SHADOW BANKING

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A Narrative of the Financial Crisis

1. A housing bubble inflates in the mid 2000's. Homes are financed by mortgages that are increasingly securitized. Although the quality of mortgages deteriorates, the securities into which these mortgages are packaged (mortgage backed securities or MBS) are perceived to be safe and receive AAA-ratings.

2. Financial institutions such as banks and dealer banks retain substantial exposure to the real estate market, through direct holdings of commercial real estate, direct holdings of MBS, but also implicit guarantees of special investment vehicles they organize, which hold MBS and finance them with commercial paper.

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A Narrative of the Financial Crisis (cont'd)

3. Bad news about the housing market in the summer of 2007 surprises investors in AAA-rated MBS and precipitates a sequence of substantial disruptions in financial markets, such as the collapse of the asset backed commercial paper market. Aggressive liquidity interventions from the Federal Reserve, including lending to market participants against risky collateral, stabilize markets through the summer of 2008 despite continued bad news about housing.

4. In September 2008, several events, including a run on money market funds, nationalization of AIG, Fannie Mae, and Freddie Mac, and particularly the collapse of Lehman Brothers, precipitate a massive financial crisis. Banks balance sheets contract because of massive losses on assets and withdrawal of short term financing, which prompts banks to liquidate assets in fire sales. The consequences of fire sales are exacerbated by uncertainty about bank solvency and government policy.

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A Narrative of the Financial Crisis (cont'd)

5. In response to their losses and to reduced availability of financing, banks cut lending to firms. The economy slides into a major recession.

6. Starting in October 2008, the government begins massive interventions in financial markets, including equity injections in banks, expansion of lending against risky collateral, but also direct purchases of long term agency bonds, which sharply reduce the supply of risky bonds in the market. The combination of government interventions eventually stabilizes the financial markets by the Spring of 2009, although the real economy remains sluggish.

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Shadow banking and the 2007-2008 crisis

- Shadow (or securitized) banking:
  - Origination/acquisition of loans by intermediaries
  - Assembly of them into diversified pools
  - Financing of pools with short term-low risk debt
  - Keep some risk (directly or as a guarantee for the pool)

- During the crisis of 2007-2008, as the mortgages in securitization pools lost their value, the system unraveled
  - External financing suddenly stopped,
  - Intermediaries suffered huge losses from retained risks

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Build a "neglected risks" model of these events

- Origination: Intermediaries originate safe and risky loans, and finance them using their own wealth and by issuing debt. Outside investors only want riskless debt.

- Securitization: Risky loans are subject to institution-specific idiosyncratic risk and to aggregate risk. As investors' wealth becomes large, intermediaries expand their safe collateral by diversification. They do so by trading risky loans, which eliminates idiosyncratic risk. This allows greater borrowing.

- Fragility: investors and intermediaries neglect low probability aggregate risks (GS 2010, GSV 2011).

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Main Results

- Pooling of risky projects allows intermediaries' assets (loan portfolios) and liabilities (riskless debt) to grow together. Undiversifiable, aggregate, risk yields a carry trade.

- Pooling risk endogenously makes intermediaries interconnected. Under RE, this increases stability, and improves welfare.

- With neglected risks, there is a "diversification myth": pooling of *idiosyncratic* risks leads to excessive debt issuance. The combination of debt and insurance raises exposure of intermediaries to tail *aggregate* risks. Ex-ante pooling creates ex-post illiquidity/fragility.

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Some Related Literature

- Link shadow banking to growing investor wealth (Farhi et al. 2008). Account for link between risk-taking and low interest rates (Maddaloni and Peydro 2011, Jimenez et al. 2011). Show that with, neglected risks, insurance creates catastrophe bonds (Coval, Jurek, and Stafford 2009b).

- Explain comovement of assets and leverage (Adrian and Shin, 2010) and intermediaries' risk retention (Acharya, Schnabl, and Suarez 2010).

- Endogenize bank interconnectedness and systematic risk. Shin (2009a) and Allen and Gale (2000). We focus on neglect of aggregate tail risks.

- Explain how banks lose a fortune holding other banks' risks in a crisis. See Benmelech and Dlugosz on CDO's.

- Ex-post illiquidity. Geanakoplos (2009), SV (2010), Gorton and Metrick (2010), etc. We focus on ex-ante insurance, not on short term debt.

- Model pooling and tranching, but not as a result of asymmetric information (De Marzo and Duffie 1999) or ring-fencing.

