Liquidity and the Threat of Fraudulent Assets

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fraudulent behavior in asset markets

in this paper:

- Asset's vulnerability to fraud affects its liquidity.
- Fraud: Individuals can produce deceptive versions of existing assets
- Examples of fraud throughout history:
  - Clipping of coins in ancient Rome and medieval Europe
  - Counterfeiting of banknotes during the first half of the 19^{th} century
  - Identity thefts
  - originating/securitizing bad loans
  - cherry picking bad collateral for OTC credit derivatives

What we do

- Setup a model where
    1. many assets differ in vulnerability to fraud
    2. assets are traded over the counter
    3. agents can use assets as collateral or means of payment
- Solve for terms of OTC bargaining game
- Solve for asset prices: implications for liquidity premia

Main findings

- Assets differ in liquidity

  How much of it can be used as collateral or means of payment

- Cross-sectional liquidity premia

  1. Liquid assets, with low vulnerability to fraud
     sell above fundamental value
  2. Partially liquid assets, intermediate vulnerability to fraud
     sell above fundamental value, but for less than liquid assets
  3. Illiquid assets, with high vulnerability to fraud
     sell at fundamental value

Main findings (con't)

- Policies
  - Open-market purchases targeting partially liquidity assets can reduce welfare
  - Policies targeting illiquid assets can increase welfare.
- Asset retention and haircuts emerge in equilibrium
- Liquidity crisis explained by a heightened threat of fraud

Related literature

1. Macro models in which assets have limited re-salability
   Kiyotaki and Moore (2001, 2005), Lagos (2010), Lester et al. (2011)
2. Private information and money
   Williamson Wright (1994), Nosal Wallace (2007) among many others
3. Asset pricing when moral hazard generates limited pledgeability
   Holmstrom and Tirole (2011) among many others
4. Asset pricing with adverse selection
   Rocheteau (2011), Guerrieri Shimer (2011) among many others

THE ENVIRONMENT

A model with monetary frictions

- Three periods, continuum of risk neutral agents

  measure one of *buyers*, measure one of *sellers*

- $\underline{t = 0}$: agents trade assets in a competitive market

- $\underline{t = 1}$: agents trade goods/assets in a decentralized (OTC) market

  - a buyer is matched with a seller with probability σ

- Lack of commitment, limited enforcement

  - no unsecured credit
  - assets are useful as means of payment or collateral

- $\underline{t = 2}$: assets pay off their terminal value

Preferences

- The utility of a buyer is:

$$x_0 + u(q_1) + x_2$$

where $x_t \in \mathbb{R}$ is the consumption of the numéraire good
$q_1 \in \mathbb{R}_+$ is the consumption of the DM good

- The utility of a seller is:

$$x_0 - q_1 + x_2$$

Assets and the threat of fraud

- Assets come in (arbitrary) finitely many types $s \in S$
  - Supply of $A(s)$ shares, with terminal value normalized to 1
  - Type-specific vulnerability to fraud
  - At $t = 0$, for a fixed cost $k(s)$, can create type–s fraudulent assets
- Fraudulent asset
  - zero terminal value zero
  - may be used in decentralized trades
  - undistinguishable from their genuine counterpart

Some interpretations

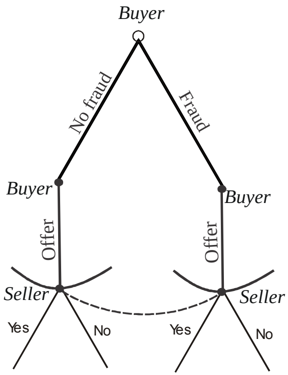
- Counterfeiting of means of payment.
    - coins or banknotes
    - $k(s)$ is the cost to acquire plates and dies or, nowadays, the price of photo-editing software and copy machines.
- Fraud on asset-backed securities (ABS).
    - First stage: fraud during the origination of ABSs e.g., deficient lending and securitization practices
    - $k(s)$ is the cost of producing false documentations
    - Second stage: ABS are sold to investors or are used as collateral in credit markets, such as the repo market.

