Liquidity and the Threat of Fraudulent Assets

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Fraudulent behavior in asset markets

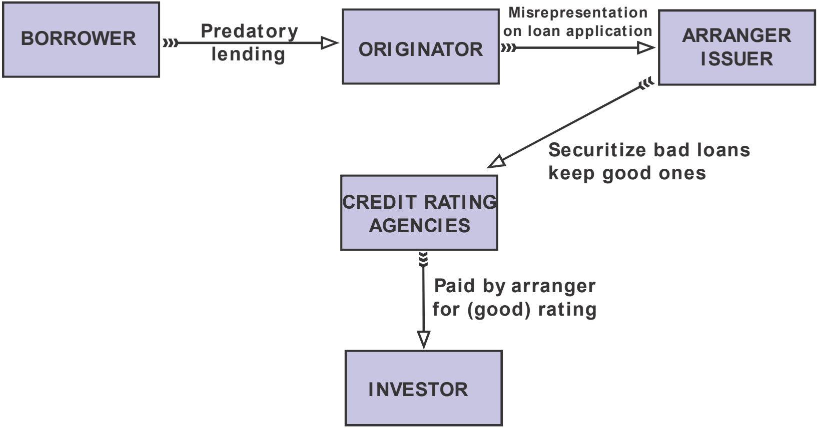
- In this paper:
  - A key property of liquid assets: they are immune against fraud
  - Fraud: Individuals can produce deceptive versions of existing assets
- Examples of fraud throughout history:
  - Clipping of coins in ancient Rome and medieval Europe
  - Counterfeiting of banknotes during the first half of the 19^{th} century
  - Identity thefts
  - originating/securitizing bad loans
  - cherry picking bad collateral for OTC credit derivatives

Counterfeiting of currency

Mortgage fraud

Fraud and securitization of mortgage loans

- Ashcraft and Shuermann (2008): "an overaching frictions which plagues every step in the process is asymmetric information."



Fraud and securitization (cont'ed)

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"*

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, with 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 (cont'ed)

- Policies
  - Open-market purchases targeting partially liquidity assets can reduce welfare
  - Policies targeting illiquid assets can increase welfare.
  - Retention requirement can raise welfare
- "Flights to liquidity"
  - Shocks on demand and supply for liquid assets
- Time-varying liquidity premia

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

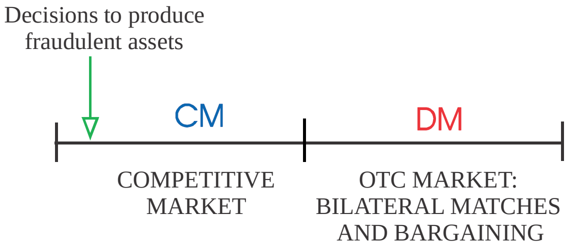
   Rocheteau (2011), Guerrieri Shimer (2011) among many others

THE ENVIRONMENT

A model with monetary frictions

- Two 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
- $\underline{\text{End of } t = 1}$: assets pay off their terminal value

The timeline



Preferences

- The utility of a buyer is:

$$x_0 + \beta \left[u(q_1) + x_1 \right]$$

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:

$$x_0 + \beta \left(-q_1 + x_1 \right)$$

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 money
  $k(s)$ = cost of printing equipment
- Fraudulent or bad collateral
  - Houses used as collateral in consumer loans
  - Assets used as collateral for credit derivative contracts
  - $k(s)$ = cost of false documentation / information cost
- Securitization fraud
  - bad mortgages bundled inside mortgage-based securities
  - $k(s)$ =cost to originate bad loans and game rating agencies

BARGAINING UNDER THE THREAT OF FRAUD

OTC bargaining game

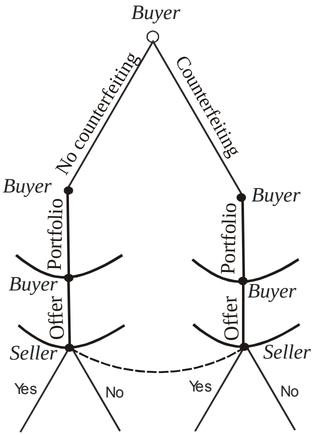
- Bargaining is subject to private information frictions

"An OTC bargaining game can be complex because of private information ... The counterparties may have different information regarding the common-value aspects of the asset, current market conditions, and their individual motives for trade." (Darrell Duffie, Dark Markets, 2012)

The bargaining game

- For now take asset prices $\phi(s) \geq \beta$ 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



Equilibrium concept and refinement

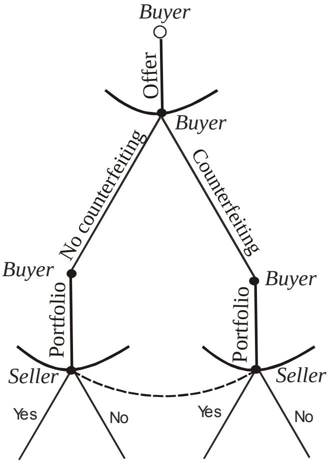
- Perfect Bayesian equilibrium
  PBE puts little discipline on sellers' beliefs
  LOTS of equilibria, some of them arguably unreasonable

- Inn 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

The reverse order bargaining game



Equilibrium outcome

- There is no fraud in equilibrium
  - fraud with proba 1 is not optimal
    the buyer might as well offer $d(s) = 0$, and not incur $k(s)$
  - fraud with proba in $(0, 1)$ is not optimal
    lowering the proba of fraud effectively raises payment capacity
- The seller accepts the offer with probability one
  - the buyer could increase q and $\{d(s)\}$
  - the seller would accept probabilistically to discipline the buyer
  - with fixed cost of fraud: not optimal

Equilibrium asset demands and offers

- Asset demand and offer maximize

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

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

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

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

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

Intuition

No fraud IC constraints

- Eliminates buyers' incentives to bring fraudulent assets

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

- 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)

Fraud in equilibrium

- Uncertainty about the cost of fraud
- Sequence of moves as in the reverse-ordered game

1. Buyers commit to a contract, (q, d)
2. The cost of fraud, $k \in \{0, \bar{k}\}$ with $\Pr[k = k] = \bar{\lambda}$, is realized
3. Buyers make their portfolio choices and are matched in the DM

- In the state where fraud is costless the buyer always finds it profitable to execute his offer with fraudulent assets.

