seek to understand better the role of the underwriter in these IPOs in part because of the spectacular first-day returns and the massive implied underpricing in the 1999 issues.

3. Common factor weights

Despite the dominance of the underwriter in aftermarket trading, prior evidence suggests that the underwriter shares the price discovery role with other brokers. Aggarwal and Conroy (2000) examine the role of underwriters in the pre-open period for Nasdaq IPOs. The authors report that the lead underwriter and co-managers account for only 37% of the bid improvements and just 8% of the ask improvements during the pre-open period.

[5]In measuring risk factors as total page lengths of intertwined idiosyncratic risk factors plus boilerplate, we adopt the approach of Koh and Walter (1989).

In order to understand more fully the cross-sectional differences in the role of the underwriters, we begin by estimating directly the relative contribution to price discovery of the underwriters versus other brokers. We first construct a time series of synchronous paired trades--one from the underwriter channel and one from the non-underwriter channel--using the MINSPAN procedure of Harris, McInish, Shoesmith, and Wood (1995) developed for a study of price discovery in Dow stocks trading on the NYSE and regional exchanges. Having estimated the order of integration properties of these series, we next examine the optimal lag length for the two-equation system of underwriter and other broker prices that minimizes the Akaike Information Criterion (AIC). Six to ten lags of synchronous trades minimize the AIC in most cases, but the optimal lag structure stretches somewhat longer in several cases.

At an optimal lag length for each stock, we use Johansen's reduced rank regression procedure to test the log price series for one cointegrating vector versus the null hypothesis of zero cointegrating vectors. Using critical values obtained from Enders (1995, Table B), the maximal eigenvalue rejects the null hypothesis in 29 out of 30 cases, so we conclude that the continuous return (and by implication the price) series for underwriter and other brokers are in fact cointegrated.[6]

Interestingly, the IPO price series of business management software developer MYOB Limited (MYO) was not cointegrated across execution channels. Instead, the prices of the underwriter and other brokers diverged for substantial periods, allowing persistent arbitrage opportunities. The MYOB Limited issue exhibited 1) a first day "pop," 2) a positive deterministic time trend thereafter, and 3) a positive drift in the price expectations. To our knowledge, microstructure research has never reported the non-cointegration of prices across alternative execution channels in any secondary market. MYOB illustrates a folklore that IPO trading at times generates abnormally persistent arbitrage returns.

Having confirmed cointegrated underwriter and other broker price series in 29 out of 30 cases, we then employ Gonzalo and Granger's (1995) common factor components procedure (the GG

[6] Earlier versions of the paper incorporated several tables of these time-series results, which are available upon request from the authors.

procedure) to estimate and test the proportion of the common stochastic trend $\sum_{t=1}^{T} w_t$ attributable to the underwriter versus other broker trades (see Table 3). GG restrict these common factors to linear functions of the current observable prices, and they restrict transitory disturbances to not Granger-cause the permanent information arrivals w_t,. DeJong (2002), Ballie, Booth, Tse, Zabotina (2002), Harris, McInish, and Wood (2002a and 2002b), Hasbrouck (2002) and Huang (2002) debate these restrictions. However, our main interest in this paper lies elsewhere--i.e., with the corporate-finance characteristics that explain the *cross-sectional* variation in this price discovery metric.

In the second and fourth columns of Table 3, we report for each IPO the appropriate eigenvalues normalized as common factor weights [f_1, f_2], which we interpret as the proportion of permanent price adjustment contributed by each execution channel (see Harris, McInish, and Wood, 2002a). In BNO, for example, the underwriter executed trades that contributed 73% of the permanent changes in the price trends in that stock; other brokers contributed 27%. Both parameters are statistically different from zero. Single or double asterisks on the chi-square statistic in the third and fifth columns indicate, respectively, 95% or 99% significance in likelihood ratio tests of the null hypothesis H_0: f = [0,1] against the one-tailed alternative H_a: $f_1 > 0$ and $f_2 < 1$ -- i.e., both common factor weights are statistically significant.

The fact that there is no post-issue quiet period in Australia during which the underwriter must stop advising clients about changes in material facts might lead to the conjecture that the underwriter provides the only game in town. However, the parameter magnitudes and test statistics in Table 3 tell a quite different story. Not only is the underwriter not information dominant in all cases, but rather, there are some IPOs in which the underwriter plays a subsidiary role or no role at all in post-issue price discovery. Most relevant to our motivation for examining the cross-sectional determinants of the role of the underwriter in price discovery, the parameter estimates of these common factor weights in Table 3 exhibit substantial cross-sectional variation..

In the top half of the table (Panel A), both the underwriter and the other brokers contribute to price discovery. In AAP and TAP, for example, the common factor weights are nearly equal. In the next set of sixteen IPOs, both channels contribute, but the underwriter dominates so that firms such as

CAB, PRI, and VXS have common factor wieghts for the underwriter of 65% to 85%. These price discovery parameters approximate the share of the dollar volume these underwriters control, much like the role of the NYSE in trading listed equities (Hasbrouck 1995).

In the six IPOs in Panel B (BRS, EIS, HOY, HRD, MLB, and OTT), the underwriter provides the only execution channel in which there is price discovery. Stoughton, Wong and Zechner (2001) predict such an extensive role for the underwriter in first IPOs in fast-changing high technology industries where an underwriter's reputation for certifying successful past issues substitutes for verifiable product and service quality information about the offering firm. Where few analysts thoroughly understand the technology, the reputation effect of the underwriter for effective due diligence and information processing is especially important in attracting counterparties to trades that may involve new information. Three of these six IPOs are just such issues in software development (HRD), dot-coms (MLB), and telecommunication and ISP services (OTT).

In two IPOs in Panel C (BMC and REA), the underwriter provides no price discovery, a curious result indeed given the usual asymmetry of accurate information available to the underwriter's customers. BMC was a media dot.com IPO handled by a small brokerage firm with less than 1/5 of 1% of the Australian market in equity capital raising. Subscriptions were few, and we conjecture that the weak reputation of the underwriter was insufficient to attract liquidity traders as a counterparty for informed trades. REA was a real estate IPO that exhibited little asymmetry of information relative to the typical issue. Finally, three IPOs (ALL (Gaming equipment), BDA (Electronics), and LIB (Telecoms)) exhibit only noise trading in both channels with no statistically significant price discovery.

4. Cross-sectional determinants of price discovery in the IPO aftermarket

4.1. Relevant literature

Beatty and Ritter (1986) find empirical support for the hypothesis that IPO underpricing is related to the uncertainty of investors concerning IPO values. Rock (1986) develops a model in which underpricing of IPOs is necessary to compensate uninformed investors for the risk of dealing with informed investors. Carter and Manaster (1990) confirm that IPOs with more informed investor

capital require more underpricing and generate therefore higher initial returns. Koh and Walter (1989) also provide support for Rock's model using data for Singapore IPOs. Michaely and Shaw (1994) report that where investors know in advance that they do not have to compete with informed investors, IPOs are not underpriced. Prestigious underwriters are associated with IPOs that have lower returns from issue to the first trade suggesting that underwriter reputation for certifying past successful IPOs may well mitigate the asymmetric information problem. Ellis, Michaely, and O'Hara (2000) report that the lead underwriter is always the dominant market maker in the aftermarket. Ritter and Welch (2002) provide a review of this literature.