BARGAINING UNDER THE THREAT OF FRAUD

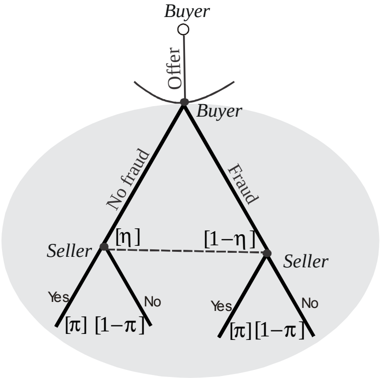
The OTC bargaining game

- For now take asset prices $\phi(s) \geq 1$ as given
- $t = 0$: buyer chooses a portfolio of assets
    - genuine assets of type s at price $\phi(s)$
    - fraudulent assets of type s at fixed cost $k(s)$
- $t = 1$: buyer matches with seller and makes an offer specifying that
    - the seller produces q units of goods for the buyer
    - the buyer transfers a portfolio $\{d(s)\}$ of assets to the seller
- The seller accepts or rejects. If accepts:
    - the buyer enjoys $u(q)$
    - the seller suffers q

The OTC bargaining game



Original game



Reverse ordered game

Equilibrium concept and refinement

- Perfect Bayesian equilibrium

  PBE puts little discipline on sellers' beliefs

  LOTS of equilibria, some of them arguably unreasonable

- In and Wright's (2011) refinement for signaling games with endogenous types
  - a strategically equivalent game: the "reverse order game"
    - the buyer first commits to an offer $(q, \{d(s)\})$
    - then the buyer chooses how much genuine and fraudulent asset assets to hold

- This pins down beliefs and this selects the best equilibrium for the buyer

Solving the game

- Following an offer, $(q, \{d(s)\})$, the seller's decision to accept an offer must be optimal given the buyer's decision to produce fraudulent assets $\eta(s)$:

$$\pi \in \arg\max_{\hat{\pi} \in [0,1]} \hat{\pi} \left\{ -q + \sum_{s \in S} \eta(s) d(s) \right\}$$

- Following an offer, $(q, \{d(s)\})$, the buyer minimizes the cost of financing his DM trade given π:

$$\{\eta(s)\} \in \arg\min_{\{\hat{\eta}(s)\}} \sum_{s \in S} \left\{ k(s) [1 - \hat{\eta}(s)] + [\phi(s) - 1] \hat{\eta}(s) d(s) + \sigma \pi \hat{\eta}(s) d(s) \right\}$$

- Given equilibrium decision rules $\{\eta(s)\}$ and π, the optimal offer, $(q, \{d(s)\})$, maximizes

$$-\sum_{s \in S} \left\{ k(s) [1 - \eta(s)] + [\phi(s) - 1] \eta(s) d(s) \right\} + \sigma \pi \left\{ u(q) - \sum_{s \in S} \eta(s) d(s) \right\}$$

Equilibrium outcome

- There is no fraud in equilibrium
  - fraud with probability in $(0, 1)$ is not optimal lowering the probability of fraud effectively raises payment capacity
- The seller accepts the offer with probability one
  - If not, and $\pi \in (0, 1)$, the buyer could reduce q and $\{d(s)\}$.
  - With fixed cost of fraud, smaller trade induces lower incentive to commit fraud. As a result, the seller can accept the new offer with a higher probability.