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Organization of Presentation

- The model with rational expectations

- The model with local thinking and results

- Extensions (briefly)

- Three dates $t = 0, 1, 2$

- There is a measure 1 of infinitely risk averse investors

$$E_\omega[C_0 + \min_\omega C_{1,\omega} + \min_\omega C_{2,\omega}]$$

  - they receive wealth w at $t = 0$

- There is a measure 1 of risk neutral intermediaries

$$E_\omega[C_0 + C_{1,\omega} + C_{2,\omega}]$$

  - they receive wealth w_{int} at $t = 0$

- Intermediaries invest by using their own wealth w_{int} and by issuing *riskless* debt to investors:

  - Issue debt D at t $= 0$, promise to repay rD *at* t $= 2$.

- Intermediaries have access to the following technologies:

  - Safe technology H. Invest $I_{H,j}$ at t = 0 and obtain:

$$f_H(I_{H,j}) = RI_{H,j} \quad \text{at t = 2}$$

Limited total supply, namely $\int I_{H,j} dj \leq 1$.

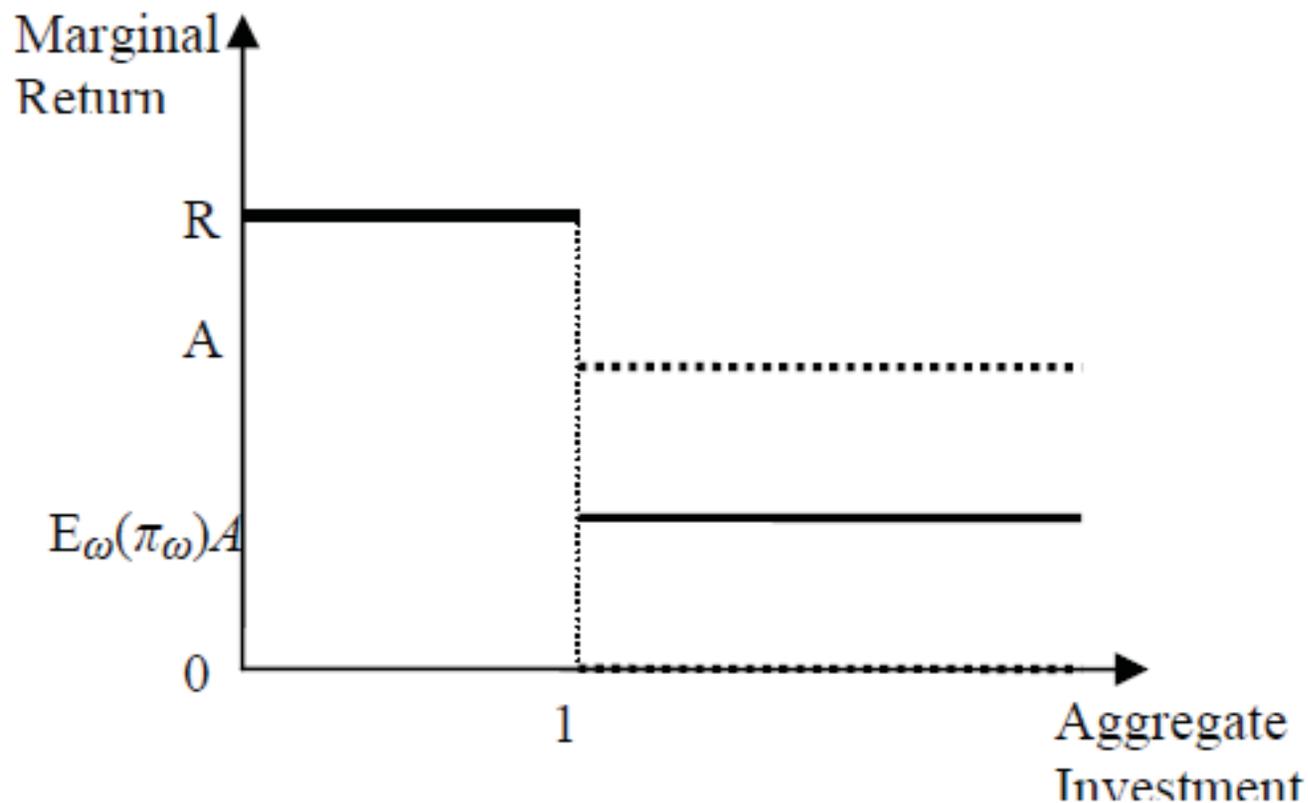 - Risky technology L. Invest $I_{L,j}$ at t = 0 and obtain:

$$f(I_{L,j}) = \begin{cases} AI_{L,j} & with \quad probability \quad \pi_\omega \\ 0 & with \quad probability \quad 1 - \pi_\omega \end{cases}$$

