Texas CD Auctions

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Trade and Investment Strategy

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Course Overview

A trading mechanisms is a tool for allocating resources between competing uses

- Trading mechanisms:
    1. assign values to resources in alternative uses.
    2. allocate the resources to those areas assigned the highest values.

- Trading mechanisms can be used to regulate and guide resources:
    1. between stand alone entities, such as B2B or B2C.
    2. within an entity, such as internal markets to guide inventory, or schedule capital equipment shared between plants.

- There are other ways of determining how to allocate resources:
    1. algorithmic schedules programmed by software engineers.
    2. negotiations between different parties who want the resource.
    3. centralized decisionmaking by a manager or owner.

Course Overview
Course themes and topics

- Much of Trade and Investment Strategy (T&IS) explores the mechanics of trade, and optimal trading strategies:

- In this part of the course we take the value of a security as a given to each individual. We focus on:
  1. auctions
  2. procurement contracts
  3. limit order markets.

- The last parts of the course analyze how securities are valued.

- We divide the discussion into three parts, explaining how
  1. consumers choices over time affect their financial position
  2. uncertainty affects consumer choices and firm governance
  3. dynamics and uncertainty affect portfolio investment strategy

- This course is about strategically exploiting the gains from trade. I hope you:
  - develop a working familiarity with auctions and limit order markets as a trader, investor and portfolio analyst.
  - better predict and evaluate trading opportunities.
  - better respond as a contractor and bidder in an auction.
  - think about creating trading mechanisms and market based platforms as organizational tools.

- The course website is:
  http://www.comlabgames.com/45-871

Introduction to Auctions
Why study auctions?

- There are three basic reasons to begin T&IS with a study of auctions:

  1. Auctions serve a vital role in business and government:
     - Private individuals and government agencies buy and sell goods and services using auctions.
     - Auctions are sometimes used in competitive contracting between an (auctioneer) firm and other (bidder) firms up or down the supply chain to reach trading agreements.

  2. Several other forms of trade have an auction flavor about them:
     - merger and acquisitions.
     - submission for research grants and government contracts.

  3. Auctions are relatively simple to analyze, providing opportunities to:
     - get hands-on bidding experience
     - learn how to bid.
     - discover what auctions produce the most revenue.

Auctioning Certificates of Deposit in Texas
Overview

- A certificate of deposit (CD) is a fixed rate short term loan:
  https://www.investopedia.com/terms/c/certificateofdeposit.asp
- In Texas (and several other states) the state government auctions
  CDs to provide liquidity for banks' lending operations:
  - The loans are for several months (six).
  - The auctions are held once a month and last 30 minutes.
  - There is an upper bound on total available funds at each auction
    (usually $80 million).
  - Banks can bid for as little as $100,000 and as much as $7 million.
  - Consequently multiple banks win CDs at each auction.

- Prior to bidding the auctioneer (state government) sets:
  - a reservation interest rate (lower than commercial rates available nationally)
- During the auction banks (bidders):
  - cannot withdraw a bid but can be increase it throughout the auction.
  - can increase their bids as many times as they like by any amount.
- Funds are allocated to banks offering the highest interest rates.
  - Winning banks pay the highest (most recent) interest rate they bid.
  - Losing banks pay nothing.
- Very little information is provided to banks during the auction.
  - The ONM rate is the lowest bid to win a CD if bidding stops.
  - When a bank bids the only information is receives is whether their bid is less than the ONM.

The Data
The sample

- Our data set contains 78 auctions from 2006-2010 straddling the financial crisis of 2008.
- A pool of 73 potential banks bid over this period with an average of 24.5 banks entering each auction.
- Averaging across auctions, 72% of banks win.
- Money left on the table (MLT) is the dollar difference in interest payments for a winning submission and the highest losing bid.
- MLT is $624 (pre) and $1372 (post) per winning bid.
- The average national CD rate in the post-2008 period is 0.79% per annum.
- The average reserve rate between 2008 and 2010 in these auctions at 0.71% is slightly less.