Whereas the underpricing literature focuses on the return from the issue price to the first trade, other studies have focused on short-run or long-run price performance in the aftermarket.[7] Field and Hanka (2001) investigate share lockup agreements that prevent insiders from selling their shares immediately after the IPO. They report a permanent 40 percent increase in average trading volume and statistically significant three-day negative returns of –1.5 percent following the lockup expiration.

Turning to the long run, Krigman, Shaw, and Womack (1999) report that first-day winners continue to be winners over the first year. Nevertheless, most IPOs have exhibited poor long-run performance (Aggarwal, Leal, and Hernandez, 1993, Loughran and Ritter, 1995, Lee, Taylor, and Walter, 1996). Carter, Dark, and Singh (1998) find that IPOs handled by more prestigious underwriters have relatively less under-performance over three years than other IPOs.

Stoughton, Wong, and Zechner (2001) analyze the underwriter certification of the issue, focusing on product quality. The certification role of the underwriter, especially in first IPOs in high technology industries, substitutes for retained equity and/or venture capital involvement in externally monitoring the start-up's business plan. We test these propositions directly with a cross-section of the Australian IPOs using as the dependent variable our time-series measure of the price discovery in the underwriter execution channel.

[7]IPOs have been a focus of related studies on signalling from clients (Aggarwal, Prabhala, and Puri, 2002), binding regulations, contractual mechanisms, and characteristics of the firms going public (Loughran, Ritter, and Rydvist, 1994).

4.2. An overview of theoretical models

The multiple roles of the underwriter in the pre-issue and post-issue market can be clarified by a three-period IPO signaling model. In period 1 (see Figure 4), a new venture secures start-up and mezzanine financing and moves toward an initial public offering. Venture capitalists may or may not choose to invest. If so, VCs help develop the business plan, assist in the formation of the management team, and provide strong external monitoring which typically lowers the underpricing at issue (Megginson and Weiss, 1991). VC financing is costly to the owner-founders with each of the seed round and mezzanine round financings requiring assignment to the VC of 25-33% of the company. Therefore, the earlier the VC invests and the later the VC exits, the stronger the signal of issue quality from any subsequent decision to proceed to an IPO.

Stochastic processes (N) complicate the assessment of issue quality in the middle of the sequence of events in Figure 4. Some start-ups become low quality issuers (LQSU) despite venture capitalist involvement. Other start-ups emerge as high quality issuers (HQSU) without VC involvement. High quality start-ups (HQSU) always decide to do IPOs, while lower quality start-ups (LQSUs) chose between mimicking the high quality issuers or reverting to private equity financing. Underwriters play two key roles in this pre-issue period: they conduct much of the price search (Aggarwal and Conroy, 2000), and they withhold certification of lower quality issues.

At the IPO (displayed as three decisions on the far right of Figure 4), underwriters advise issuers about the proportion of equity to retain Eq^0, then set an offer price P_0^- in the registered prospectus, and soon thereafter allocate the shares to subscribers. By retaining more equity, founder-owners of HQSUs seek to discourage founder-owners of LQSUs from attempting to mimic. Equilibrium P_0^- underprices the issue just enough to offset the uninformed (liquidity) traders' future expected losses in buying an issue of certified but still unknown quality.

In period 2, informed traders (IT) detect the true issue quality and begin secondary market trading on this information, buying HQSUs and selling LQSUs (in the asymmetrically-informed dashed-line box at the left-hand-side of Figure 5). ITs seek to stealth trade in execution channels populated by large numbers of liquidity traders (LTs) who can serve as counterparties. The market price that emerges from this stealthy order flow eventually reflects a separating equilibrium between high and low quality firms. But price is not fully revealing immediately because the informed trader

trades strategically.[8] Specifically, informed traders attempt to find liquidity traders (LTs) from whom they can buy HQSUs at a discount or to whom they can sell LQSUs at a premium. Knowing this, liquidity traders seek out advice from the underwriter to mitigate the expected losses from being less informed. As a result, as we show in the next section, LTs chose to trade in the aftermarket through execution channels where they have access to underwriter advice.

4.3. Implications for execution channel choice

In the Non-U (Non-Underwriter) execution channel depicted in the NW cell of Figure 5, informed traders attempt to buy HQSUs from liquidity traders at the issue price P_0^- and attempt to sell LQSUs to liquidity traders at P_0. In contrast, having obtained underwriter advice, liquidity traders who acquired HQSUs at issue are advised to sell at P_0 (not at P_0^-), thereby pocketing the equilibrium underpricing premium ($P_0 - P_0^-$) on their allocated shares. These transactions are depicted in the SE cell of Figure 5, where they are referred to as the Underwriter (execution) Channel. No trade occurs in the NE or SW cells of Figure 5 other than through arbitrage activities of intermediaries.

In a one-shot simultaneous game, the liquidity trader in Figure 5 has a dominant strategy to execute in the underwriter's execution channel. LTs earn a positive cash flow that represents an *equilibrium* risk premium for bearing the adverse selection risk from offer to issuance. Anticipating this, the informed traders also prefer to execute in the underwriter's channel, an iterated dominant strategy equilibrium. This post-issue equilibrium leads to the testable hypothesis that post-issue price discovery will occur predominantly in the underwriter's channel.

In period 3 (not shown), differences between HQSU and LQSU issuers become apparent, and liquidity traders become fully informed. Only then does market price become fully revealing and impound all public information about future price trends. Price discovery in the aftermarket should thereafter occur in all execution channels. However, prior to period 3, price discovery will occur in

[8]Market price may also not be fully revealing empirically because, off the equilibrium path, some low quality firms mimic the high quality issuers if expected high quality issuers set either their retained equity or the degree of underpricing too low to assure a separating equilibrium.

the underwriter channel where informed traders will find sufficient numbers of liquidity traders to act as counterparties for medium-sized to larger trades.

During this intermediate post-issue time period, the role of the underwriter should vary with the cross-sectional characteristics of the IPO. For example, when verifiable facts about a new venture's business plan are present, liquidity traders approach the underwriter to assess and interpret those facts. This advisory service establishes the amount of underpricing premium a liquidity trader who receives allocation should expect to realize in post-issue trading. In contrast, when few facts are verifiable as with the first IPO in a new technology or product space, Stoughton, Wong, and Zechner (2001) predict that issue quality will be certified by the high reputations of underwriters entrusted to perform advisory services in previous IPOs. Alternatively, in this case the issuer would have to retain more equity in order to establish the credibility of the claims regarding issue quality.

So, in theory, IPO issuers have two distinct reasons to employ underwriters who perform their post-issue advisory services well: 1) underwriter verification of complex facts reduces the underpricing required to offset adverse selection risk, and 2) underwriter reputations support claims of a high quality issue involving technological firsts when only extraordinary retention would substitute. In addition to the cross-sectional differences in verifiable facts and technological firsts, advisory services available through the underwriter are more valuable to liquidity traders the greater the issue quality uncertainty, the smaller the proportion of equity retained by the founder-owners, and the less the venture capital involvement.

