Non-Fundamental Dynamics and Financial Markets Integration

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ESSIM, Tarragona, May 2014

Financial Integration and Asset Prices: Two Stylized Facts

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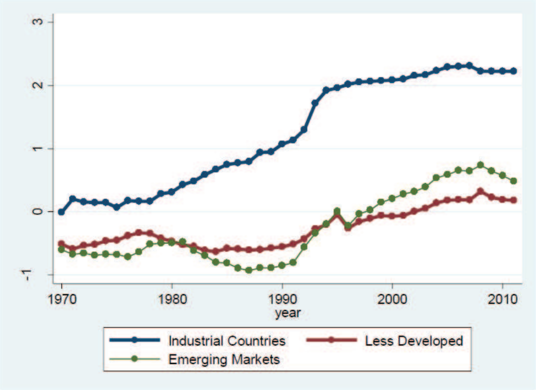

Chinn-Ito Index of Capital Account Openness

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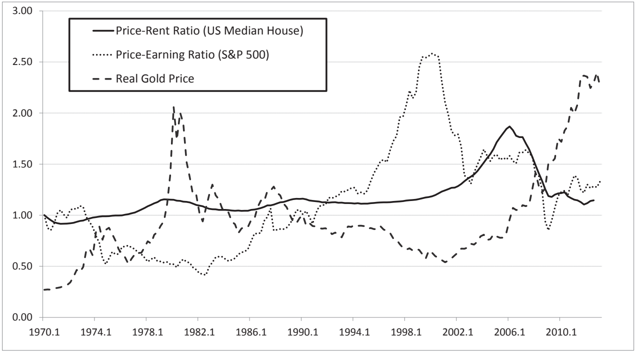

US Stocks, US Real Estate and Gold

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this paper: theoretical model that can predict 2 from 1

Financial Integration and Asset Prices: This Paper

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framework

- two-region global equilibrium model
- heterogeneous financial development
- financial investors' sentiments

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predictions

- in financial autarky sentiments remain "dormant"
- under financial integration sentiments can drive fluctuations

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key mechanism: non-monotonic impact of financial development

Related Literature

financial globalization and macroeconomic volatility

- Kose, Prasad, Rogoff and Wei (*HDE*, 2009)

more closely related

- Tirole (*ECMA*, 1985), Martin and Ventura (*AER*, 2012)
- Caballero, Farhi and Gourinchas (*AER*, 2008)

Plan of the Talk

i the model and equilibrium

ii closed economy

iii global economy

The Model: Basics

neoclassical growth model with overlapping generations

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neoclassical growth model with overlapping generations

- 3 generations: young, adult and old, each of measure 1
- consumption linearly valued only when old, $\mathbb{E}_{it-1}(c_{it+1})$
- output technology

$$y_t = k_t^{\alpha} \ell_t^{1-\alpha}, \qquad \alpha \in (0,1)$$

- capital fully depreciates after production
- factors are paid at marginal return, unitary prices R_t^k and w_t
- young supply 1 unit of labor inelastically, adult and old do not work

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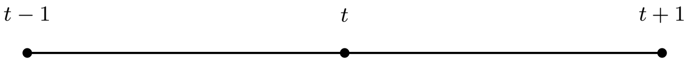
- young supply 1 unit of labor inelastically, adult and old do not work
- young and adult can invest output at t in production of $t+1$ capital

$$k_{it+1} = A_{it+1} x_{it}$$

- A_{it+1} productivity specific to investing agent i
- young and adult can deposit output with an intermediary with return R_t^d

The Model: Invest or Deposit Decision



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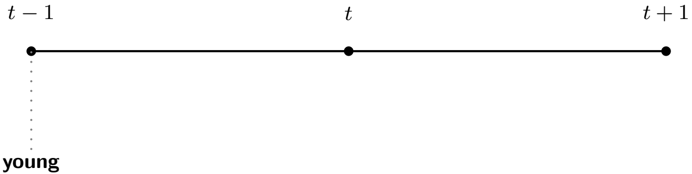

