Supply-Side View of Financial Frictions

704 Macroeconomic Theory
Lecture 10

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Financial Friction

- Empirical evidence:
  Disruption in financial intermediation negatively affects the economy

- What is the mechanism?

- Two different views:

  1. Supply-side:
     productive firms cannot borrow $\Rightarrow$ resource misallocation, lower TFP
  2. Demand-side:
     households who need to spend cannot borrow $\Rightarrow$ lower aggregate demand

- Today: we focus on 1 through the lens of Kiyotaki-Moore (1997) model

Big Picture Idea

Productive

⬆️

Unproductive

- Suppose entrepreneurs differ in productivity

- First best: less productive should lend all money

- Kiyotaki-Moore (1997) (henceforth KM):

    1. ability to borrow limited
       ⇒ endogenous misallocation and TFP
       ⇒ wealth distribution determines aggregate TFP & GDP
    2. state-noncontingent debt contract
       ⇒ negative shock redistributes wealth from productive to unproductive
       ⇒ misallocation.

Balance Sheet Recession

Based on Kiyotaki (1998), Section 2

Entrepreneurs

■ The economy is populated by a unit mass of entrepreneurs

■ Preferences:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \ln c_t$$

■ Technology of entrepreneur $i \in [0,1]$ is one of the following:

$$y_{t+1} = z^h x_t, \quad y_{t+1} = z^l x_t, \quad z^h > z^l$$

■ Random productivity switch:

Pr(unproductive | productive) = Pr(productive | unproductive) $= \chi < 1/2$

Borrowing Constraint

- Budget constraint:

$$c_t + x_t = y_t + b_t - R_{t-1}b_{t-1}$$

- Borrowing constraint:

$$R_t b_t \leq \theta y_{t+1} = \theta z^i x_t, \quad \theta \in [0,1]$$

- Microfoundation:
lenders can seize at most θ fraction of production if borrowers walk away

- Market clearing:

$$C_t^h + C_t^l + X_t^h + X_t^l = z^h X_{t-1}^h + z^l X_{t-1}^l$$

No Financial Friction

No Financial Friction

■ In the absence of borrowing constraints,

$$R_t = z^h$$

- If $R_t > z^h$, everyone will lend
- If $R_t < z^h$, productive will infinitely borrow

■ As a result, all agents solve (let $a_t \equiv z^h x_{t-1} - R_{t-1} b_{t-1}$ denote the wealth):

$$V(a_t) = \max_{c_t, a_{t+1}} \ln c_t + \beta V(a_{t+1})$$

$$\text{s.t.} \quad a_{t+1} = z^h(a_t - c_t)$$

■ Guess and verify:

$$c_t = (1 - \beta)a_t, \quad a_{t+1} = z^h \beta a_t$$

No Financial Friction: Aggregation

- Since bonds are in zero net supply, $A_t = \int (z^h a_t) di = z^h X_{t-1} = Y_t$

- The economy follows

$$Y_t = z_h X_{t-1}$$

$$X_t = \beta z_h X_{t-1}$$

- Exogenous TFP. This is a standard AK economy

Financial Friction

Frictional Financial Market

- Now suppose θ is small enough so that

  - borrowing constraint for productive binds
  - unproductive agents cannot lend all their money and start to invest

- Unproductives must be indifferent between producing and lending, implying

$$R_t = z^l$$

  - If $R_t > z^l$: unproductive will not produce
  - If $R_t < z^l$: everyone borrows, no one will lend

- Implication: financial frictions lower the interest rate

- This confirms productive will borrow up to the limit because $z^h > R_t$

Networth Matters for Investment

- Networth matters for productive's investment:

$$c_t^h + x_t^h = a_t^h + \underbrace{b_t^h}_{\theta z^h x_t^h / z^l} \qquad \Rightarrow \qquad x_t^h = \underbrace{\frac{1}{1 - \theta z^h / z^l}}_{\text{leverage}}(a_t^h - c_t^h)$$

- The networth of productive agents evolve

$$a_{t+1}^h = (z^h x_t^h - R_t b_t^h) = \underbrace{\frac{(1-\theta)z^h}{1 - \theta z^h / z^l}}_{\text{rate of return} \equiv z^{h+}}(a_t^h - c_t^h)$$

- $z^{h+} > z^h$ because earns excess return $z^h > R_t$.