We therefore hypothesize that trades that discovery of permanent price trends will occur more frequently in the underwriter channel,

1) the larger the number of customer and supplier contracts to be verified (CONTRACTS),

2) the smaller the proportion of equity retained (RETAIN),

3) the less the involvement of venture capitalists (VC),

4) the greater the number of risk factors enumerated in the prospectus (PAGES), a measure of issue uncertainty,

5) the greater the issue delay from announcement to issue (DELAY), another measure of issue uncertainty, and

6) the larger the number of other IPOs in that year by the underwriter (OTHERIPOS).

Two importance conditioning variables will be institutional ownership (INSTOWN) and whether the IPO is the first is a new technology or product space (FIRST).

We first implement an error-correction/cointegration methodology to estimate the proportion of price discovery occurring in each of the competing execution channels, and then we relate this microstructure metric of the role of the underwriter to the above cross-sectional determinants of execution channel choice.

5.0 Empirical Results

Table 4 reports the cross-sectional determinants of CF_U, the common factor weight in price discovery attributable to synchronous trades in the underwriter execution channel. All four specifications of the model explain more than 94% of the variation in the normalized dependent variable CF_U with F tests from 43.98 to 62.72. The dependent variable is a normalized factor weight between zero and one, the ratio of an eigenvalue for one execution channel relative to the sum of the eigenvalues for both channels. This normalization procedure is required since the distribution of the individual eigenvalues in the numerator is not known and conspicuously non-normal. In addition, the R-square is high because we had access through the Security Industry Research Center Asia-Pacific to a large set of IPO corporate histories from which we derived the right-hand-side variables, many of which exhibit extraordinary cross-sectional variation.

The right-hand-side variables may be classified into four types of measures regarding reputation effects, verifiable facts, issue uncertainty, and ownership characteristics.

Reputation Effects We first discuss the effect of underwriter reputations achieved outside the present IPO's arrangements. OTHERIPOS (the number of other IPOs by the underwriter within the same year) provides a reputational asset that complements the underwriter's advisory services (as measured here by CF_U, the common factor weight in price discovery attributable to the underwriter).[9] In particular, in Table 4, row 13, the larger the number of other IPOs that have been entrusted to any

[9] Other measures of underwriter reputation, like IPOs in the previous one, three or five years, have similar effects.

given underwriter, the greater the factor weight of that underwriter in post-issue price discovery: $\partial CF_U/\partial OTHERIPOS = +0.058$. When OTHERIPOS is present in this specification #4, the role of VCs as external monitors, the role of institutional ownership, and the role of retained equity by the founder-owners as a signal of issue quality all become obscured by the overwhelming reputation effects. More importantly, the role of the underwriter in verifying issue quality through CONTRACTS proves insignificant.

This result should not be misinterpreted as a displacement of the role of underwriters in verifying contracts by the external reputation effects of the underwriters. Rather, OTHERIPOS and CONTRACTS are collinear with a statistically significant positive simple correlation and a large variance inflation factor. Apparently, higher external reputation of the underwriter assists the issuer in securing supply chain and customer contracts that then must be underwriter verified to confirm the development of an IPO's business plan. Especially in such circumstances, uninformed traders seek out the underwriter for counsel as they provide liquidity in the post-issue aftermarket. As we have argued, one prominent reason for this advisory relationship is that such traders are exposed to picking off risk as counterparties to informed traders whose executions will thereafter establish the new permanent price trends.

Verifiable Facts Salient facts that liquidity traders may need verified, assessed, and interpreted are measured by the number of supply chain or customer relationships identified in the prospectus that have been formalized into contractual agreements (CONTRACTS) and by a dummy variable for the first IPO in a technology or product space (FIRST). The number of contracts is significantly positively related to price discovery through the underwriter execution channel. Interpreting the first row of Table 4, the larger the number of contracts claimed in the prospectus, the greater the value to liquidity traders (and hence, to informed traders seeking counterparties in that channel) of due diligence verifications performed by an underwriter.

In the final column, if the significant interaction effects of CONTRACTS with FIRST and of CONTRACTS with PAGES are omitted from the model (i.e., specification #4), then reputation effects (OTHERIPOS) appear to substitute for verification of contract facts. However, specifications #1 thru #3 show this is a misspecification. Instead, the role of underwriter in verifying CONTRACTS

interacts with important conditioning variables (FIRST and PAGES) without which the true relationship between underwriter price discovery and CONTRACTS can not be detected.

In Table 4 row 2, for example, we find that the role of the underwriter in aftermarket price discovery is inversely related to FIRST. More than a third of the IPOs in our Top 30 sample 1996-99 were first in their technology or product space. Very few verifiable facts are available in a new technology or product space and, as we have seen, the underwriter's due diligence about such facts is essential to his role as an advisor in the aftermarket. This inverse relationship between the role of the underwriter and FIRST holds whether or not one controls separately for the reputation effect of underwriters in certifying an IPO; FIRST is negative and significant even when one includes (in the final specification) the number of other issues underwritten by this firm during the year (OTHERIPOS).

As one might expect, where customer and supplier contracts do exist in first IPOs, the conditioning effect of CONTRACTS on the role of the underwriter interacts with FIRST. Interpreting the coefficients in the first and third rows of Specification #1conveys that the partial derivative effect of CONTRACTS is +0.0094 (i.e., +0.0751 - 0.0657) when FIRST = 1 and eight times larger (+0.0751) when FIRST = 0, i.e., when the IPO is not first in a new technology or product area. That is, again, the difficulty in verifying claims made in the prospectus when an IPO is FIRST reduces the value of the underwriter advisory services in the aftermarket.

However, consistent with Stoughton, Wong, and Zechner's (2001) prediction, we find that the underwriter certification of issue quality is particularly important in some FIRST IPOs. Specifically, DELAY exhibits a statistically significant interaction term with FIRST. Interpreting rows 4 and 5 of specification #1, the role of the underwriter in resolving delay-based issue uncertainty is accentuated threefold by the presence of a first IPO in a new technology or product area: that is, $\partial\, CF_U/\partial$ DELAY = + 0.0119 + 0.0245 FIRST = + 0.036 when FIRST = 1 whereas $\partial\, CF_U/\partial$ DELAY = + 0.0119 when FIRST = 0.[10] These results are almost identical in magnitude across all four specifications of the model.

[10] Here we are ignoring the unchanging effect on the partial derivative of the quadratic term DELAYSQR listed in row 6-- namely, – (2) 0.0002 DELAY.