  - In state ω, an aggregate share π_ω of risky projects succeeds. There are three states g, d, r, with

$$\pi_g > \pi_d > \pi_r \quad \text{and} \quad \Pr(\pi_\omega) = \varphi_\omega$$

  - there is both idiosyncratic and aggregate risk

Intermediaries' return to investment

Technology features decreasing returns + increasing risk

Timing

- At t = 0 each intermediary borrows D_j, invests $I_{H,j}$ and $I_{L,j}$, sells $S_{H,j}$ and $S_{L,j}$ units of own investment, buys $T_{H,j}$ and $T_{L,j}$ units of *diversified pools* of other intermediaries' investments.

  - Interest rate r, prices of investments p_H and p_L are competitively set at t = 0.

  - Investors lend all of their wealth w if $r > 1$, they are indifferent between lending or not at $r = 1$.

- At t = 1 state ω and intermediaries' returns are revealed.

- At t = 2 investment pays off and debt is repaid.

Intermediaries' expected profits at t = 0

- At t = 0 each intermediary j has expected profits:

$$[R \cdot (I_{H,j} + T_{H,j} - S_{H,j}) + p_H(S_{H,j} - T_{H,j})] +$$
$$+ [E_\omega(\pi_\omega) \cdot A \cdot (I_{L,j} - S_{L,j}) + E_\omega(\pi_\omega) \cdot A \cdot T_{L,j} + p_L(S_{L,j} - T_{L,j})] +$$
$$+ D_j - I_{H,j} - I_{L,j} + w_{int} - rD_j.$$

- Return from idiosyncratic risk kept $(I_{L,j} - S_{L,j})$ is 0 or A.

- Return from securitized pool $T_{L,j}$ is $\pi_\omega \cdot A$ in ω.
  - The pool is only subject to aggregate risk about π_ω.

- The constraints faced by the intermediary are:
  - Feasibility: at t = 0 cannot invest more than resources raised
  - Riskless debt constraint:

$$rD_j \leq R{\cdot}(I_{\mathrm{H},j} + T_{\mathrm{H},j} - S_{\mathrm{H},j}) + \pi_r{\cdot}A{\cdot}T_{\mathrm{L},j}.$$

  - Pledge safe return and securitized pool in worst state π_r.
  - Intermediaries' "carry trade" is $[\,\mathrm{E}_\omega(\pi_\omega)A - r\,]{\cdot}T_{\mathrm{L},j}$

  - Feasibility of Securitization:

$$S_{\mathrm{H},j} \leq I_{\mathrm{H},j}, \quad S_{\mathrm{L},j} \leq I_{\mathrm{L},j}$$

  - Cannot sell more investments than those undertaken

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Preliminaries

- In equilibrium the safe asset is not securitized

  - Intermediaries can as well issue debt against safe return R

- Risky asset is securitized only if debt constraint is binding

  - Pooling of risks relaxes investors' demand for safe collateral

- Securitization pools are bought by intermediaries: they are the high value buyers. Thus, $T_{L,j} = S_{L,j}$. Use pools to back debt.