- Again, policy functions are $c_t^i = (1-\beta)a_t^i$ and $x_t^i - b_t^i = \beta a_t^i$

Balance Sheet

Productive

| Investment Return Y_t^h | Debt $R_{t-1}B_{t-1}$ |
| | Net Worth A_t^h |

$$\text{Investment} = \underbrace{\frac{1}{1 - \theta z^h/z^l}}_{\text{leverage}} \beta a_{t-1}^h$$

Unproductive

| Lending $R_{t-1}B_{t-1}$ | Net Worth A_t^h |
| Investment Return Y_t^l | |

Aggregation and Endogenous TFP

- The aggregate output in the economy is

$$A_{t+1} = Y_{t+1} = z^h X_t^h + z^l X_t^l$$

$$= \frac{z^h}{1 - \theta z^h/z^l} \beta A_t^h + z^l \left(\beta A_t - \frac{1}{1 - \theta z^h/z^l} \beta A_t^h \right) \qquad (1)$$

- TFP in the economy is (note $\beta A_t = \int_0^1 \beta a_t^i di = \int_0^1 (x_t^i - b_t^i) di = X_t$)

$$Z(s_t^h) \equiv \frac{Y_{t+1}}{X_t} = (z^h - z^l) \frac{1}{1 - \theta z^h/z^l} s_t + z^l$$

where $s_t \equiv A_t^h/A_t$ denote the **wealth share of productive entrepreneurs**

- TFP is endogenous to wealth distribution: low $s_t \Rightarrow$ more misallocation

Evolution of Wealth Share

- The wealth of productive entrepreneurs evolves

$$A_{t+1}^h = (1 - \chi) \underbrace{z^{h+}\beta A_t^h}_{\text{wealth of } h \to h} + \chi \underbrace{z^l \beta (A_t - A_t^h)}_{\text{wealth of } l \to h} \qquad (2)$$

