Initial Underpricing of IPOs

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Contents

1 Evidence on Average Initial Underpricing

- Common practice to price IPOs using earnings multiple discount of 10-20% to an industry estimate of the P/E
- IPOs are on average underpriced in most years
  - In markets without daily price limits, most of the underpricing is evident by the closing of the offering day
  - In most markets, the offer price is set only hours before the offer starts, so market movements between the offer price determination and opening are negligible
  - The total dollar value of the underpricing represents "money left on the table" only if the entire offering could have been sold at the closing price
  - There is substantial time variation in average underpricing. The average tend to fluctuate between 10 and 20 percent
  - In the "hot issue markets" of 1999 and 2000 it was 71% and 57%, and the issuer left $62 billion on the table in these two years alone
  - Underpricing is relatively low in France and Germany, and relatively high in Asia

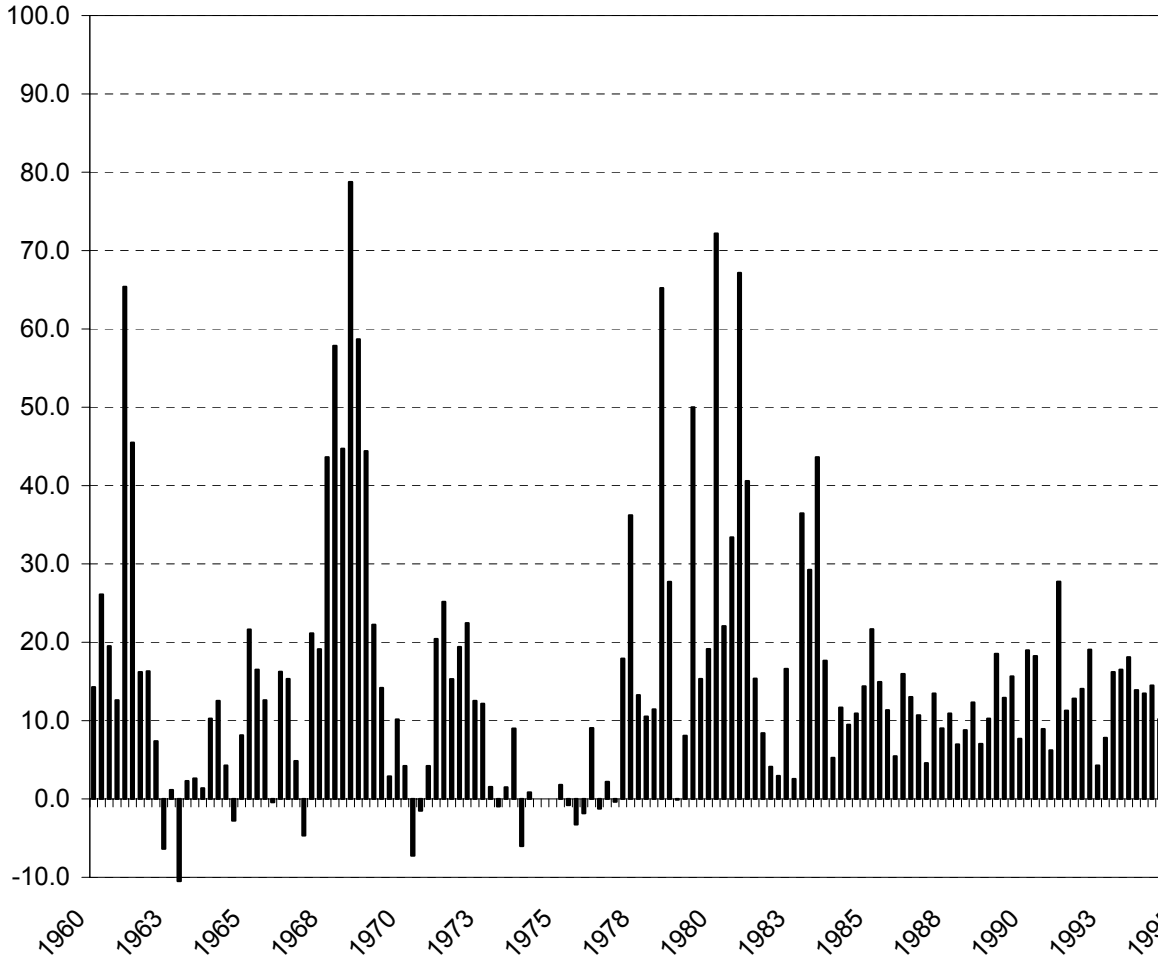

Figure 1. Initial IPO returns in the United States, 1960 to 2003.
The figure reports quarterly equal-weighted average initial IPO returns in % for 14,906 IPOs completed in the United S
as the first-day closing price over the IPO offer price less one. Source: Jay Ritter. Data used by permission.

