

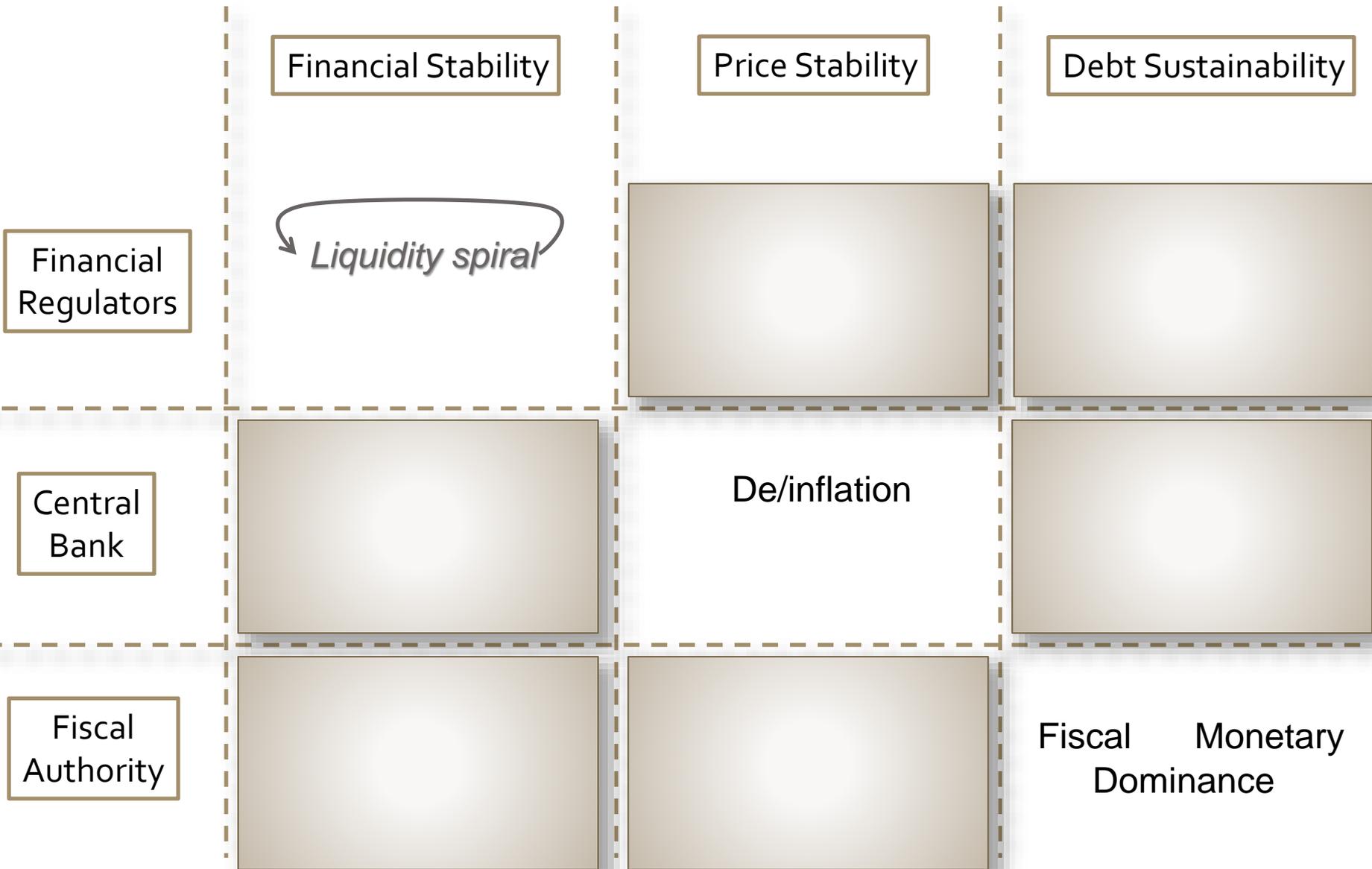


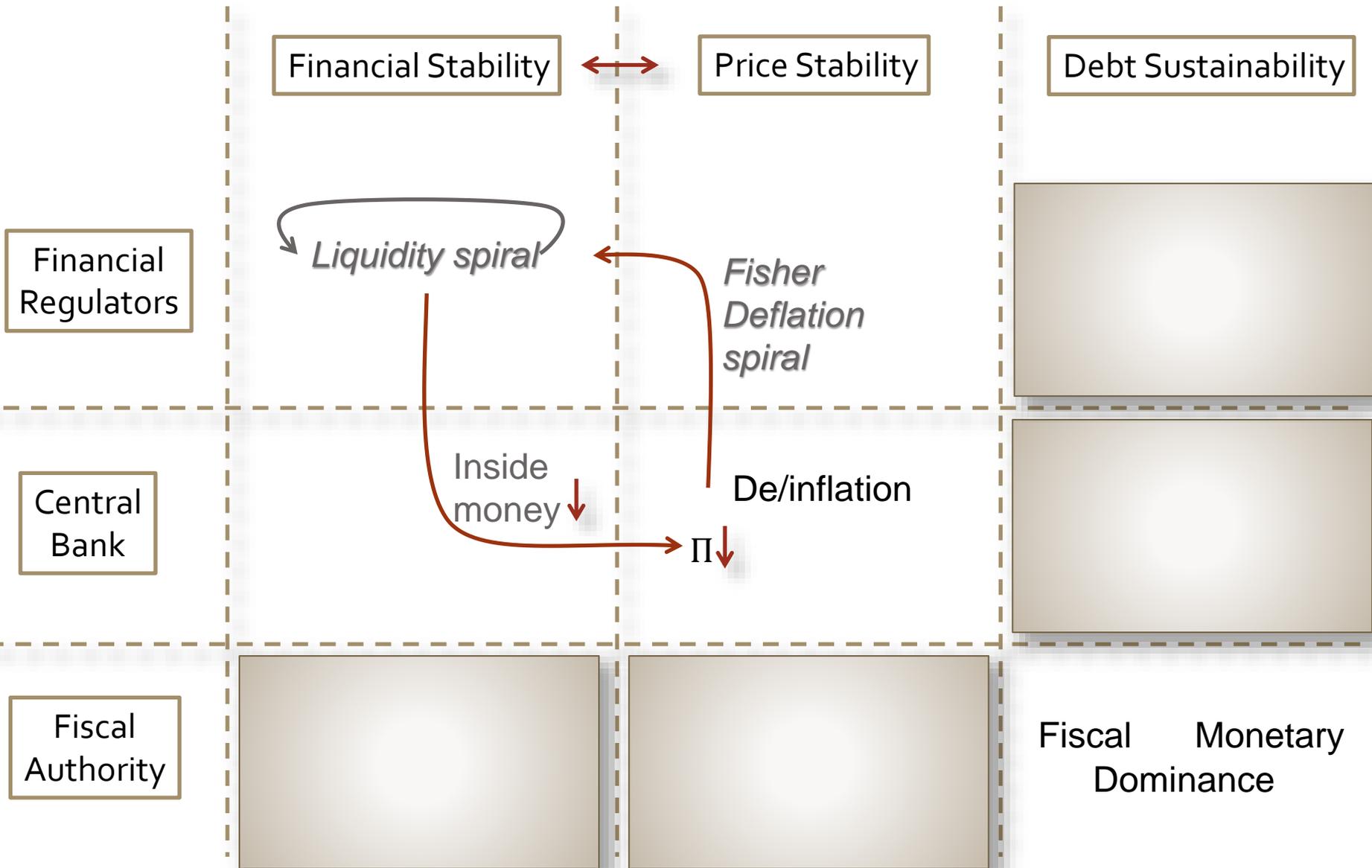
THE ITHEORY OF MONEY

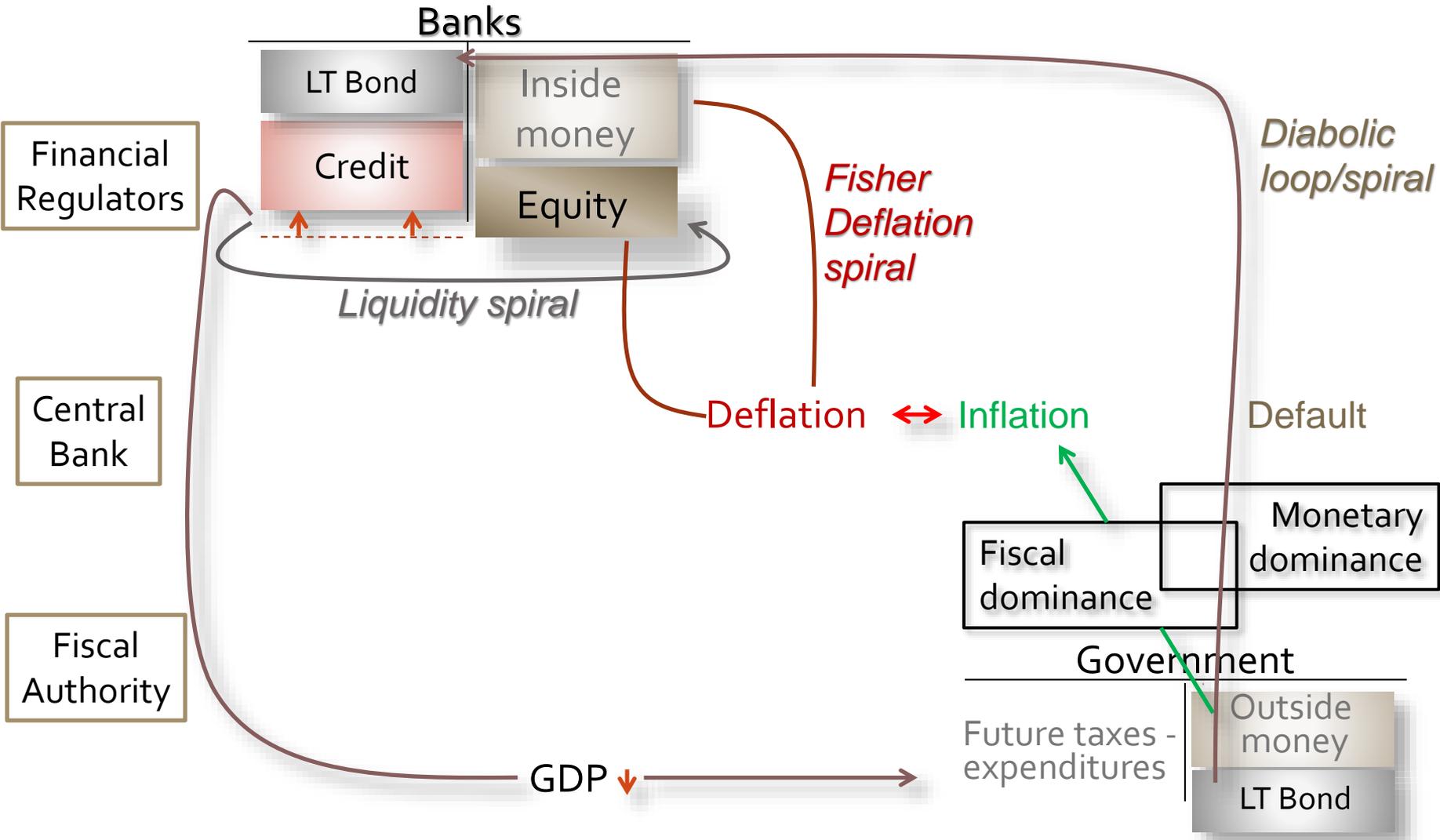
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Princeton University

Updates: http://scholar.princeton.edu/markus/files/i_theory_slides.pdf







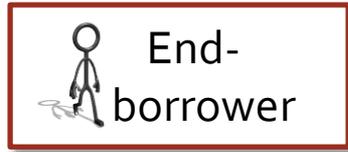
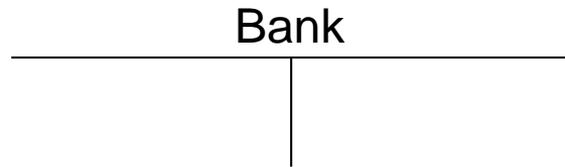
■ Motivation