- Dividing (1) by (2), we obtain the law of motion for s_t

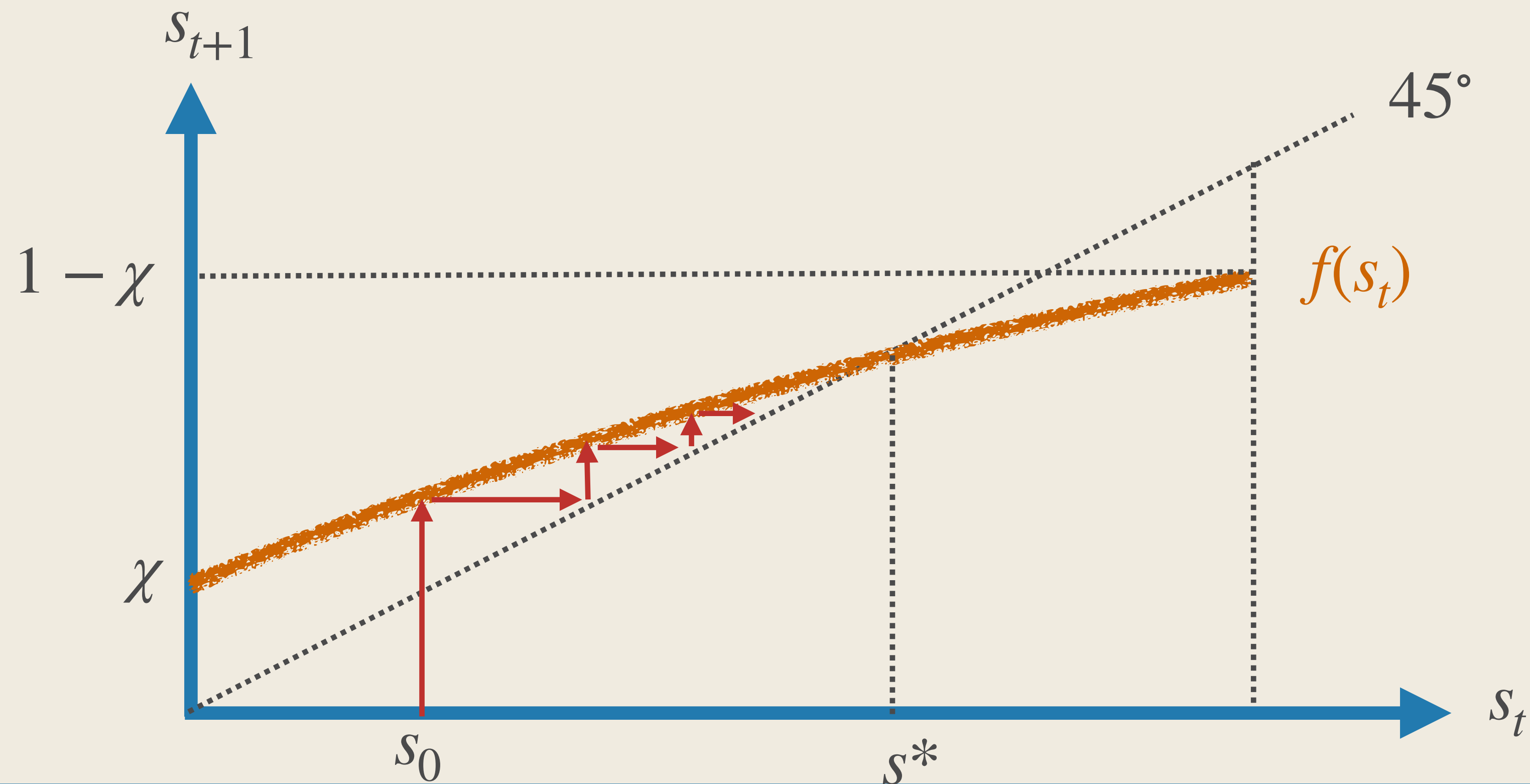$$s_{t+1} = \frac{(1 - \chi)z^{h+}s_t + \chi z^l(1 - s_t)}{z^{h+}s_t + z^l(1 - s_t)} \equiv f(s_t)$$

- Note $f'(s) > 0$, $f(0) = \chi$, and $f(1) = (1 - \chi)$

Dynamics

$$Y_{t+1} = Z(s_t)X_t$$

$$X_{t+1} = \beta Z(s_t)X_t$$

$$s_{t+1} = f(s_t)$$

Productivity Shock

- Suppose the economy is initially at the steady state with $s*$

- Now consider a one-time & unexpected reduction in productivity:
At $t = 0$: $z^h, z^l \to z^h(1 - \Delta), z^l(1 - \Delta)$