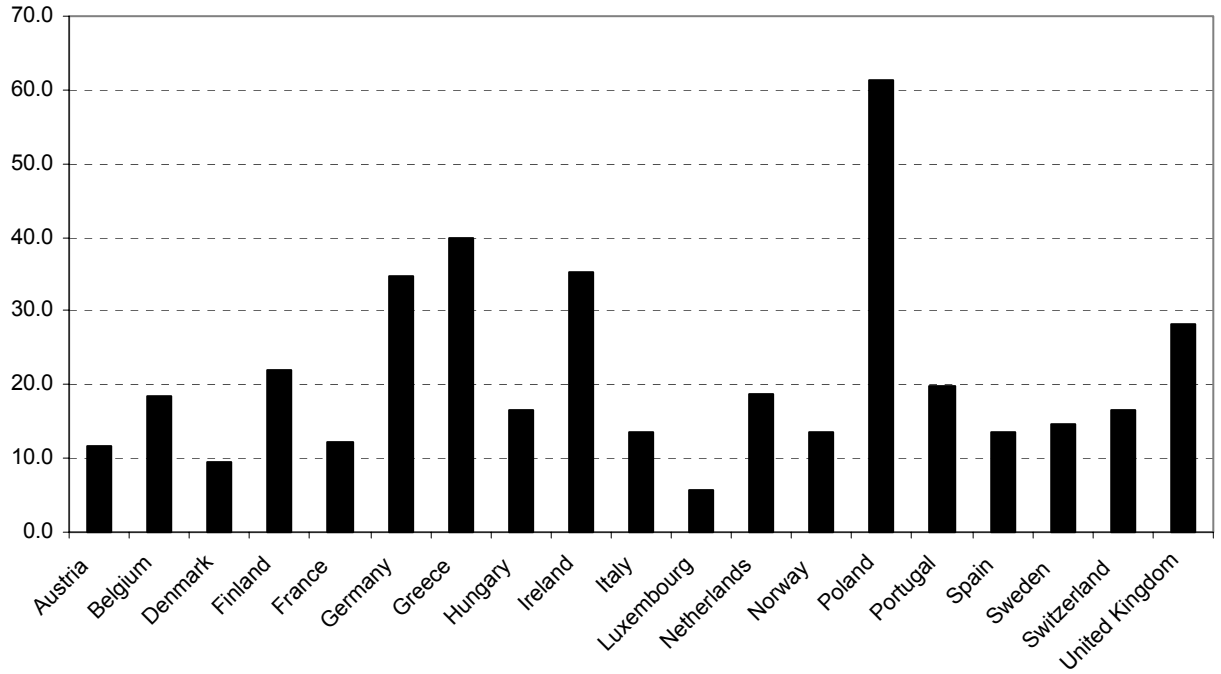

Figure 2. Initial IPO returns in Europe, 1990 to 2003.
The figure reports equal-weighted average initial IPO returns in % for 19 European countries, calculated as the aftermarket trading price over the IPO offer price less one. Aftermarket trading prices are measured on the first day of trading in all countries except France and Greece, where they are measured on the fifth day of trading due to daily volatility limits. IPOs are identified by the author using a range of sources including national stock exchanges, Thomson Financial's SDC global new issue database, Equityware, and news searches. Due to cross-listings, some companies go public outside their home country. The figure shows initial IPO returns by country of *listing*. Aftermarket trading prices are mostly from Datastream, with missing data hand filled from news searches. Between 1990 and 2003, 4,079 IPOs were completed in the 19 countries shown in the figure. This breaks down as follows: Austria (83), Belgium (102), Denmark (69), Finland (70), France (679), Germany (583), Greece (301), Hungary (54), Ireland (22), Italy (158), Luxembourg (5), Netherlands (77), Norway (167), Poland (214), Portugal (33), Spain (47), Sweden (180), Switzerland (68), and United Kingdom (1,167). Source: author's calculations.

