Agency Costs, Net Worth, and Endogenous Business Fluctuations

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- I use an agency problem in a borrower-lender relationship to study how entrepreneur and investor's incentives vary over the cycles in a way that booms lead to recessions and recessions to booms, even though no external shocks hit the economy.

Motivation

- Large macro-literature have stressed the role of credit frictions as a source of amplification and persistence of exogenous shocks to the economy:
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- Industrialized and emerging countries have experienced erratic financial cycles, whereby credit booms and high investment are followed by credit contractions and recessions.

Road Map

1. Building Blocks and Main Idea.

3. Static Model.

4. Dynamic Model.

5. Conclusions.

Building Blocks

- Investment productivity depends upon the *joint-non-contractible* actions of an investor and an entrepreneur:
  - Entrepreneur effort essential to evaluate and select projects,
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  - Entrepreneur effort essential to evaluate and select projects,
  - Investor control crucial to select only profitable projects.
- Entrepreneur moral hazard, generates a monotonic investment dynamics that, at low level of entrepreneur net worth, constraints investment.
- Investor moral hazard, generates a non-monotonic investment dynamics that, at high level of entrepreneur net worth, originates endogenous fluctuations.

Main Idea

- Investor incentive to control entrepreneur is countercyclical:
  - High in recessions, "forcing" the entrepreneur to select only profitable projects,
  - Weak in booms, "permitting" that less profitable projects get their way.

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3. Exogenous shocks to the economy may be dampened rather than amplified.

The Model

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- Both E and I are risk neutral and protected by limited liability.
- E has an endowment w
  - w can be stored at a gross return of r
  - used to partly finance an investment project, which has a fixed outlay of $1 > w$.

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Projects: $J = \{G, B, U\}$

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Private Benefits	0	b	$-\infty$
Cash Flows	Π	0	Π

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- A conflict of interest arises if

$$b > (1 - \boldsymbol{\alpha})\Pi$$

where $\boldsymbol{\alpha}$ is the fraction of cash flows Π that E must share with I.

Timing

$t = 0$	$t = 1/2$	$t = 1$	$t = 2$
E exerts effort $e \in (0,1) \longrightarrow$ $\downarrow$ rw	Financing occurs and contract signed $(1-w),\ \ \alpha$	I exerts control or monitoring $m \in (0,1)$	Π and/or b realize.

First Best

Can be attained **if** $b < (1 - \alpha)\Pi$

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$$\max_e \ (1-e)rw + e(1-\alpha)\Pi - c_e e^2/2$$

$$s.t. \ \ \alpha\Pi = r(1-w)$$

$$e^{fb} = \frac{\Pi - r}{c_e}$$

Second Best

If $b > (1 - \alpha)\Pi$

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$$\max_{e,\alpha} \; e\{m^*(1-\alpha)\Pi + (1-m^*)b\} + (1-e)rw - c_e e^2/2$$

$$\text{s.t.} \quad m^* = \arg\max_{m} \; e^* \left\{ m\alpha\Pi + (1-m)\times 0 - c_m \frac{m^2}{2} \right\} + (1-e^*)(1-w)r$$

$I's$ BEC

$E's$ PC

$0 \leq \alpha \leq 1$

The Basic Trade-off

$$m^* = \frac{\alpha \Pi}{c_m}$$

$$e^* = \frac{b - rw - m^* \{b - (1 - \alpha)\Pi\}}{c_e}$$

$$\alpha = \frac{\sqrt{2r(1 - w)c_m}}{\Pi}$$

Implications

Using $\alpha = \frac{\sqrt{2r(1-w)c_m}}{\Pi}$

$b > (1 - \alpha)\Pi$ **if**

$$w < 1 - \frac{(\Pi - b)^2}{2rc_m} \equiv \overline{w}$$

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E's participation constraint:

$e(\widetilde{w}) \geq 0$ or

$w \geq \widetilde{w}$

Lemma 1 *There exist two cut-off values $\widetilde{w}$ and $\overline{w}$, with $\widetilde{w} < \overline{w}$ such that:*

1. If $0 \leq w \leq \widetilde{w}$ the entrepreneur has not sufficient wealth to undertake the project. In this case, $e = m = 0$.

