1.6 Business cycle applications

- Outside finance premium: is it countercyclical?
- Investment volatility: is there amplification/propagation?
- general answer: it depends on the shocks (persistence)
- We focus on amplification

- almost temporary shock $\rho = .05$

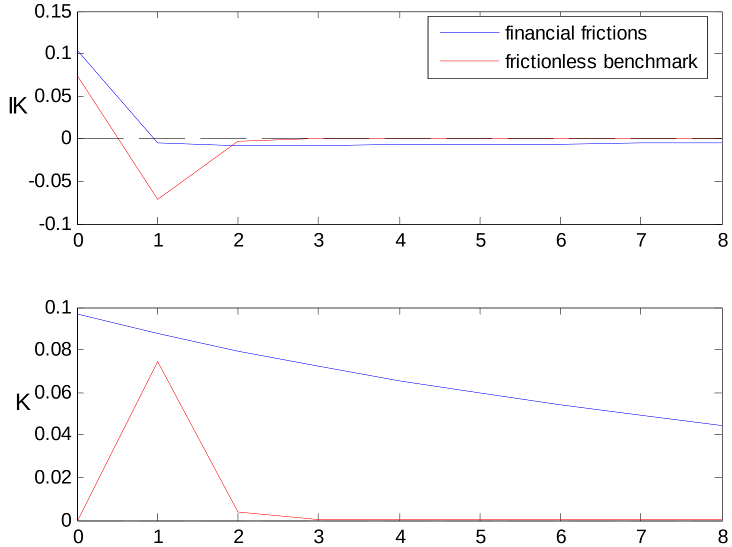

Figure 10:

- more persistent shock $\rho = .1$

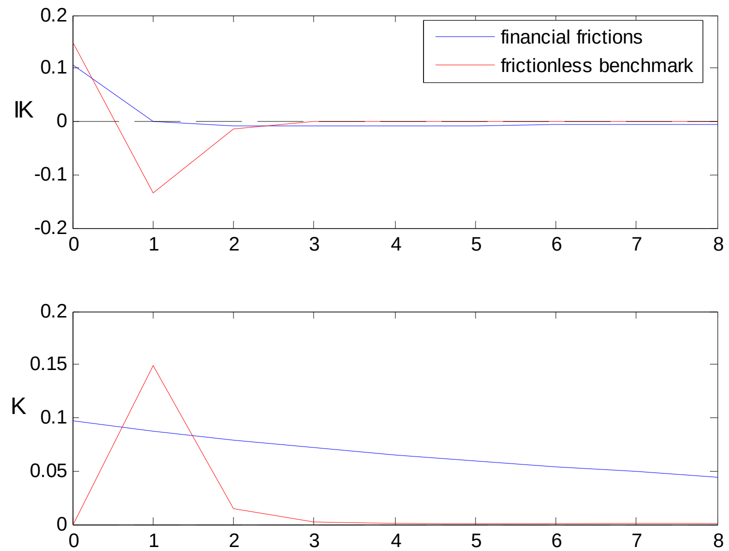

Figure 11:

- persistent shock $\rho = .5$

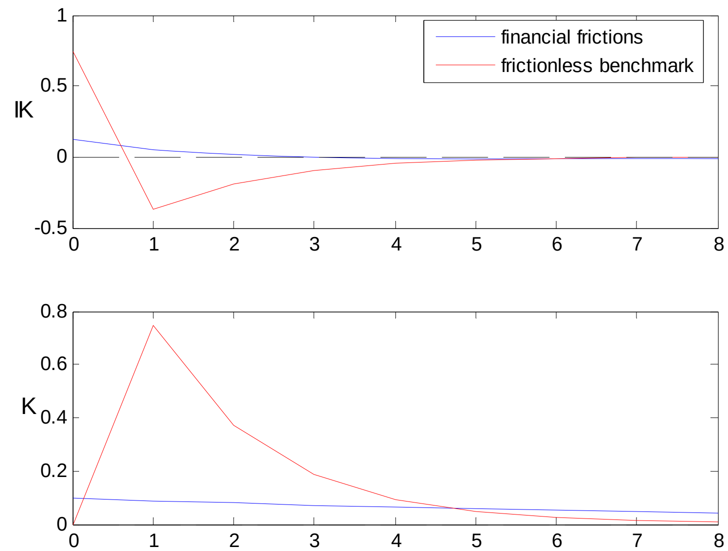

Figure 12:

- Related empirical micro issue: do firms with tighter constraints respond more/less to cash flow shocks?