Equilibrium asset demands and offers

- Asset demand and offer maximize

$$-\sum_{s\in S}\left[\phi(s)-1\right]a(s)+\sigma\left[u(q)-q\right]$$

with respect to $q, \{a(s)\}, \{d(s)\} \geq 0$, and subject to

$$\text{Seller's IR:} \quad q \leq \sum_{s\in S} d(s)$$

$$\text{Buyer's no-fraud IC:} \quad \left[\phi(s)-1+\sigma\right]d(s) \leq k(s), \quad \text{for all } s \in S$$

$$\text{Feasiblity:} \quad d(s) \leq a(s), \quad \text{for all } s \in S$$

Intuition

No fraud IC constraints

- Eliminates buyers' incentives to bring fraudulent assets

$$\underbrace{(\phi(s) - 1 + \sigma)\, d(s)}_{\text{net cost of offering } d(s) \text{ genuine assets}} \quad \leq \quad \underbrace{k(s)}_{\text{cost of fraud}}$$

- Asset specific

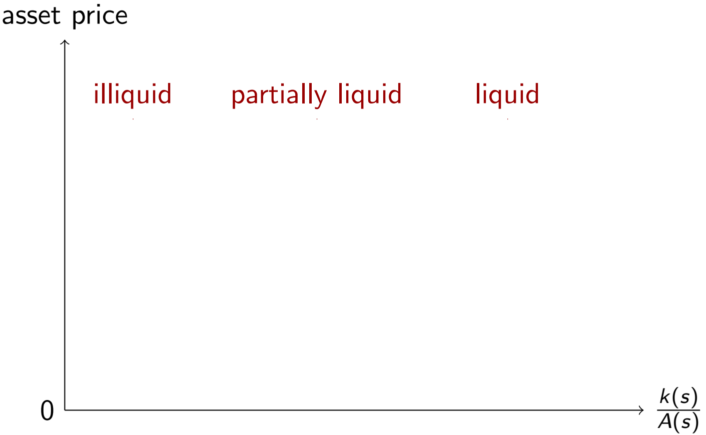
- depends on vulnerability to fraud, $k(s)$
- depends on market structure, σ
- depends on price, $\phi(s) \Rightarrow$ pecuniary externality

- Create endogenous limits to assets resalability

  foundations for the constraints in Kiyotaki Moore (2001)

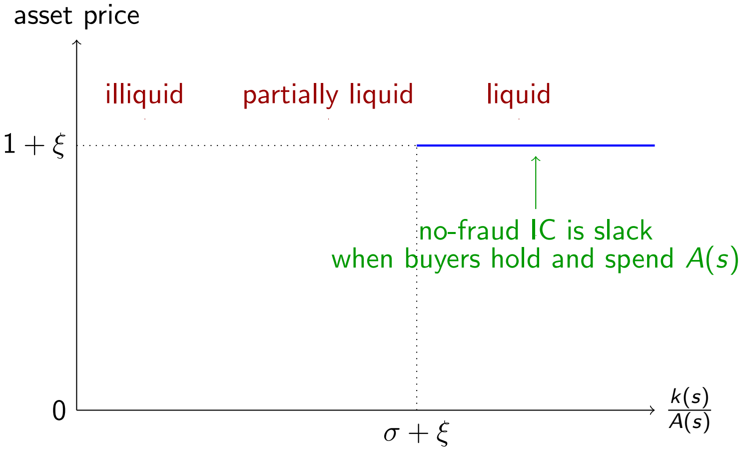
ASSET PRICES AND LIQUIDITY

asset prices at $t = 0$



- $k(s)/A(s)$= cost of fraud per unit of asset

asset prices at $t = 0$



- $k(s)/A(s) =$ cost of fraud per unit of asset
- $\xi = \sigma\left(u'(q) - 1\right)$

