



PRINCETON INITIATIVE 2012
MACRO, MONEY AND FINANCE
MARKUS BRUNNERMEIER AND YULIY SANNIKOV

Princeton University

Macro-literature on Frictions

1. Net worth effects:
 - a. Persistence: Carlstrom & Fuerst
 - b. Amplification: Bernanke, Gertler & Gilchrist
 - c. Instability: Brunnermeier & Sannikov
2. Volatility effects: impact credit quantity constraints
 - a. Margin spirals : Brunnermeier & Pederson
 - b. Endogenous constraints: Geanakoplos
3. Demand for liquid assets & Bubbles – “self insurance”
 - a. OLG, Aiyagari, Bewley, Krusell-Smith, Holmstrom-Tirole,...
4. Financial intermediaries & Theory of Money



DEMAND FOR LIQUID ASSETS, BUBBLES, ...

M. BRUNNERMEIER, T. EISENBACH, AND Y. SANNIKOV

Princeton University

■ Demand for Liquid Assets

- So far: Technological & market illiquidity → *amplification*
 - Liquidity spirals:
 - Depressed price, q_t , tightens debt constraint, which in turn ...
 - Higher volatility of q_t , tightens debt constraint, which in turn ...
- Now: “safety cushion” + self-insurance
- Focus on *demand for liquid instruments*
 - No amplification effects:
perfect techn. liquidity due to reversibility of investment
 - constant price of capital q
 - Borrowing constraint = collateral constraint
 - Steps: Introduce (i) idiosyncratic risk, (ii) aggregate risk,
(iii) amplification (revisited)

|| Outline – Demand for Liquid Assets

- **Deterministic Fluctuations**
 - Overlapping generations
 - Completing markets with liquid asset
- **Idiosyncratic Risk**
 - Precautionary savings
 - Constrained efficiency
- **Aggregate Risk**
 - Bounded rationality
- **Amplification Revisited**

Overlapping Generations

- Samuelson (1958) considers an infinite-horizon economy with two-period lived overlapping agents
 - Population growth rate n
- Preferences given by $u(c_t^t, c_{t+1}^t)$
 - Pareto optimal allocation satisfies $\frac{u_1}{u_2} = 1 + n$
- OLG economies have multiple equilibria that can be Pareto ranked

OLG: Multiple Equilibria

- Assume $u(c_t^t, c_{t+1}^t) = \log c_t^t + \beta \log c_{t+1}^t$
 - Endowment $y_t^t = e, y_{t+1}^t = 1 - e$
- Assume complete markets and interest rate r
- Agent's FOC implies that $\frac{c_{t+1}^t}{\beta c_t^t} = 1 + r$
 - For $r = n$, this corresponds to the *Pareto solution*
 - For $r = \frac{1-e}{\beta e} - 1$, agents will consume their endowment
- Autarky solution is clearly *Pareto inferior*

OLG: Completion with Durable Asset

- Autarky solution is the **unique** equilibrium implemented in a sequential exchange economy
 - Young agents cannot transfer wealth to next period
- A durable asset provides a store of value
 - Effective store of value reflects *market liquidity*
 - Pareto solution can be attained as a competitive equilibrium in which the price level grows at same rate as the population, i.e. $b_{t+1} = (1 + n)b_t$
 - Old agents trade durable asset for young agents' consumption goods

OLG: Production

- Diamond (1965) introduces a capital good and production
 - Constant-returns-to-scale production $Y_t = F(K_t, L_t)$
- Optimal level of capital is given by the *golden rule*, i.e. $f'(k^*) = n$
 - Here, lowercase letters signify **per capita** values
- Individual (and firm) optimization implies that
 - $\frac{u_1}{u_2} = 1 + r = 1 + f'(k)$
 - It is possible that $r < n \Rightarrow k > k^* \Rightarrow$ Pareto inefficient

OLG: Production & Efficiency

- Diamond recommends issuing government debt at interest rate r
- Tirole (1985) introduces a rational bubble asset trading at price b_t
 - $b_{t+1} = \frac{1+r_{t+1}}{1+n} b_t$
- Both solutions *crowd out* investment and increase r
 - If baseline economy is inefficient, then an appropriately chosen debt issuance or bubble size can achieve Pareto optimum with $r = n$

OLG: Crowding Out vs. Crowding In

- Depending on the framework, government debt and presence of bubbles can have two opposite effects
 - Crowding out refers to the decreased real investment
 - Crowding in refers to increased investment due to improved risk transfer
- Woodford (1990) explores both of these effects

OLG: Woodford 1

- Consider a model with two types of agents
 - Per capita production $f(k)$
 - Alternating endowments $\bar{e} > \underline{e} > 0$
 - No borrowing
- Stationary solution
 - High endowment agents are *unconstrained*, consuming \bar{c} and saving part of endowment
 - Low endowment agents are *constrained*, consuming $\underline{c} \leq \bar{c}$ and depleting savings