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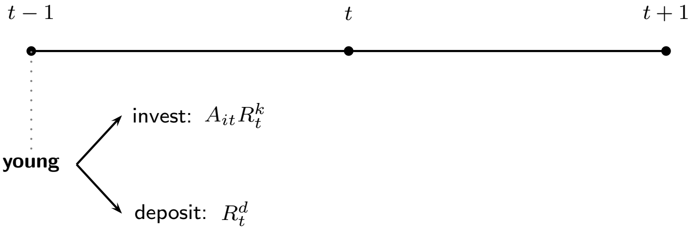

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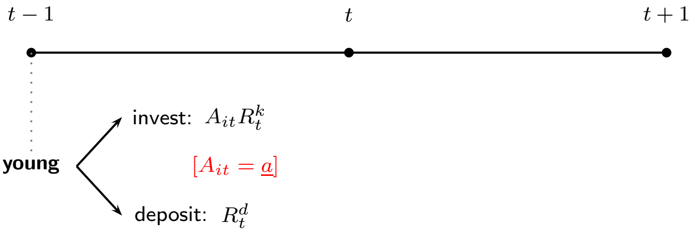

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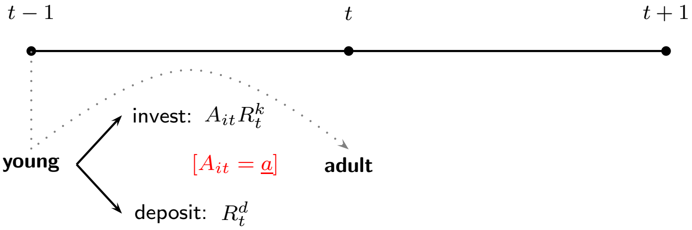

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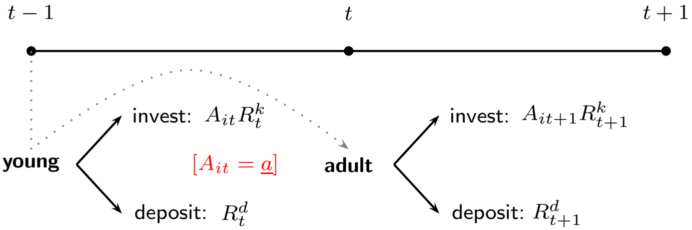

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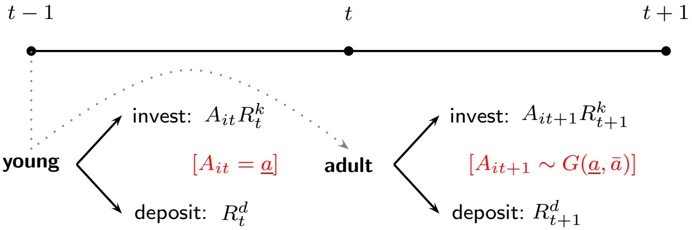

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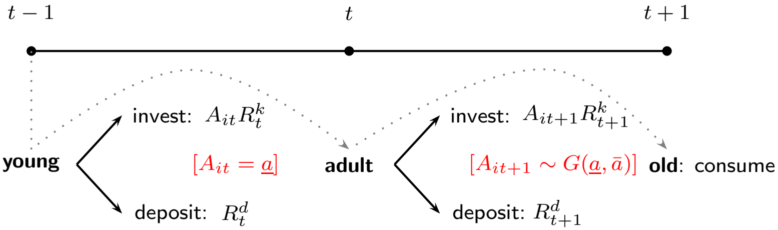

