Discussion of "Blockchain Disruption and Smart Contracts" by Lin William Cong and Zhiguo He

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[1] The views expressed in this discussion do not necessarily reflect the views of the Federal Reserve Bank of Cleveland or the Federal Reserve System.

This Paper

Two Parts to Paper

1. Blockchain/smart contracts
   - Discussion of applications to financial system
   - Incentives for decentralized record keepers to verify database of transactions

2. A Green and Porter (1984) model
   - Collusion under imperfect information

This Discussion

Most of paper about collusion model

What I'll do

1. Go through basics of their collusion model
2. Talk about applicability of their model
3. Link to banking history
    - Discuss "collusion" very broadly

Their Version of Green and Porter (1984)

$t = 1, 2, ...$

Two established sellers - A and B
One potential seller C

Cost μ to produce good
Discount factor δ

Each t, sellers draw quality $q_i > \mu$
Each t, unit measure of buyers who arrive with probability λ

Buyers buy zero or one unit

Sellers offer $p_i(q)$. Don't see other sellers prices.

The Basic Model: No Blockhain

Ignore C for now.

Bertrand Competition

assume $q_B > q_A$

A and B compete price down to $q_B - q_A + \mu$

Do this in each t

This is a Nash equilibrium

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Bertrand Competition

assume $q_B > q_A$

A and B compete price down to $q_B - q_A + \mu$

Do this in each t

This is a Nash equilibrium

There is a better Nash equilibrium (for sellers)

Green-Porter Collusion Equilibrium

Let $f(q)$ be how sellers divide market

Another equilibrium

- Sellers collude and divide market
- If both sellers get buyers, continue to collude
- If a seller gets no buyers, resort to Bertrand for T periods
  - In equilibrium, probability $(1-\lambda)$
- Then, return to colluding

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Value function in collusion phase

$$\forall q, V^+(q) = \lambda(f(q)(q_i - \mu) + \delta V^+) + (1-\lambda)\delta V^-$$

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Value function in collusion phase

$$\forall q, V^+(q) = \lambda(f(q)(q_i - \mu) + \delta V^+) + (1-\lambda)\delta V^-$$

Constraint to prevent deviation in collusion phase

$$\forall q, V^+(q) \geq \lambda((q_i - \mu) + \delta V^-) + (1-\lambda)\delta V^-$$

Implications

There exists $\delta^{Traditional}$ where for $\delta \geq \delta^{Traditional}$ the collusion equilibrium can be supported.

Lowers total welfare and consumer surplus.

First Change to Model from Blockchain

Potential entrant C

- Potential entrant C (may be good or bad)
  - Probability that bad. Private info to C.
  - If bad, can't deliver q_C
  - Expected quality low, can't sell, doesn't enter
- Add blockchain - payment now can depend on successful delivery of good
  - Keeps out a bad seller C
  - Allows seller C to enter if good
  - Extra seller, good for welfare and consumer surplus

Second Change to Model from Blockchain

Back to no seller C

Blockchain changes information structure

- Blockchain allows a seller to see if other seller did a transaction
- Now can tell if other seller deviated
- Makes easier to collude
  - Don't punish if buyers don't show up
  - Only punish if deviation
- In equilibrium, never play Bertrand

Result
There exists $\delta^{blockchain} < \delta^{Traditional}$ such that for $\delta > \delta^{blockchain}$ the collusion equilibrium can be supported.

Combine the Two Changes

Results

- Any welfare and consumer surplus attainable under basic model is attainable under blockchain model.
- There are equilibria with higher and lower welfare and consumer surplus levels attainable under blockchain model.

This is an interesting model with some clean results.

Mapping the Theory to Observation

Blockchain does two things here

1. Ties payment to performance (and automates)
2. Makes collusion easier by changing information structure

- Also, allows for decentralized verification of transactions, but not focus of paper. I won't talk about.

Tying Payment to Performance

Not sure this follows from blockchain

Depends on how easy it is to measure performance

If an experience good - blockchain doesn't help. Quality is subjective.

- Did you like your dinner?

Would work for package delivery

- Make payment when UPS indicates delivery

In banking?

- Makes payments easy
- But imagine trouble with complicated contractual arrangements that require use of judgment and where performance is hard to measure

Example: Mortgage Trusts and Servicing

Since 1990s, many mortgages put in bankruptcy remote trusts

Terms of trust specifies rules for servicers

- How to handle foreclosures
- How servicer reimbursed (like a smart contract)
- Agency problems

Example (continued)

Worked fine in normal times

But when foreclosures spiked, the trusts had problems

- Rules didn't give much detail on how to modify loans
- Labor intensive to contact borrowers. Lots of nonresponse
- Servicers had incentive problems
- Heterogeneity in quality of servicers
- Performance hard to measure

Maybe with this experience, rules could be improved to deal with this sort of shock, but seems hard to do.

Blockchain and Entry

Effect of tying payment to performance

- More entry

Maybe something to this

Payment systems are networks

- Need buyer and seller to participate to be useful
- If more use, more valuable to join network
  - e.g., Mastercard, Visa
- Makes entry hard, since entrants don't have much scale

Bitcoin lowers entry cost

- Need less infrastructure. Just computers.
- Still network effects, but can operate at smaller scale than if large fixed costs

Collusion

Collusion in this model is about preventing price competition

Blockchain gives sellers better ability to monitor each other

But in banking, already lots of public information

- Call reports have long been public
- Regulators report deposits by branch

More importantly, monitoring serves another role

Clearinghouses as Clubs

Clearinghouses

- Early innovation in banking
- London in late 18th century, Suffolk System around 1810, New York in 1850s
- Net settlement. Saves on physical delivery of gold and currency.

Evolves into a club (in the Buchanan (1965) sense)

- Banks physically close to each other, so can monitor
- Set rules for members and examine them
- Sometimes limited deposit rates
- Clubs may collude on price, but also collude in beneficial ways

Some Social Value to the Club

Club important during panics

- Members cooperate to stop panic
  - Combine reserves. Publish joint balance sheet. Clearinghouse certificates.
- Trying to solve a collective action problem in providing confidence
  - Wicker's view of National Bank era panics

This club/collusion feature important, but well before blockchain and does something else entirely than just limit price competition.

Final Comments

I like the model. It is clean and interesting.

Blockchain technologies very interesting and relevant to banking

Less convinced that the features they emphasize (collusion, pay for performance) describe new features that blockchain brings to banking.

Suspect that there are non-blockchain applications of the model