OLG: Crowding Out

- Euler equations
 - Unconstrained: $u'(\bar{c}) = \beta(1+r)u'(\underline{c})$
 - Constrained: $u'(\underline{c}) \geq \beta(1+r)u'(\bar{c})$
- Interest rate is lower than discount rate
 - $f'(k) - 1 = r \leq \beta^{-1} - 1 \equiv \rho \Rightarrow$ Pareto inefficient
- Increasing debt provides *market liquidity*
 - This increases interest rate and reduces capital stock
 - With $r = \rho \Rightarrow \underline{c} = \bar{c}$ (full insurance)

OLG: Woodford 2

- Assume agents now have alternating *opportunities* (instead of endowments)
 - Unproductive agents can only hold government debt
 - Productive agents can hold debt *and* capital
- Stationary solution
 - Unproductive agents are *unconstrained*, consuming \bar{c} and saving part of endowment (as debt)
 - Productive agents are *constrained*, consuming $\underline{c} \leq \bar{c}$ and investing savings and part of endowment in capital

OLG: Crowding In

- Euler equations
 - Unconstrained: $u'(\bar{c}) = \beta(1 + r)u'(\underline{c})$
 - Constrained: $u'(\underline{c}) = \beta f'(k)u'(\bar{c})$
 - Interest rate satisfies $1 + r \leq f'(k)$
- Increasing debt provides *market liquidity*
 - This increases r and k since $\beta(1 + r) = \frac{1}{\beta f'(k)}$
 - Transfer from unproductive periods to productive periods
 - Increase debt until both agents are unconstrained

Outline – Demand for Liquid Assets

- Deterministic Fluctuations
 - Overlapping generations
 - Completing markets with liquid asset
- Idiosyncratic Risk
 - Precautionary savings
 - Constrained efficiency
- Aggregate Risk
 - Bounded rationality
- Amplification Revisited

Precautionary Savings

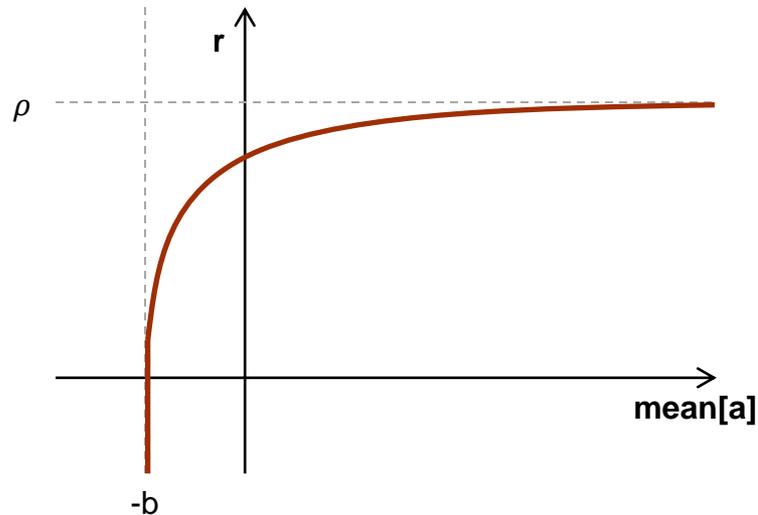
- Consumption smoothing implies that agents will save in high income states and borrow in low income states
 - If markets are **incomplete**, agents may not be able to efficiently transfer consumption between these outcomes
- Additional precautionary savings motive arises when agents cannot insure against uncertainty
 - Shape of utility function u'''
 - Borrowing constraint $a_t \geq -b$

PCS 1: Prudence

- Utility maximization $E_0[\sum_{t=0}^{\infty} \beta^t u(c_t)]$
 - Budget constraint: $c_t + a_{t+1} = e_t + (1+r)a_t$
 - Standard Euler equation: $u'(c_t) = \beta(1+r)E_t[u'(c_{t+1})]$
- If $u''' > 0$, then Jensen's inequality implies:
 - $\frac{1}{\beta(1+r)} = \frac{E_t[u'(c_{t+1})]}{u'(c_t)} > \frac{u'(E_t[c_{t+1}])}{u'(c_t)}$
 - Marginal value is greater due to uncertainty in c_{t+1}
 - Difference is attributed to *precautionary savings*
- Prudence refers to curvature of u' , i.e. $P = -\frac{u'''}{u''}$