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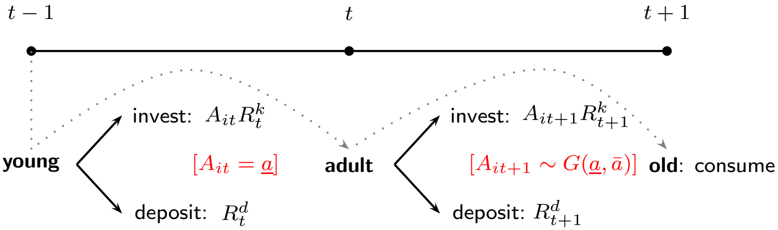

let $\rho \equiv R^d/R^k$, then if $A_i \geq \rho$ invest, deposit otherwise

The Model: Invest or Deposit Decision

$t-1$ $\qquad$ t $\qquad$ $t+1$

young $\to$ invest: $A_{it}R_t^k$ / deposit: R_t^d $\quad [A_{it} = \underline{a}]$

adult $\to$ invest: $A_{it+1}R_{t+1}^k$ / deposit: R_{t+1}^d $\quad [A_{it+1} \sim G(\underline{a}, \bar{a})]$

old: consume

let $\rho \equiv R^d/R^k$, then if $A_i \geq \rho$ invest, deposit otherwise

Example. Suppose $\rho_t > \underline{a}$ and $\rho_{t+1} > \underline{a}$

young: deposit $\to$ **adult** $\to$ $1 - G(\rho_{t+1})$ invest / $G(\rho_{t+1})$ deposit $\to$ **old**: consume

The Model: Financial Friction

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- investing agent i at t can borrow amount l_{it+1}, at gross interest rate R^f_{t+1}
- limited pledgeability of capital investment income

$$l_{it+1} R^f_{t+1} \leq \theta R^k_{t+1} k_{it+1} \qquad \text{where} \qquad \theta \in [0, 1]$$

[microfoundation: moral hazard problem, Holmstrom and Tirole (2010)]

The Model: Financial Intermediation

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representative intermediary, operating under price-taking and zero-profit

- issue one-period deposit contracts d_t, return R^d_{t+1}
- extend one-period loans l_t, return R^f_{t+1}

in equilibrium $R^f_{t+1} = R^d_{t+1}$ and intermediary balance sheet

$$l_t = d_t$$

The Model: Aggregate Leverage

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- linear investment technology implies investing agents borrow to the limit
- aggregate capital produced by investing adults

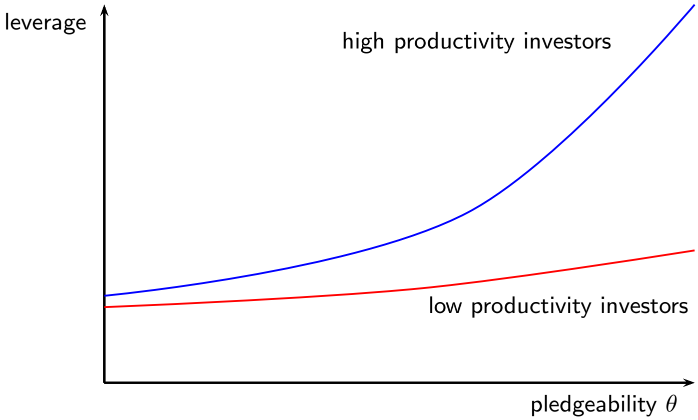
$$k_{t+1} = \rho_{t+1} U_\theta(\rho_{t+1}) w_t^A$$

- where U is "*leverage function*"

$$U_\theta(\rho) \equiv \int_{A \geq \rho} \frac{A}{\rho} \frac{1}{1 - \theta \frac{A}{\rho}} dG$$