  - Securitization supports growth in leverage and…

  - Allows intermediaries to earn a return above safe debt

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Equilibrium (I): very low investor wealth
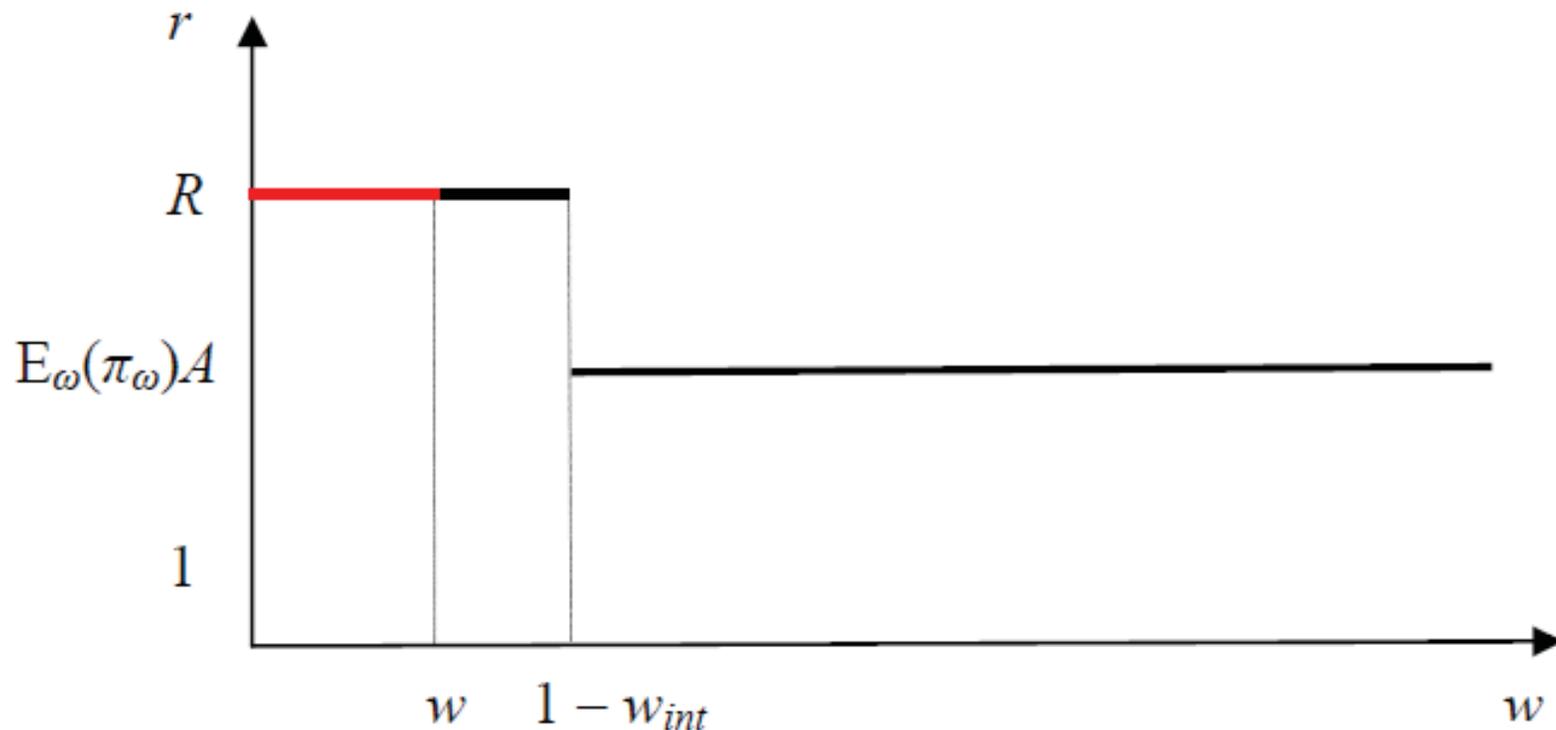
For very low w, undertake only safe project. Securitization does not arise. $r = R$.