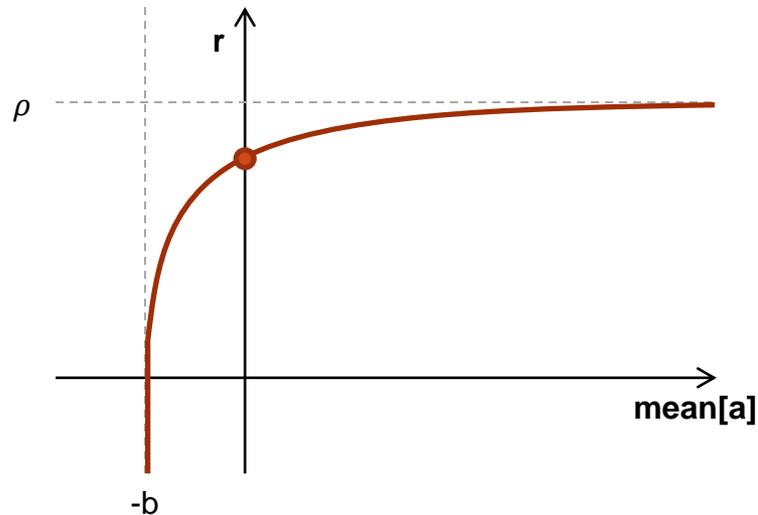
PCS 2: Borrowing constraint + Idiosync. Risk

- With *incomplete markets* and *borrowing constraints*, agents engage in precautionary savings in the presence of idiosyncratic income shocks
- Following Bewley (1977), mean asset holdings $E[a]$ result from individual optimization



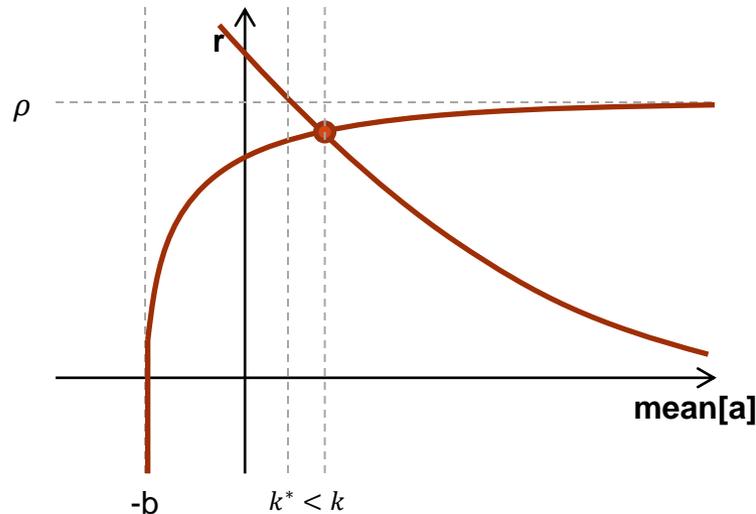
IR: Exchange Economy

- In an exchange economy, aggregate supply of assets must be zero
 - Huggett (1993)
- Equilibrium interest rate always satisfies $r < \rho$



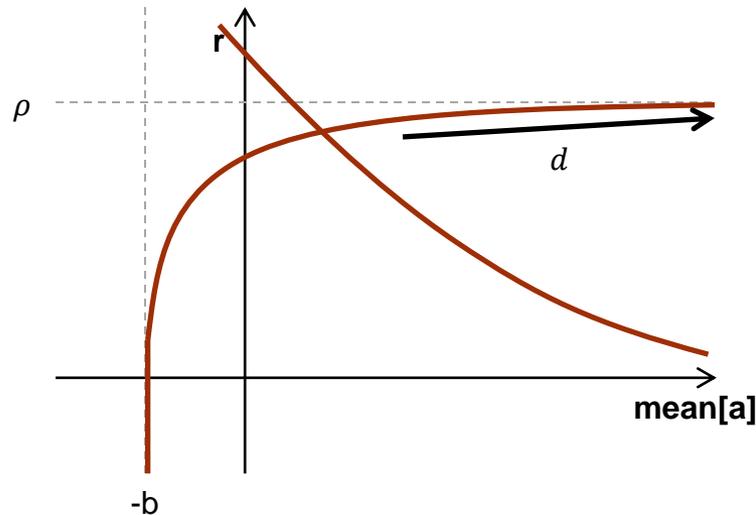
IR: Production Economy

- Aiyagari (1994) combines the previous setup with standard production function $F(K, L)$
 - Constant aggregate labor L
- Demand for capital is given by $f'(k) - \delta = r$
 - Efficient level of capital $f'(k^*) - \delta = \rho \Rightarrow k^* < k$