features of U: decreasing in ρ, increasing in θ, non-linear in A

The Model: Pledgeability, Productivity and Leverage



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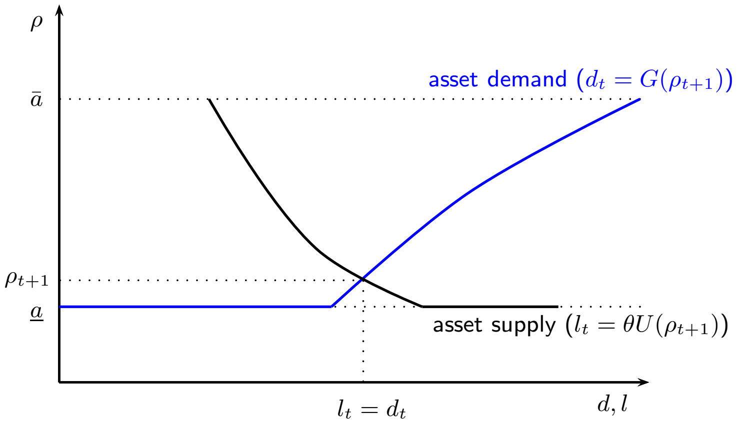
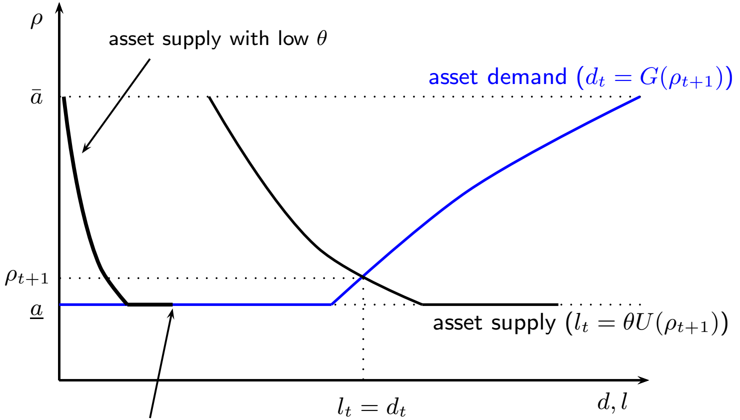


The Model: Fundamental Equilibrium with low θ



equilibrium $\rho_{t+1} = \underline{a}$ [economy has severe asset supply “shortage”]

The Model: Introducing the Non-Fundamental Asset b_t

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- intermediary can trade on a "non-fundamental" asset with value b_t
- supply of asset is fixed (or out of control of agents and intermediary)
- return on asset is from capital gain

$$R^b_{t+1} = \frac{\mathbb{E}_t(b_{t+1})}{b_t}$$

- intermediary balance sheet

$$b_t + l_t = d_t$$

- b_t is purchased by current depositors and sold to future depositors
- conditions to hold b_t: **competitive** return, **affordable** to future depositors

interpretation

The Model: Non-Fundamental Asset, Crowding-out and Crowding-in

existence of b_t asset operates transfer of funds (completes markets)

- **crowding-out**: low productivity investors (young) turn depositors
- **crowding-in**: high productivity investors (adult) have more internal funds

Stationary Stochastic Equilibrium

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define

$$z_t \equiv \frac{b_t}{W_t}$$

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focus on Stationary Stochastic Equilibrium (SSE)

$$\rho^*, z^* > 0$$

[similar to Weil (1987), Kocherlakota (2009), Farhi and Tirole (2011)]

Non-Fundamental Equilibrium in the Closed Economy

Proposition

A SSE of the closed economy (ρ^*, z^*) *is the solution to*

$$\alpha = (1-\alpha)U_\theta(\rho^*), \tag{U}$$

$$z^* = \frac{1}{2}\left[G(\rho^*) - \theta\frac{\alpha}{1-\alpha}\right] > 0. \tag{Z}$$

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how do (U) and (Z) depend on degree of pledgeability θ?

Degree of Pledgeability θ and Existence of SSE

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as θ gets bigger, (Z) eventually violated

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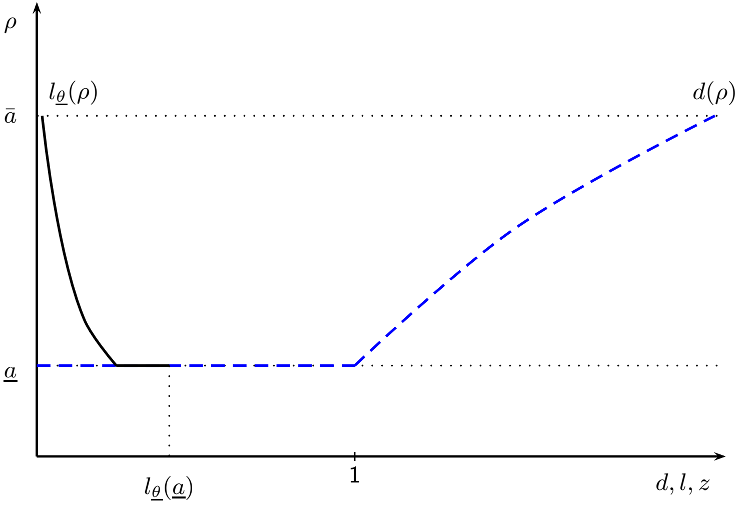