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2. If $\widetilde{w} < w < \overline{w}$, the project is funded and the equilibrium levels of effort and monitoring are:

$$e^* = \frac{b - rw - m^* \{b - (1 - \alpha)\Pi\}}{c_e}$$

$$m^* = \frac{\alpha \Pi}{c_m}$$

with

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3. If $w \geq \overline{w}$, the conflict of interest vanishes. The optimal level of effort is

$$e^{fb} = \frac{\Pi - r}{c_e}$$

Output and Productivity

Overall output

$$y = e\{m\Pi + (1 - m)b\}$$

Productive output

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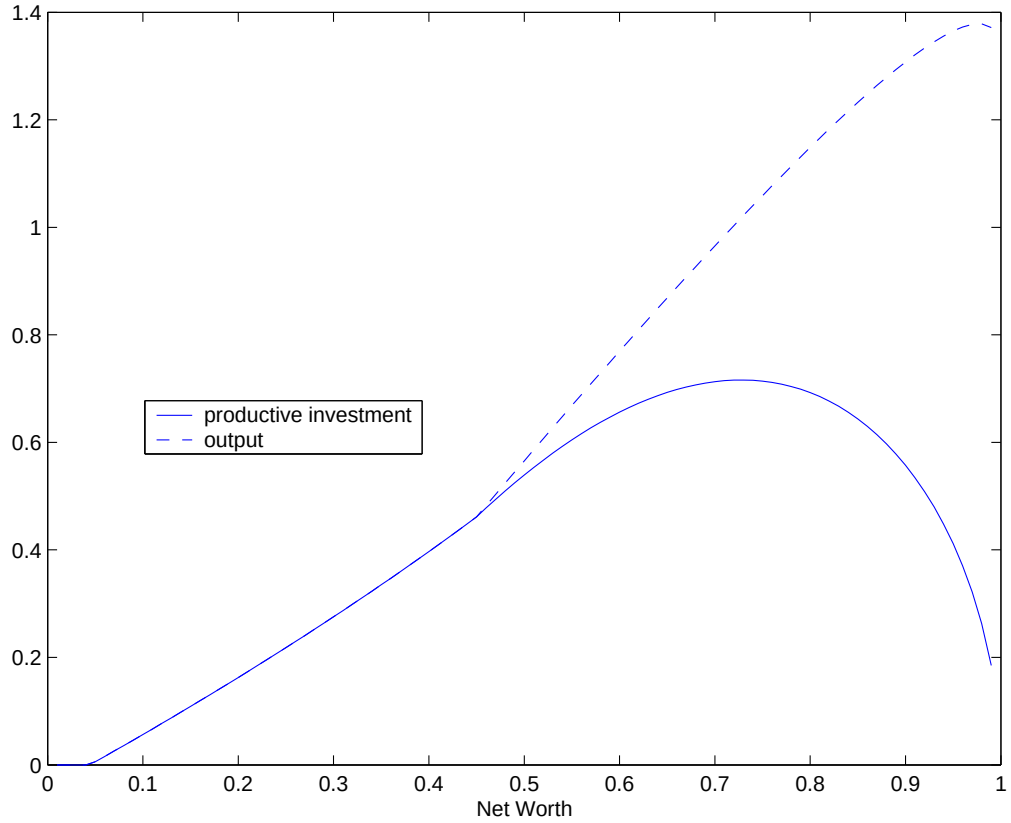
Proposition 1. *For* $w \in (\widetilde{w}, \overline{w})$,

1 *Total output,* y*, increases monotonically.*

2 *Productive output is non-monotonic. There is a threshold* $w^* \in (\widetilde{w}, \overline{w})$ *such that* p*, rises for* $w < w^*$ *and falls for* $w > w^*$*.*



Numerical Example

$\Pi = 2$, $b = r = 1$, $c_m = c_m = 1.1 \Rightarrow w \in (0.04, 0.90)$

Comparative Statics

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- Firms with high leverage invest less (Stein (03)).
- Counter-cyclical bank lending standards (Rajan (95), Asea and Bloomberg (98)).