The Data
The bidding process

- At each point in the auction, if the bidding were to stop altogether:
  - ONM is the interest rate of the lowest winning bid
  - INM are higher interest rates (or bids)
  - OUT are losing bids
- As the auction progresses:
  - the lowest previous bids go stale falling OUT
  - because more higher INM bids displace older lower bids.
- This implies the ONM rate:
  - stays flat until the total quantity of bids exceeds the amount offered
  - then steadily increases throughout the remaining auction time.
- My work with Aaron Barkley (former student) and Joachim Groeger (former Tepper colleague), BGM 2020, shows:
  1. Many bids are submitted far in excess of the ONM rate.
  2. ONM bids are preceded by a bid OUT just below ONM.
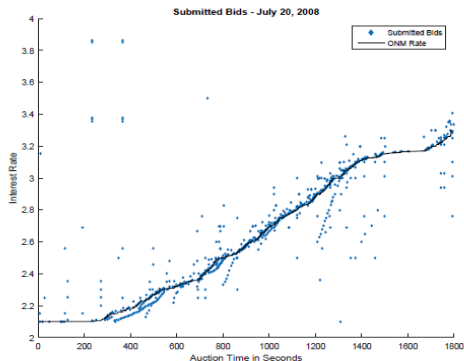 3. After an INM bid, if a further bid is made, it comes with a jump.

The Data
Tracking bidding behavior in a typical auction
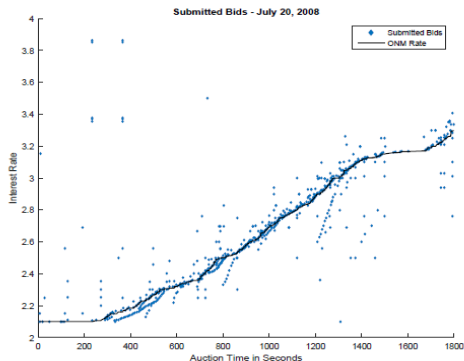
- Banks do not know the current ONM rate when submitting bids.
- Instead they creep up to the ONM submitting successive bids to learn it.
- Many bidders submit INM bids immediately after reaching the ONM rate.
- Other bidders jump directly INM without creeping.
- The following slide shows all bids from a single auction displaying:
  - the ONM rate rising throughout the auction.
  - Jump bidding
 - Creeping

Submitted Bids - July 20, 2008

Note: The figure shows each submitted bid within one auction. Each point represents a single bid, and the solid black line is the ONM rate. The ONM rate starts at the auction reserve rate of 2.100 and increases over the course of the auction as more INM bids are placed.

- The black line is the ONM rate, and it shows how banks:
  - creep up to the ONM submitting successive bids to learn it.
  - jump bid when there is nothing more to learn right now

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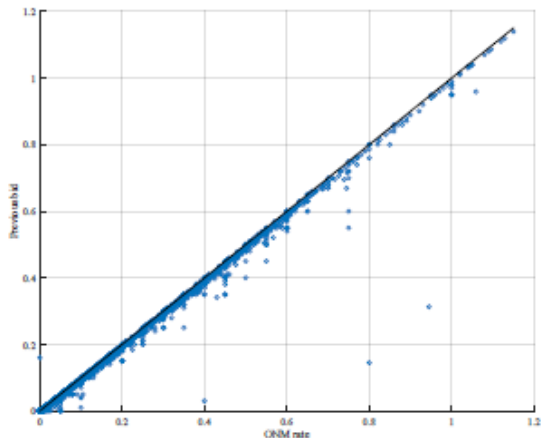 - jump bid when there is nothing more to learn right now

- ONM rates are shown on the horizontal axis, bids on the vertical.
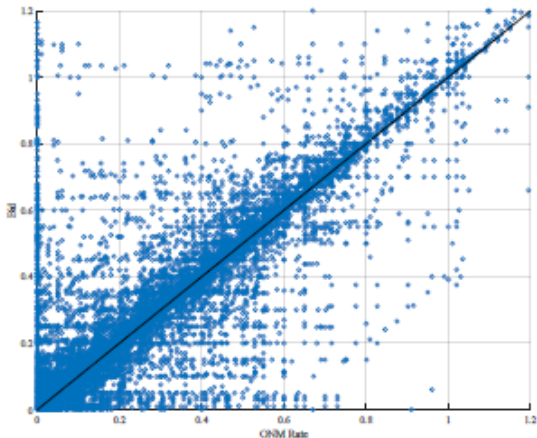
Auctioning Certificates of Deposit in Texas
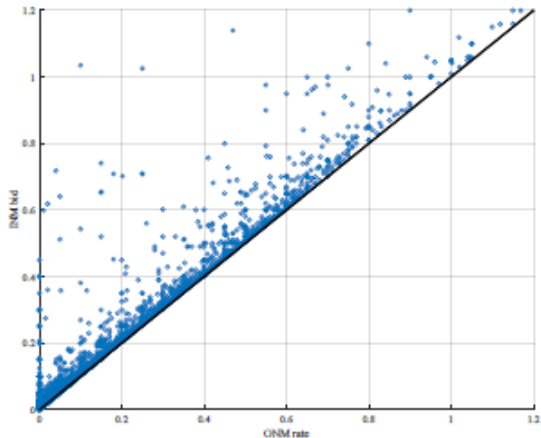
Figure 2(b) BGM 2021

- For each ONM bid calibrated on the horizontal axis, the vertical axis plots the previous bid.