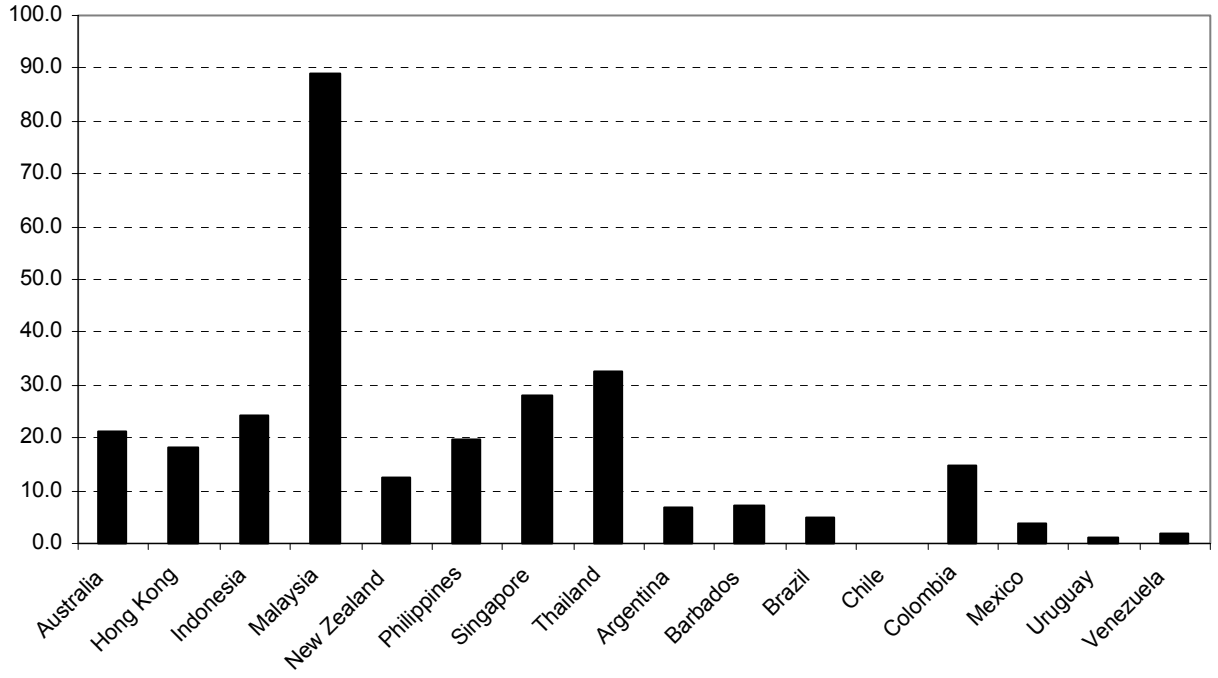

Figure 3. Initial IPO returns in Asia-Pacific and Latin America, 1990 to 2001.
The figure reports equal-weighted average initial IPO returns in % for eight Asian-Pacific and eight Latin-American countries, calculated as the aftermarket trading price over the IPO offer price less one. Aftermarket trading prices are measured on the first day of trading. IPOs are identified by the author using a range of sources including national stock exchanges, Thomson Financial's SDC global new issue database, Equityware, and news searches. Due to cross-listings, some companies go public outside their home country. The figure shows initial IPO returns by country of *listing*. Aftermarket trading prices are mostly from Datastream, with missing data hand filled from news searches. Between 1990 and 2001, 2,716 IPOs were completed in the 16 countries shown in the figure. This breaks down as follows: Australia (633), Hong Kong (523), Indonesia (213), Malaysia (506), New Zealand (51), Philippines (91), Singapore (313), Thailand (251), Argentina (25), Barbados (1), Brazil (13), Chile (7), Colombia (3), Mexico (79), Uruguay (1), and Venezuela (6). Source: author's calculations.