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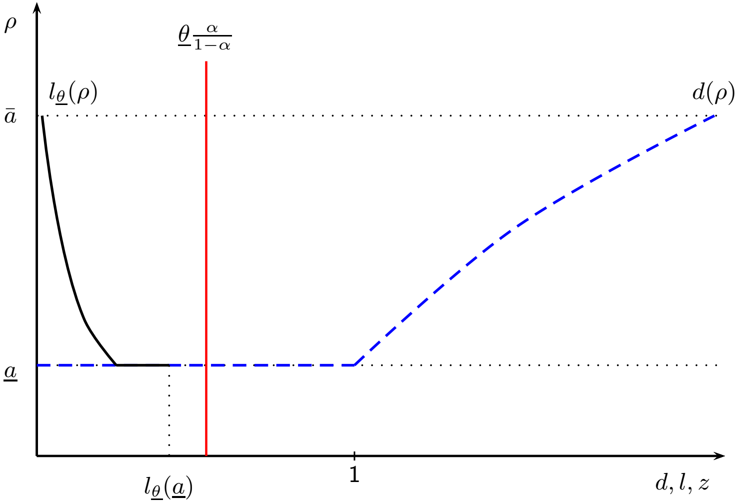

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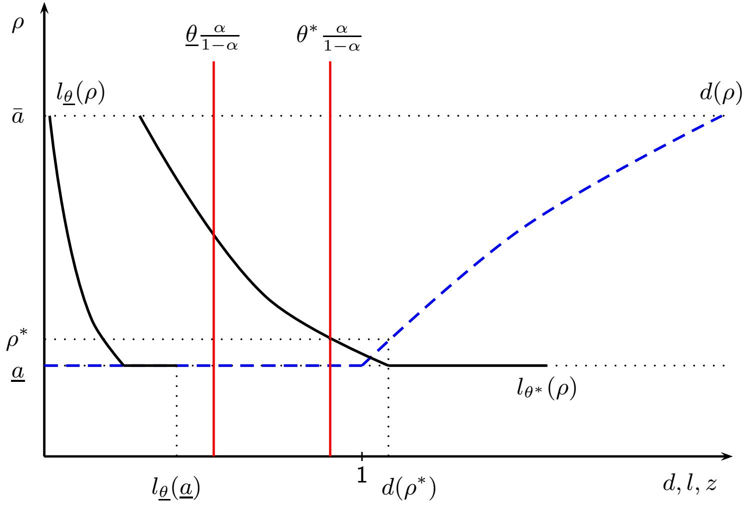

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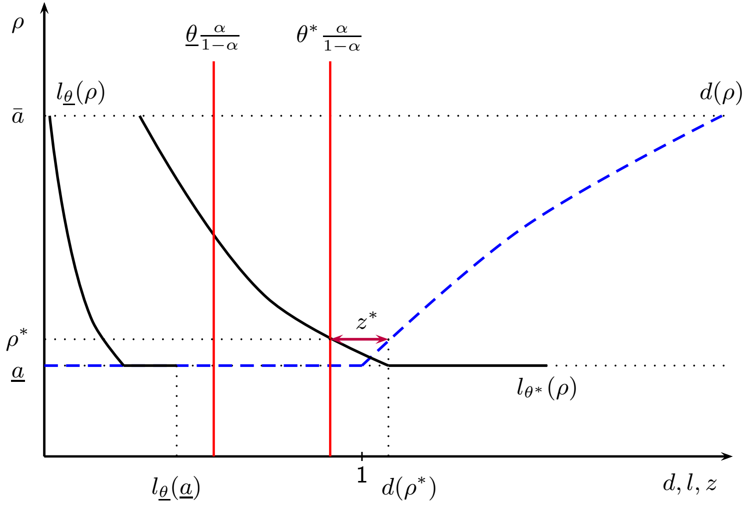