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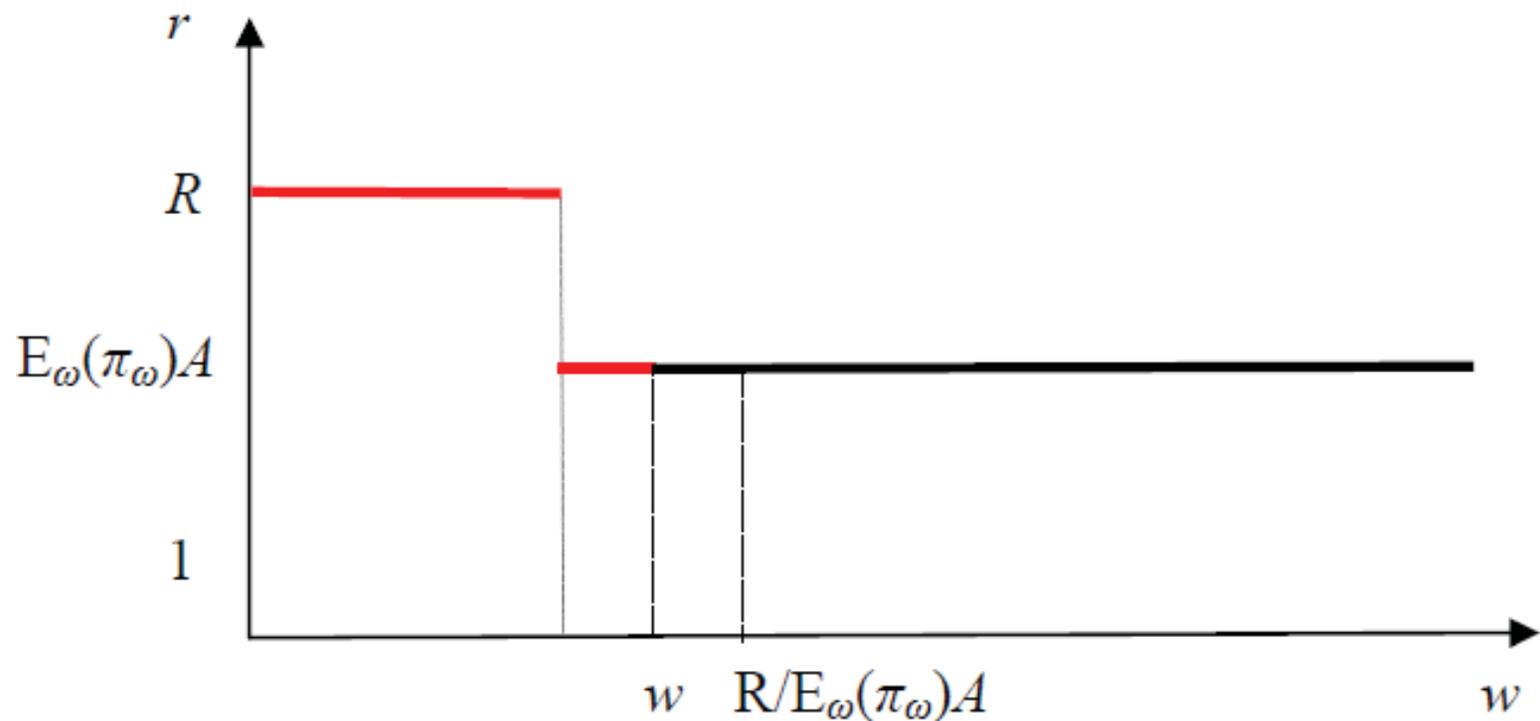
At higher w, some risky projects financed. There is enough safe return that securitization does not arise. $r = E_\omega(\pi_\omega)A$.

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(III): intermediate wealth/securitization
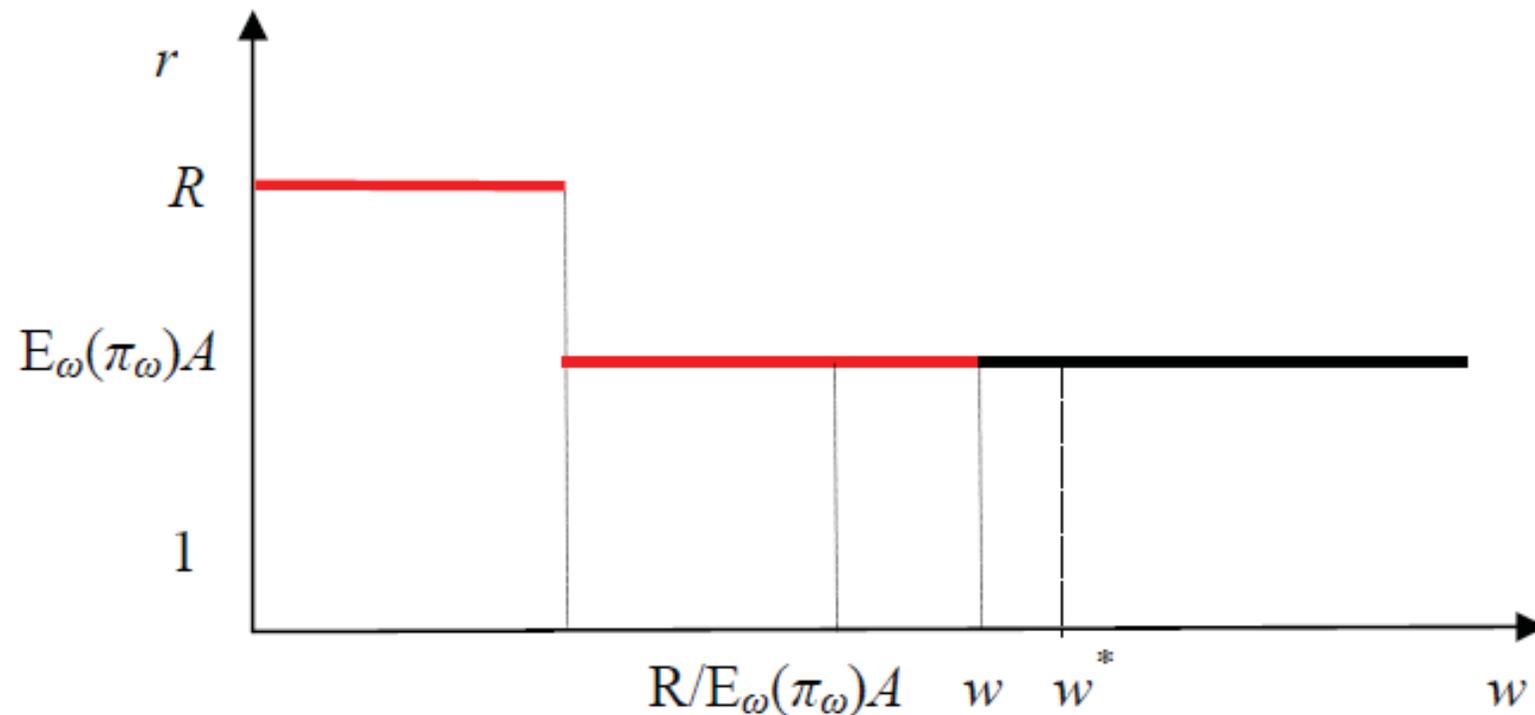
Safe cash flow is longer enough. To absorb w, some securitization $S_{L,j} < I_{L,j}$ is needed. Still true that $r = E_\omega(\pi_\omega)A$.

