IPO Auctions

Why Don't Issuers Choose IPO Auctions

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ECON 1465 - Market Design: Theory and Applications
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Outline

1. IPO Pricing
   - Introduction
   - Baseline Model
2. Why Issuers Avoid IPO Auctions
   - Possible Explanations
   - Empirical Examples
3. Summary

Outline

What is IPO?

IPO stands for initial public offering and occurs when a company for the first time sells its shares to the public.

Types of IPO Pricing

- Book Building
- Uniform Price Auction
- Fixed Price Auction
- Mise en Vente

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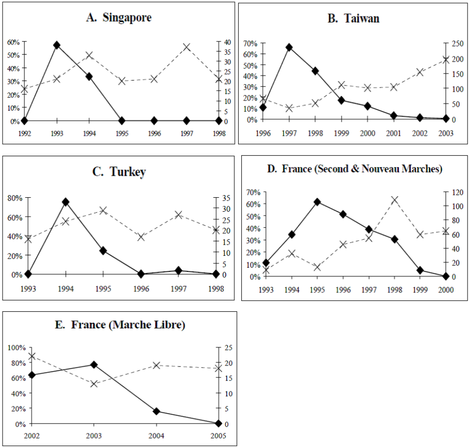
Why Focusing on Uniform Price Auctions?

- Regulations in many countries prohibit price discrimination.
- If uniform price auctions work under some conditions, more complex auctions may work under more general conditions.

How Auctions Evolved over Time in Four Countries

In each graph, the X's (right axis; connected by dashed lines) give the number of total IPOs per year in that country, while the diamonds (left axis; connected by solid lines) are the percentages of IPO auctions out of all IPOs.

Sources: A: E-mail from the Stock Exchange of Singapore, October, 1999. B: The data was given to us by K.C. John Wei. See Liu et al. (2001) and, for 2002-2003 data, Hsu and Hung (2005). C: E-mail from the Istanbul Stock Exchange, March, 1999. D: Derrien and Womack (2003) and Chahine (2001). E: Euronext website (www.Euronext.com, in IPO Archives).



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- utility function:

$$u(c_0 + (V - p)x)$$

  when $x =$number of shares $(0 <= x <= 1)$, $p =$ price, $c_0 =$initial capital
- $u(c_0) = 0$

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Assume no information/transaction cost:

- Each bidder i receives conditionally independent, identically distributed signals s_i about V.

$$s_i \sim F(s|V)$$

- F has finite expectation and strictly positive density
- $E[s_i] = V$

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Bidding function/strategy:

- After observing signals s_i, each bids b_i
- bidding strategy

$$B_i(s_i) = b_i$$

- Auctioneer collects bids $b = b_1, ..., b_N$

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Clearing price:

- p lies between Kth and $(K+1)$th agents
- assign only one lot to each bidder with bid higher than p
- ties broken at random

Equilibrium

Each bidder i, B_i = optimal response to collection of other strategies

Theorem 1 (See Milgrom (1981) for Proof)

Unique symmetric equilibrium, every bidder i has the same strictly increasing $B_i(s_i)$ that solves:

$$E[u(V - B(s))|s_i = s, s_{-i}^K = s] = 0$$

and in the risk-neutral case: $u(x) = x$ take a simple form of

$$B(s) = E[V|s_i = s, s_{-i}^K = s]$$

where s_{-i}^K is the K'th highest signal of all agents other than i

In other words...

- Bidders can't do better than bid under the assumptions that they have received the lowest of the winning signals.
- Monotonicity of $B \rightarrow$ all N bidders submit bids in equilibrium
- As $N \uparrow$, auction price $\rightarrow V$
- The auction discount $\rightarrow 0$.
  See `Pesendorfer and Swinkels (1997)`

Outline

Winner's Curse and Bid Shaving

Case 1: $N \geq 2K$

- $\#$ Losers $\geq$ $\#$ Winners
- $b_i \sim s_i$.
- As $N \uparrow$ grows, original signal more likely in the right tail of distribution **(winner's curse)**
- Bidders shave their bids.

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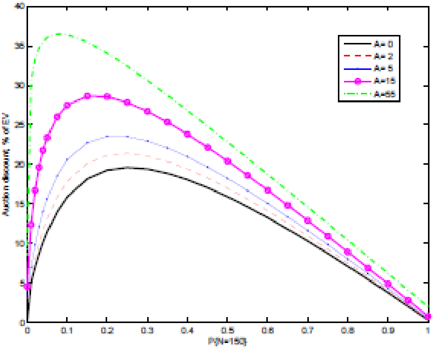
The equilibrium: low equilibrium discount

Structural Risk

Inherent risk in high variation of number and strategy of bidders

We illustrate the effect of structural risk by considering an environment similar to the baseline model, but with added uncertainty about the number of bidders. For simplicity assume that all bidders are identical and there are L potential bidders, out of whom either N_1 or N_2 get to participate, with ex ante probabilities p and $1 - p$.
Discount and $P(N_2 = 150)$
X-axis: $P(N = 150)$
Y-axis: auction discount, % of EV
A: level of risk aversion