- Unified framework to study financial and price stability
- I: Intermediation (credit) - Inside money
 - Revive “money and banking”
- Value of money endogenous - store of value, liquidity
- In downturns, intermediaries create less inside money
 - Value of **outside** (base) money goes up
 - Fisher (1933) **deflationary spiral** hits borrowers on liability side
 - **Endogenous** money multiplier = $f(\text{health of intermediary sector})$
- **Monetary policy** (interest rates, open market operations)
 - Fills in demand for money when money multiplier contracts
 - “Stealth redistribution” from/towards intermediary sector

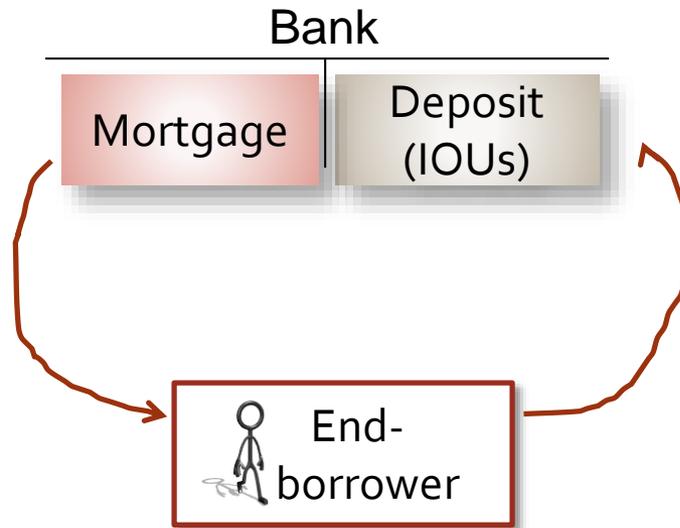
|| Main results

- Money multiplier depends on banks' balance sheets (rather than reserve requirements)
 - banks well-capitalized or not → level of economic activity
 - Banks create less money in downturns → deflation
- Money as unit of account
 - Nominal deposits: deflationary spiral hurts borrowers
- Monetary policy redistribute wealth “stealth recapitalization”
 - Interest rate policy, forward guidance, asset purchases, QE
 - 1. limits endogenous (systemic) risk
 - Switch of deflationary spiral money view
 - Switches of liquidity spiral credit view
 - 2. reduces risk premia (pure welfare loss)

Setting up the Economy

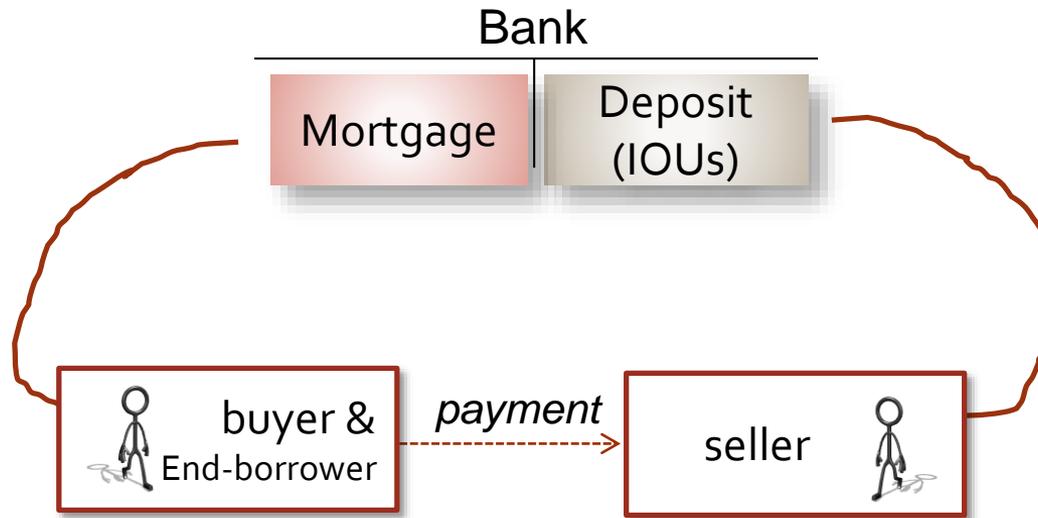


|| Credit and Money Creation



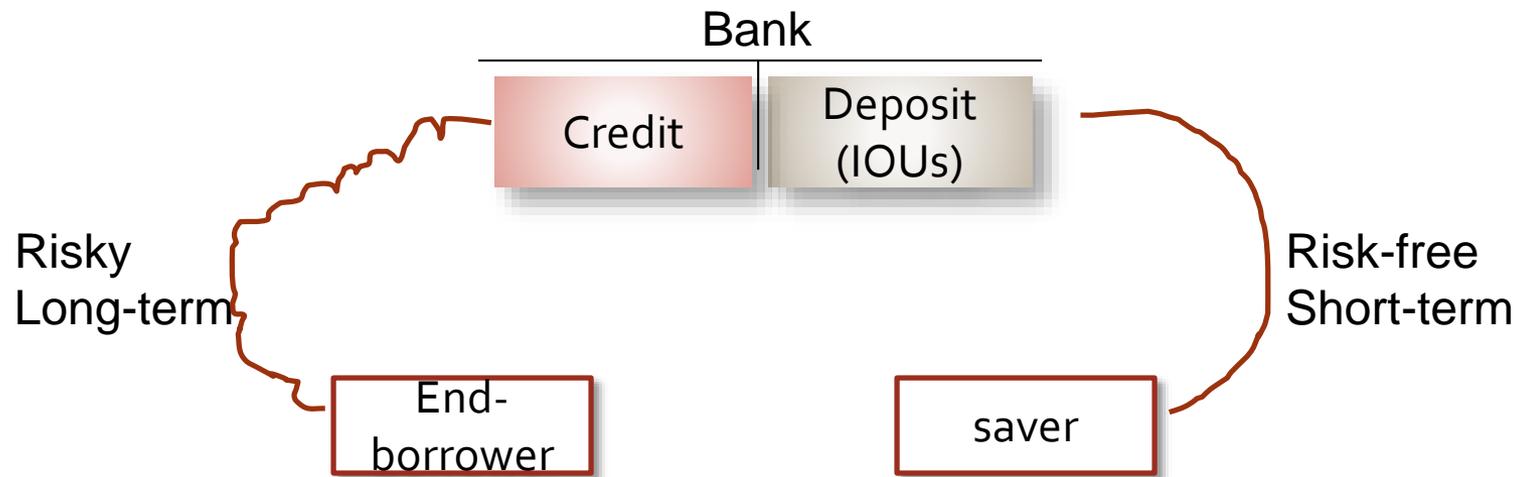
Transferring/accepting Deposits

- End-borrower buys house & transfers deposit to seller of house
- As long as seller holds deposits, he lends through the bank



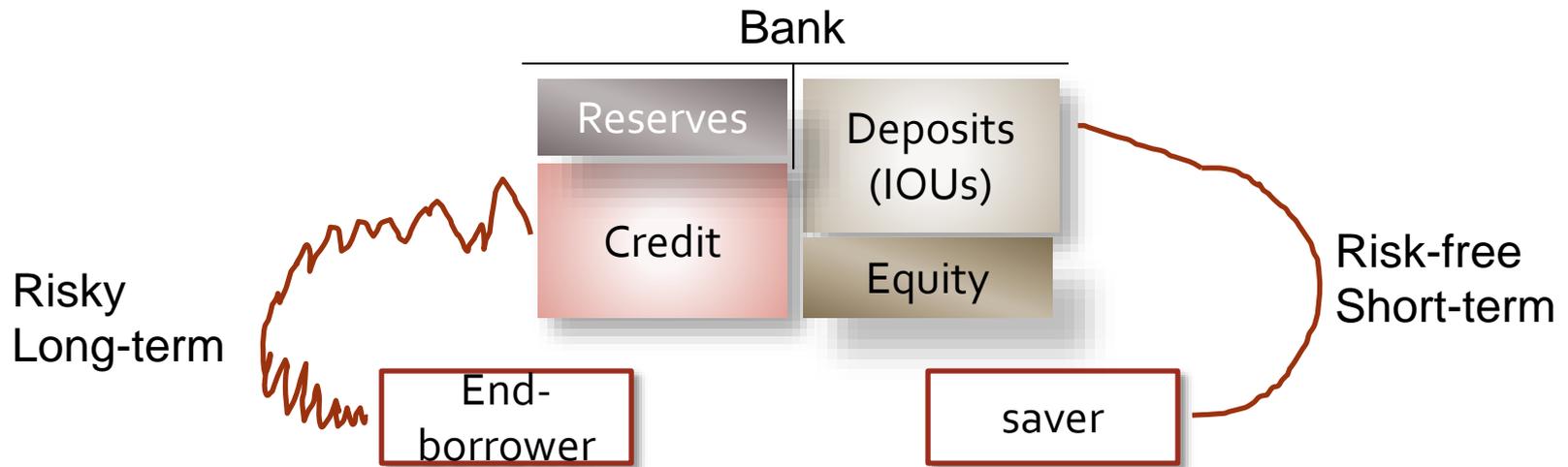
- Money is a “witness” for mortgage/credit
- End-borrower needs money in the future to pay back mortgage

Risky long-term vs. Risk-free short-term

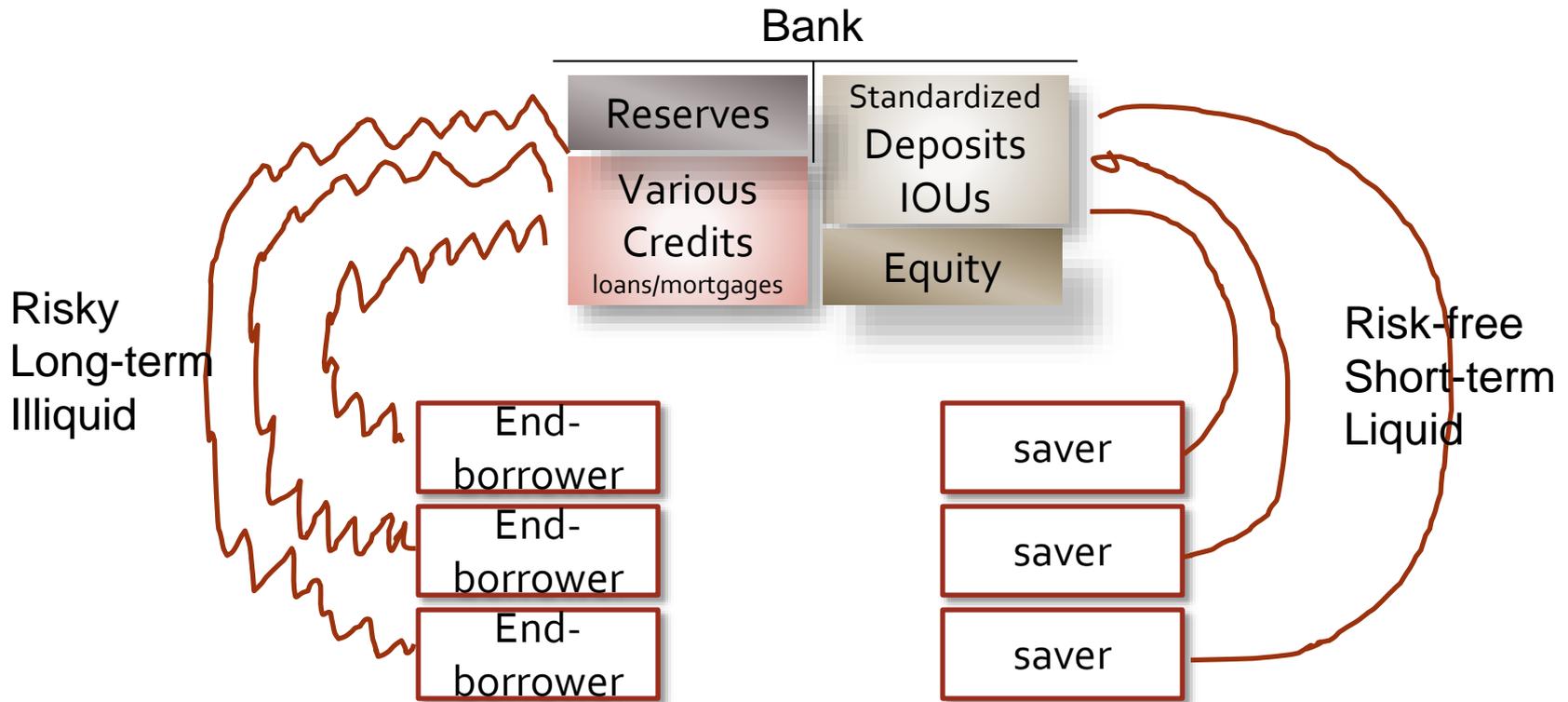


- Two risks:
 - Asset side: Credit/default risk
 - Liability side: Liquidity funding/run risk