Dynamics

- OLG model à la Diamond (65):

  - Unit mass of risk neutral agents that live for two periods and care only about second period consumption. Young agents are heterogenous: η are entrepreneurs, $1 - \eta$, lenders.

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  - Unit mass of risk neutral agents that live for two periods and care only about second period consumption. Young agents are heterogenous: η are entrepreneurs, $1-\eta$, lenders.
  - Each young is endowed with L units of labor.

Technology

- **Final sector** produces a consumption good,

$$Y_t = A_t K_t^{\beta} L_t^{1-\beta}$$

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- As in Romer (86), $A_t = K_t^{\gamma}$ with $\gamma + \beta = 1$, hence:

$$\rho_t = \beta \text{ and } w_t = w(k_t) = (1-\beta)k_t$$

- **Intermediate sector**, produces capital k_t at $t-1$, and sell it to the FGS at t at the price β.

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  - Projects are $\{G, B, U\}$

    * G produces capital goods, Π,

    * B produces consumption goods b.

Credit Market

- Perfect supply of capital

$$w_t > \eta e_t$$

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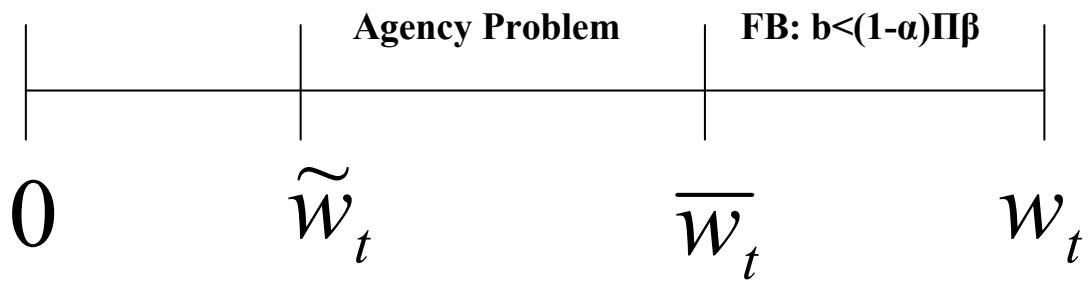
- The lending contract lasts for one period only.

Investment Dynamics



First-Best

$w_t(k_t)$ is used to undertake technology, G

$$e_t^{fb} = \frac{\Pi\beta - r}{c_e}, \qquad i_t = e_t^{fb} \times \eta$$

$$k_{t+1} = i_t \times \Pi = \frac{(\Pi\beta - r)}{c_e} \times \eta \times \Pi$$

which is independent of period$-t$ variables.

Equilibrium with an Agency Problem

- k_{t+1} depends on how saving $w_t(k_t)$ is allocated between G and B.

$$i = \left[\underbrace{e_t\left[m_t(w_t)\right] \times m_t(w_t) \times \Pi}_{k_{t+1}} + \underbrace{e_t\left[m_t(w_t)\right] \times (1 - m_t(w_t)) \times b}_{b_{t+1}} \right] \eta$$

$$k_{t+1} = K(e(w(k_t)), m(w(k_t)))$$

where $K_e > 0$ and $K_m > 0$.

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$$k_{t+1} = K(e(w(k_t)), m(w(k_t)))$$

where $K_e > 0$ and $K_m > 0$.

- Hence, even though the supply of credit is perfectly elastic, k_{t+1} depends indirectly on w_t. As a consequence the accumulation path of capital

$$\frac{dk_{t+1}}{dk_t} = \left(\underset{+}{\frac{\partial K}{\partial e}} \underset{+}{\frac{\partial e}{\partial w}} + \underset{+}{\frac{\partial K}{\partial m}} \underset{-}{\frac{\partial m}{\partial w}} \right) \underset{+}{\frac{\partial w}{\partial k_t}}$$

may be non-monotonic.