Issue Uncertainty Like Ljungqvist and Wilhelm (2002), we refrain from adopting offer size as a proxy for issue uncertainty on the grounds that issue size is the endogenous consequence of the equilibrium underpricing decision in Figure 4.[11] Instead, in the spirit of ferreting out primary, antecedent effects that correlate with issue size, issue uncertainty is measured by two variables: PAGES (the number of pages in the prospectus required to enumerate the applicable risk factors) and DELAY (the number of days after the IPO announcement until the issue date). Delay between announcement and issuance suggests business plan complexity, unfinished due diligence, and occasionally mispricing. For example, delaying the issue can result from the uncovering of disruptive technologies (during due diligence) that threaten the issuing firm's business plan, technologies that were thought to be incremental when the indicative range of prices was set.

PAGES captures the issuing firm's attempt to secure a safe harbor against subsequent non-disclosure litigation. This enumeration of specific risk factors embedded in the prospectus boilerplate must be accomplished without dampening excessively the issue valuation. In the case of both increasing PAGES and increasing DELAY, the resulting rise in issue uncertainty should be positively related to the value of the underwriter in answering liquidity traders' questions about the issue. In all four specifications of the model, we find in rows 4 and 7 of Table 4 that both DELAY and PAGES are positively related to the aftermarket price discovery in the underwriter execution channel.

In row 6, we find that the second measure of issue uncertainty, the DELAY variable, is a negative quadratic, declining in its positive proportional effect on the role of the underwriter in price discovery as the length of delay increases. This result may be necessary for the separating equilibrium between high quality issuers and lower quality private equity financing. If lower quality firms could reduce the underpricing required to attract liquidity traders to their issue by simply delaying the issue and offering more underwriter advisory services, said lower quality firms would mimick high quality issuers rather than revert to private equity financing. Again, then, the role of the underwriter peaks when the issue is on schedule and diminishes when the issue is several weeks or even in some cases, several months late.

[11] Moreover, Lewellyn (2002) finds that offer size is insignificant as a factor in the aftermarket inventory accumulation of the underwriter.

In row 8, we find that the PAGES variable interacts with CONTRACTS in the same way that the FIRST variable interacts with CONTRACTS. That is, the positive effect of contract verification by the underwriter on price discovery in the underwriter channel is reduced by both new, unproven technology and by page after page of idiosyncratic risk factors listed in the prospectus. From rows 1, 3 and 8, we see that the partial derivative of CONTRACTS at the mean number of PAGES is ∂ CF_U/∂ CONTRACTS = + 0.0751 – 0.0657 FIRST – 0.0006 (97.7) = + 0.0161 – 0.0657 FIRST. Because of the two negative and statistically significant interaction terms, CONTRACTS can easily have a negative total effect in FIRST issues.

Ownership Characteristics IPOs monitored, financed, and allocated with venture capitalists involved (VC) and with a higher percentage of the equity retained by the owners and managers (RETAIN) will have less need to certify issue quality through underwriters. The negative and significant parameter estimate on VC in row 9 suggests that the prior external monitoring of an IPO's business plan by a venture capitalist can indeed substitute for the role of the underwriter in providing advisory services. This effect of VC involvement on the role of the underwriter is influenced, however, by the percentage of institutional ownership at issue (INSTOWN). Although INSTOWN is itself insignificant in all specifications as illustrated in Specification #2, an interaction term VC*INSTOWN conveys that the monitoring and certification role for the venture capitalist is diminished by large institutional allocations: $\partial CF_U/\partial VC$ = -0.4991 + 0.0095 INSTOWN. We interpret the positive and significant interaction term VC*INSTOWN in row 11 to mean that for some owners, VC involvement does not substitute for underwriter certification and advice. Specifically, institutional liquidity traders prefer to acquire underwriter certification and advice when faced with the dire prospect of being the counterparty to trades with an informed venture capitalist.

The negative sign on RETAIN in all specifications (see row 12) confirms the signaling mechanism that issuers employ to reduce the underpricing cost of doing an IPO.[12] By retaining more equity, founder-owners can diminish the rational discounting of the issue price and yet sustain a separating equilibrium in which low quality firms do not issue. Since more retention cuts into issue

[12] RETAIN is highly collinear, as one would expect, with VC involvement. Therefore, the statistical significance of RETAIN in specification #3 reveals the unencumbered effect of retention on the role of the underwriter in price discovery.

proceeds and therefore into underwriting fees, the underwriter advisory services in a competitive market would diminish. However, this decline in underwriter-executed trades that permanently move the aftermarket price happens not because underwriting service costs must be economized when competitive fee income declines, but rather because the value of even a monopoly underwriter's advisory services to liquidity traders is diminished when high proportions of retained equity provide a credible commitment by the principals to an IPO's issue quality.

6.0 Summary and conclusions

Previous research such as Ellis, Michaely, and O'Hara (2000) has shown that underwriters are dominant in after market trading of IPOs. But Aggarwal and Conroy (2000) present indirect evidence that underwriters are not dominant in price discovery. Examining preopen trading for Nasdaq IPOs, these authors show that the majority of peropen bid and ask quote improvements come from non-underwriters.

We examine the cross–sectional determinants of aftermarket price discovery, using the common factor components approach of Gonzalo and Granger (1995) to measure the dependent variable directly. This time-series approach to microstructure metrics involves constructing synchronous pairs of trades for underwriters and other brokers, and then estimating which trades permanently move the markets. Our sample comprises issue databases, aftermarket audit trails, and six months of trade-to-trade data for the most actively traded IPOs in Australia during the years 1996-1999. One unique feature of this data set is the ability to identify execution channels and distinguish underwriter executions versus those of other brokers.

Overall, the contribution to price discovery by underwriters (as measured by the Gonzalo-Granger common factor weight) exceeds the underwriter's participation in trading activity in approximately two-thirds of the IPOs examined. However, given the underwriters' on-going access to company officials and their information advantage about the placement of the initial shares distributed, it is quite extraordinary that other brokers also provide statistically significant price discovery in as many as twenty-one of the heavily-traded 30 IPOs we examined. That is, the

processing of new information from informed trades is substantially more diffuse than simple asymmetric information models of IPO issuance would suggest.

Examining the cross-sectional determinants of these common factor weights, we find that the underwriter contribution to price discovery is significantly positively related to issue uncertainty as measured by the pages of risk factors enumerated in the prospectus and by the time delay between IPO announcement and issue. In addition, we find a diminished role for the underwriter in IPOs previously financed (and therefore externally monitored) by venture capitalists and in IPOs for which owners and managers have signaled higher issue quality by retaining more equity. However, these substitute credibility mechanisms of external monitoring and signaling quickly prove more costly, we conjecture, than establishing issue quality through underwriter certification.

The certification role of the underwriter proves especially useful we find in three instances: 1) when heavy institutional ownership seeks to avoid being picked off as a counterparty to informed trades of VC founder-owners, 2) when first IPOs in a new technology or product space experience substantial delays between the announcement date and the offering, and 3) when numerous claims about the effect of complex contracts on the issuing firm's business model are in need of verification.

In particular, we find a positive relationship between the underwriter contribution to price discovery and the magnitude and complexity of verifiable facts concerning supplier and customer contracts reported in the prospectus. Verifiable facts are not a substitute for, but a complement to, the underwriter's certification and advisory services. Controlling for any unusual announcement delays or risk factors in the offering, when verifiable facts are few, we find that the contribution of the underwriter to price discovery is significantly reduced. These results coincide with the view that verification processes (not de novo information production) is the key function of the underwriter.