2 Theories of Initial Underpricing

Four classes of theories (not mutually exclusive)

- Asymmetric information theories
  - underwriter better informed than everyone else about demand conditions, leading to rent extraction by bank], or
  - issuer is better informed, leading to signaling arguments
  - Some investors are better informed than everyone else, leading to "winner's curse" arguments, or
- theories emphasizing the institutional environment
  - legal liability
  - price stabilization
  - taxes
- theories emphasizing corporate control motives
  - managers care about the composition of the shareholder base, possibly affecting monitoring
- behavioral models
  - Irrational investors push up the market price
  - Irrational issuers fail to push up the offer price

3 Asymmetric Information Theories

3.1 The winner's curse

- Rock (1986), in an application of Akerlof (1970)'s "lemmons" problem

  Underpricing compensates uniformed investors for quantity rationing induced by adverse selection

Model setup

- Issuer wants to sell N shares
- Each share worth $\tilde{v}$, where $\tilde{v} \sim F(\tilde{v})$. Firm does not know $\tilde{v}$ and sets offer price p. If offer is oversubscribed, the shares are rationed pro-rata
- Two investor types:
  - *Uninformed* with total wealth U (U investors with \$1 each). Type-U investors don't know $\tilde{v}$
  - *Informed* with total wealth I. Type-I investors observe $\tilde{v}$ perfectly
  - All parties are risk-neutral; no borrowing
- $I < \overline{v}N$, where $\overline{v} = E(\tilde{v})$. $\Rightarrow$ *need uninformed to sell issue completely*

Investor demand

- Uninformed investors can't condition their demand on $\tilde{v}$. Thus, they buy only if the price is on average low enough for them to rationally participate in the market (they must break even on average)
- Informed investors place orders with value I only if $\tilde{v} > p$

Expected Payoff to Uniformed Investors

- Expected Payoff to uninformed, if they bid:

$$E(\Pi_U) = \int_{\tilde{v} \leq p} (v - p) f(v) dv + \frac{U}{I + U} \int_{\tilde{v} > p} (v - p) f(v) dv$$

  $\Rightarrow U$-investors get the stock if $\tilde{v} \leq p$ (first integral) and get rationed if $\tilde{v} > p$ (second integral)

  - So, uninformed investors buy more shares in states when $\tilde{v} \leq p$
  - *This is the heart of the winner's curse problem*
  - In order to get uninformed to bid, the firm must therefore set a price below its unconditional expected value $\overline{v}$

How low must the offer price be to attract U-investors?

- The maximum p the firm can charge while not scaring away the uninformed sets $E(\Pi_U)$ equal to zero. We can write $E(\Pi_U)$ as:

$$E(\Pi_U) = \overline{v} - p - \alpha \int_{\tilde{v}>p} (v - p) f(v) dv = 0$$

  where $\alpha = \frac{I}{I+U}$, the proportion of informed investors

- Let Δ denote one standard deviation of $\tilde{v}$. Assuming $f(v)$ is uniform on

$$[\overline{v} - \frac{1}{2}\Delta, \overline{v} + \frac{1}{2}\Delta]$$

  we can write the condition as:

$$E(\Pi_U) = \overline{v} - p - \frac{\alpha}{2\Delta}(\overline{v} + \frac{1}{2}\Delta - p)^2 = 0$$

- Note:

  (1) $\alpha = 0 \Rightarrow$ no underpricing: $p = \overline{v}$.

  (2) $\frac{dp}{d\alpha} < 0 \Rightarrow$ an increase in proportion that is informed lowers the price (produces more underpricing)

  (3) $\frac{dp}{d\Delta} < 0 \Rightarrow$ an increase in uncertainty about firm value increases underpricing

Empirical predictions

1. *Adjusted for rationing, uninformed investors earn zero initial returns. Informed investors' conditional returns just cover their costs of becoming informed*

   - Koh and Walter (1989), 66 IPOs in Singapore where in the 70s and 90s, oversubscribed IPOs allocated by random ballot. Find that

     (i) two investors bidding for the same number of shares have an equal chance of receiving an allocation,

     (ii) the likelihood of receiving an allocation negatively related to oversubscription,

     (iii) average initial returns fall from 27% to 1% when adjusting for rationing

   - Less clear evidence of zero conditional underperformance in other countries (e.g. UK, Finland, Israel)
   - No evidence on costs of becoming informed
   - Difficult to verify whether institutional buyers are "informed". However, Aggarwal, Prabhala, and Puri (2002) find evidence that institutions tend to receive a greater allocation of the most underpriced shares