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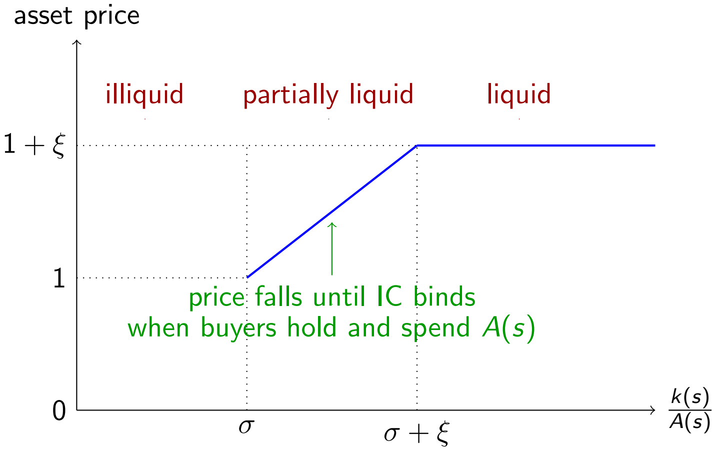

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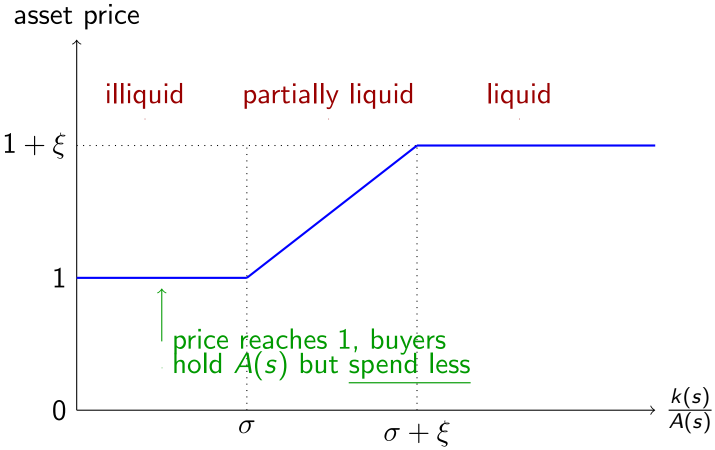

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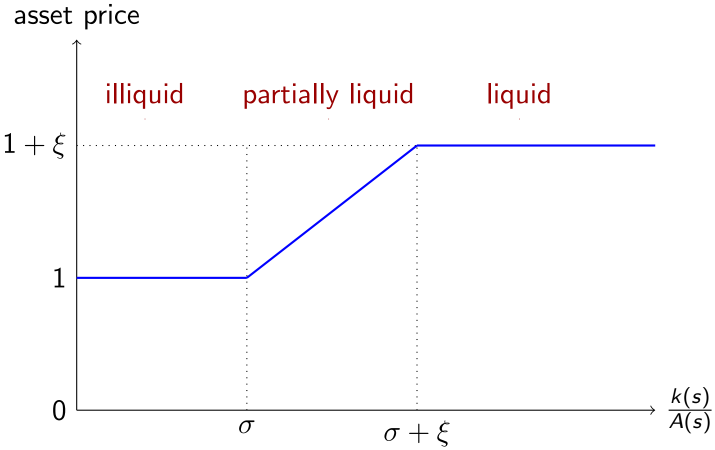

- $k(s)/A(s)$= cost of fraud per unit of asset
- $\xi = \sigma\left(u'(q) - 1\right)$

Three-tier categorization of assets

- Aggregate liquidity is measured by:

$$L \equiv \sum_{s \in S} \theta(s) A(s),$$

  where $\theta(s) = \min\left[1, \frac{\kappa(s)}{\sigma}\right]$.