(IV): high wealth/high securitization
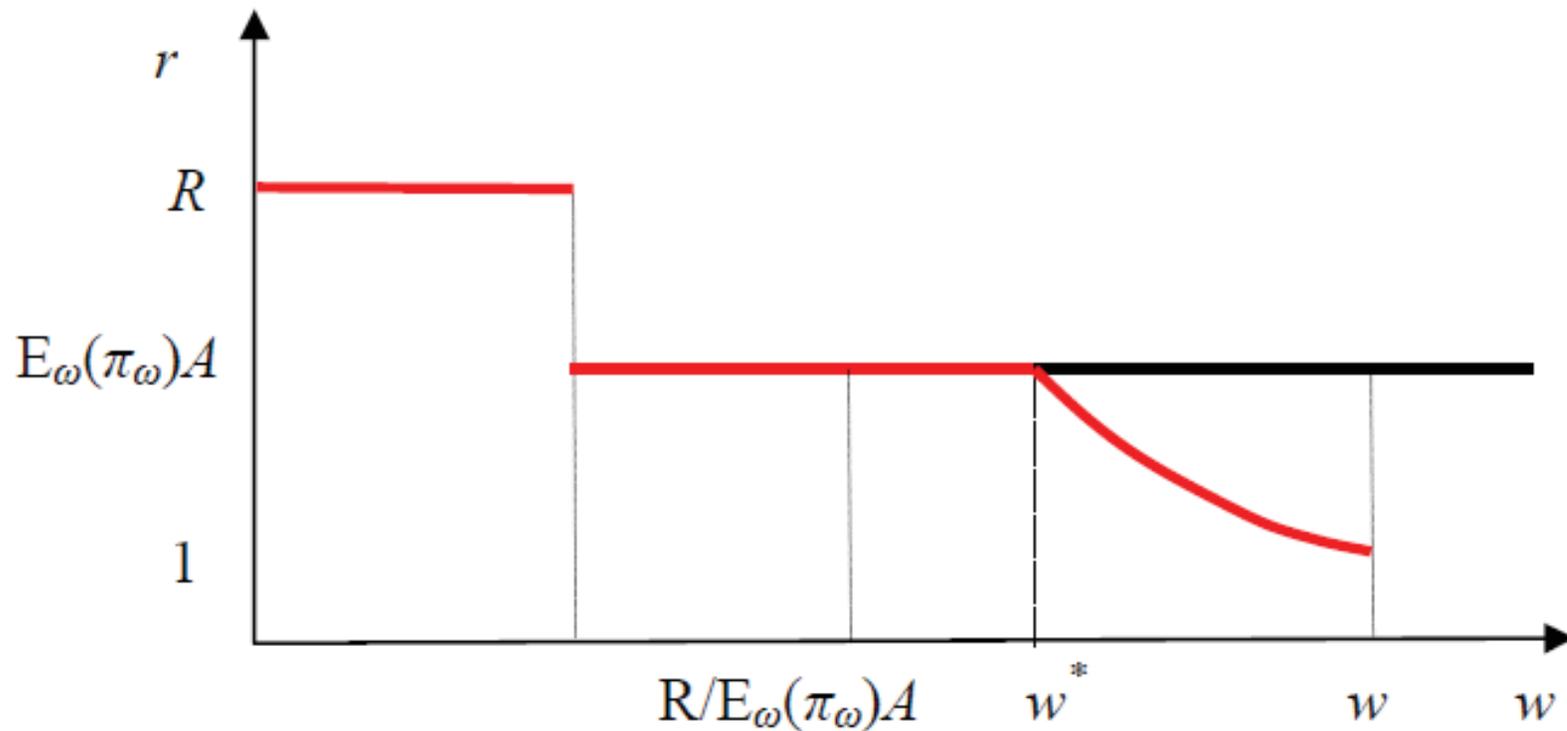
To absorb large w, maximal securitization $S_{L,j} = I_{L,j}$. Interest rate falls below $E_\omega(\pi_\omega)A$ for riskless debt to be sustainable.