2. *Underpricing decreases as information becomes less heterogeneous across investor groups*
   - Institutional investors tend to avoid Master Limited Partnerships (MLPs) IPOs for tax reasons. As a result, buyers are more homogeneous as a group. Michaely and Shaw (1994): Underpricing -0.04% for 39 IPOs (84-88) versus 8.5% for non-MLPs

3. *The greater the ex ante uncertainty about the true value of the IPO shares, the greater is expected underpricing*
   - This prediction is shared by all asymmetric information theories
   - Proxies for ex ante uncertainty: Firm size, industry, risk factors listed in prospectus, aftermarket trading volume and volatility
   - Bank/auitor "reputation" believed to reduce ex ante uncertainty

4. *Underwriters that underprice too much (too little) lose business from issuers (investors)*

3.2 Book building and Information Extraction

Model Framework

- The winner's curse results from a strict pro-rata allocation rule

- Book building may allow a quid pro quo in which informed (institutional) clients reveal some of their private information to the bank in return for a preferred pricing and allocation

- Benveniste and Spindt (1989) formalizes this possibility
  - Bank allocates few shares to investors who bid conservatively
  - Investors who bid aggressively are rewarded with disproportionately large allocations
  - Bank underprices the IPO

Empirical Predictions

1. *Aggressive bidding is rewarded with greater allocations*
   - Supported by Cornelli and Goldreich (2001) using proprietary information for a single UK bank
2. *The more positive the information possessed by investors, the greater the incentive to withhold it, and so the greater the required underpricing (money left on the table) to induce revelation*
   - This is also called the "partial adjustment" hypothesis: Bank pre-committed not to exploit all positive information received in book building process, but will reduce offer price to fully reflect negative information
   - Empirical evidence largely consistent with such partial adjustment of offer price
   - Selective price support ("money back" guarantee) a substitute to partial adjustment
3. *Underwriters will economize on information collection*
   - "Bundling" of IPOs over time (resulting in IPO "waves")
   - Encouraging clients to participate in a sequence of offerings (IPO followed by SEO, debt offering, etc.)

3.3 Principal-Agent Models

Model Framework

- Highlights agency issues between issuer (principal) and underwriter (agent) due to asymmetric information (bank knows more than issuer) and "moral hazard" (bank's selling effort is unobservable)

- Leads to rent-seeking and possible collusion between bank and informed investors

- Side-payments in the form of excessive commissions on unrelated trades (CSFB fined $100 mill in 2002)?

- Allocation of underpriced IPO shares to executives ("spinning")?

- Early models focused on how the bank could "shirk" on effort (Baron (1982))
  - Screening model where the issuer (uninformed party) offers banks a menu of contracts
  - Contract menu designed to optimize the issuer's objective [analogy: a car insurer offers a combination of premium and deductible to price-discriminate between different risks (unobservable types) or to induce safe driving (moral hazard)]
  - Issue pricing decision delegated to the underwriter
  - Underwriter self-selects a contract from a menu of combinations of IPO prices and underwriter spreads
    - If likely demand is low, a low price–high spread contract is chosen, and vice versa
    - This makes the underwriter profit dependent on market demand for the issue, and induces selling effort provosion
    - The greater the uncertainty about the true value of the IPO, the greater the underpricing and thus sales effort

- More recent model by Biais, Bossarts, and Rochet (2002) adding the presence of relatively informed investors to Baron's basic framework
  - Now we may get collusion between informed investors and the bank
  - The issuer's optimal contract, the IPO price is set higher the fewer shares are allocated to uninformed (retail) investors
  - When informed investor' private information is positive, they get more of the allocation and at a higher price
  - When informed investors' private information is negative, the opposite happens, thus lowering winner's curse

- Issuers can monitor the banks's behavior by (i) oversee selling effort and bargain hard over offering price, or (ii) use contract design to realign banks incentives, by making its compensation increasing in offer price

Empirical Evidence

- Ljungqvist and Wilhelm (2002) provide evidence indicating monitoring and bargaining in the US in the late 1990s. They find that first-day returns lower the greater the CEO's interests are aligned with issuer's shareholders

- Muscarella and Vetsuypens (1989) looked at 38 self-underwritten investment bank IPOs. These are underpriced roughly as much as other IPOs