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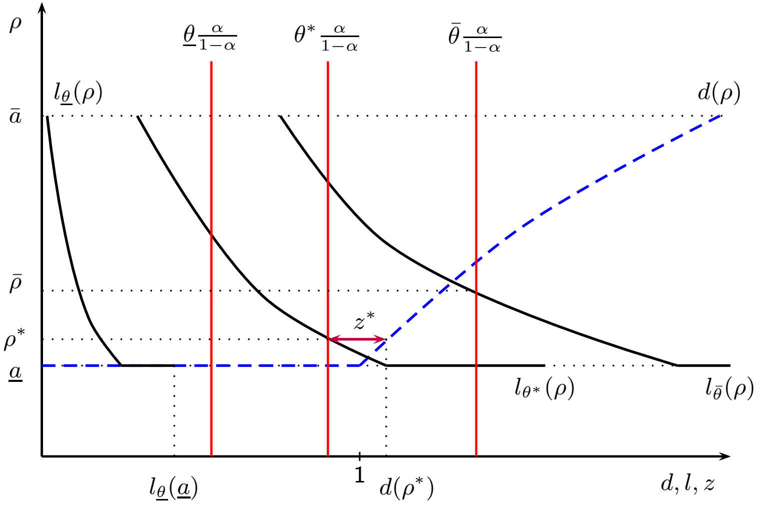

Degree of Pledgeability θ and Existence of SSE

Corollary

Equilibria with non-fundamental dynamics, $b_t > 0$ ($z_t > 0$), are possible for intermediate values of the degree of pledgeability θ.

Global Economy

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global equilibrium, two regions, North and South

- financial capital free to move
- physical capital must be used where produced
- output good free to move
- agents cannot move

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pledgeability of investment income

- autarky: North region θ, South region $\tilde{\theta} \approx 0$
- financial integration:

  ϕ fraction of North pledgeability now possible for South investors

$$\tilde{\theta} = \phi\theta$$

Global Economy

express variables in terms of wealth in North W_t

$$z_t^* \equiv \frac{b_t^*}{W_t}$$

relative size of wealth across regions

$$v_t = \frac{\tilde{W}_t}{W_t}$$

relative return on physical capital

$$q_{t+1} \equiv \frac{R_{t+1}^k}{\tilde{R}_{t+1}^k}$$

Stationary Stochastic Equilibrium in the Global Economy (GSSE)

Corollary

A GSSE of the global economy (ρ^*, q^*, z^*, v^*) *is the solution to*

$$U_\theta(\rho^*) = \frac{\alpha}{1-\alpha}, \tag{U}$$

$$U_{\phi\theta}(q^*\rho^*) = \frac{\alpha}{1-\alpha}, \tag{U'}$$

$$z^* = \frac{1}{2}\left[G(\rho^*) + v^*\left[G(q^*\rho^*)\right] - \theta\frac{\alpha}{1-\alpha}\left(1+\phi v^*\right)\right] > 0, \tag{Z}$$

with $v^* = q^{*\frac{\alpha}{1-\alpha}}$.

Non-Fundamental Equilibrium in the Global Economy

can a GSSE exist when no SSE's exist for the two regions in autarky?

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Suppose:

Non-Fundamental Equilibrium in the Global Economy

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Suppose:

no SSE in South, due to limited leveraging potential

$$\alpha > (1 - \alpha)U_0(\underline{a})$$

Non-Fundamental Equilibrium in the Global Economy

can a GSSE exist when no SSE's exist for the two regions in autarky?