- The wealth of productive entrepreneurs is,

$$A_0^h = (1 - \chi)((1 - \Delta)z^h X_0^h - \underbrace{R_{-1}B_{-1}^h}_{= \theta z^h X_0^h}) + \chi((1 - \Delta)z^l X_0^l + \underbrace{R_{-1}B_{-1}^l}_{= \theta z^h X_0^h})$$
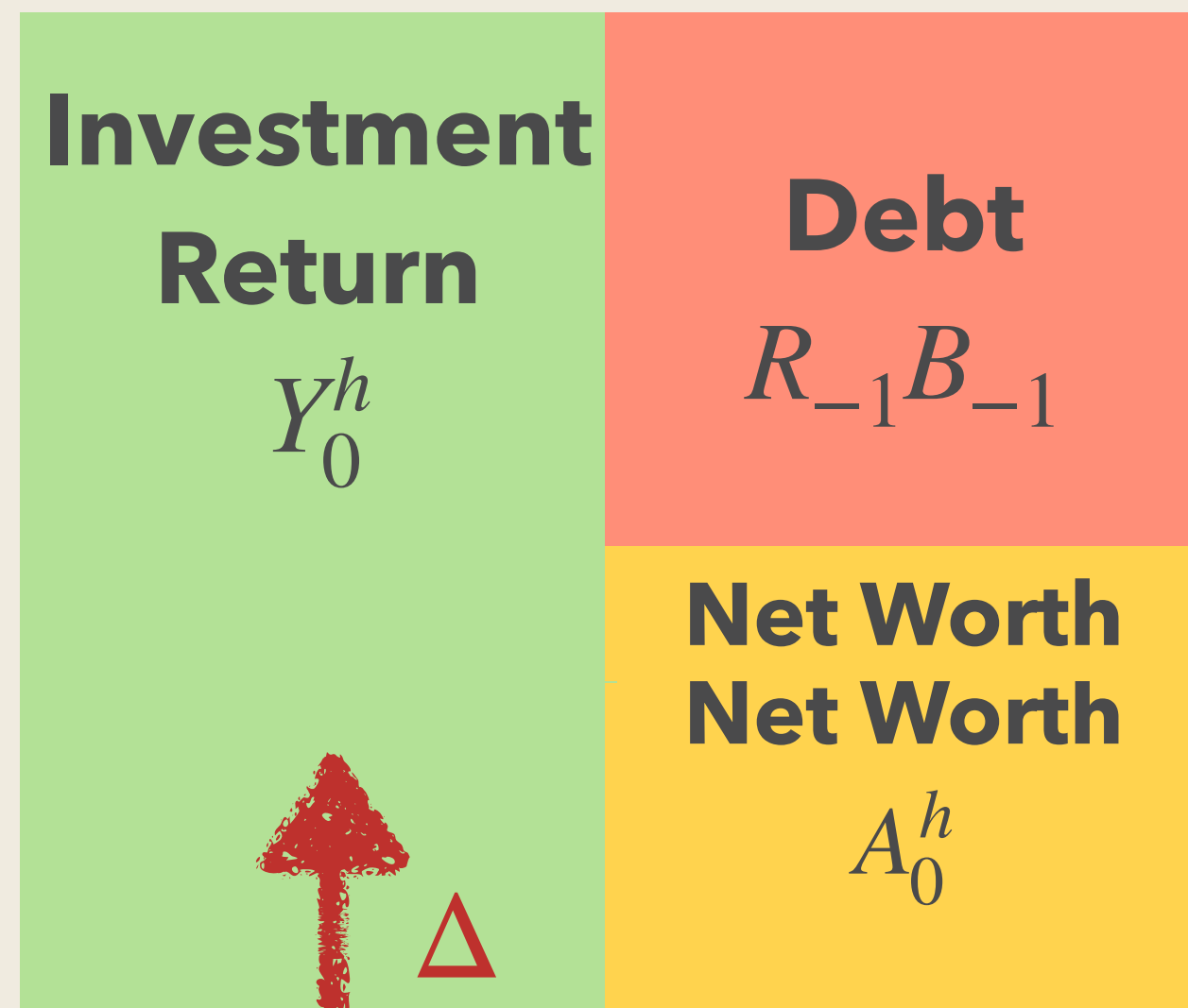
- Therefore, the wealth share of productive entrepreneurs falls:

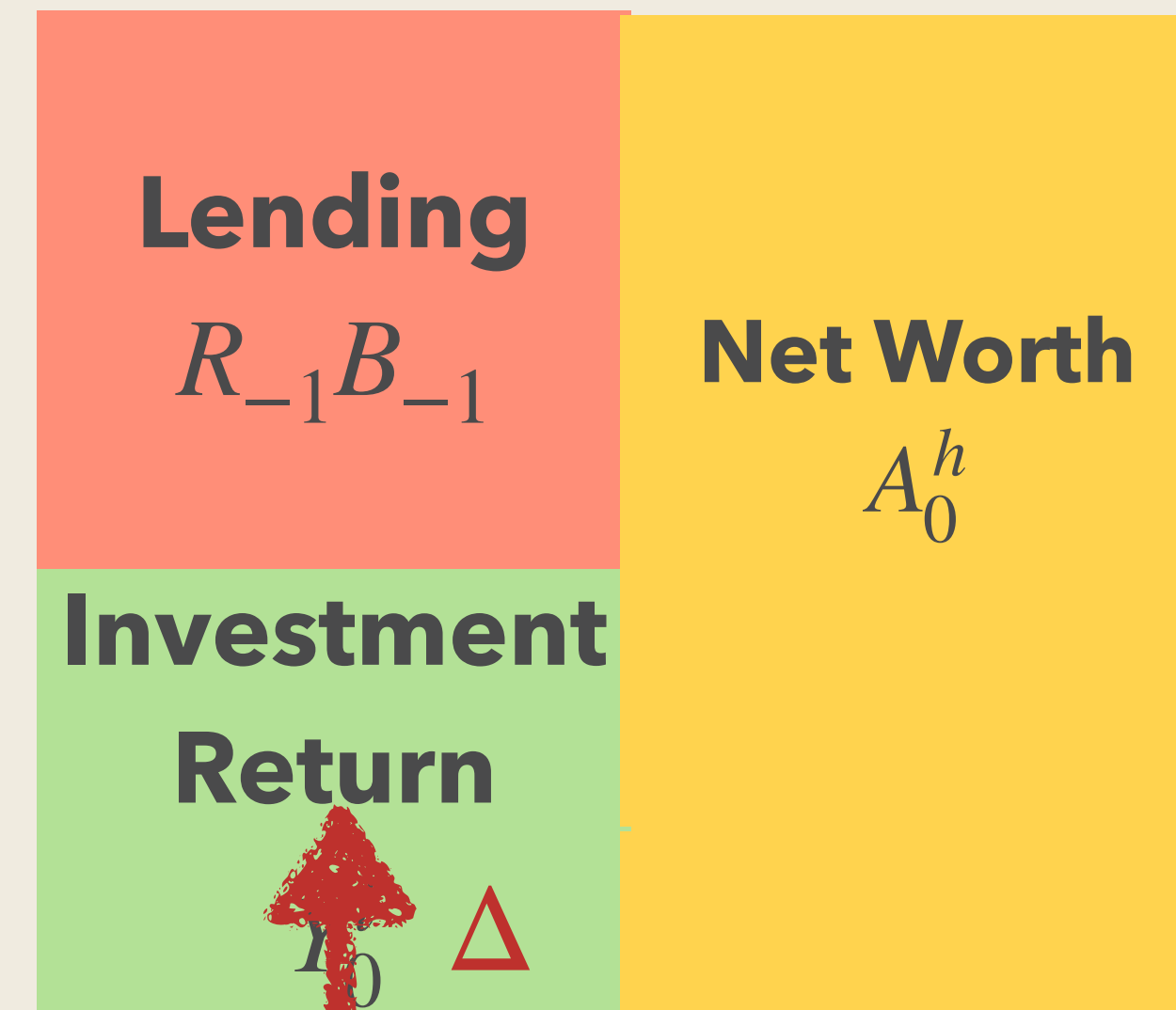$$s_0 = \frac{A_0^h}{(1 - \Delta)\bar{A}_0} = s* - \frac{(1 - 2\chi)\Delta R_{-1}B_{-1}^h}{(1 - \Delta)\bar{A}_0}$$