IR: Production Economy

- Aiyagari (1995) shows that a tax on capital earnings can address this efficiency problem
 - This decreases the net interest rate received by agents
- Government debt does not work “perfectly”
 - No finite amount of government debt will achieve $r = \rho$



|| Constrained Inefficiency

- Bewley-Aiyagari economies result in competitive allocations that are not only Pareto inefficient, but are also *constrained* Pareto inefficient
 - Social planner can achieve a Pareto superior outcome even facing same market incompleteness
- This result can be attributed to *pecuniary externalities*
 - In competitive equilibrium, agents take prices as given whereas a social planner can induce wealth transfers by affecting relative prices
 - Stiglitz (1982), Geanakoplos-Polemarchakis (1986)

|| CI: Aiyagari Economy

- Davila, Hong, Krusell, Rios-Rull (2005) consider welfare increasing changes in Aiyagari setting
- Higher level capital leads to higher wages and lower interest rates
 - Higher wage amplifies contemporaneous effect of labor endowment shock
 - Lower interest rate dampens impact of endowment shock in following periods

CI: Amplification

- Two period setting with $t \in \{0,1\}$
 - Initial wealth y
 - Labor endowment $e \in \{e_1, e_2\}$ (i.i.d)
 - Aggregate labor: $L = \pi e_1 + (1 - \pi)e_2$
 - Production function $f(K, L)$
- Agent consumption plan given by $\{c_0, c_1, c_2\}$
 - $c_i \leq e_i w + K(1 + r)$
 - $\frac{dU}{dK} = \{-u'(c_0) + \beta(1 + r)[\pi u'(c_1) + (1 - \pi)u'(c_2)]\} +$
 $\beta[\pi u'(c_1)K + (1 - \pi)u'(c_2)K] \frac{dr}{dK} +$
 $\beta[\pi u'(c_1)e_1 + (1 - \pi)u'(c_2)e_2] \frac{dw}{dK}$

CI: Amplification

- The first expression is zero from agent's FOC
 - Agents take prices as given, i.e. assume $\frac{dw}{dK} = \frac{dr}{dK} = 0$
- In a competitive equilibrium $\frac{dr}{dK} = f_{KK}$ and $\frac{dw}{dK} = f_{KL}$
 - f linearly homogeneous implies $Kf_{KK} + Lf_{KL} = 0$
- This provides:
 - $\frac{dU}{dK} = \beta\pi(1 - \pi) \frac{Kf_{KK}}{L} (u'(c_1) - u'(c_2))(e_2 - e_1) < 0$
 - Reducing level of capital improves ex-ante utility

CI: Dampening

- Consider addition of third period $t = 2$
 - Same labor endowment $e \in \{e_1, e_2\}$
- Effect of change in capital level at $t = 1$ depends on realization of labor endowment
 - $\Delta = \beta\pi(1 - \pi) \frac{Kf_{KK}}{L} (u'(c_1) - u'(c_2))(e_2 - e_1) < 0$
 - $\frac{dU_i}{dK} = \beta[\Delta + \beta(\pi u'(c_{i1}) + (1 - \pi)u'(c_{i2}))(K_i - K)f_{KK}]$
- Second term is positive if and only if $K_i < K$
 - Increasing capital more desirable for low endowment agents and less desirable for high endowment agents

Outline – Demand for Liquid Assets

- Deterministic Fluctuations
 - Overlapping generations
 - Completing markets with liquid asset
- Idiosyncratic Risk
 - Precautionary savings
 - Constrained efficiency
- Aggregate Risk
 - Bounded rationality
- Amplification Revisited

Aggregate Risk

- Krusell, Smith (1998) introduce aggregate risk into the Aiyagari framework
 - Aggregate productivity shock that follows a Markov process z_t and $Y_t = z_t F(K_t, L_t)$
- Aggregate capital stock determines equilibrium prices r_t, w_t
 - However, the evolution of aggregate stock is affected by the **distribution** of wealth since poor agents may have a much higher propensity to save
 - Tracking whole distribution is practically impossible

AR: Bounded Rationality

- Krusell, Smith assume agents are boundedly rational and approximate the distribution of capital by a finite set of moments M
 - Regression R^2 is relatively high even if $\#M = 1$
- This result is strongly dependent on low risk aversion and low persistence of labor shocks
 - Weak precautionary savings motive except for poorest agents
 - Since wealth-weighted averages are relevant, this has a negligible effect on aggregate quantities

AR: Persistence

- Constantinides & Duffie (1996) highlight importance of persistent income shocks
 - Any price process can be replicated (in a non-trading environment)
- With non-stationary and heteroskedastic individual income processes, self-insurance through precautionary saving is far less effective
 - Any shock to agent's income permanently affects expected share of future aggregate income
 - Wealth heterogeneity is significant

|| Outline – Demand for Liquid Assets

- Deterministic Fluctuations
 - Overlapping generations
 - Completing markets with liquid asset
- Idiosyncratic Risk
 - Precautionary savings
 - Constrained efficiency
- Aggregate Risk
 - Bounded rationality
- Amplification Revisited