All together

Since $w_{t+1} = (1-\beta)k_t$ the law of motion of k_t is expressed in terms of w_t:

$$w_{t+1} = \Phi(w_t) = \begin{cases} 0 & \text{if} \quad w_t < \widetilde{w}_t \\ \phi(w_t) & \text{if} \quad \widetilde{w}_t \leq w_t \leq \overline{w}_t \\ w^{fb} & \text{if} \quad w_t > \overline{w}_t \end{cases}$$

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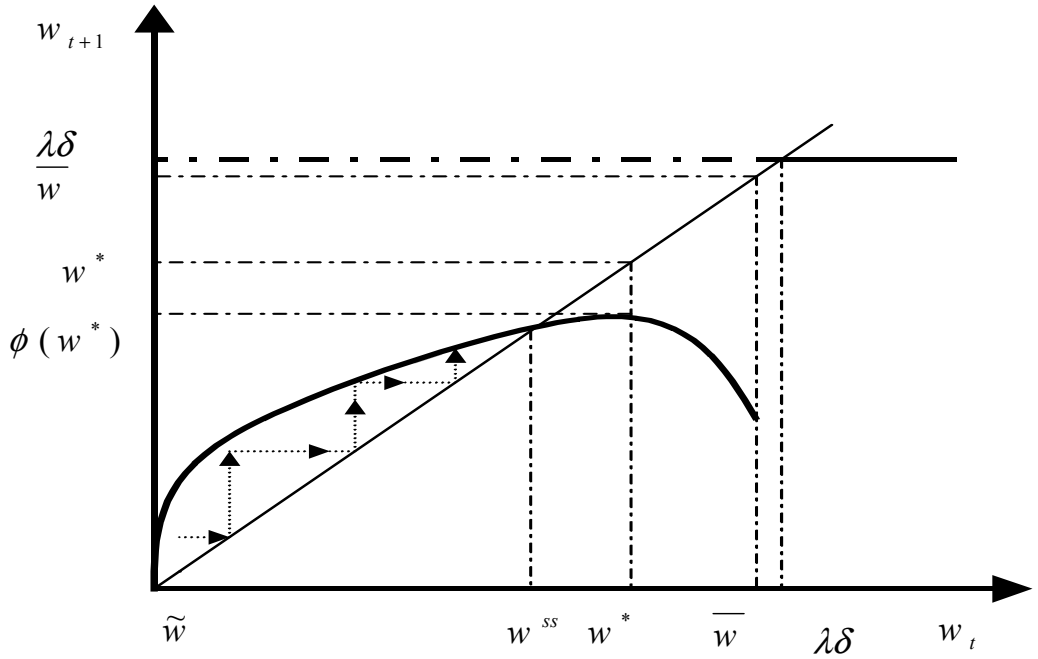
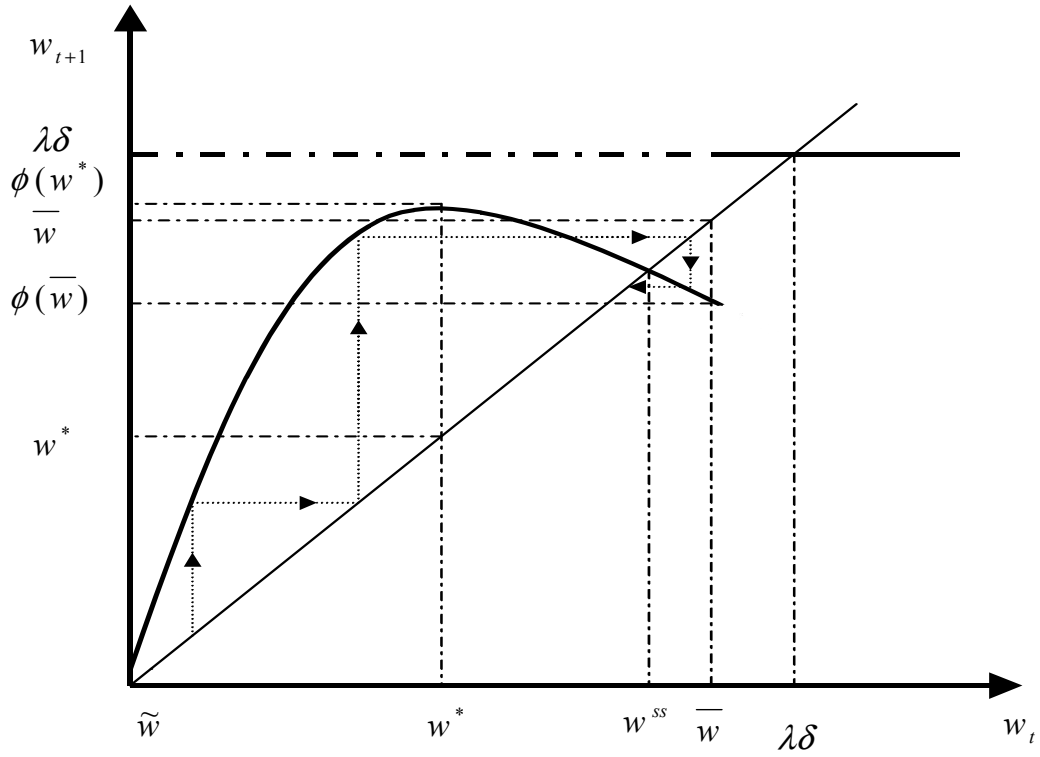
Lemma 4 *The map $\phi(w_t)$ is unimodal with a critical point at $w^* \in (\widetilde{w}, \overline{w})$. Moreover, if*