- Fazzari, Hubbard, Petersen (1998): Yes

  (see table before)

- Kaplan and Zingales:

  – in theory: maybe

  – in empirics: no

- Crucial macro issue: are contracts state-contingent?

- Balance sheet

$$R_t k_t - b_t$$

- Investment

$$k_{t+1} = \frac{R_t k_t - b_t}{q_t^m - \theta \beta_C \mathbb{E}\left[R_{t+1}\right]}$$

- question is b_t sufficiently responsive to shocks?

1.6.1 Amplification

- In Kiyotaki-Moore no state contingent contracts
- Feed-back investment-asset prices in KM
- Recall that

$$R_t = A_t F_1 (K_t, 1) + q_t^o$$

- Suppose we are in region where $R_t k_t - b_t$ close to zero/bankruptcy
- with non-state contingent contracts that may happen

- then small positive productivity shock increases k_{t+1} more than proportionally

- this increases q_t^o-$>$ larger increase in K_{t+1} and so on

- Krishnamurthy (2003): it all depends on ability to condition on aggregate shocks

- Detour on models of Costly State Verification

- Caveat: CSV helps explain why non-state contingent debt is used at the micro level, but it does not really help at the macro level

- In general aggregate shocks seem relatively easy to condition upon: why sometimes balance sheets very exposed?

1.6.2 A failure of diversification

- Three period version

- No adjustment costs

- *Risk averse* consumers $\mathbb{E}\left[u\left(c_1 + c_2\right)\right]$

- In period 0 no investment, no consumption, only financial contracting ex ante

- Shock in period 1: $s = H, L$

- In period 1 entrepreneurs have initial endowment $\omega_s^E \in \{\omega_H, \omega_L\}$

- Consumers have endowment ω_s^C in period 1 and work in period 2

- No aggregate shock

$$\omega_s^C + \omega_s^E = 1$$

- Entrepreneurs

- In period 1: Invest $k_{2,s}$

- In period 2: produce $F\left(k_{2,s}, l_{2,s}\right) - w_s l_{2,s}$

- Balance sheet of the entrepreneur at date 1

$$n_{1,s} = \omega_s^E + z_s^E$$

- state contingent contracts z_s are available at date 0

- question: will they hedge?

- Consumer problem

$$
\begin{aligned}
\max \quad & \sum \pi_s u \left(c_{1,s} + c_{2,s} \right) \\
s.t. \quad & \sum q_s z_s^C \leq 0 \\
& c_{1,s} = \omega_s^C + z_s^C \\
& c_{2,s} = w_s
\end{aligned}
$$

- Entrepreneur problem

$$\begin{aligned} \max \quad & \sum \pi_s \left(c^E_{1,s} + c^E_{2,s} \right) \\ s.t. \quad & \sum q_s z^E_s \leq 0 \\ & c^E_{1,s} + k_{2,s} = \omega^E_s + z^E_s \\ & c^E_{2,s} = R_{2,s} k_{2,s} \end{aligned}$$

- $\theta = 0$ only internal funds can be used

- Value function of entrepreneur now is simply

$$V\left(\omega^E_s + z^E_s, s\right) = R_{2,s}\left(\omega^E_s + z^E_s\right)$$

as long as $R_{2,s} \geq 1$.