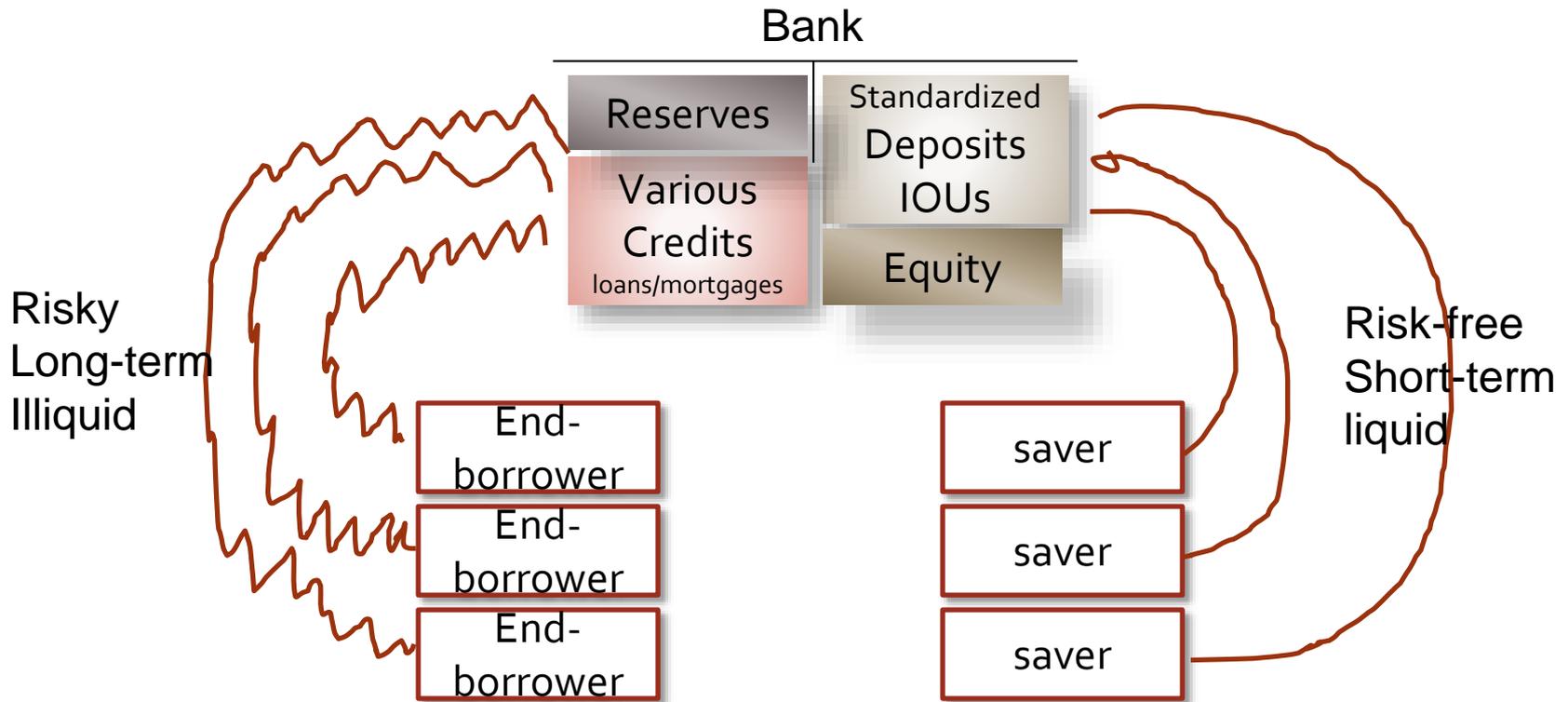
Equity cushion to protect against risk



Many forms of credit, standardized IOUs

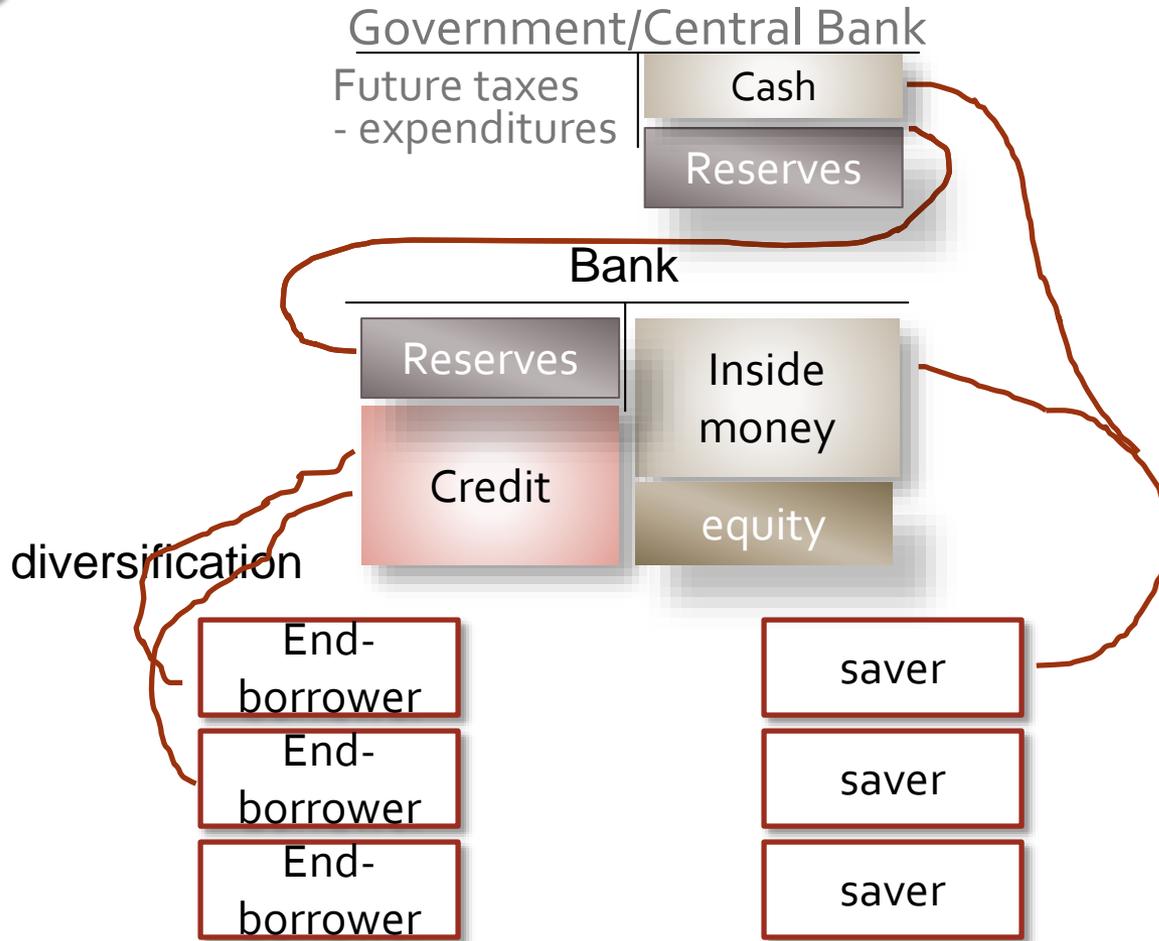


Many forms of credit, standardized IOUs

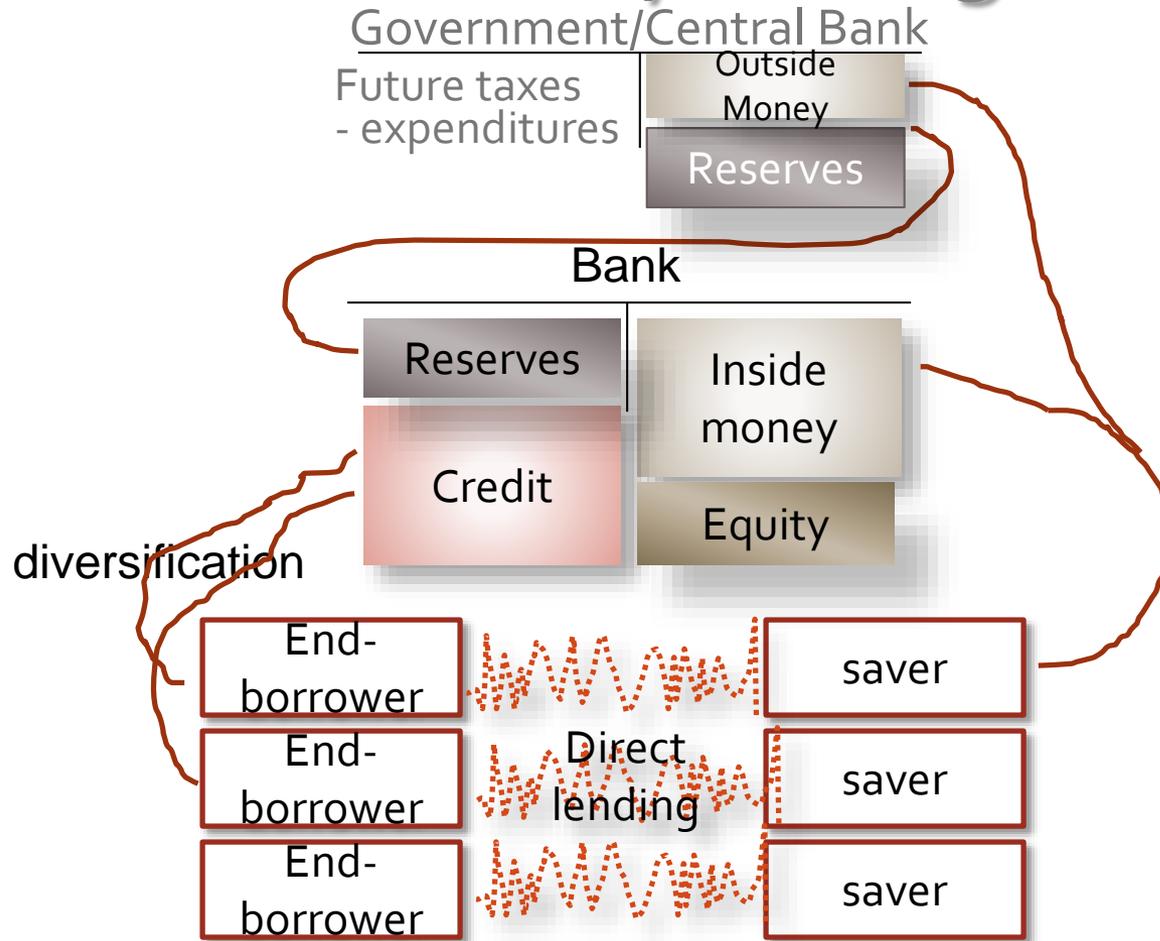


- Inside Money: Standardized IOUs
 - Limited credit risk, no asymmetric information, easy netting!