Suppose:

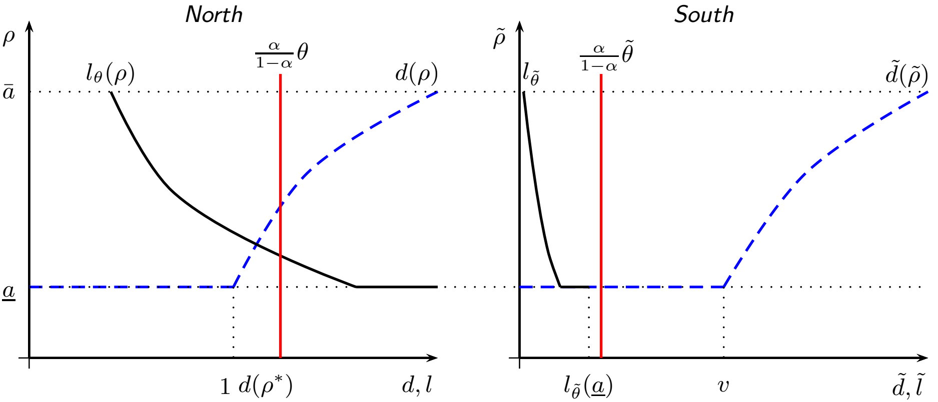
no SSE in South, due to limited leveraging potential

$$\alpha > (1-\alpha)U_0(\underline{a})$$

no SSE in North, due to sufficient fundamental asset supply

$$G(\rho^*) \leq \theta \frac{\alpha}{1-\alpha} \quad \text{for} \quad \rho^* : U_\theta(\rho^*) = \frac{\alpha}{1-\alpha}$$

Non-Fundamental Equilibrium in the Global Economy



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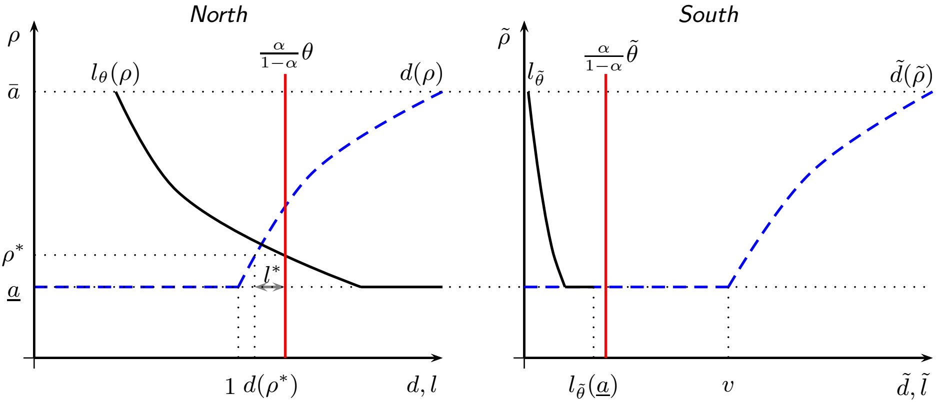

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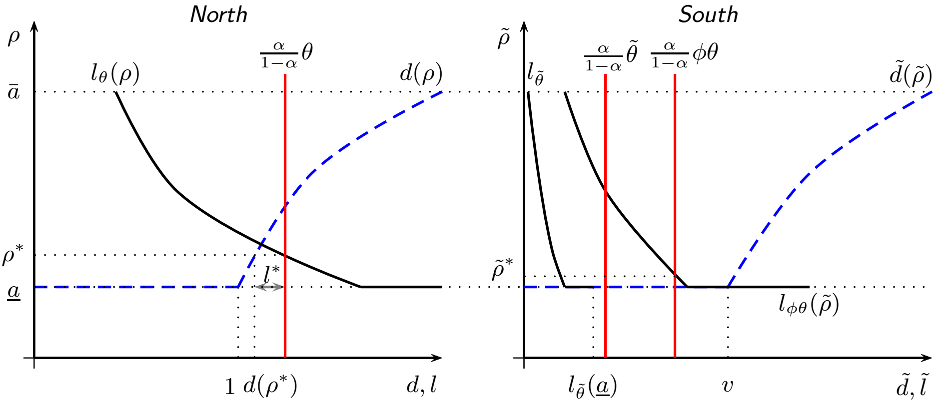