$$\underline{\underline{c}}_m < c_m < \overline{\overline{c}}_m$$

holds, the mapping $\phi(w)$ has at most one interior steady state and maps $(\widetilde{w}, \overline{w})$ into itself.



$$c_m > \overline{c}_m, \text{ or } \lambda = (\Pi\beta - b) < \underline{\lambda}$$



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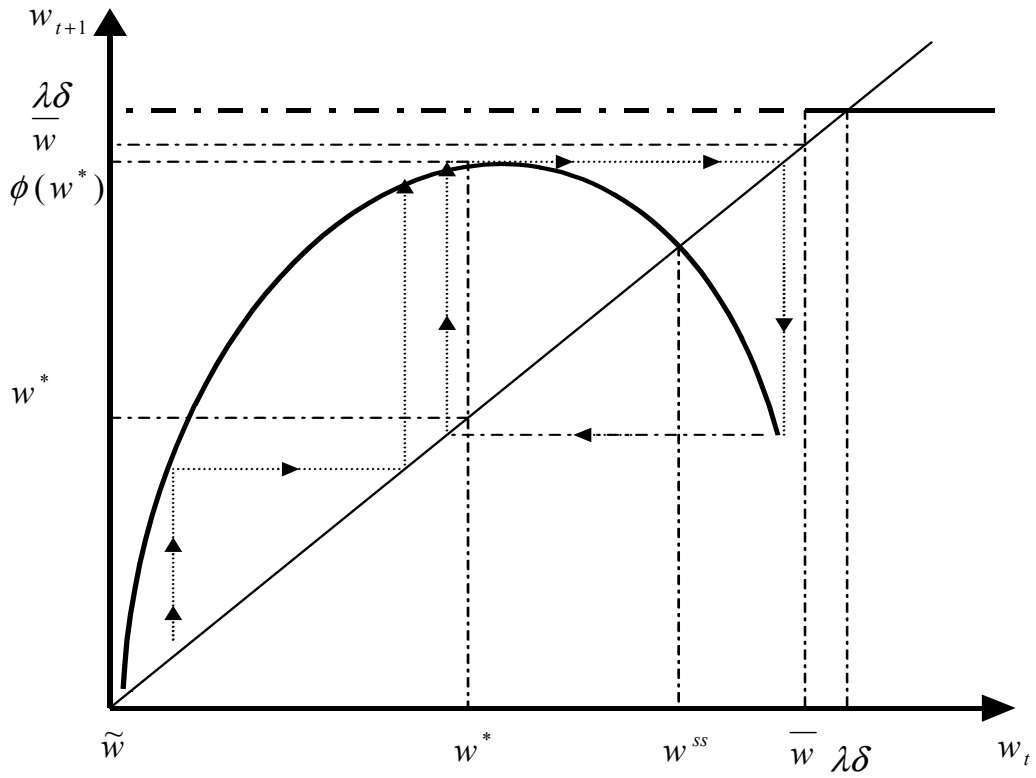