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Table 1. Descriptive statistics. Panel A displays the percentage of the total shares outstanding at issue held by shareholders with holdings of a given size for all 214 Australian IPOs June 1996-December 1999. Panel B presents the offer size and underwriting fees for all 214 IPOs, for the 176 underwritten IPOs, and for the Top 30 underwritten IPOs. Panel C presents the market share of of the underwriter and the syndicate of the volume and of trades. On the first trading day, the underwriter accounts for 58.5% of the trading volume, 53% of the trades, 39.4% of the order volume, and 33.7% of the orders. Panel D presents the average number of contracts, the number of pages of risk factors plus boilerplate listed in the prospectus, the percentage of shares retained by pre-IPO owners, and the percentage of shares held by institutions in the Top 30 heavily-traded IPOs.

Panel A: Distribution of allocations by size

	Size of Allocation					Percentage held by top 20 shareholders
Number of Shares	*1-1,000*	*1,001-5,000*	*5,001-10,000*	*10,001-100,000*	*100,001 and over*	
Mean (%)	2.2%	10.8%	8.5%	12.6%	65.9%	68.0%

Panel B: Offer statistics and fees

		Sample		
	N	Mean	Median	Standard Deviation
Offer size (millions AUD)	All 214	116.4	9.9	1008.7
	176	26.9	10.0	43.6
	Top 30	59.8	42.5	72.3
Underwriting Fee (%)	All 214	3.92	4.0	1.24
	176	3.84	4.0	1.23
	Top 30	3.21	3.0	1.17
Management Fee (%)	All 214	1.18	1.0	0.87
	140 of 176	1.14	1.0	0.49
	Top 30	0.93	0.75	0.77
Handling Fee (%)	All 214	1.16	1.0	0.46
	55 of 176	1.03	1.0	0.36
	Top 30	0.95	1.0	0.34

Panel C: Underwriter and syndicate market share

	Underwriter Alone		Syndicate	
	% Volume	% Trades	% Volume	% Trades
176 Underwritten IPOs				
Day 1	58.5	53.0	60.1	55.2
Day 2	52.7	47.9	55.0	50.7
Day 3	54.0	49.3	55.6	51.2
Day 7	53.3	50.3	55.2	52.6
Day 45	52.1	49.1	51.4	49.2
Day 90	41.3	39.3	48.1	45.0
Top 30 Underwritten IPOs				
Day 1	82.1	52.5		
Day 2	85.2	49.7		
Day 3	74.6	47.5		
Day 7	73.3	48.1		
Day 45	60.8	46.0		
Day 90	48.0	32.8		

Table 1 (continued)

Panel D: Selected issue characteristics (Top 30 Underwritten IPOs)

Symbol	No. of Contracts	Pages of Risk Factors + Boilerplate	Percent Equity Retained	Percent Institu-tional Owner-ship	Symbol	No. of Contracts	Pages of Risk Factors + Boilerplate	Percent Equity Retained	Percent Institu-tional Owner-ship
AAP	6	100	83.4	91.6	LIB	12	90	74.0	47.4
ALL	1	106	60.7	77.8	MLB	5	100	15.0	50.9
BDA	1	48	5.0	39.1	MYO	14	80	70.7	41.5
BMC	2	88	75.6	36.7	OTT	7	108	81.9	92.0
BNO	4	104	37.3	26.2	PRI	1	90	61.0	79.6
BRS	4	104	30.0	42.1	REA	9	80	63.3	72.5
CAB	7	64	31.5	71.5	ROC	14	132	36.0	38.6
CDO	5	72	3.9	44.9	SPK	4	113	73.6	79.5
CLT	3	86	34.6	63.2	SSX	2	155	61.2	88.7
EIS	14	124	62.1	73.9	TAP	10	100	9.6	59.3
GTP	1	71	60.0	73.1	TMN	7	52	73.2	83.8
HOY	7	115	47.2	87.4	TNE	13	68	72.2	79.7
HRD	7	108	70.4	52.6	TVL	6	101	55.1	43.0
IIN	12	80	51.0	70.4	UEL	7	145	58.5	66.8
ISC	7	112	53.5	62.0	VXS	8	136	74.6	4.2

	Mean	Standard deviation
No. of Contracts	6.7	4.1
Pages of Risk Factors + Boilerplate	97.7	25.7
Percent Equity Retained	52.9	23.1
Percent Institutional Ownership	61.3	21.6

Table 2. Statistics for first day returns of Underwritten IPOs. Panel A presents the returns from the offering price to the first trade price and to the closing price on the first trading day for the 176 underwritten IPOs. Panel B repeats the information provided in panel A after adjusting for market returns.

	Offer to Open	*Offer to Close*
Panel A: Raw return		
Mean (%)	32.9	32.4
Median (%)	16.1	13.2
Standard Deviation	0.70	0.72
Number of IPOs with 1st day negative returns	27	38
Number of IPOs with 1st day positive returns	139	128
Panel B: Market-adjusted return		
Mean (%)	31.1	30.5
Median (%)	12.6	11.9
Standard Deviation	0.70	0.71
Number of IPOs with 1st day negative returns	34	48
Number of IPOs with 1st day positive returns	132	128

Table 3. Gonzalo and Granger common factor weights representing the proportion of price discovery attributable to each channel. For each of the execution channels, we present the normalized common factor weights (in percent). We test the elements of this common factor vector for significance using the methodology developed by Gonzalo and Granger (1995). In each case the null hypothesis is that the factor weight for the indicated channel is 0. The test statistic is distributed chi-squared with one degree of freedom and rejects the null with the indicated level of significance. Panel A presents the results for the IPOs for which both the underwriter and the other brokers attract informed trades. Panel B presents IPOs for which the underwriter alone attracts informed trades. Panel C presents IPOs for which the underwriter does not attract informed trades.

	Underwriter		**Other Brokers**	
Issuing Firm	Common Factor Weight	Chi-Square Test	Common Factor Weight	Chi-Square Test
Panel A: Underwriter and other brokers both attract informed trades				
AAP	0.47	5.36*	0.53	7.33**
TAP	0.54	12.15**	0.46	18.58**
BNO	0.73	16.99**	0.27	24.55**
CAB	0.82	27.36**	0.18	15.45**
CDO	0.69	12.49**	0.31	10.78**
CLT	0.83	24.35**	0.17	11.51**
GTP	0.78	26.78**	0.22	15.67**
IIN	0.79	32.89**	0.21	14.44**
ISC	0.73	24.66**	0.27	25.44**
MYO	n.a.	n.a.	n.a.	n.a.
PRI	0.82	17.3**	0.18	10.51**
ROC	0.72	24.54**	0.28	17.36**
SPK	0.73	18.50**	0.27	11.80**
SSX	0.65	10.61**	0.35	12.73**
TMN	0.73	16.57**	0.27	8.21**
TNE	0.85	10.64**	0.15	6.52**
TVL	0.76	20.30**	0.24	12.44**
UEL	0.72	11.57**	0.28	7.69**
VXS	0.83	13.27**	0.17	5.13*
Panel B: Underwriter alone attracts informed trades				
BRS	0.66	4.53*	0.34	1.09
EIS	0.88	29.81**	0.12	2.78
HOY	0.93	15.1**	0.07	0.10
HRD	0.64	4.72*	0.36	1.71
MLB	0.90	11.80**	0.10	0.60
OTT	0.77	5.71*	0.23	0.60
Panel C: Underwriter does not attract informed trades				
BMC	0.16	0.09	0.84	2.55
REA	0.05	0.04	0.95	15.25**
ALL	0.46	1.10	0.54	1.71
BDA	0.62	2.53	0.38	1.00
LIB	0.76	1.12	0.24	0.25

*Significant at the 0.05 level.
**Significant at the 0.01 level.