- Reduced form consumer's problem

$$\begin{array}{ll} \max & \sum \pi_s u\left(\omega_s^C + z_s^C + w_s\right) \\ s.t. & \sum q_s z_s^C \leq 0 \end{array}$$

- Reduced form entrepreneur's problem

$$\begin{array}{ll} \max & \sum \pi_s R_{2,s}\left(\omega_s^E + z_s^E\right) \\ s.t. & \sum q_s z_s^E \leq 0 \end{array}$$

- market clearing: financial market

$$z_s^C + z_s^E = 0$$

labor market

$$R_{2,s} = F_1\left(K_s, 1\right), \quad K_s = \omega_s^E + z_s^E$$

Equilibrium

$$\frac{\pi_L u'\left(\omega_L^C + z_L^C + w_L\right)}{\pi_H u'\left(\omega_H^C + z_H^C + w_H\right)} = \frac{q_L}{q_H} = \frac{\pi_L R_{2,L}}{\pi_H R_{2,H}}$$

- multiple equilibria possible

- symmetric equilibrium always exists: full diversification

$$K_H = K_L = \sum \pi_s \omega_s^E$$

- asymmetric equilibrium $K_H > K_L$ (also the opposite possible!)

- pecuniary externality

Example

$$\pi_L = \pi_H = 1/2$$

$$\begin{aligned} u(c) &= c^{1-\gamma} \\ F(k,1) &= Ak^{\alpha} \end{aligned}$$

$$\begin{aligned} \omega_L^E &= 0, \omega_H^E = 1 \\ \omega_L^C &= 1, \omega_H^C = 0 \end{aligned}$$

$$\begin{aligned} z &= z_L^E \\ q &= \frac{q_L}{q_H} \end{aligned}$$

Two relations

$$\frac{u'\left(1 - z + Az^{\alpha}\right)}{u'\left(qz + A\left(1 - qz\right)^{\alpha}\right)} = q$$

$$\frac{z^{\alpha-1}}{\left(1 - qz\right)^{\alpha-1}} = q$$

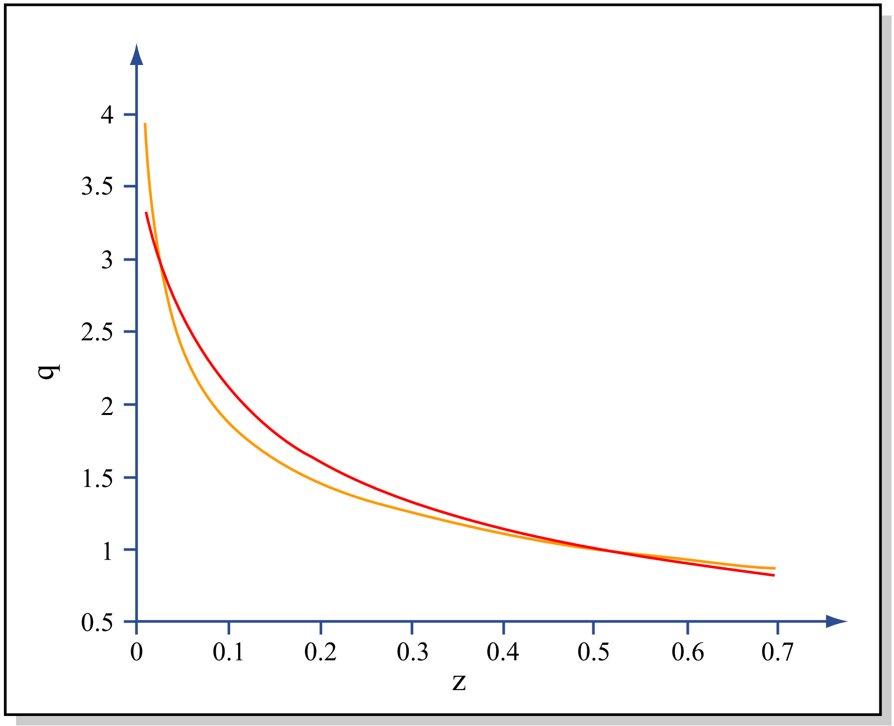

Figure by MIT OCW.

Examples:

- US vs Japan asset price bubble
- real estate concentrated in banks -> feed back

- stock market diffused -> no feed back

- Dollarized economies: consumers want deposits in US$ to be safe, then banks lend in US$, then companies exposed to XR risk, wages more volatile, consumers want deposits in US$...

- very different balance sheet effects

- “financial fragility” difficult to assess, credit chains...