Liquidity Concepts

- Financial instability arises from the fragility of liquidity

A

L

Technological liquidity

- Reversibility of investment

Market liquidity

- Specificity of capital
Price impact of capital sale

Funding liquidity

- Maturity structure of debt
 - Can't roll over short term debt
- Sensitivity of margins
 - Margin-funding is recalled

~~Liquidity~~
Maturity mismatch



- Liquidity mismatch* determines severity of amplification

Amplification Revisited

- Investment possibility shocks
 - Production possibilities: Scheinkman & Weiss (1986)
 - Investment possibilities: Kiyotaki & Moore (2008)
- Interim liquidity shocks
 - Exogenous shock: Holmstrom & Tirole (1998)
 - Endogenous shock: Shleifer & Vishny (1997)
- Preference shocks
 - No aggregate risk: Diamond & Dybvig (1983)
 - Aggregate risk: Allen & Gale (1994)

|| Scheinkman & Weiss

- Two types of agents with perfectly negatively correlated idiosyncratic shocks
 - No aggregate risk, but key difference is that labor supply is now elastic
- Productivity reflects *technological liquidity*
 - Productivity switches according to a Poisson process
 - Productive agents can produce consumption goods
- No capital in the economy
 - Can only save by holding money (fixed supply)
 - Productive agents exchange consumption goods for money from unproductive agents

SW: Aggregate Dynamics

- Aggregate fluctuations due to elastic labor supply
- Price level is determined in equilibrium
 - As productive agents accumulate money, wealth effect induces lower labor supply
 - Aggregate output declines and price level increases
- Effect of changes in money supply depends on distribution of money between agent types
 - Increase in money supply will reduce (increase) aggregate output when productive agents hold less (more) than half the money supply, i.e. when output is high (low)

|| Kiyotaki & Moore 08

- Two types of agents, entrepreneurs and households
 - Entrepreneurs can invest, but only when they have an investment opportunity
 - Opportunities correspond to *technological liquidity*
- Investment opportunities arrive i.i.d. and cannot be insured against
 - Entrepreneur can invest with probability π
- Agents can hold equity or fiat money

|| KM: Financing

- Entrepreneurs have access to 3 sources of capital
 - New equity claims, but a fraction $1 - \theta$ must be held by entrepreneur for at least one period
 - Existing equity claims, but only a fraction ϕ_t of these can be sold right away
 - Money holdings, with no frictions
- Capital frictions represent *illiquidity*

KM: Entrepreneurs

- Budget constraint:
 - $c_t + i_t + q_t(n_{t+1} - i_t) + p_t(m_{t+1} - m_t) = r_t n_t + q_t(1 - \delta)n_t$
 - Equity holdings net of investment $n_{t+1} - i_t$
 - Price of equity/capital q_t can be greater than 1 due to limited investment opportunities
- Liquidity constraint:
 - $n_{t+1} \geq (1 - \theta)i_t + (1 - \phi_t)(1 - \delta)n_t$
 - Limits on selling new and existing equity place lower bound on future equity holdings

|| KM: Investment Opportunity

- For low θ , ϕ_t , liquidity constraints are binding and money has value
- An entrepreneur with an investment opportunity will spend all of his money holding
 - Budget constraint can be rewritten as $c_t^i + q_t^R n_{t+1}^i = r_t n_t + (\phi_t q_t + (1 - \phi_t) q_t^R)(1 - \delta) n_t + p_t m_t$
 - Replacement cost of capital: $q_t^R \equiv \frac{1 - \theta q_t}{1 - \theta}$
 - Can create new equity holdings at cost $q_t^R < q_t$, but this reduces value of remaining unsold holdings

|| KM: No Investment Opportunity

- Entrepreneur without investment opportunity decides on allocation between equity (depends on opportunity at $t + 1$) and money
 - Return to money: $R_{t+1}^m \equiv \frac{p_{t+1}}{p_t}$
 - No opportunity: $R_{t+1}^s \equiv \frac{r_{t+1} + q_{t+1}(1-\delta)}{q_t}$
 - Opportunity: $R_{t+1}^i \equiv \frac{r_{t+1} + (\phi_{t+1}q_{t+1} + (1-\phi_{t+1})q_{t+1}^R(1-\delta))}{q_t}$

|| KM: Logarithmic Utility

- Under logarithmic utility, entrepreneurs will consume $1 - \beta$ fraction of wealth
- Around steady-state, aggregate level of capital is smaller than in first-best economy, i.e. $K_{t+1} < K^*$
 - Expected return on capital $E_t[f'(K_{t+1}) - \delta] > \rho$
- Conditional liquidity premium arises since $E_t[R_{t+1}^m] < E_t[R_{t+1}^s] < 1 + \rho$
 - Unconditional liquidity premium may also arise (but is smaller) since $E_t[R_{t+1}^i] < E_t[R_{t+1}^m]$