- Ljungqvist and Wilhelm (2002) find that investment banks are pre-IPO shareholders in issuer in 44% of cases by year 2000. They find that the underpricing is lower the greater the pre-offer equity stake, as expected given monitoring incentives

- Li and Masulis (2003) look at VC-backed IPOs and find initial returns decrease in the VC's pre-IPO equity stake (more pronounced effect for lead underwriter)

- Reuter (2004) proxies institutional IPO allocations with their post-IPO reported holdings in IPO firms. They find a positive relation between the commissions mutual funds paid to lead managers and the size of these holdeings, as if they "buy" underpriced IPO allocations

3.4 Underpricing as a Signal of Firm Quality

- Allen and Faulhaber (1989), Welch (1989), Grinblatt and Hwang (1989): *Main idea: Issuing firms knows their type better than investors, and want to leave "good taste in the mouth" of investors because they may return to the market to issue more equity*

Empirical Evidence: Links IPO-SEO are weak. Spiess and Pettway (1997) find that insiders in IPO firms do not sell less in the (dual) offering the greater the underpricing

4 Institutional Explanations

4.1 Legal Liability

- *Main Idea: Underpricing insures against lawsuit*
- Motivated by the US litigious environment
- In the US, the amount of damage increases in the difference between the offering price and the subsequent (lower) market price. Thus underpricing reduces chance of damages
- However, evidence that several countries where threat of lawsuit is low nevertheless underprice IPOs (Finland, Germany, Japan, Sweden, Switzerland, UK)
- Tinic (1988) find that 70 IPOs between 1923 and 1930 (before enactment of the 1933 SE Act which created legal liability in the US) were underpriced 5.2% versus 11% 1966-1971
- Drake and Vetsuypens (1993) find that probability of being sued is <u>not</u> greater the lower the underpricing, while Lowry and Shu (2002) finds that it <u>does</u> and that greater ex ante litigation risk requires greater underpricing to insure against a lawsuit
- Overall implication: Legal threat a second-order explanation for underpricing at best

4.2 Price Stabilization

Rules

- As of 1997, post-IPO price support exempted from the anti-manipulative provisions in Section 10(b)-7 of the 1934 Securities Exchange Act
- Prior to 1985, underwriters engaging in stabilization were required to disclose with the SEC
- Bids placed by underwriter for price stabilization must be at or below offer price
- Allowed to stabilize only for a reasonable period, typically a few days (less than two weeks)

Mechanics

- Underwriter shorts 10-20% of the issue at the offering
- If price increases, cover the short position with the "Green Shoe" (over-allotment) option (no loss on the covered part). If price decreases, cover the short position by purchases in the market (a gain). Typically, in this case, the underwriter repurchases at the offer price (no gain)

Statistical implication of price support

- *Successful price intervention truncates the lower tail of the distribution of the stock price, turning what would otherwise have been evidence of positive overpricing to an observation of zero. Thus, even if IPOs are not underpriced on average, data that reflect stabilization will necessarily show positive underpricing on average*

- Intuition: Intervention truncates the observed distribution of underpricing at zero, mechanically producing a positive (conditional) average
- Ruud (1993) use a "Tobit" regression technique, which corrects for data truncation, to estimate the *unconditional* mean undepricing. She cannot reject the hypothesis that this unconditional mean equals zero
- Thus, she fails to reject that the hypothesis that IPO are *not* underpriced

Why Intervene?

- Since dollar fees increase in gross offering proceeds, underwriters have an incentive to maximize the offer price
- This means that the bank have an adverse incentive to overstate its information about investor demand acquired through the book-building process
- Benveniste, Busaba, and Wilhelm (1996): By implicitly committing to price support, which is costlier the more the offer price exceeds the issuer's true share value, underwriters may convince investors that IPOs will not be intentionally overpriced
- This argument holds for those investors who are in a position to reveal private information to the underwriter during book building (i.e. mostly the bank's institutional clients)
- Chowdhry and Nanda (1996): Price support also provides insurance for retail investors, and thus reduces winner's curse

How widespread is intervention?