Securitization and rational expectations

- Securitization endogenously arises to meet the demand "w" for riskless debt. Driven by marginal, risky, projects.

    - By lowering idiosyncratic risk, pooling boosts safe collateral and debt capacity. Growth of assets and leverage

    - Pools allow intermediaries to earn a yield ("carry trade")

- When at t = 1 returns are revealed, not much happens

    - Some intermediaries do better than others (if securitization is partial), but all debt is truly safe.

    - Securitization is welfare improving.

Securitization and Local Thinking

- Local thinking (GS 2010, GSV 2011): neglect unlikely (tail) risk. Here is "recession", because $\varphi_r = \min \varphi_\omega$.

  - At t = 0, all agents think only of "growth" and "downturn"

- Two things change with respect to RE at t = 0

  - Assess higher average return $E_\omega^{LT}(\pi_\omega)A$

  - <u>Relax debt constraint:</u>

$$rD_j \leq R + \pi_d \cdot A \cdot S_{L,j}.$$

Equilibrium under Local Thinking at t = 0
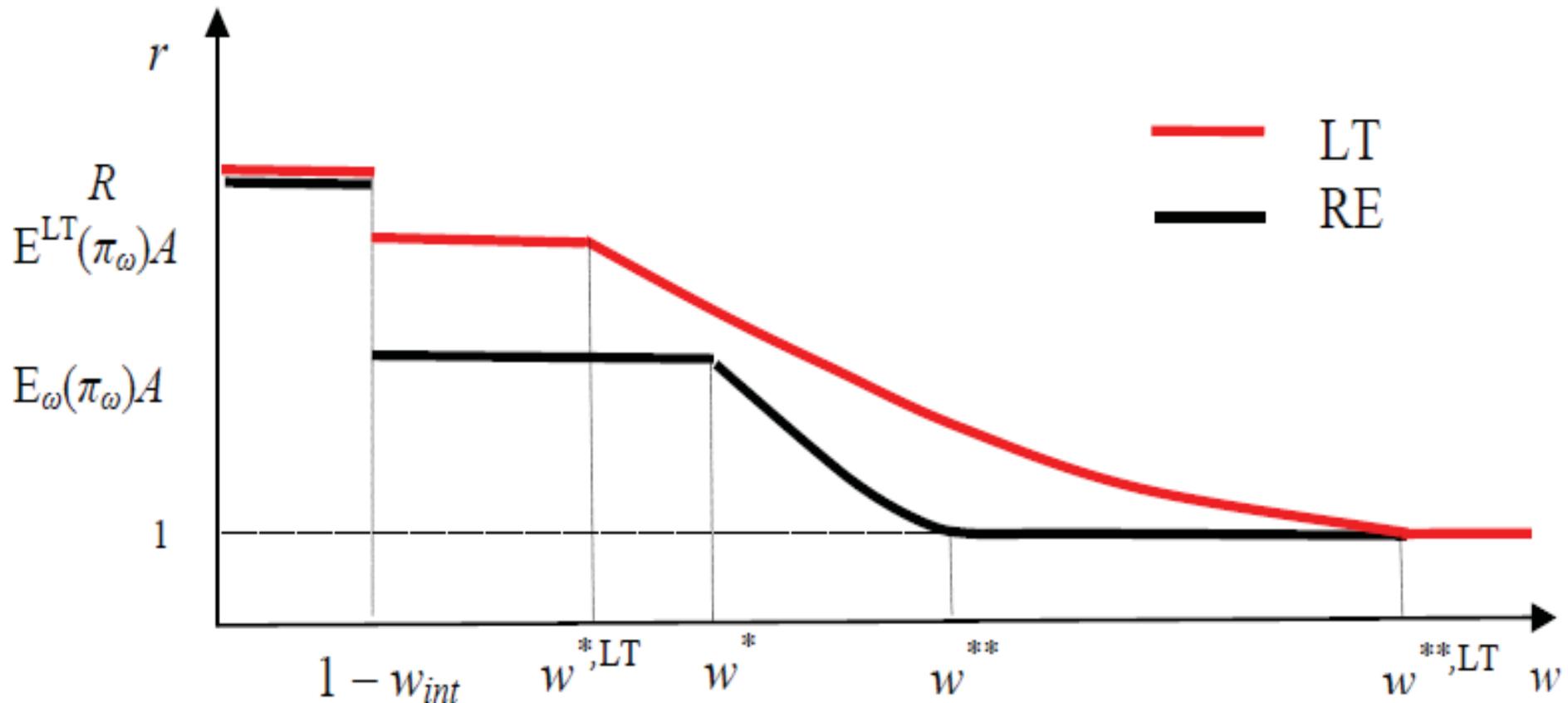
Securitization and leverage expand. At low *w* this raises interest rates, at higher *w* this also boosts investment