|| Add government/Central bank



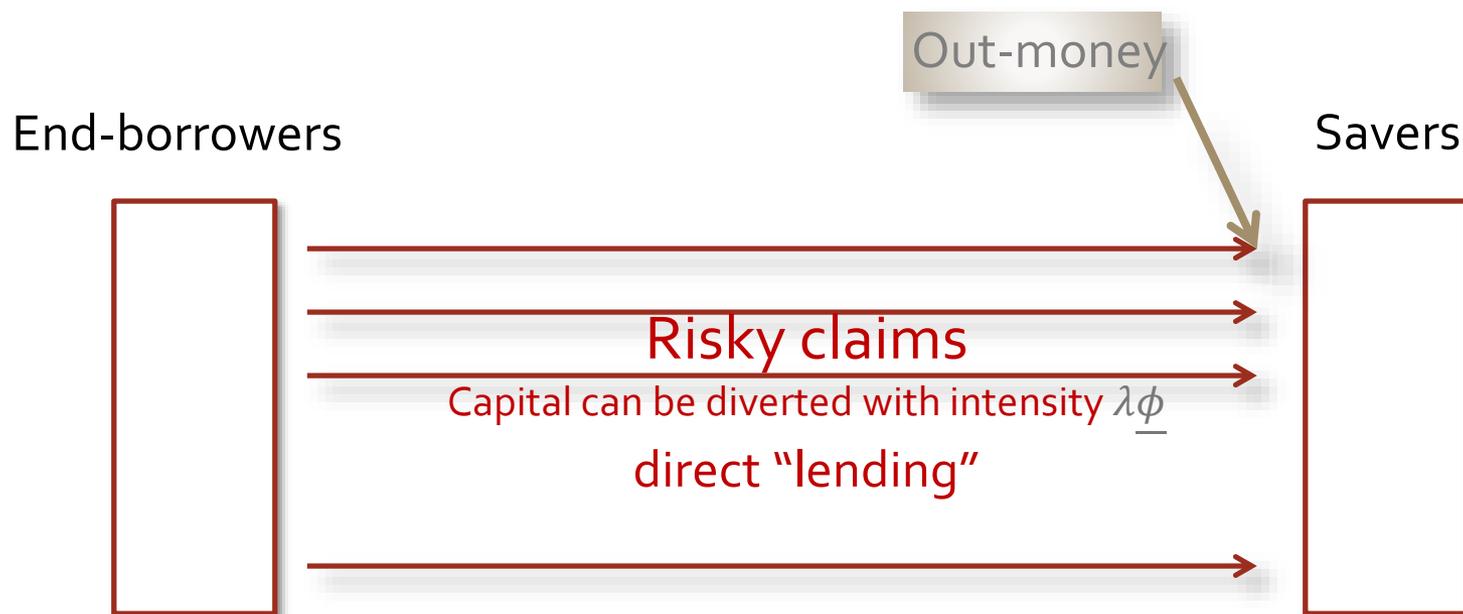
Contrast to direct risky lending



- Direct lending is more risky since
 - No diversification
 - Repayment less enforced

|| The economy without intermediaries

- Savers have net worth – end borrowers don't
- Friction: direct "lending" is risky
 - end borrowers divert funds with probability $\underline{\phi}$
 - after a shock, which occurs with arrival rate λ



|| The economy without intermediaries

- Saver HHs rent out capital to end-borrowers (entrepreneurs) with zero wealth, who produce
- Consumption output: $y_t = (a - \iota)k_t$
- Capital: $dk_t = (\phi(\iota_t) - \delta) k_t dt$
- Shocks are purely redistributive
 - λ arrival rate of macro shock
 - ϕ fraction of end-borrowers divert capital and become HHs
- Consumption:
 - Saver HH $E\left[\int_0^\infty e^{-rt} \log c_t dt\right] \Rightarrow$ consume $r * \text{wealth}$
 - End-borrowers consume zero (until they divert and become savers)

|| Benchmark 1: No intermediaries + Frictions

- Value of aggregate capital $q_t K_t$
- Value of money $p_t K_t$

End-borrowers sell goods for cash with which they pay taxes

Return	Absent shock	shock
On capital r_t^K	$\frac{a - l}{q} + \phi(l) - \delta$ <p>Dividend yield + capital gain</p>	Loss with prob $\lambda \underline{\phi}$
On money r_t^M	$\underbrace{\phi(l) - \delta}_{=g}$	No loss

|| Benchmark 1: only direct "lending"

- Optimal portfolio choice for Savers

- $r\underline{V}(n_t) = \max_{\underline{c}, \underline{x}} \log \underline{c} + \underline{V}'(\underline{n}_t) [(x r_t^K + (1 - x) r_t^M)] + \lambda \underline{\phi} [\underline{V}((1 - x) \underline{n}_t) - \underline{V}(\underline{n}_t)]$

- where $\underline{V}(\underline{n}_t) = \frac{\log \underline{n}_t}{r} + \text{const}$

- FOC, \underline{c} : $\underline{c} = r \underline{n}_t$

$$\underline{x} : \left(\frac{a - \iota}{q} + \phi(\iota) - \delta \right) - (\phi(\iota) - \delta) - \lambda \underline{\phi} \frac{1}{1 - \underline{x}} = 0$$

- Market clearing, output: $r(q + p)K = (a - \iota)K$
capital: $\underline{x} = qK / (qK + pK)$

- Hence, $q = \frac{a - \iota}{r + \lambda \underline{\phi}}$, $p = \frac{a - \iota}{r} \frac{\lambda \underline{\phi}}{r + \lambda \underline{\phi}}$, $\Phi'(\iota)q = 1$

■ Benchmark 2: No frictions

- With frictions:

$$q = \frac{a-\iota}{r+\lambda\underline{\phi}} \text{ and } p = \frac{(a-\iota)}{r} \frac{\lambda\underline{\phi}}{r+\lambda\underline{\phi}}$$

- Without frictions, $\lambda = 0$ or $\underline{\phi} = 0$:

$$q = \frac{a-\iota}{r} \text{ and } p = 0$$

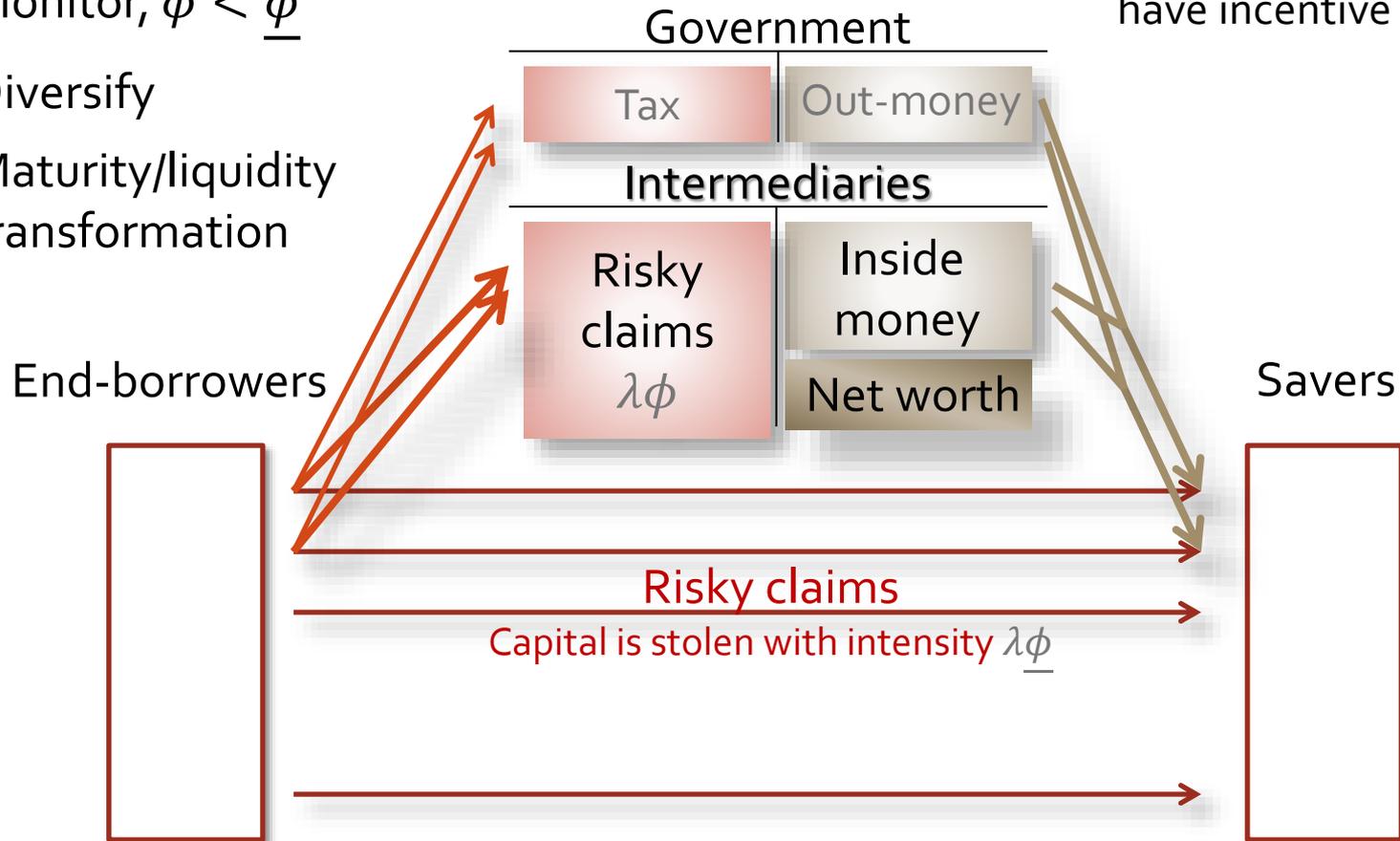
$$\dots \text{ and } r^M = (a - \iota)q = r^K = \tau(a - \iota)/p$$

- Fazit
 - Value of capital is lower with frictions
 - Value of money is higher with frictions

Intermediaries (discount rate $\rho > r$)

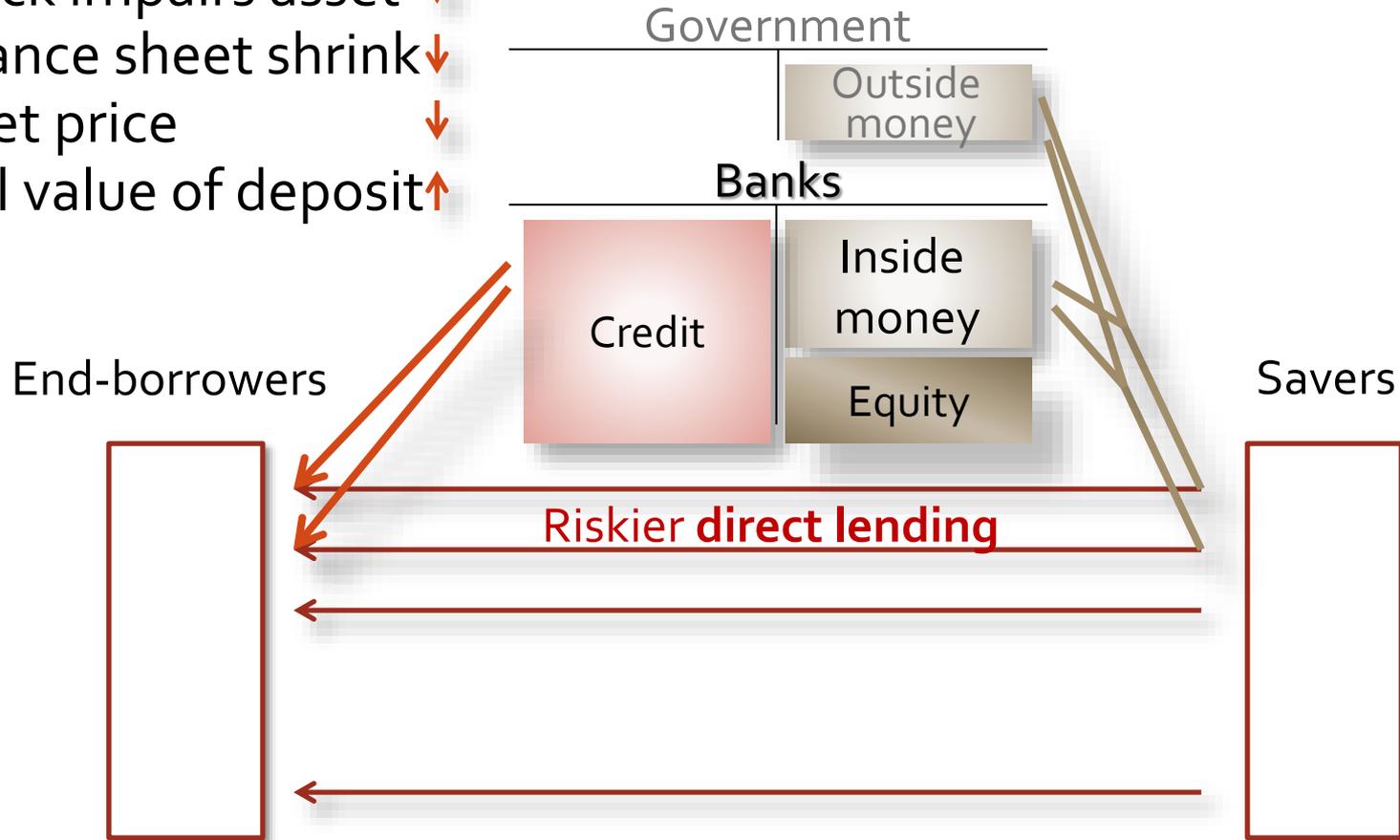
Intermediaries must fully absorb risk of their assets through net worth, e.g. to have incentive to monitor