|| KM: Real Effects

- Negative shocks to *market liquidity* ϕ_t of equity have aggregate effects
 - Shift away from equity into money
 - Drop in price q_t and increase in p_t
 - Decrease in investment and capital
- Shock to financing conditions feeds back to real economy as a reduction in output
 - KM find that government can counteract effects by buying equity and issuing new money (upward pressure on q_t and downward pressure on p_t)

|| Holmstrom & Tirole 98

- Three period model with $t \in \{0,1,2\}$
- Entrepreneurs with initial wealth A
 - Investment of I returns RI in $t = 2$ with probability p
 - Interim funding requirement ρI at $t = 1$ with $\rho \sim G$
 - Extreme *technological illiquidity*, as investment is worthless if interim funding is not provided
- Moral hazard problem
 - Efficiency requires $\rho \leq \rho_1 \equiv pR \Rightarrow$ continuation
 - Only $\rho \leq \rho_0 < \rho_1$ of funding can be raised at $t = 1$ due to manager's private benefit, i.e. principal-agent conflict

HT: Optimal Contracting

- Optimal contract specifies:
 - Investment size I
 - Continuation cutoff $\hat{\rho}$
 - Division of returns contingent on realized ρ
- Entrepreneurs maximize expected surplus, i.e.
 - $\max_{I, \hat{\rho}} \left\{ I \int_0^{\hat{\rho}} (\rho_1 - \rho) dG(\rho) - I \right\}$
- Households can only be promised ρ_0 at $t = 1$
 - Breakeven condition: $I \int_0^{\hat{\rho}} (\rho_0 - \rho) dG(\rho) = I - A$
- Solution provides cutoff $\hat{\rho} \in [\rho_0, \rho_1]$

HT: General Equilibrium

- Without a storage technology, liquidity must come from financial claims on real assets
 - *Market liquidity* of claims becomes crucial
- If there is no aggregate uncertainty, the optimal contract can be implemented:
 - Sell equity
 - Hold part of market portfolio
 - Any surplus is paid to shareholders as dividends

HT: Aggregate Risk

- With aggregate risk, optimal contract may not be implementable
 - Market liquidity of equity is affected by aggregate state
- Consider perfectly correlated projects
 - Liquidity is low when it is needed (bad aggregate state)
 - Liquidity is high when it is not needed (good state)
- This introduces a role for government to provide a store of wealth

|| Shleifer & Vishny 97

- Fund managers choose how aggressively to exploit an arbitrage opportunity
- Mispricing can widen in interim period
 - Investors question investment and withdraw funds
 - Managers must unwind position when mispricing is largest, i.e. most profitable
 - Low *market liquidity* due to limited knowledge of opportunity
- Fund managers predict this effect, and thus limit arbitrage activity
 - Keep buffer of liquid assets to fund withdrawals

|| Diamond & Dybvig 83

- Three period model with $t \in \{0,1,2\}$
- Continuum of ex-ante identical agents
 - Endowment of 1 in $t = 0$
 - Idiosyncratic preference shock, i.e. probability λ that agent consumes in $t = 1$ and probability $1 - \lambda$ that agent consumes in $t = 2$
- Preference shock is not observable to outsiders
 - Not insurable, i.e. incomplete markets

DD: Investment

- Good can be stored without cost
 - Payoff of 1 in any period
- Long term investment project
 - Payoff of $R > 1$ in $t = 2$
 - Salvage value of $r \leq 1$ if liquidated early in $t = 1$
 - Market for claims to long-term project at price p
- Trade-off between return and *liquidity*
 - Investment is subject to *technological illiquidity*, i.e. $r \leq 1$
 - Market liquidity is represented by interim price p

DD: Consumption

- Investing x induces contingent consumption plan:
 - $c_1 = px + (1 - x)$
 - $c_2 = Rx + \frac{R(1-x)}{p}$
- In equilibrium, we require $p = 1$
 - If $p < 1$, then agents would store the asset and purchase project at $t = 1$
 - If $p > 1$, then agents would invest and sell project at $t = 1$

DD: Optimality

- With interim markets, any investment plan leads to $c_1 = 1, c_2 = R$
 - If $r < 1$, fraction $1 - \lambda$ of aggregate wealth must be invested in project (market clearing)
 - Since $p > r$, then asset's *market liquidity* is greater than its *technological liquidity*
- This outcome is clearly superior to autarky, with $c'_1 = r, c'_2 = R$ or $c''_1 = c''_2 = 1$
- Optimality:
 - For log utility market outcome is optimal
 - If customers are more risk averse banks dominate