Auctioning Certificates of Deposit in Texas

Figure 2(c) BGM 2021

- For each ONM bid the vertical axis plots the next bid.

- The next figure is the empirical distributions of submission for:
  - all bids
  - initial bids
  - winning bids

- Three other notable features of this figure are:
  1. bidding is most intense at the beginning and end of the auction
  2. there is some sniping (last seconds bids that preclude a competitive response)
  3. Many winning bids are submitted prior to the final minutes of the auction (further evidence that banks do not incrementally increase their bids).
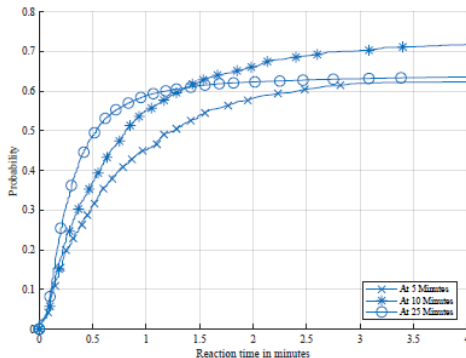
- All bids, first bids, winning bids and last bids by losing banks.
  - As the auction progresses monitoring becomes more intense.
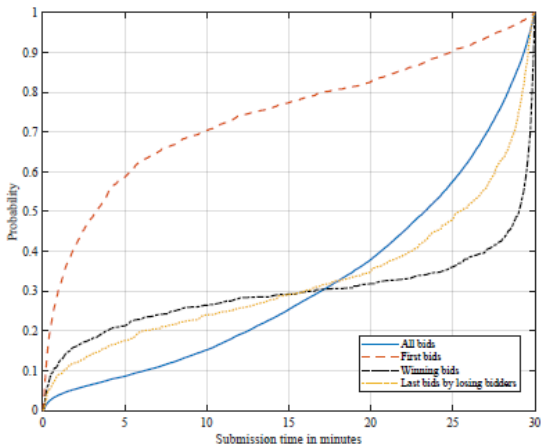
The Data

- How long does it take banks to respond when their INM bid falls OUT?
- The figure displays the distribution of reaction times at the 5 minute, 10 minute and 25 minute mark.

A Model
Towards a theory

- Summarizing the data:
    - The number of banks bidding is uncertain until the auction ends.
    - Bidders creep to ONM and then jump to INM
    - Bidding activity is most intense at the beginning and end of the auction.
    - Sniping (bidding in the last few seconds) is not universal.
    - Many winning bids are submitted in the early stages of the auction.

- Some pointers towards a theory:
    - Perhaps bankers balance off time demands between tracking the ONM rate and other investment opportunities.
    - They creep to check ONM and then jump to INM and then work on another activity.
    - To compute their losses from MLT we would compare the product of:
        - the margin between their borrowing and lending rates.
        - total amount of loans.

Efficiency Considerations
Allocating the CDs to banks with the highest valuations

- Part of the reason auctions are commonly used is because they are supposed to provide an efficient means of allocating resources amongst competing uses.
- We analyzed the Texas CD auction from that standpoint.
- We estimate the efficiency loss relative to an ideal mechanism is about :
  - 10% prior to the 2008 financial crash
  - 2% after the financial crash
- The probability distribution of valuations is less dispersed post 2008, so mistakenly ranking a project is less likely.
- Thus an important contributing factor to the decline is that projects were easier to evaluate post 2008.

Efficiency Considerations
Revenue consequences

- Another consideration is how much revenue the state of Texas generates from these auctions.
- Suppose it was possible to implement a uniform price auction in which there were no bidding frictions.
- Such an auction would achieve the optimal allocation.
- In addition it would have increased revenue by an estimated:
  - 8.5% pre 2008
  - 2.6% post 2008.
- Note that allocating CDs to higher valuation projects broadens the scope for extracting rent in the form of higher bids