- Aggregate output $= L$.
- Recall Friedman and Schwartz (1970):

  the quantity of money should be defined as the the weighted sum of the aggregate value of all assets, the weights varying with the degree of moneyness

Three-tier categorization of assets (con't)

1. Liquid assets: $\theta(s) = 1$

   IC constraint doesn't bind when buyers hold and spend $A(s)$

2. Partially liquid assets: $\theta(s) = 1$

   IC constraint binds when buyers hold and spend $A(s)$

3. Illiquid assets: $\theta(s) = \frac{k(s)}{\sigma} < 1$

   IC constraint binds, buyers hold $A(s)$ but spend less

   only optimal because price equal 1

More on partially liquid assets

- Have the same $\theta(s)$ as liquid assets but have a lower price
    - liquidity premia $<$ social value of their liquidity services
- Why?
- Pecuniary externality running through the IC constraint
    - a higher price reduces asset demand in two ways:
    - through the budget constraint (no externality)
    - through the IC constraint, b/c raise incentive to commit fraud
- Welfare calculations in reduced-form models are inaccurate

SOME APPLICATIONS

Balanced-budget open market operations

e.g., the NY Fed sells Treasuries from its portfolio to purchase MBS

1. Using liquid assets to purchase partially liquid assets
   - Liquid assets have higher prices
     - one share of liquid asset buys more than one share of partially liquid assets
   - but liquid assets and partially liquid assets have the same $\theta(s)$
   - L, q, interest rates, and welfare go down
2. Using liquid assets to purchase illiquid assets
   - marginally illiquid assets do not contribute to L
   - L, q, interest rates, and welfare go up

Asset retention and haircuts

- Mechanisms to mitigate the informational asymmetries: asset retention and overcollateralization
- Assume portfolios are (partially) observable and fraud involves a variable cost, $k_v(s)$, per unit of fraudulent asset, in addition to the fixed cost $k_f(s)$.
- The resalability constraint of becomes:

$$[\phi(s) - 1]\, a(s) + \sigma d(s) \leq k_f(s) + k_v(s) a(s).$$

Asset retention and haircuts (con't)

- For all illiquid assets:

$$\frac{\partial d(s)}{\partial a(s)} = \frac{k_v(s) - [\phi(s) - 1]}{\sigma} > 0$$

  Asset retention relaxes the resalability constraint.

- The price of illiquid assets is

$$\phi(s) = 1 + \frac{\xi k_v(s)}{\sigma + \xi}.$$

Asset retention and haircuts (con't)

- Interpret the offer as a multi-loan arrangement, $\{d(s), a(s)\}$
- The aggregate haircut on type-s assets is defined as $h(s) \equiv 1 - \frac{d(s)}{A(s)}$.
- For liquid and partially liquid assets, $h(s) = 0$. For illiquid assets,
$$h(s) = 1 - \frac{k_f(s)}{\sigma A(s)} - \frac{k_v(s)}{\sigma + \xi}.$$
- Haircuts tend to be larger when aggregate liquidity is scarce.
- Haircuts are increasing with the frequency of meetings in the DM, σ.
- Finally, assuming $k_f(s) \approx 0$, $\phi(s) = 1 + \xi - \xi h(s)$, so that asset prices are negatively correlated with haircut sizes.

Liquidity crisis

Lucas (WSJ 2011) on the 2008 financial crisis:

> *"the shock came because complex mortgage-related securities minted by Wall street and certified as safe by rating agencies had become part of the effective liquidity supply of the system. All of a sudden, a whole bunch of this stuff turns out to be crap"*

- A shock raising the threat of fraud for a class of assets.

  $\hat{s}$ is initially liquid, $\theta(\hat{s}) = 1$.

  $k_f(\hat{s})$ and $k_v(\hat{s})$, decrease so that $\hat{s}$ becomes illiquid, $\theta(\hat{s}) < 1$.

Liquidity crisis (con't)

- Aggregate liquidity, L, falls.
  - The set of liquid assets shrinks.
  - The set of illiquid assets, requiring positive haircuts, expands.
  - Haircuts for all illiquid assets increase.

- The liquidity premium on liquid assets increases.
  - The price difference between liquid and illiquid assets increases.

Conclusion

- A fraud-based model of liquidity premium
- An explanation for price and liquidity differences
- Implications
  - open-market operations
  - asset retention and haircuts
  - liquidity crisis and flight to liquidity