- Monitor, $\phi < \underline{\phi}$
- Diversify
- Maturity/liquidity transformation

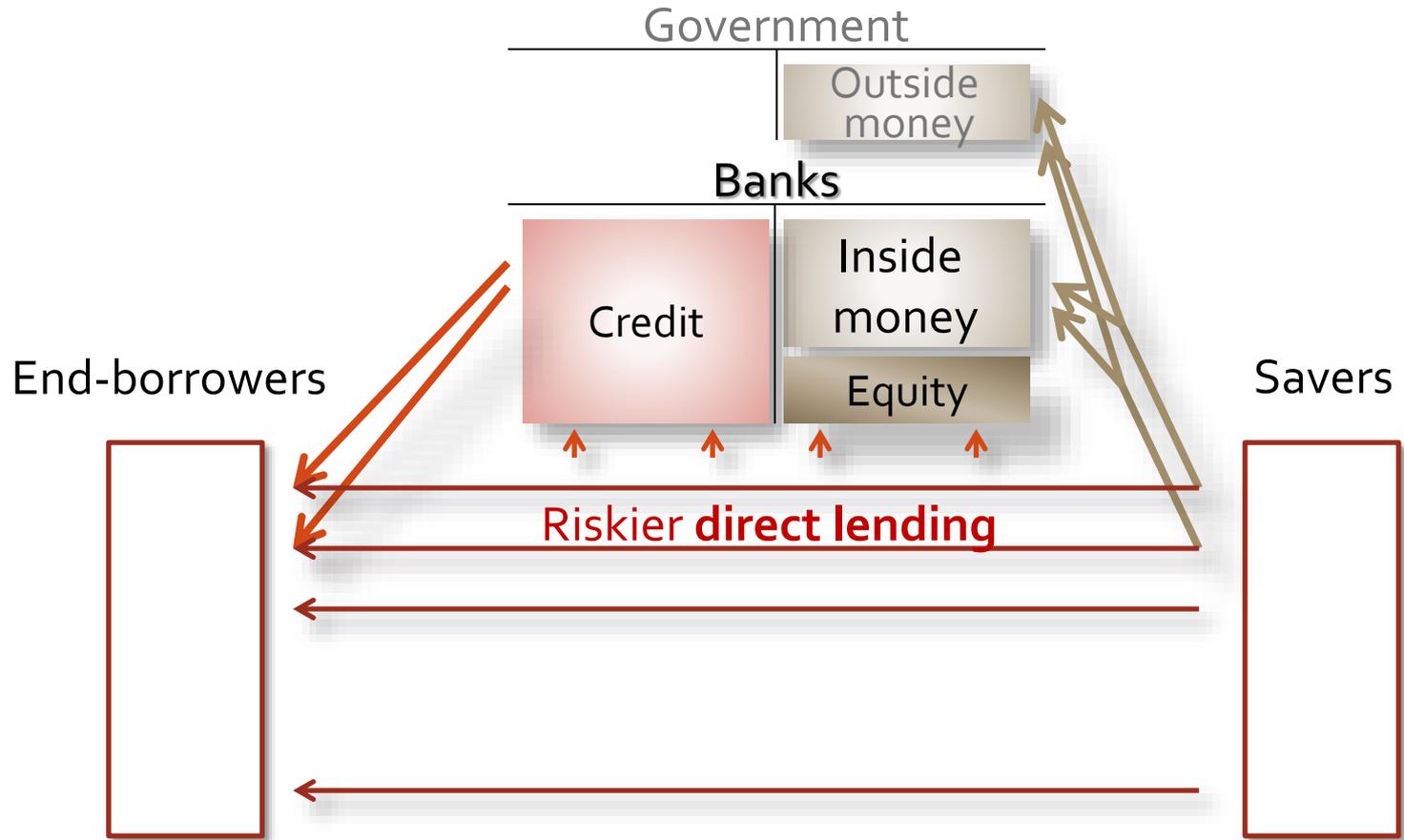


Adverse Shock split into 4 Steps

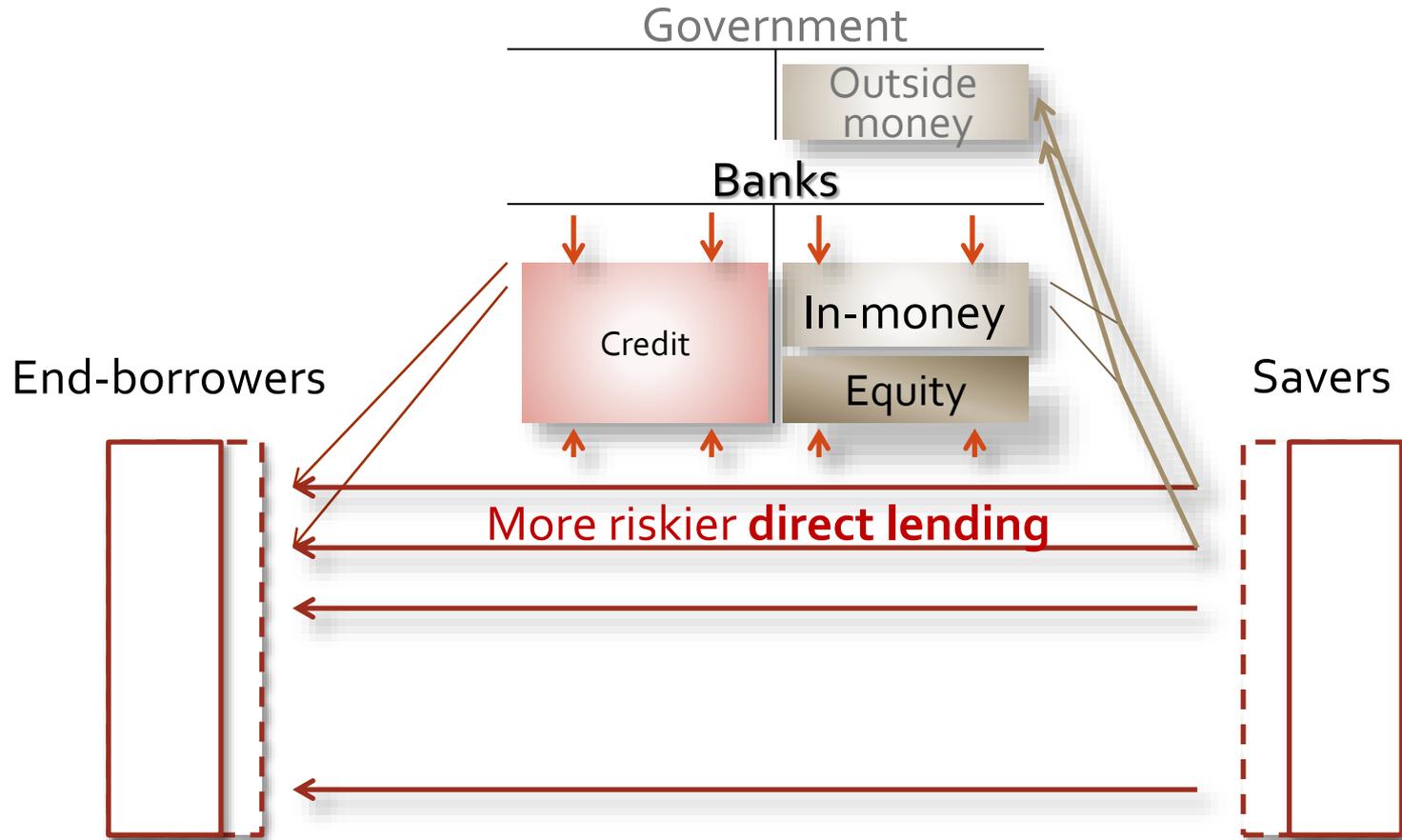
1. Shock impairs asset ↓
2. Balance sheet shrink ↓
3. Asset price ↓
4. Real value of deposit ↑



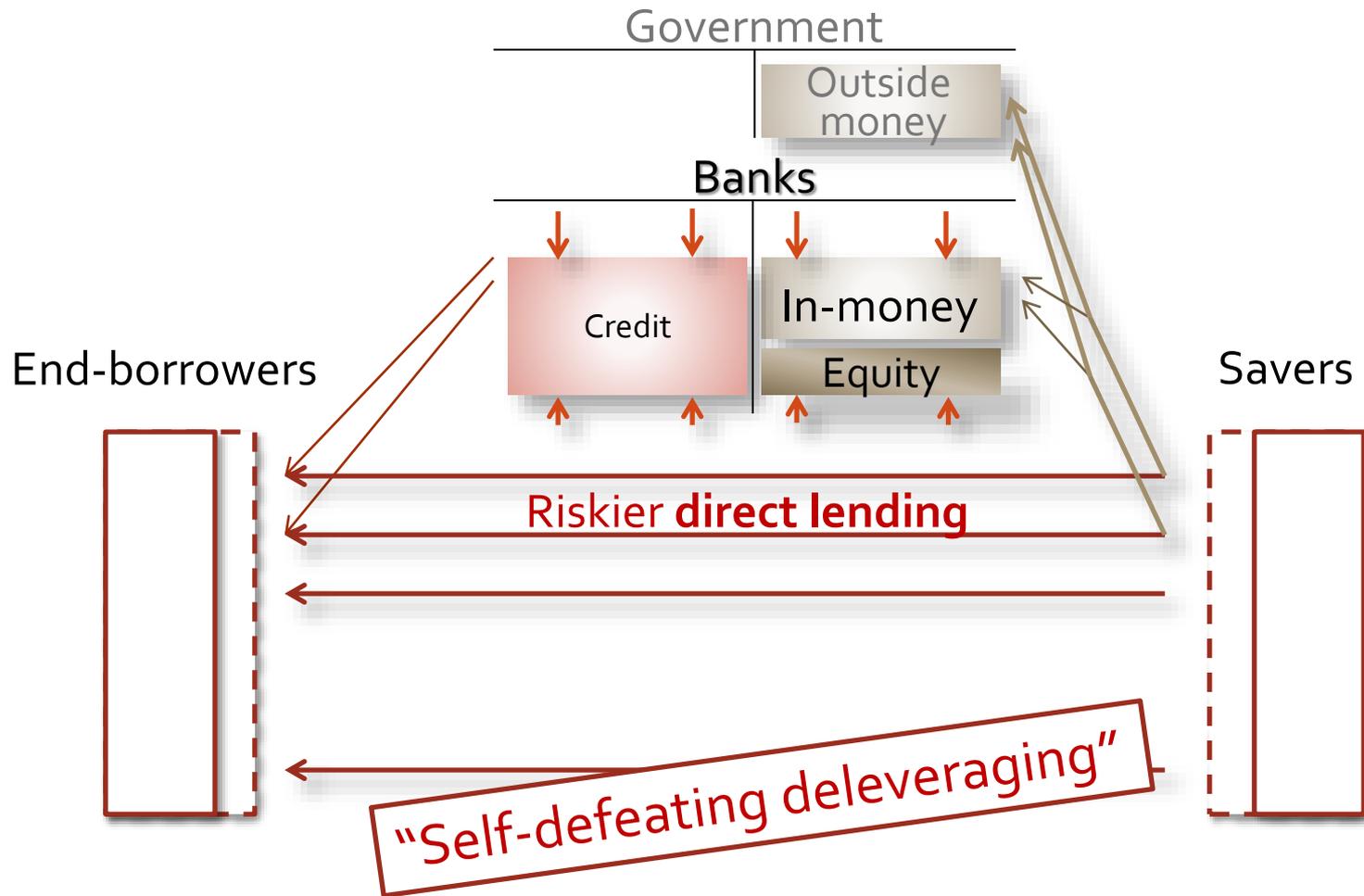
1. Shock Impairs Assets – 1st of 4 Steps