where $\bar{A}_0$ is wealth without shock.
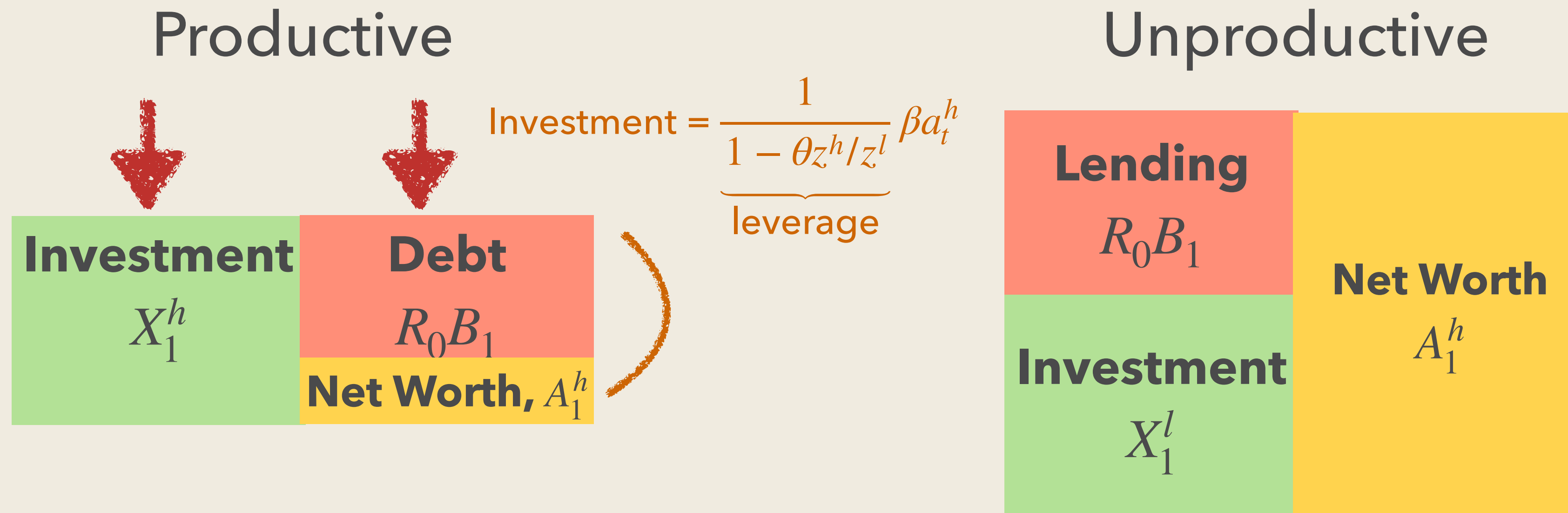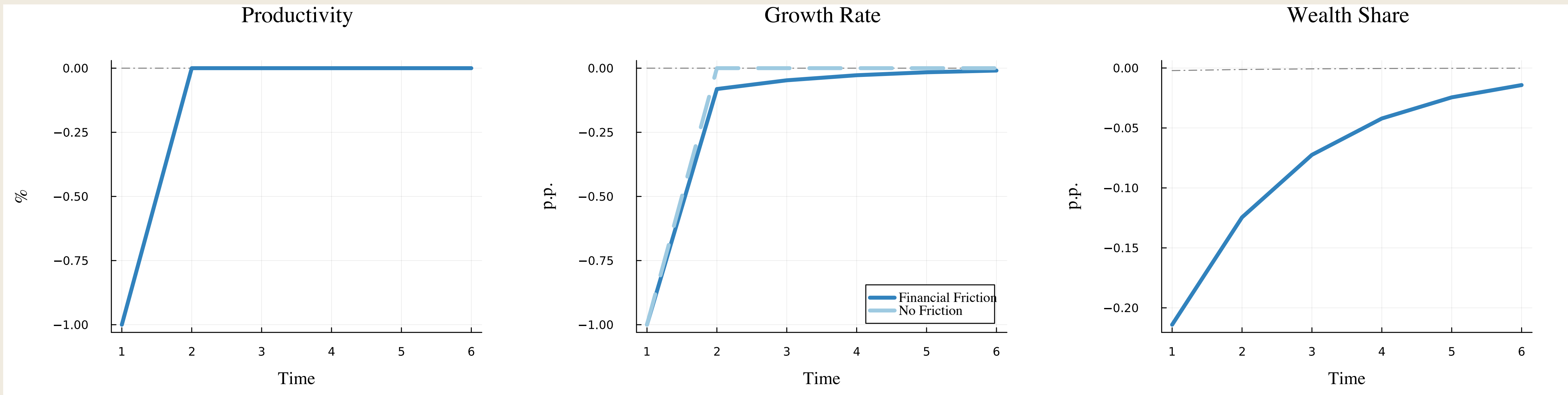
Balance Sheet Recession