Table 4. Cross-sectional Analysis. We report the results of the regression of common factor weights measuring price discovery in the underwriter channel against: **CONTRACTS**, the number of contracts representing orders and suppliers that the firm lists in its offering documents; **FIRST**, a dummy variable equal to one if the firm is the first IPO in its technology or product market space and zero otherwise; Contracts*First, the product of Contracts and First; **DELAY**, the number of days from the filing of the offering documents to the completion of the IPO; Delay*First, the product of Delay and First; DELAYSQR, the square of Delay; **RETAIN**, the percentage of equity retained by owner-founders; **PAGES**, the pages of boilerplate plus risk factors enumerated in the offering document; Pages*Contracts, the product of pages and contracts; **VC**, a dummy variable equal to one if a venture capital firm provided equity financing; **INSTOWN**, the proportion of the offering purchased by institutions; VC*INSTOWN, the product of VC and INSTOWN; **OTHERIPOS**, the number of other IPOs by the underwriter during that year. No other interaction terms were significant

	Independent variables	**Coefficients (t-statistics in parentheses)**			
		Specification 1	**Specification 2**	**Specification 3**	**Specification 4**
1	CONTRACTS	0.0751 (3.07**)	0.0746 (2.68**)	0.0695 (2.71**)	-0.0124 (-1.19)
2	FIRST	-0.9270 (-2.85**)	-0.9268 (-2.77**)	-1.0870 (-3.29**)	-1.3603 (-3.99**)
3	CONTRACTS* FIRST	-0.0657 (-2.52**)	-0.0656 (-2.45**)	-0.0567 (-2.10**)	
4	DELAY	0.0119 (2.37**)	0.0119 (2.25**)	0.0145 (2.86**)	0.0224 (4.93**)
5	DELAY*FIRST	0.0245 (3.31**)	0.0245 (3.21**)	0.0267 (3.46**)	0.0268 (3.58**)
6	DELAYSQR	-0.0002 (-3.41**)	-0.0002 (-3.28**)	-0.0002 (-3.74**)	-0.0003 (-4.69**)
7	PAGES	0.0067 (4.57**)	0.0067 (4.16**)	0.0068 (4.40**)	0.0046 (4.08**)
8	CONTRACTS* PAGES	-0.0006 (-2.70**)	-0.0006 (-2.30**)	-0.0006 (-2.51**)	
9	VC	-0.4991 (-1.81*)	-0.4938 (-1.58)		
10	INSTOWN		0.0001 (0.04)		
11	VC*INSTOWN	0.0095 (2.14**)	0.0094 (1.89*)	0.0018 (0.35)	
12	RETAIN	-0.0027 (-1.52)	-0.0027 (-1.42)	-0.0033 (-1.83*)	-0.0020 (-1.23)
13	OTHERIPOS				0.0583 (2.90**)
	Adj R-Sq	0.948	0.945	0.942	0.943
	F Test	50.64	43.98	49.68	62.72

