IPO Auctions

Why Don’t Issuers Choose IPO Auctions

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Outline

1 IPO Pricing
   - Introduction
   - Baseline Model

2 Why Issuers Avoid IPO Auctions
   - Possible Explanations
   - Empirical Examples

3 Summary
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1. IPO Pricing
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3. Summary
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.

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Consider a simple **uniform-price auction**:

- $K$ lots of shares, each has $n$ shares
- all shares have the same random value $V$, unknown
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Set-Up

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- $K$ lots of shares, each has $n$ shares  
- all shares have the same random value $V$, unknown  
- $N$ identical bidders  
- utility function:  
  \[ u(c_0 + (V - p)x) \]

when $x =$number of shares ($0 \leq x \leq 1$), $p =$ price,  
$c_0 =$initial capital  
- $u(c_0) = 0$
Set-Up

- $K = 15$ winning bidders receive identical one lot of shares.
- $N - K$ losing bidders receive 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
- \( E[s_i] = V \)
Set-Up

Bidding function/strategy:
- After observing signals $s_i$, each bids $b_i$
- bidding strategy
  \[ B_i(s_i) = b_i \]
- Auctioneer collects bids $b = b_1, \ldots, b_N$
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**Clearing price:**
- $p$ lies between $K$th and $(K + 1)$th agents
- assign only one lot to each bidder with bid higher than $p$
- ties broken at random
Equilibrium

Each bidder $i$, $B_i = \text{optimal response to collection of other strategies}$

**Theorem 1 (See Milgrom (1981) for Proof)**

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

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

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

$$B(s) = E[V|s_i = s, s^K_{\prec i} = s]$$

where $s^K_{\prec i}$ 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)
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Winner’s Curse and Bid Shaving

Case 1: $N \geq 2K$

- # Losers ≥ # 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.
Winner’s Curse and Bid Shaving

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Case 2: \( N < 2K \)
- \# Losers < \# Winners
- Losing means signal biased downward (loser’s curse)
- Bidders adjust their bids upwards.
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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
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
Bidding in Auctions can be Difficult

- Uncertainty about bidding environment
- 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 \( N = 150 \)
- \( P(N \text{ will be } 20) = P(N \text{ will be } 150) \)

\[
\text{If } N = 20, \text{ expected gain: } 0.5 \times 15/20 = 0.375
\]
\[
\text{If } N = 150, \text{ expected gain: } -1 \times 15/150 = -0.1
\]
\[
\therefore \text{Expected gain: } \frac{1}{2} \times 0.375 + \frac{1}{2} \times (-0.1) = 0.1375
\]
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- If $N = 20$, expected gain: $0.5 \times \frac{15}{20} = 0.375$
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- If $N = 20$, expected gain: $0.5 \times \frac{15}{20} = 0.375$
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- $\therefore$ Expected gain: $\frac{1}{2} \times 0.375 + \frac{1}{2} \times (-0.1) = 0.1375$
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- Expected gain: \( \frac{1}{2} \times 0.375 + \frac{1}{2} \times (-0.1) = 0.1375 \)
- Collective gain: \( \frac{1}{2} \times 0.375 \times 20 + \frac{1}{2} \times (-0.1) \times 150 = -3.75 \)
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- **Something is wrong!**
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**Fact:** more likely to win if $N = 20$, more likely to lose if $N = 150$
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**Fact:** more likely to win if \( N = 20 \), more likely to lose if \( N = 150 \)

- Assume \( N \) bidders are chosen randomly from population of \( N_0 \)
- \( P(N \text{ is } 20) = \frac{\frac{20}{N_0} \times \frac{1}{2}}{\frac{20}{N_0} \times \frac{1}{2} + \frac{150}{N_0} \times \frac{1}{2}} = \frac{20}{170} \)
Bidding in Auctions can be Difficult

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- $P(N \text{ is } 150) = \frac{\frac{150}{N_0} \times \frac{1}{2}}{\frac{20}{N_0} \times \frac{1}{2} + \frac{150}{N_0} \times \frac{1}{2}} = \frac{150}{170}$
Bidding in Auctions can be Difficult

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- \( P(N \text{ is 150}) = \frac{\frac{150}{N_0} \times \frac{1}{2}}{\frac{20}{N_0} \times \frac{1}{2} + \frac{150}{N_0} \times \frac{1}{2}} = \frac{150}{170} \)
- Expected gain: \( \frac{20}{170} \times 0.375 + \frac{150}{170} \times (-0.1) = -0.044 \)
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.
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 → 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

- **Book building**: less underpricing on average and not too complexed for investors
- might be as bad as auctions if
  - minimum allocation to the uninformed is binding
  - cost of gathering information sufficiently large
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- **Book building**: less underpricing on average and not too complexed for investors
- might be as bad as auctions if
  - minimum allocation to the uninformed is binding
  - 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.
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!