Securitization and local thinking at $t = 1$

- If at t = 1 the state is g or d, nothing happens

  - Debt issued at t = 0 is sustainable, as under RE

- Suppose at t = 1 the state is "recession." If securitization occurred, debt is no longer fully backed because:

$$rD_j = R + \pi_d{\cdot}A{\cdot}S_{L,j} \ > \ R + \pi_r{\cdot}A{\cdot}S_{L,j}$$

  - Neglected shortfall in collateral is $(\pi_d - \pi_r){\cdot}A{\cdot}S_{L,j}$

- Do intermediaries have "spare resources" to repay debt?

  - If not, investors inefficiently bear neglected risk.

Default and repayment in recession

- $(1 - \pi_r)$ intermediaries get 0 on their unsecuritized projects $(I_{L,j} - S_{L,j})$. They have no "spare liquidty." Thus, they default

- π_r intermediaries get A on their unsecuritized projects. They have spare liquidity and repay if:

$$rD_j = R + \pi_d \cdot A \cdot S_{L,j} \; < \; R + \pi_r \cdot A \cdot S_{L,j} + A(I_{L,j} - S_{L,j})$$

$$\Leftrightarrow \qquad I_{L,j} / S_{L,j} \; > 1 + (\pi_d - \pi_r)$$

- Default by "successful" intermediaries is more likely if more investment is securitized!

  - Pooling creates correlation in intermediaries' assets

Securitization and Fragility

- By reducing idiosyncratic risk, securitization creates correlation in intermediaries' balance sheets and allows all of them to borrow more. This is problematic when neglected risks materialize.

  - Insurance + leverage => riskless debt = catastrophe bonds

- Fragility is stronger the higher is investors' wealth (and the lower the interest rate), which boosts securitization.

  - When w is low only "unsuccessful" intermediaries default, when w is high all intermediaries default.

- By creating an illusion of safety, excess securitization/insurance exposes investors to misperceptions in aggregate risks.

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Conclusions I

This model of shadow banking delivers:

- Correlation between growth of global imbalances and growth of shadow banking

- Comovement of intermediary leverage and balance sheets

- Greater risk taking by intermediaries in low interest rate environments

- Concentration of systematic risk on balance sheets of banks

- Extreme fragility of financial system to neglect of systematic risk

- Massive losses from precisely diversified portfolios exposed to neglected systematic risks

- Dry ups of liquidity during crises

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Conclusions II

- Described securitization without risk transfer

- In fact argued that risk retention is the essence of securitization because investors are so risk averse

- The benefit is expansion of financing of risky projects; the cost is increased interdependence of intermediaries in exposure to systematic risk

  - Compare to ordinary real estate finance

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Conclusions III

- Neglected risks are subtle and changing

- Cannot expect regulators to stay ahead

- Capital requirements are a crude but appropriate instrument for reducing bets

- Extreme concentration of exposures to a given asset class should raise a red flag

- Deeper skepticism about innovations that capitalize on neglect of risk, such as prime MMF.

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