2. Shrink Balance Sheet: Sell off of Assets

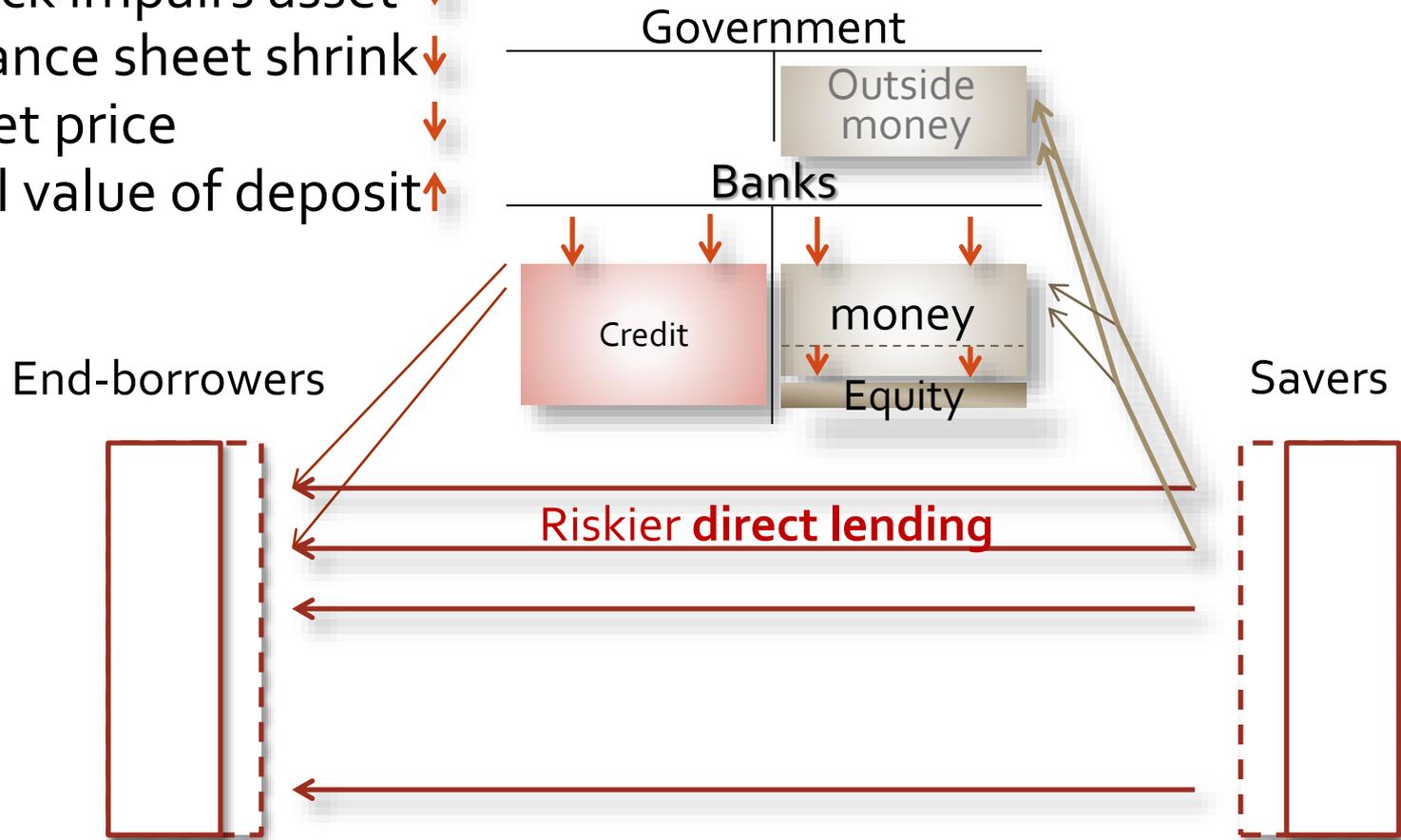


3. Liquidity Spiral: Sell off of Assets



4. Deflation Spiral: Value of Liabilities Expands

1. Shock impairs asset ↓
2. Balance sheet shrink ↓
3. Asset price ↓
4. Real value of deposit ↑



Small shock has large effect and redistributes wealth

>Returns and Portfolio choice

Return	Absent shock	Shock	
		Intermediaries	Saving HHs
On capital r_t^K	$\frac{a - l_t}{q_t} + \mu_t^q + \underbrace{\phi(l) - \delta}_{=g}$	$(1 - \phi) \frac{\check{q}_t}{q_t}$	Loss with prob. $\underline{\phi}$ $\frac{\check{q}_t}{q_t}$ with prob. $(1 - \underline{\phi})$
On money r_t^M	$\mu_t^p + \underbrace{\phi(l) - \delta}_{=g}$	$\frac{\check{p}_t}{p_t}$	$\frac{\check{p}_t}{p_t}$

- Optimal portfolio choice

Equilibrium characterization

- Equilibrium is a **map**

Histories of shocks

$$\{t_1 < t_2 < \dots < t_n \leq t\}$$

prices, allocations

$$q_t, p_t, \{x_t, (1 - x_t), \dots\}, \{C_t, \underline{C}_t\}$$

wealth distribution

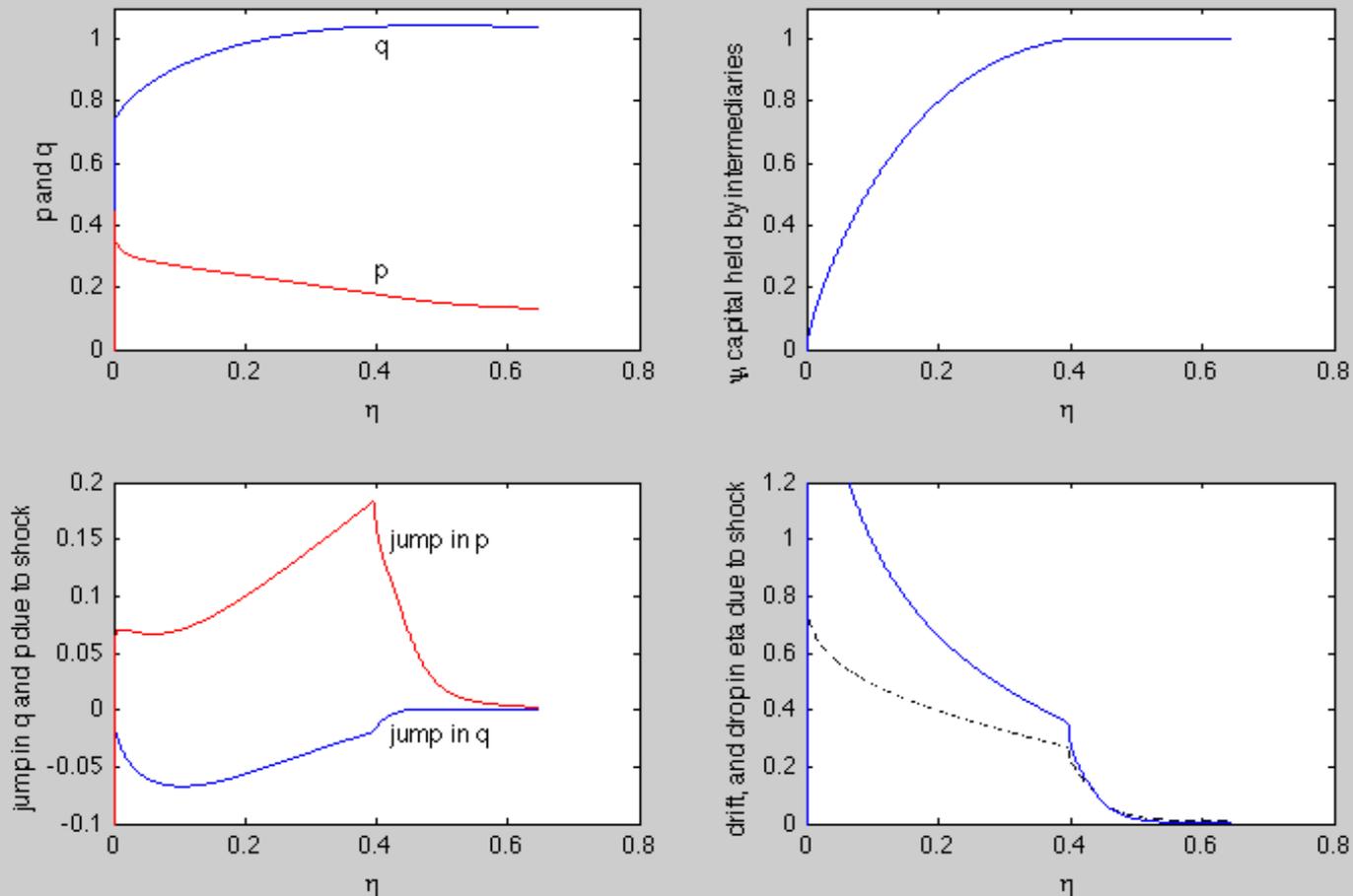
$$\eta_t = \frac{N_t}{(p_t + q_t)K_t} \in (0, 1)$$

intermediaries' wealth share

- Growth μ_t^η in η (absent a shock)
- At "steady state" $\eta^* : \mu_t^\eta = 0$
 - Intermediaries' earnings offset their consumption rate

Example

- Parameters $a = 0.1$, $\underline{a} = 0.02$, $\Phi(l)$ has quadratic adj. costs, $\delta = .04$, $r = 5\%$, $\rho = 6\%$, $\tau = 0.1$, $\lambda = 1$, $\varphi = .005$, $\underline{\varphi} = .05$, HH can't diversify

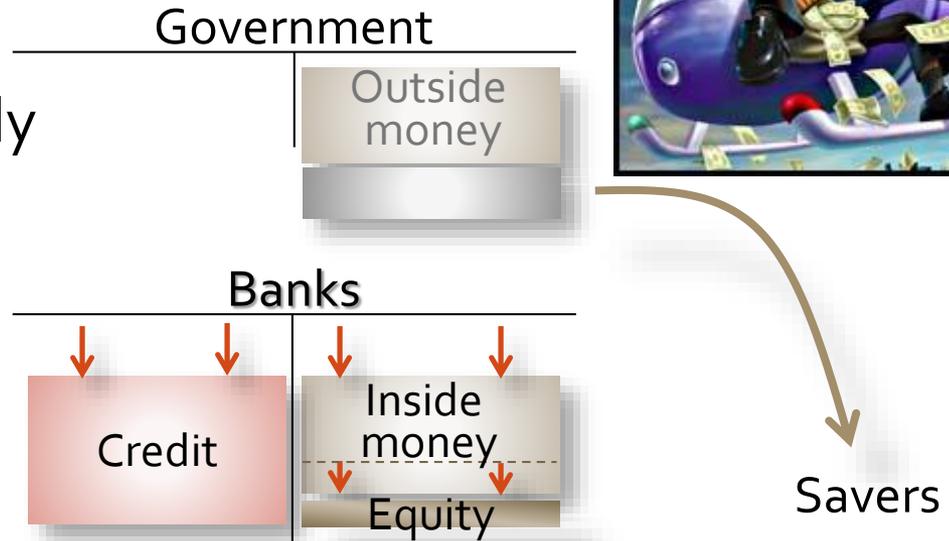


Overview

- No monetary economics
 - Fixed outside money supply
- Monetary economics
 - Money view – stylized
 - Credit view
 - Monetary policy in reality
- Connection to fiscal policy