- Direct evidence: limited as intervention is disclosed to the SEC but not to the public
- Indirect evidence: we observe underwriters becoming market-makers in their IPO companies on Nasdaq. Variables of interest:
  - Bid-ask spreads (relative to market makers not part of the IPO syndicate)
  - inventory accumulation (indicating net buying)
- Ellis, Michaely, and O'Hara (2000): Nasdaq evidence indicates that lead underwriter becomes dominant market maker and accumulates sizable inventories over the first 20 days
- Asquith, Jones, and Kieschnik (1998): Focuses on the mixed distribution of initial returns implied by intervention, and conclude that about 50% of IPOs are price supported in 1982-83. They also conclude that there is underpricing in the distribution of (presumably) *unsupported* IPOs, suggesting that intervention is not only cause of observed underpricing
- Benveniste, Erdal, and Wilhelm (1998): Transactions data on 504 US IPOs, 1994-94. Finds that sellers in the aftermarket during stabilizations are predominantly institutions (not retailers). So, institutions appears to be main beneficiaries of price support

- Unresolved: How much does the promise of price stabilization reduce required underpricing ex ante?

4.3 Tax Arguments

Main Idea: Managerial tax benefit induces greater underpricing

- Rydqvist (1997): Prior to 1990, employee gain from underpricing of new shares taxed at the capital gains rate, not the much higher income tax rate, causing a surge in ESOPs. Tax law change in 1990 made underpricing-related gains taxable at employee's income tax rate. Average IPO underpricing fell from 41% in 1980-189 to 8% in 1990-94

- Taranto (2003): Let FV denote a stocks "fair value", X the option exercise price, S the stock's market price, and OP the offer price. Holders of ESOs pay taxes in two stages:

  - At option exercise: Income tax on FV-X, and
  - At sale of stock: capital gains tax on S-FV
  - For stocks awarded through an IPO, IRS sets FV=OP (rather than S at the time of sale of the stock), so managers have a tax-based incentive to lower OP
  - Some evidence IPO underpricing is greater for companies relying heavily on ESOs
  - This is consistent with the tax argument. However, it is also consistent with the proposition that boards tend to award stock options to protect managers from some of the dilution effect of deep underpricing (a causality reversal)

4.4 Ownership and Control

1. Underpricing to *avoid* monitoring and entrench mangers

- Brennan and Franks (1997): The IPO is allows managers to achieve ownership dispersion
  - model fixed price offerings (not responsive to market demand) with pro rata share allocations
  - Underpricing creates excess demand which allow managers to allocated shares to smaller, passive shareholders
  - 69 UK IPOs, 1986-89: Large bids (for IPO allocations) are discriminated against, and this discrimination is greater the more underpriced the IPO

2. Competing interpretations of an underpricing/dispersion link:

- Ownership dispersion creates greater market liquidity, which is beneficial
- Pagano, Panetta, and Zingales (1998): Ownership dispersion at the IPO may increase price in subsequent follow-on equity offerings (e.g. private placements). They find that change of control is twice as likely in newly listed firms than in the universe of unlisted companies
- Mikkelson, Partch, and Shaw (1997): officers and directors significantly reduce their equity ownership following US IPOs (although this could also reflect lower–not greater–monitoring)
- Underpricing not only way to protect managers' private benefits of control: Field and Karpoff (2002) find that a majority of US firms deploy at least one (corporate charter) takeover defense just before going public. Moreover, these firms also issue underpriced IPOs
- Smart and Zutter (2003) IPOs of non-voting stock less underpriced and have greater institutional ownership than others
- Field and Sheehan (2002): If underpricing increases agency costs, it may be profitable to purchase a control block in the market following the IPO. They find no evidence of a relation between underpricing and the subsequent creation of new share blocks

3. Underpricing to *encourage* monitoring and reduce agency costs

- Stoughton and Zechner (1998): Managers who own large block of shares in IPO firm bear a large portion of the cost of entrenchment and may decide to use the IPO as a way to reduce those costs
  - Requires placement of a sufficiently large portion of the IPO with a few investors likely to exercise monitoring
  - Underpricing induces such individual investors to purchase at the IPO
  - The selling mechanism is book building with subsequent discretionary allocations to "monitoring" investors
  - Note: In this case, observed underpricing is not necessarily a "cost" as it reflects the benefit of greater market price caused by expectations of monitoring