Fraud in equilibrium (cont'd)

- In the state where fraud is costly, no fraud: $\eta = 1$.
- The offer is accepted with probability one.
- Problem identical to the one before up to some change of variables:

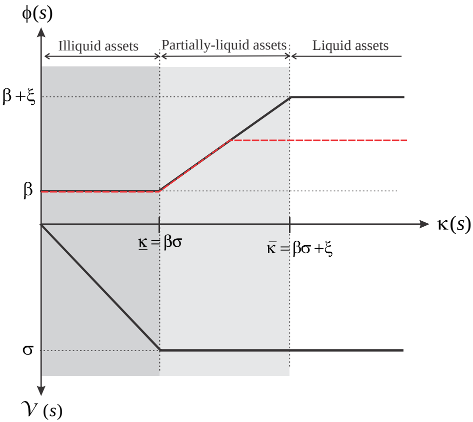
$$\max_{d,q} \left\{ -(\phi - \beta)\lambda d + \beta\sigma \left[u(q) - \lambda d \right] \right\}$$

$$\text{s.t. } q = \lambda d$$

$$d \leq \frac{\bar{k}}{\phi - \beta + \beta\sigma}$$

ASSET PRICES AND LIQUIDITY

Three-tier categorization of assets



$\kappa(s) = k(s)/A(s)$= cost of fraud per unit of asset
$\mathcal{V}(s) = \sigma d(s)/A(s)$= asset velocity
$\xi = \beta\sigma\left[u'(q) - 1\right]$

Three-tier categorization of assets (cont'd)

- Aggregate liquidity is measured by:

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

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

- 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 (cont'd)

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: $\theta(s) = \frac{k(s)}{\beta\sigma} < 1$
   IC constraint binds, buyers hold $A(s)$ but spend less
   only optimal because price equal β

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?
- Because: pecuniary externality running through the IC constraint
  - a high price reduces asset demand in two ways
  - through the budget constraint (no externality with that one)
  - 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

Regulatory measures

- Retention requirement (as in the Dodd Frank act):
  Buyers have to retain $\rho(s)$ % of assets offered
- For this exercise: assume cost of fraud is $k_f(s) + k_v(s)d(s)$
- The trade off:
  - the bad: mechanical reduction in asset re-salability
  - the good: increases the cost of committing fraud
    b/c, for any given asset offer, need to produce more fraudulent assets

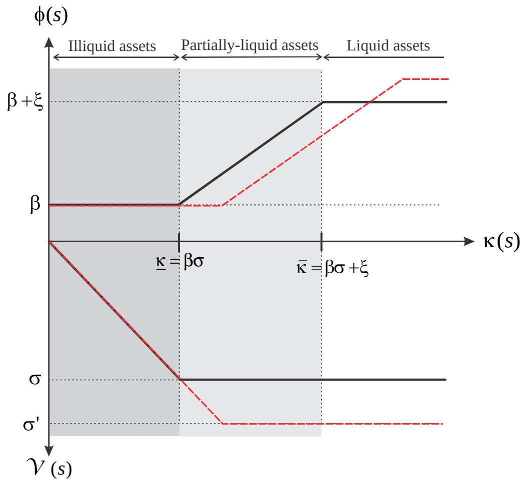
Regulatory measures (cont'd)

1. Negative impact on liquid assets
   the no-fraud IC constraint is not binding
2. Negative impact on partially liquid assets
   partial equilibrium: relax the no-fraud IC constraint
   general equilibrium: asset offer and demand $\uparrow$, asset price $\uparrow$
   tightens back IC constraint
3. Positive impact on illiquid assets
   partial equilibrium effect works
   general equilibrium effect does not operate because $\theta(s) < 1$

Flight to liquidity

concentration of demand towards liquid assets, widening of yield spreads

- Increase in σ the frequency of trade in the $t = 1$ market
  interpretation: collateral is more needed
- Two effects going in opposite directions
  1. liquidity demand increases:
     dominates for liquid assets: $\phi(s) \uparrow$
  2. fraud incentives increase:
     dominates for partially liquid assets: $\phi(s) \downarrow$
- The set of liquid assets shrinks
- The set of partially liquid and illiquid assets expands



$\phi(s)$
Illiquid assets
Partially-liquid assets
Liquid assets
$\beta+\xi$
β
$\kappa(s)$
$\underline{\kappa}=\beta\sigma$
$\bar{\kappa}=\beta\sigma+\xi$
σ
σ'
$\mathcal{V}(s)$

Time varying liquidity

- With quasi-linear preferences à-la Lagos Wright model easily

  extendable to a multiperiod-multiassets economy
- Terminal value becomes cum dividend price next period
  expectations of future liquidity premia matter
  they feed back into current liquidity premia
- Our main result: excess volatility
  self-fulfilling fluctuations can arise
  but they are confined to liquid assets

Conclusion

- A fraud-based model of liquidity premium
- An explanation for price and liquidity differences
- Implications
  - open-market operations
  - regulatory measures
  - flight to quality
  - time varying liquidity