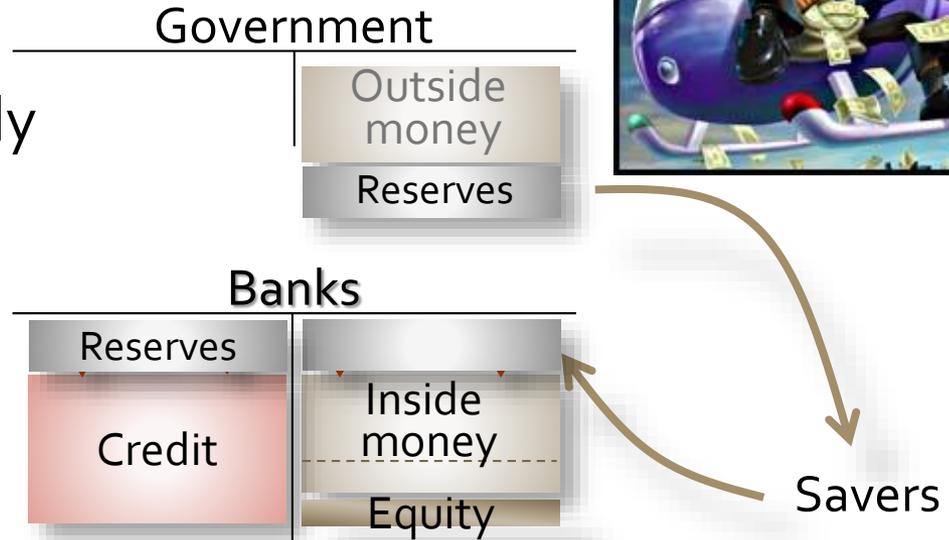
Money view

- Restore money supply
 - Helicopter drop to savers



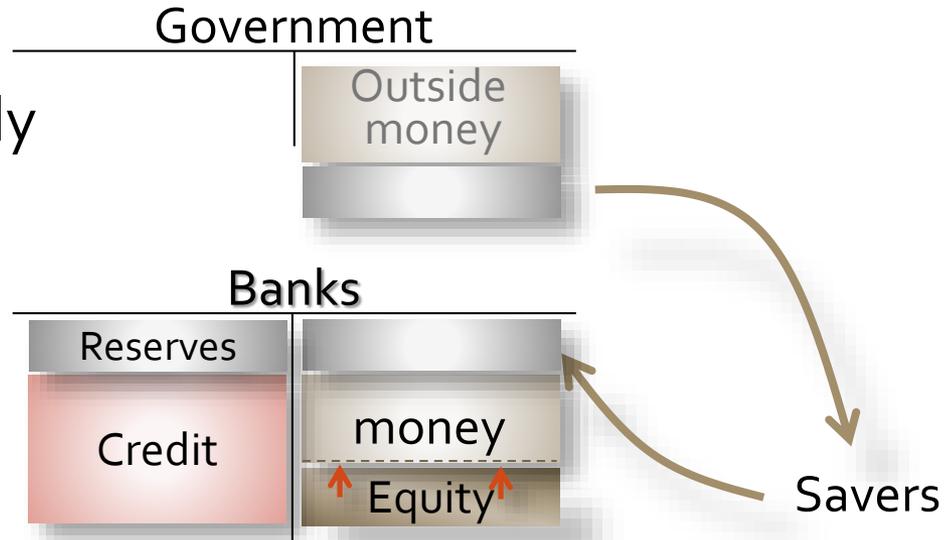
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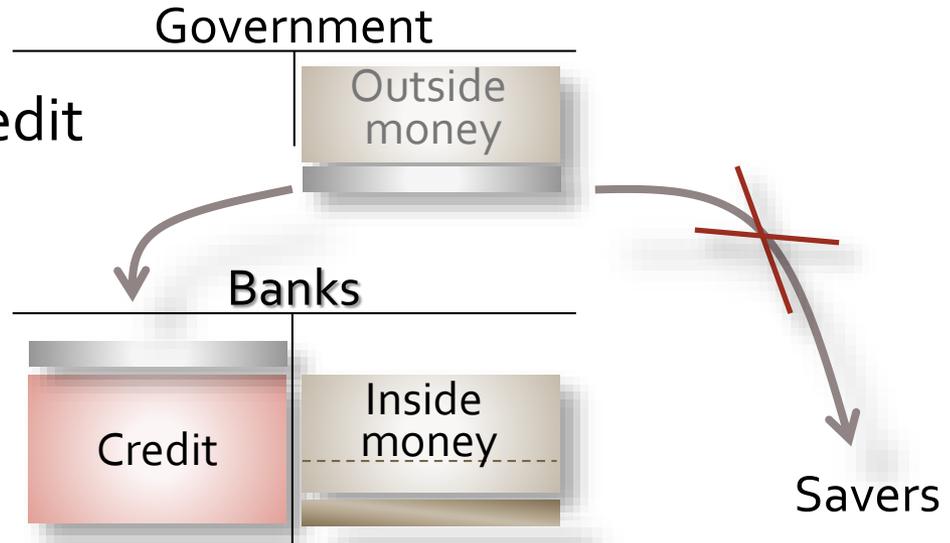
Money view

- Restore money supply
- Switches off Deflationary spiral
 - Bankers are better capitalized
 - Slightly more credit BUT credit is not restored



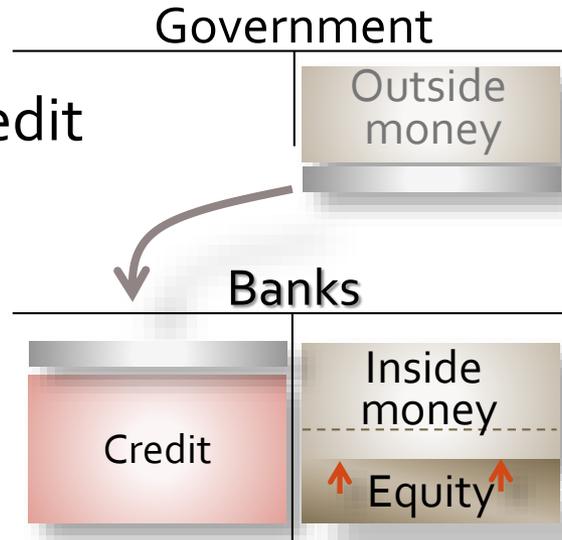
|| Credit view

- Restore “healthy” credit
 - Not Zombie banks
 - Not Vampire banks



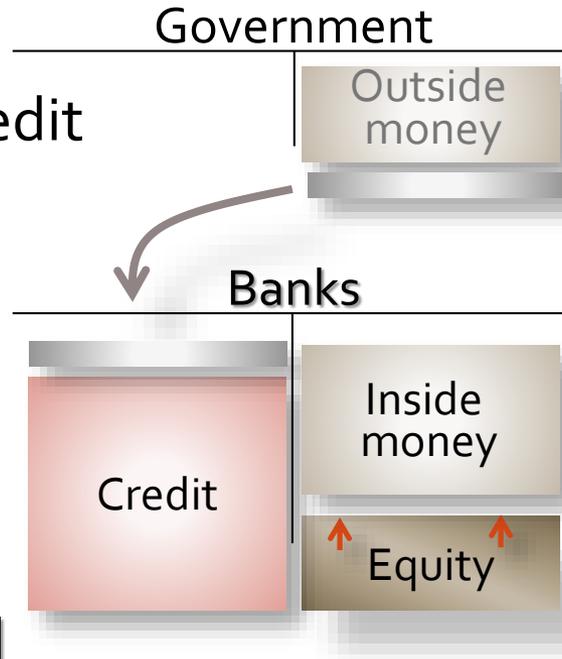
|| Credit view

- Restore “healthy” credit
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 - Not Vampire banks
- Recapitalization
 - Gift to solvent banks



|| Credit View

- Restore “healthy” credit
 - Not Zombie banks
 - Not Vampire banks
- Recapitalization
 - Gift to solvent banks
- Switches off
 - Deflationary spiral
 - Liquidity spiral
 - Credit is restored, as banks are recapitalized



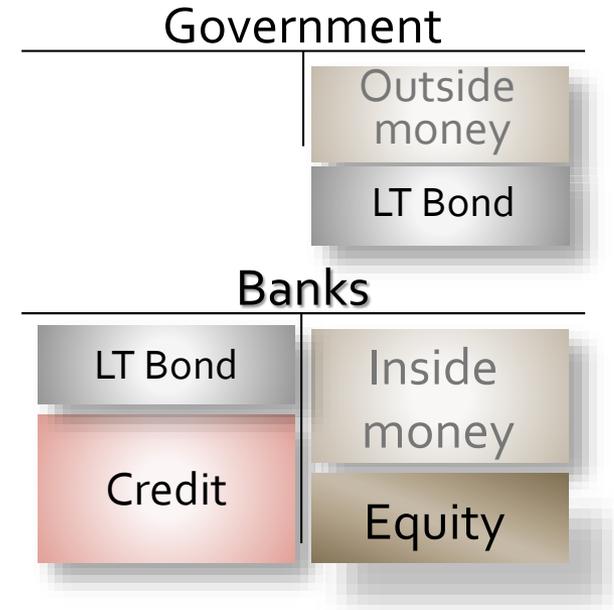
- Next, “stealth recapitalization of banks”

Monetary policy in reality

- So far, outside money fixed, pays no interest
 - Fiscal authority uses tax revenues to slowly buy money
 - baseline deflation
 - $\tau = 0$ corresponds to “Gold Standard”
- Government issues long-term (perpetual) bonds
 - pays fixed interest (in money)
- Monetary policy
 - Central bank pays interest $i_t \geq 0$ on money (by printing)
 - Sets total outstanding value $b_t K_t$ of perpetual bond (through open market operations)

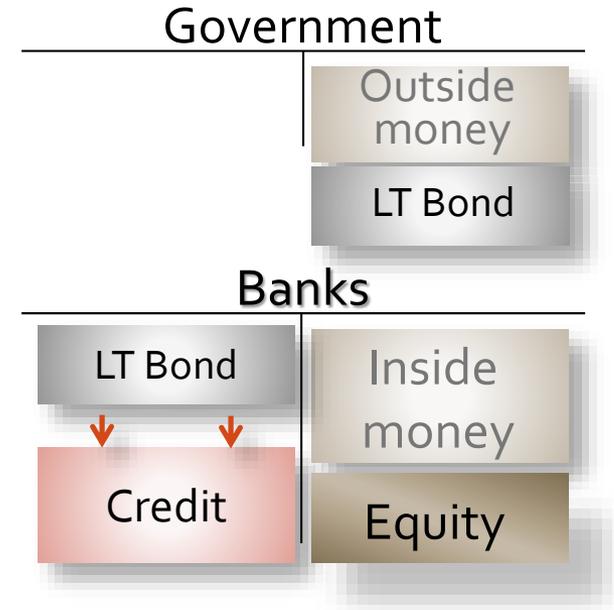
Monetary policy in reality

- Interest policy and OMO
- Introduce long-term Gov-bond
 - Fixed interest rate
 - No default
 - Held by banks
- Value of long-term bond rises when short-term interest rate falls
 - Increases the supply of assets that can be used to “store of value”



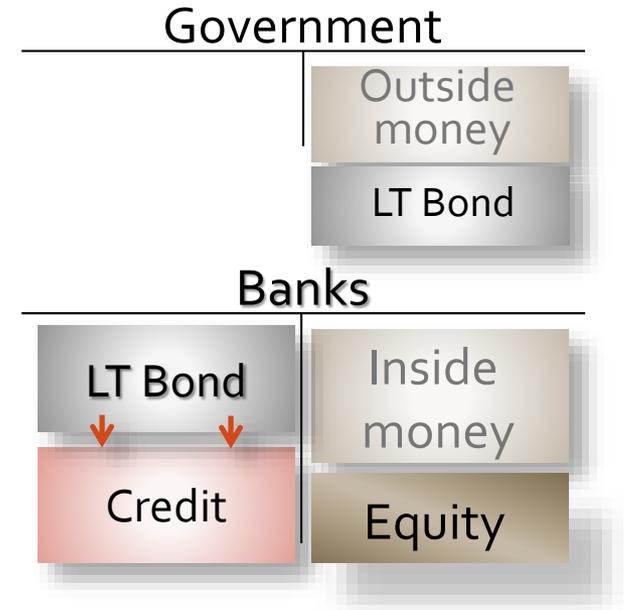
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- Adverse shock
 - ⇒ value of credit/loans drops
- Monetary Policy Response:



Monetary policy in reality

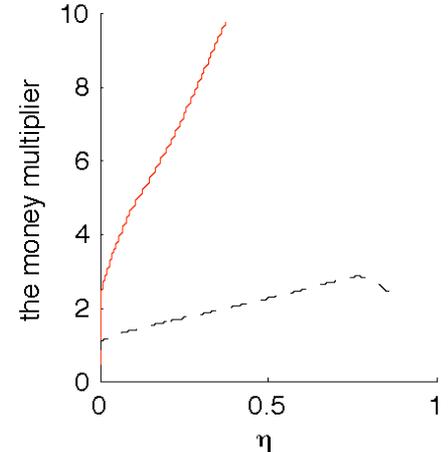
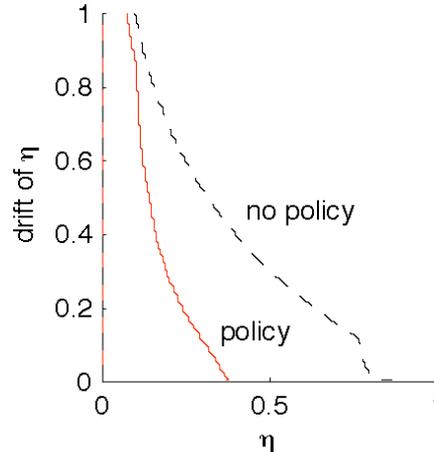
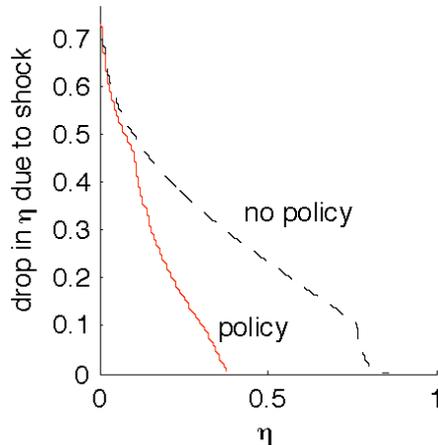
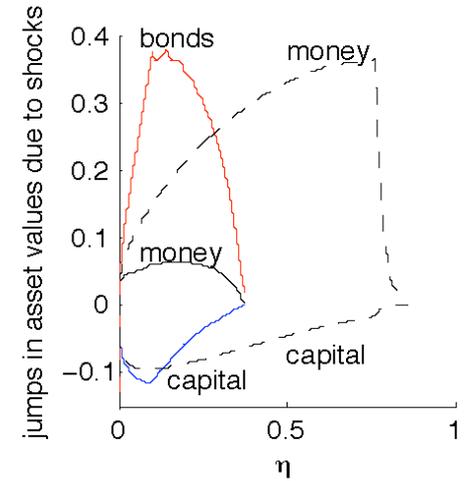
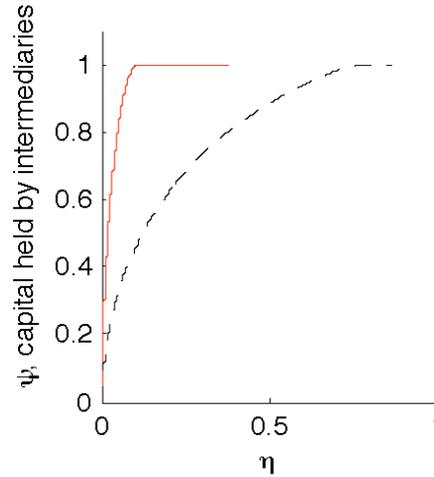
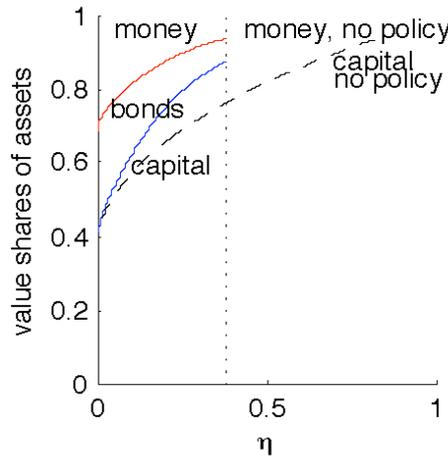
- Interest policy and OMO
- Introduce long-term Gov-bond
 - Fixed interest rate
 - No default
 - Held by banks
- Value of long-term bond rises when short-term interest rate falls
 - Increases the supply of assets that can be used to “store of value”
- Adverse shock
 - ⇒ value of credit/loans drops
- Monetary Policy Response: Cut short-term interest rate i_t
 - ⇒ value of long-term bond rises - “stealth recapitalization”
- ⇒ Liquidity & Deflationary Spiral are switched off



Example

Parameters

- ▣ $a = .1$
- ▣ $g = .04$
- ▣ $r = .05$
- ▣ $\rho = .06$
- ▣ $\tau = .1$
- ▣ $\lambda = 1$
- ▣ $\phi = .002$
- ▣ $\underline{\phi} = .2$
- ▣ **Policy**



$$\bullet i_t = 0.25\% + .1\eta_t, \frac{b_t}{p_t} = .5$$

Short-term interest rate policy

- Without long-maturity assets changes in short-term interest rate have no effect
 - Interest rate change equals instantaneous inflation change
- With bonds: of all monetary instruments, fraction $p_t/(p_t+b_t)$ is cash and $b_t/(p_t+b_t)$ are bonds
 - deflationary spiral is less pronounced because as η goes down, growing demand for money is absorbed by increase in value of long-term bonds
 - also, intermediaries hedge risks better by holding long-term bonds
 - however, intermediaries also have greater incentives to increase leverage/risk-taking ex-ante
- Effectiveness of monetary policy depend on maturity structure (duration) of government debt

Overall welfare of ex-post redistribution

- Redistribution is not a zero sum game!
- When is ex-post redistribution most desirable?
 - Endogenous risk is large
 - Technological and market liquidity (redeployability) is low
 - gap between first and second best use is large
 - Exogenous risk is small!



Financial Regulators

Liquidity spiral

Fisher Deflation spiral

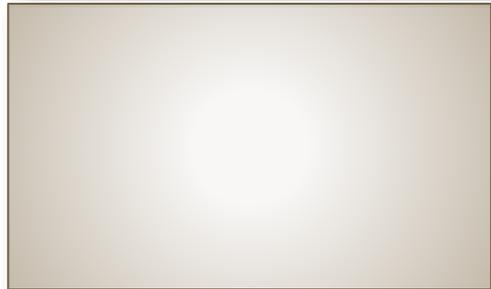
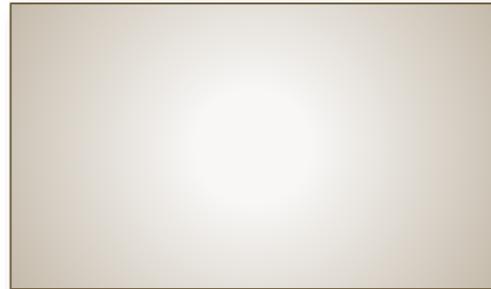
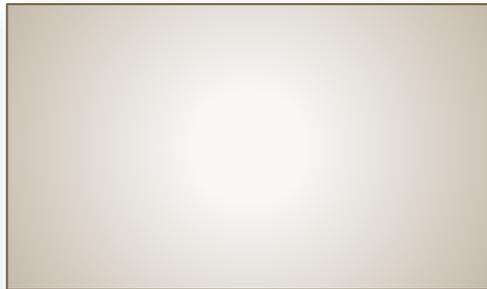
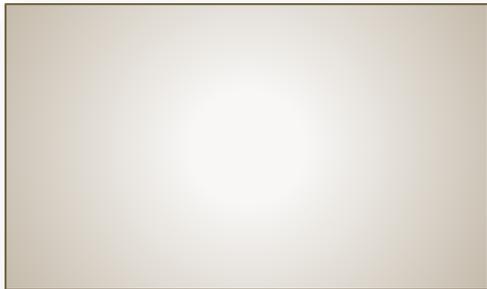
Central Bank

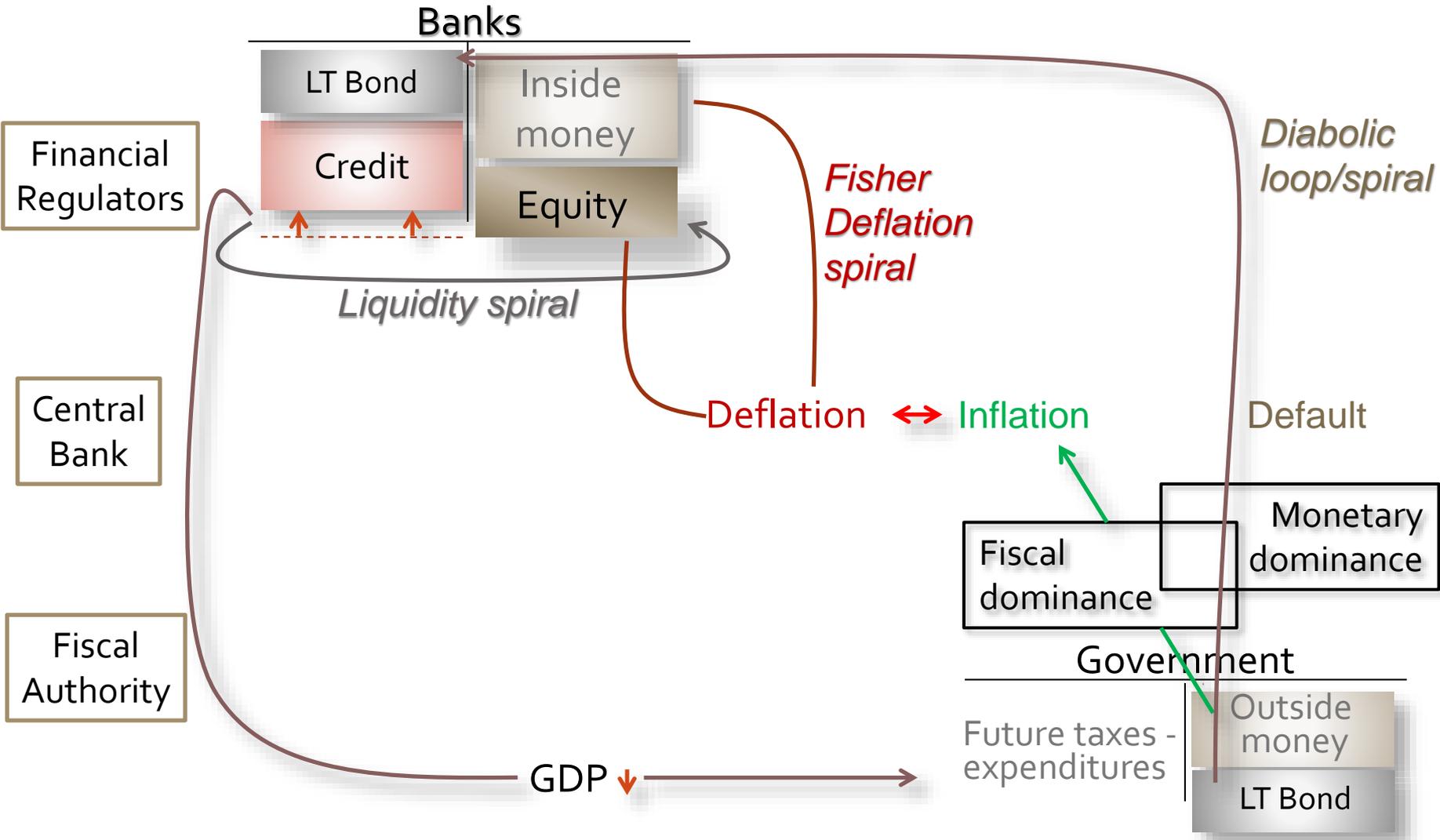
Inside money ↓

De/inflation

Π ↓

Fiscal Authority





Conclusion

- New perspective – focus on
 - Financial frictions, less on price stickiness
 - Store of value of money, not only unit of account
 - Wealth/income effects, more than substitution effects
- Stability concepts are highly interlinked
 - Financial, price stability and fiscal debt sustainability
- Default free “safe asset” (long-term bond) necessary for effective monetary policy
 - Requires sound fiscal policy
 - ESBies (without joint liability)

Conclusion

- New perspective – focus on
 - Financial frictions, less on price stickiness
 - Store of value of money, not only unit of account
 - Wealth/income effects, not only substitution effects
- Crisis management: “Bottle-neck monetary economics”
 1. Figure out which sector is undercapitalized (debt overhang)
 2. Redistribute monetary policy in (i) wealth & (ii) risk
 - Monetary policy reduces endogenous (self-generated) risk
 - Avoid moral hazard
- Crisis prevention – measure sectors’ debt/GDP ratios
- Stability concepts are highly interlinked