Allen & Gale

- AG extend DD framework by adding aggregate risk
 - Here, $\lambda = \lambda_H$ with probability π and $\lambda = \lambda_L < \lambda_H$ with probability $1 - \pi$
- Agents observe realization of aggregate state and idiosyncratic preference shock at $t = 1$
 - After resolution of uncertainty, agents can trade claims to long-term project at $p_s \in \{p_H, p_L\}$
 - *Asset's market liquidity* will vary across states
- For simplicity, assume $r = 0$

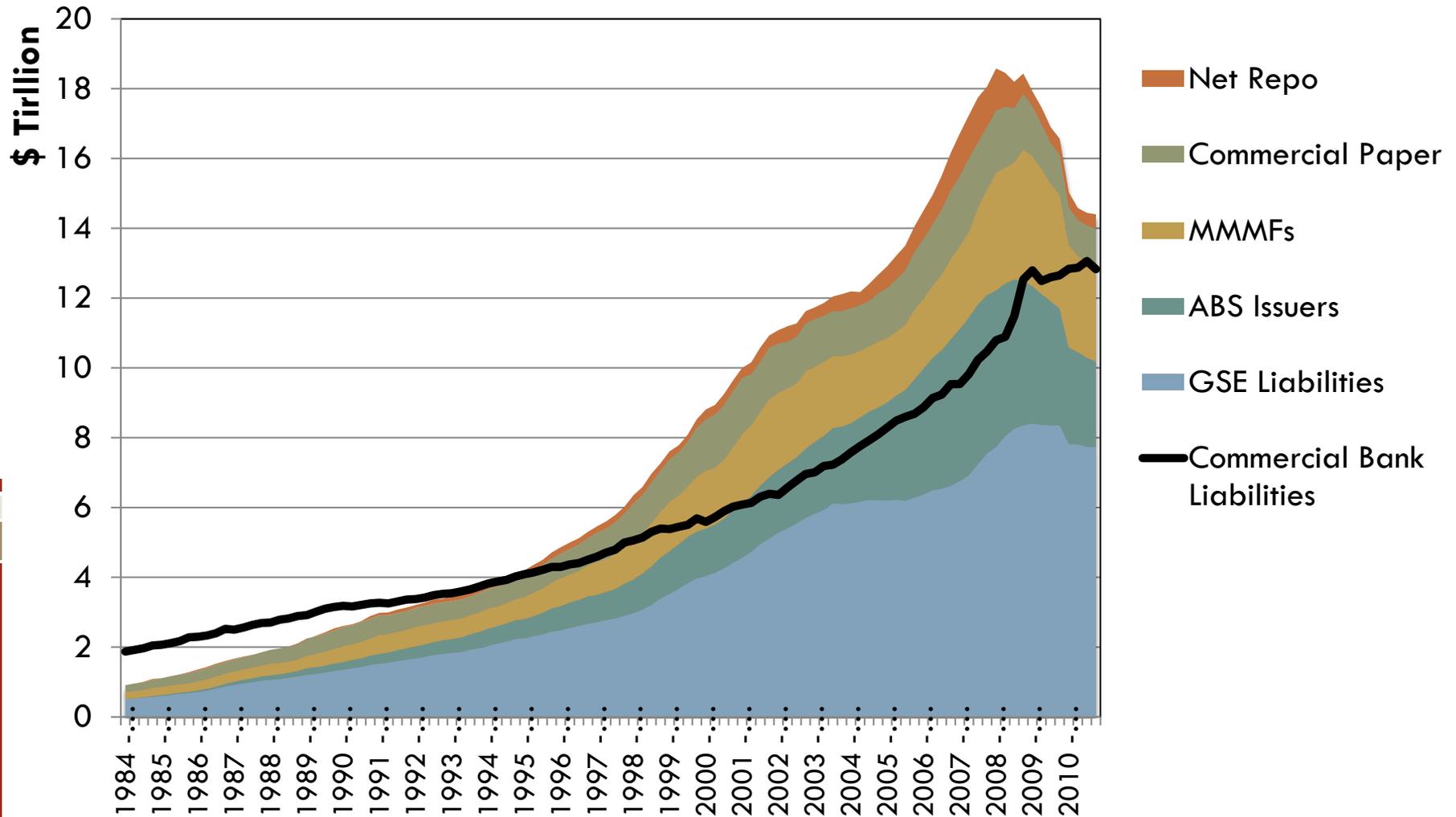
AG: Prices

- Market clearing requires $p_s \leq R$
 - Late consumers stored goods: $(1 - \lambda_s)(1 - x)$
 - Early consumers invested goods: $\lambda_s x$
- Cash-in-the-market pricing
 - $p_s = \min \left\{ R, \frac{(1 - \lambda_s)(1 - x)}{\lambda_s x} \right\}$
 - This implies that $p_H \leq p_L$, i.e. *market liquidity* is weaker when there are a large proportion of early consumers
- Despite deterministic project payoffs, there is volatility in prices