Productive

Unproductive

- Debt is non-state contingent (or shocks are unanticipated)
  $\Rightarrow$ negative shock to investment induces redistribution from borrowers to lenders

Then Investment is Misallocated

Productive

Unproductive

$$\text{Investment} = \underbrace{\frac{1}{1 - \theta z^h / z^l}}_{\text{leverage}} \beta a_t^h$$

Investment X_1^h

Debt $R_0 B_1$

Net Worth, A_1^h

Lending $R_0 B_1$

Investment X_1^l

Net Worth A_1^h

- Misallocation, lower TFP, & lower growth

Impulse Response

- Even a temporary productivity shock leads to a persistent effect

- This is because the wealth share of productives needs to be slowly rebuilt

- This was a big deal in the 90s, where RBC needed counterfactually persistent shocks

When is Amplification Large?

- When θ is large enough, the economy is first best $\rightarrow$ no amplification

- When $\theta = 0$, no amplification either

- Volatility is hump-shaped in θ
  Alleviating financial friction (financial liberalization) may destabilize the economy

1. Not Enough Amplification?

- Kocherakota (2000): Quantitatively, amplification is small

- Two responses:

    1. Jermann and Quadrini (2012):

        - The reason is that investment is too small a component of output

        - Introduce financial friction on hiring rather than on investment
          $\Rightarrow$ large amplification through fluctuations in labor demand

    2. Brunnermeier and Sannikov (2010), He and Krishnamurthy (2011):

        - Solve fully stochastic non-linear version of KM

        - No longer guaranteed that the economy goes back to the original SS

        - The model is highly non-linear:
          large negative shocks can lead the economy into (near) permanent slump
          ... where productive cannot borrow & asset price low & extreme misallocation

2. Why Not Hedge Risk?

- The key assumption in KM is that agents write state noncontingent debt contracts

  - As a result, negative shock redistributes wealth from productive to unproductive

- Do productive agents hedge negative shock if they are allowed to do so?

- Krishnamurthy (2003), Di Tella (2017):

  - Yes, they do!
  - With state-contingent securities, balance sheet recession completely disappears

- "**Puzzle**": In reality, banks do have access to such securities. Why not hedge?

  1. Di Tella (2017): May not want to hedge against certain shock ("uncertainty shock")
  2. Bocola & Lorenzoni (2023): Hedging is endogenously costly if unproductives are

     - also highly exposed to recession (due to labor income)
     - more risk averse

3. Empirical Test of KM?

- Many papers test the relevance of financial friction:

  - Bank health papers that we have seen
  - Does a pure transfer to some firms induce changes in investment/hiring?
    – Yes, it does (Rauh, 2006, Melcangi, 2022)

- But they are not really tests of KM

- A direct test of KM is to ask whether shocks to financial friction induces misallocation

- Bau-Matray (2022):
  foreign capital liberalization in India reduced misallocation and raised TFP