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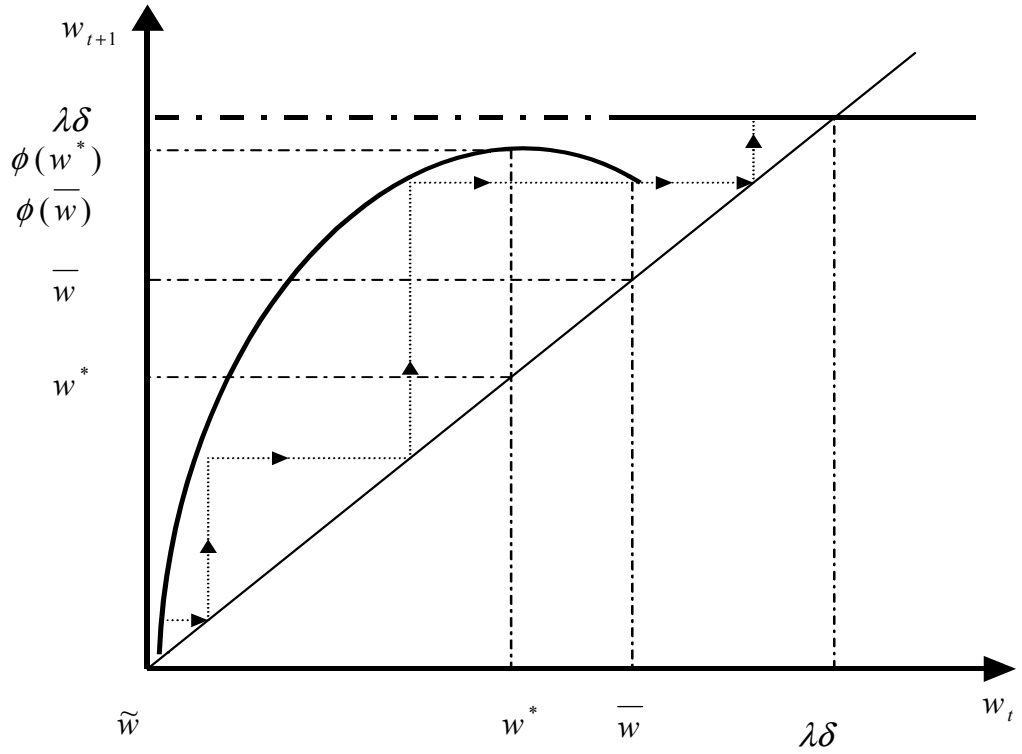

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Empirical Predictions

- c_m, λ, varies across financial systems, and industries.
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  - Bank based vs. market based economies (shareholders vs. bank control).
  - Young vs. mature technologies.

Conclusions

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- Exogenous shocks to firm net worth may be dampened rather than amplified.

Literature Review

- Bernanke and Gertler (89, 90), Kiyotaki and Moore (97):
  - Credit frictions generate persistence and amplification of exogenous shocks.
- Aghion, Banerjee and Piketty (99), Matsuyama (04):
  - Credit frictions are source of endogenous business cycles.
- Philippon (05):
  - Shareholders control and managers' empire building preferences amplify expansions.

Literature Review

- Diamond (86, 91), Besanko and Kanatas (93), Holmström and Tirole (97):
  - Banks reduce entrepreneurs misbehavior through auditing or control.
- Rajan and Winton (95), Manove Padilla and Pagano (01):
  - Collateral affects banks' incentives.
- Burkart, Gromb and Panunzi (97):
  - Optimal ownership structure to solve the trade-off between control and initiative.

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Can be attained **if** $b < (1-\alpha)\Pi$

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