Overview

- Persistence
- Dynamic Amplification
 - Technological illiquidity BGG
 - Market illiquidity KM97
- Instability, Volatility Dynamics, Volatility Paradox
- Volatility and Credit Rationing/Margins/Leverage
- Demand for Liquid Assets
- **Financial Intermediation**

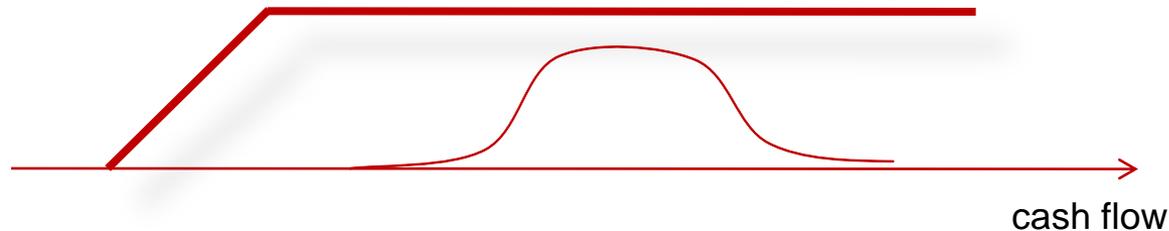
Gross Shadow Banking and Commercial Banking Liabilities



Brunnermeier, Eisenbach, Sannikov

Creating Info-Insensitive Securities

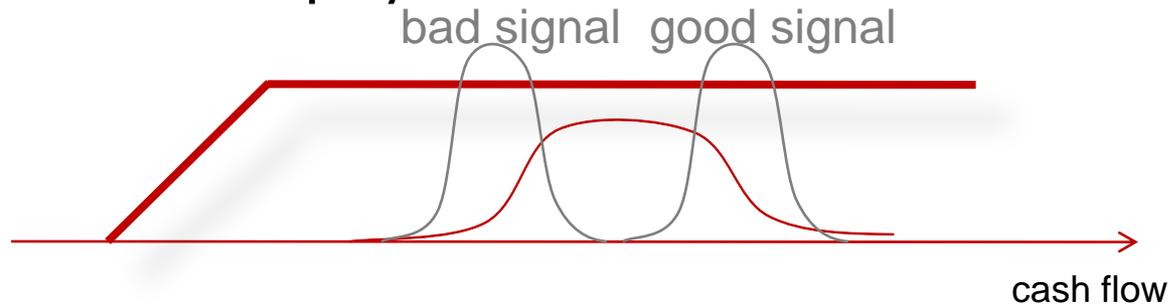
- Debt contract payoff – prior distribution of cash flow



- Asymmetric info (lemons') problem kicks in
 - No more rollover
- Maturity choice:
 - Short-term debt: distribution shrinks (less info-sensitivity)

Creating Info-Insensitive Securities

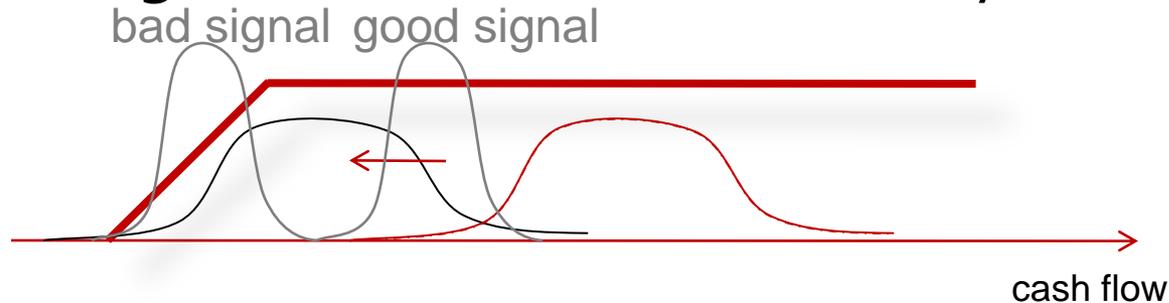
- Debt contract payoff



- Informational value of signal is extremely low (in flat part of contract payoff)

Creating Info-Insensitive Securities

- Increasing the information sensitivity of debt



- Now signal is very valuable
- Asymmetric info (lemons') problem kicks in
 - No more rollover
- Maturity choice:
 - Short-term debt: distribution shrinks (less info-sensitivity)

Repo market

- Repurchase agreement
 - Borrow: sell assets with a agreement to repurchase it in one day/months
 - Repo types:
 - General collateral (GC) repos
collateral are treasuries, agency papers
 - MBS repos
collateral are mortgage backed securities
 - Outside of bankruptcy protection(in US not in UK)
- Repo haircuts widened sharply