5 Behavioral Explanations

5.1 Informational Cascades

- Suppose you observe investors bidding up the price of an IPO. You interpret this as indicating these earlier investors have received positive information about the IPO
- Now, you receive a private signal that the IPO may be overpriced. Under certain conditions (Welch (1992)), you rationally disregard your own signal and mimic the demand of earlier investors
- In this case, successful initial sales encourages later investors to invest whatever their own information
- Conversely, disappointing initial sales can dissuade later investors from investing irrespective of their private signals
- As a consequence, demand either snowballs or remains low over time
- Such "informational cascades" are rational, driven by a lack of free communication among investors
- Issuers may be better off with cascades than with free information, because free communication aggregates all available information which maximizes the issuer's informational disadvantage

- Moreover, preventing free communication may reduce the chance that one investor's negative information becomes widely known, and so can reduce the failure rate of IPOs

- *The possibility of cascades gives market power to early investors who can demand greater underpricing in return for committing to the IPO and thus start a positive cascade*

- *During book building, cascades do not develop because the underwriter can maintain secrecy over the development of demand in the book. Less underpricing is therefore required*

5.2 Investor Sentiment

- *Presumes that investors systematically over- or under-price stocks*
- Systematic overpricing (investors are overconfident) implies mean reversion in the IPO stock price as the true information is revealed
- This proposition is rejected by the long-run return study in Eckbo and Norli (2004)
- One interpretation of Eckbo-Norli is that arbitrageurs eliminate any arbitrage profits emanating from investor sentiment

5.3 Prospect Theory and Mental Accounting

- Loughran and Ritter (2002):
  - *Issuers fail to get upset about leaving millions of dollars on the table (via underpricing) because they tend to sum the wealth loss due to underpricing with the (often larger) wealth gain on retained shares as the price jumps in the aftermarket*
  - *Such complacent behavior benefits the investment bank if investors engage in rent-seeking to increase their chances of being allocated underprice stock*
- Ljungqvist and Wilhelm (2004) find that issuers of follow-on SEOs are less likely to switch underwriter following an IPO where the issuer was satisfied the IPO satisfied the above net wealth gain

A Information Links between IPO and Follow-on SEO

Elements of Allen and Faulhaber (1989)

- At date 0:
  - fraction θ of firms are "optimists"; $1-\theta$ are "pessimists"
  - firms do IPOs selling a fraction α of equity
- At date 1:
  - λ of the optimists become "good" firms; $1-\lambda$ become "bad" firms
  - All pessimists become bad firms
  - Good firms pay a dividend of $D = H$ with certainty

    Bad firms pay $D = H$ w.p. π and $D = L$ w.p. $1-\pi$, where $H > L$
  - After dividend, firms sell remaining $1-\alpha$ of equity in a seasoned equity offering (SEO)
- At date 2:
  - Good firms pay $D = H$ (liquidating)
  - Bad firms pay $D = 0$

- Allen and Faulhaber (1989) construct a separating equilibrium in which only optimists underprice

- Main idea:

  – At time 1, when the firm tries to issue more equity, investors will use two pieces of information to assess firm type

  -Did firm underprice? Only optimists do and they are more likely to be good

  -What is time 1 dividend? Good firms more likely to pay H

  However, neither piece of information is sufficient:

  – $\lambda < 1$ implies optimism alone does not guarantee the firm is good

  – $\pi > 0$ implies dividend of H does not mean firm is surely good

  Both critical because:

  (1) If $\lambda = 1$, no further information revealed about optimists $\rightarrow$ know they are good for sure. Then pessimists would mimic

  (2) If $\pi = 0$, then date 1 dividend is perfectly informative. No point to underpricing to improve date 1 prospects

- Market believes firm is likely to be good only when:
  - underprice
  - get dividend of H at date 1
- If either condition fails, firm is certainly worthless and so can't sell stock. Underpricing helps only if you get a dividend of H at date 1
- We can sustain a separating equilibrium because:
  (i) Underpricing is costly to both types, but
  (ii) Optimists are more likely to benefit because they are more likely to get a dividend of H.
- Implications:
  (1) IPOs perceived as underpriced by all investors, so they are rationed. But, uninformed can earn profits
  (2) Correlation between IPO underpricing and a subsequent SEO
- Comments:
  (1) All else equal, optimists need to issue less equity later on (they don't need as much cash since they are more profitable)
  (2) More of a theory of "money-burning" than IPO underpricing

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