*Significant at the 0.1 level
**Significant at the 0.05 level

Figure 1. The ASX Flotation Process

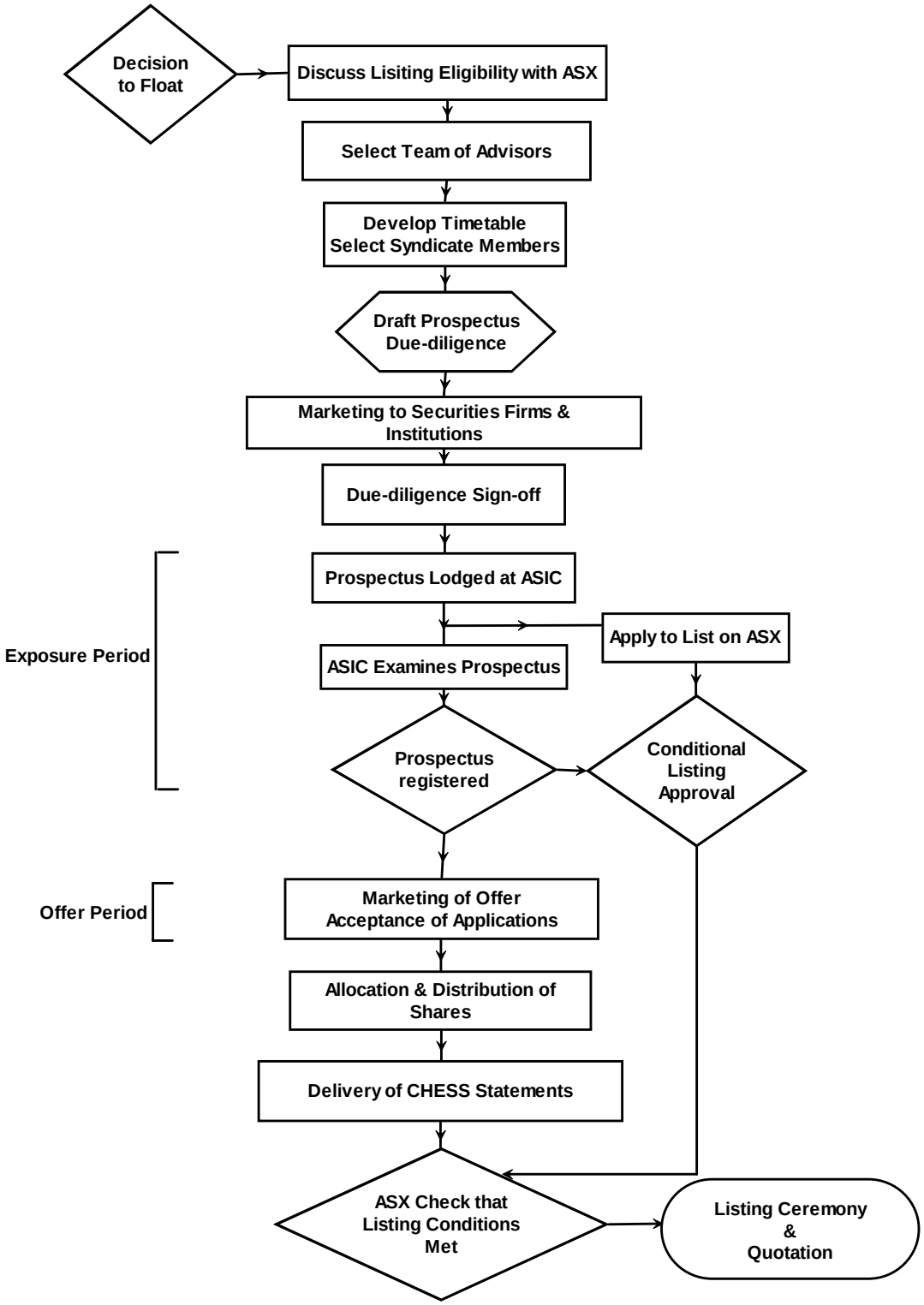


Figure 2. Underwriter's market share of trading volume and number of trades

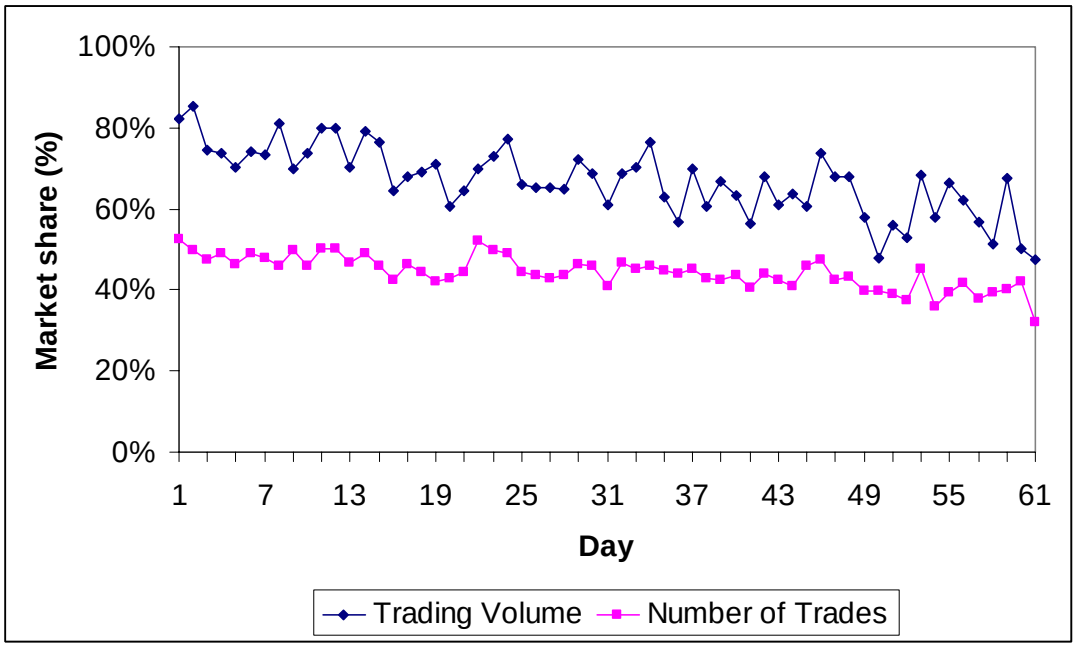
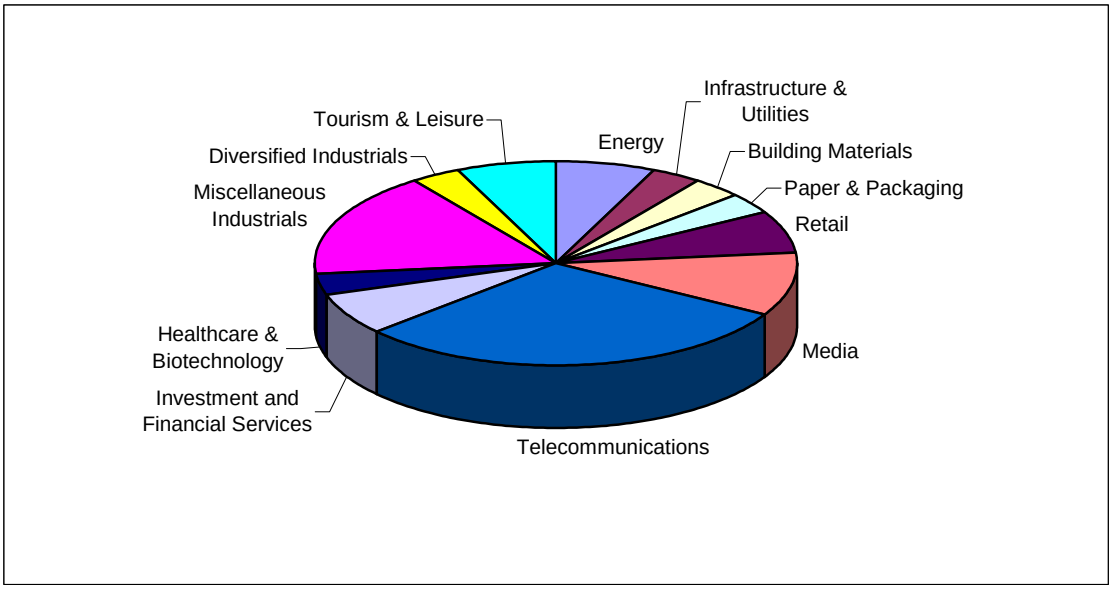


Figure 3. Industry classification of most actively traded IPOs 1996-1999



Industry	Sample IPOs
BUILDING & MATERIALS	1
DIVERSIFIED INDUSTRIALS	1
ENERGY	2
HEALTHCARE & BIOTECHNOLOGY	1
INFRASTRUCTURE & UTILITIES	1
INVESTMENT& FINANCIAL SERVICES	2
MEDIA	3
MISCELLANEOUS INDUSTRIALS	5
PAPER & PACKAGING	1
RETAIL	2
TELECOMMUNICATIONS	9
TOURISM & LEISURE	2

Figure 4: The pre-issue role of VCs and the underwriter in IPOs (Period 1)