Figure 6: Discount and $\Pr[N_2 = 150]$



Underpricing of Securities

- Positive abnormal first-day trading returns
- Gross elasticity
- Incomplete knowledge
  - Unknown number of investors
  - Unknown accuracy of information
- First day trading behavior reveals additional information

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- Overlook conditional probabilities

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Example: bidding strategy:

- $K = 15$ winners gain \$ 0.5 when $N = 20$
- $K = 15$ winners lose \$ 1 when $N = 150$
- $P(N \text{ will be } 20) = P(N \text{ will be } 150)$

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- If $N = 20$, expected gain: $0.5x\frac{15}{20} = 0.375$
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- $\therefore$ Expected gain: $\frac{1}{2}x0.375 + \frac{1}{2}x(-0.1) = 0.1375$

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- Something is wrong!

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- Assume N bidders are chosen randomly from population of N_0
- $P(N \text{ is } 20) = \frac{\frac{20}{N_0}x\frac{1}{2}}{\frac{20}{N_0}x\frac{1}{2}+\frac{150}{N_0}x\frac{1}{2}} = \frac{20}{170}$

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- $P(N \text{ is } 150) = \frac{\frac{150}{N_0}x\frac{1}{2}}{\frac{20}{N_0}x\frac{1}{2}+\frac{150}{N_0}x\frac{1}{2}} = \frac{150}{170}$
- Expected gain: $\frac{20}{170}x0.375 + \frac{150}{170}x(-0.1) = -0.044$

In Summary...

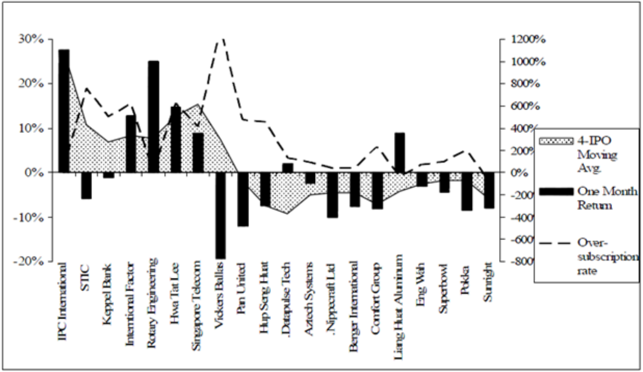
- Auctions: indirect mechanisms requiring a level of sophistication above that of many investors.
- Computational burden on participants
- Even sophisticated ones make mistakes, imposing costs on others.

Outline

Singapore

- Large fluctuation in number of bidders
  - Lower average bid numbers over time
- Stock prices resulting from IPO auctions fall below reservation price, resulting in undersubscription to future IPO auctions
  - 10% of IPO auctions were undersubscribed.
- Decreasing returns to bidding (eventually going negative)

Buy-and-Hold Returns and Subscription Levels



All 1993-1994 auctions are ordered by date. One month raw returns are the returns to winning bidders that held their shares for 30 days in the after-market. The 4-IPO moving average is the average return on the last 4 offers (or all previous, if less than 4). The oversubscription rate is in percent an offering that was 60% oversubscribed received orders for 1.6 times the shares available.

Example: Singapore Telecom

- Oversubscribed - 162,492 bidders (over half Singapore's total population)
- Reservation price = S$ 2.00
- Market Clearing price = S$ 3.60
- Bids went as high as S$ 100
- First-day trading price peaks at S$ 4.14
- Price declines despite the overall market going up
- After-market price drops to $S 1.90

Google IPO 2004

Purpose: allow for equal opportunity for both big and small investors

- Bidders must obtain a bidder identification number before the start of bidding $\rightarrow$ limits the number of potential bidders
- Analysts predicted a valuation of $108-$135
- Offer price = $85
- First day trading opens at $100
- Within a few months after-market price rises above $200
- Price has never fallen below IPO offer price

Book Building VS Auctions

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- might be as bad as auctions if
  - minimum allocation to the uninformed is binding
  - cost of gathering information sufficiently large

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  - cost of gathering information sufficiently large
- **Auctions** fail because they are indirect.
  - require high degree of sophistication of all participants.

A Hybrid Auction

- Auction tranche
  - for informed investors
  - issue price determined
- Fixed price tranche
  - for those without relevant pricing information
- Self-selection
- Issuer can distinguish informed investors from non-informed ones but cannot prevent informed ones to act as uninformed.

Summary

- There are many ways to price IPOs
- Uniform price auctions can potentially make the distribution of shares more equitable
- However, auctions also have many sources of inefficiency, leading them to fall mostly out of use
- Most countries use a hybrid system that combines uniform price auctions with the book building method

Thank you very much!