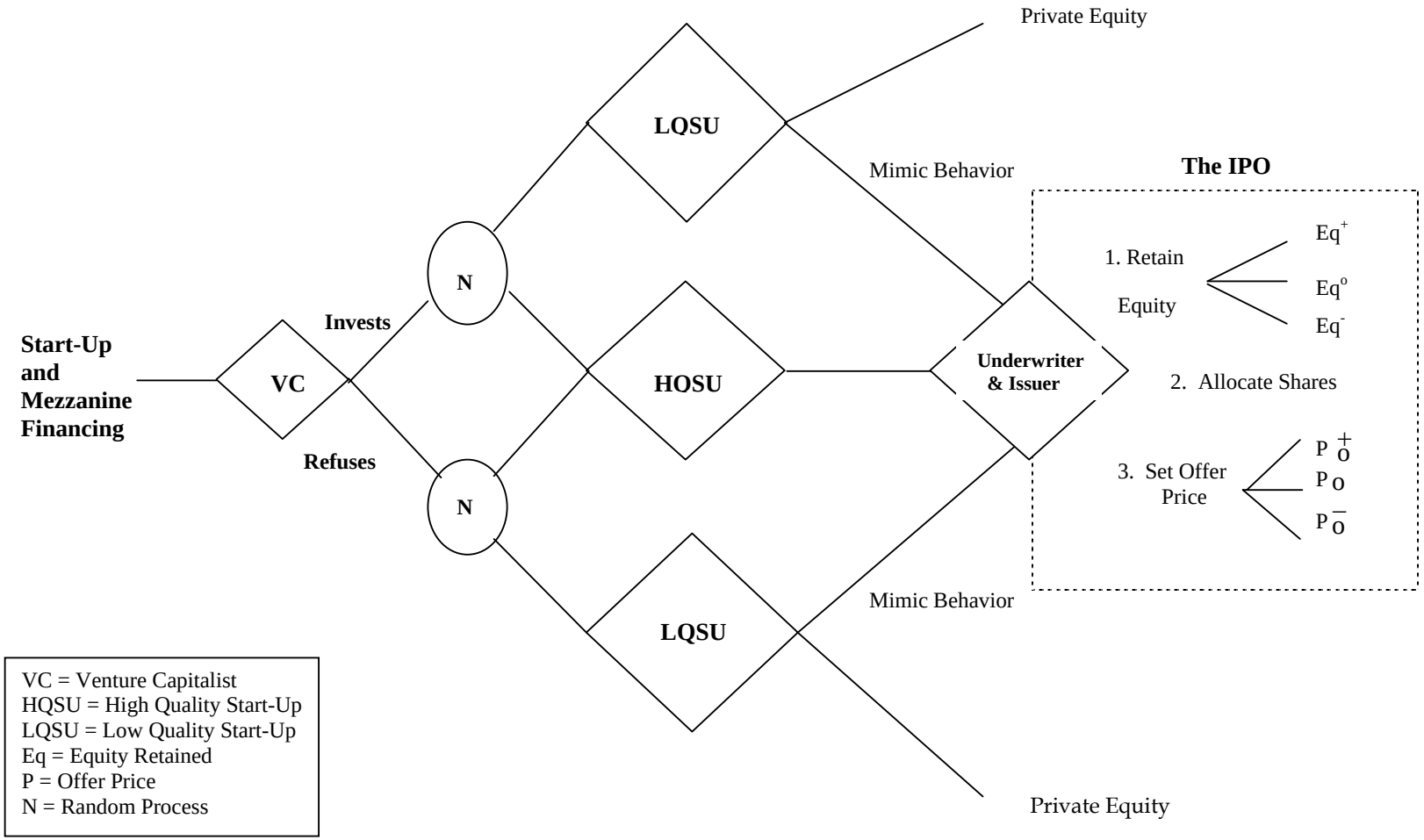
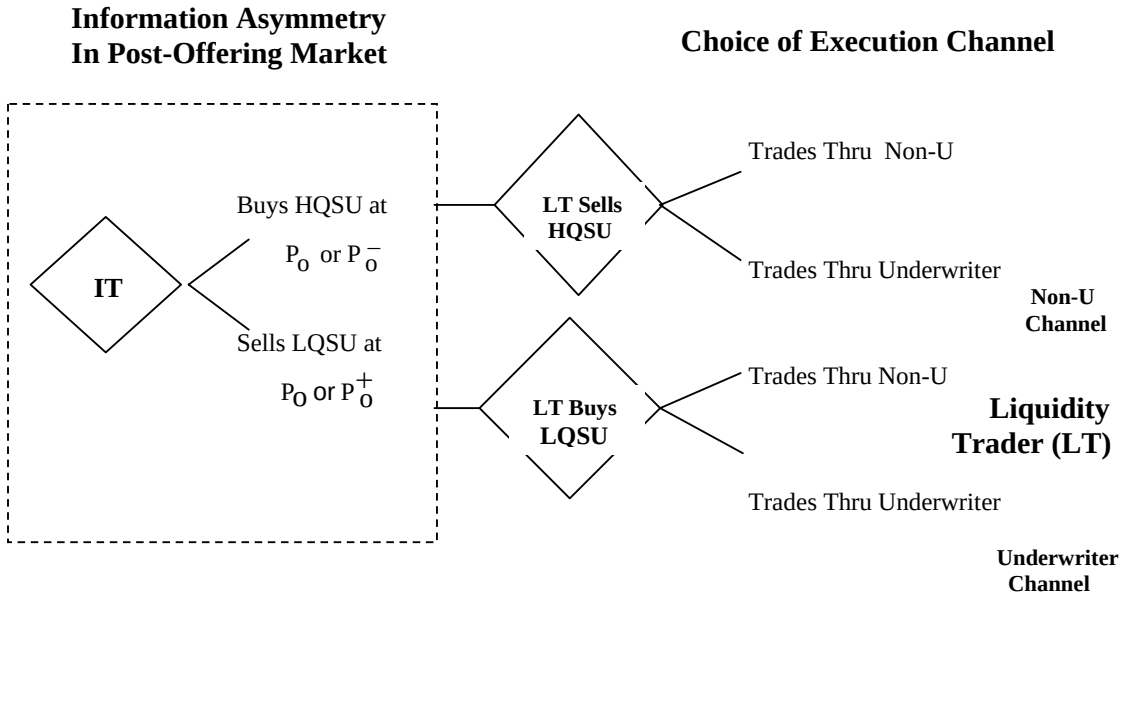
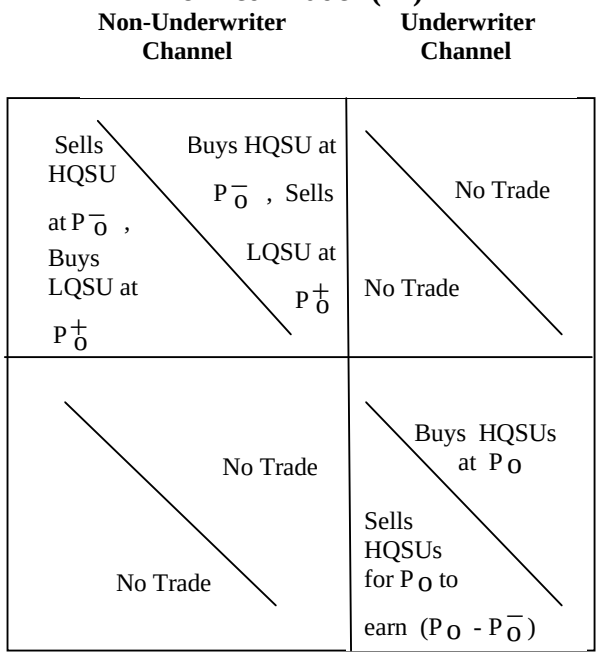


Figure 5: The post-issue role of the underwriter in IPOs (Period 2)

An Iterated Dominant Strategy Equilibrium {Underwriter Channel $_{LT}$, Underwriter Channel $_{IT}$}





IT = Informed Trader
LT = Liquidity Trader