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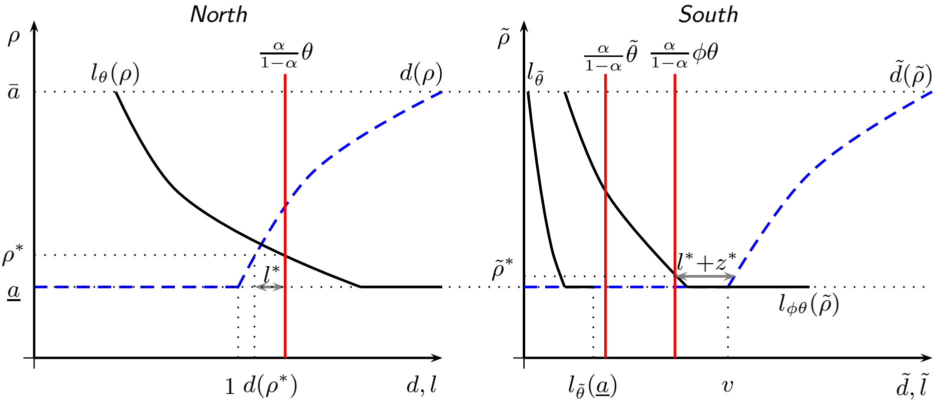

Non-Fundamental Equilibrium in the Global Economy

Corollary

Suppose that in autarky equilibria with Non-Fundamental Dynamics are not possible in both the North and South regions.

Equilibria with Non-Fundamental Dynamics are possible when financial markets integrate if

- *the North region is "close" to asset supply shortage (l^* small)*
- *financial integration results in an intermediate increase in the degree of pledgeability for the South region (ϕ intermediate).*

numerical simulation

Summary

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- global equilibrium model with investors' sentiment shocks

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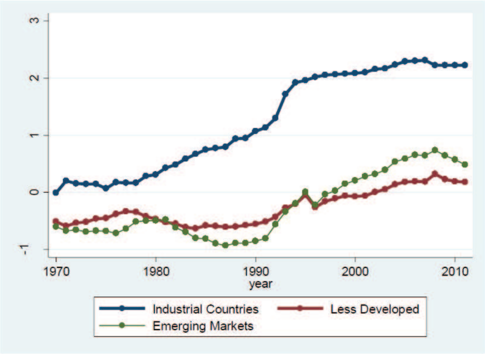
next: risk considerations in intermediary portfolio allocation

Measures of Financial Integration



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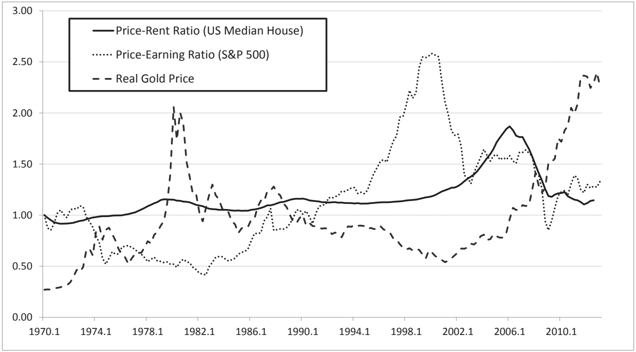
Asset Prices in Advanced Economies



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Interpretation of Non-Fundamental Asset

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- capital investment and next period production done by "entrepreneurs"
- to become entrepreneurs agents must purchase an "empty firm" in the stock market
- if adult agent i purchases a firm at price b_t^i she can borrow up to b_t^i plus the pledgeable income
- after production the intermediary seizes the pledgeable income plus the empty firm from entrepreneur i
- the intermediary sells the empty firms to next period entrepreneurs in the stock market
- in the end, because adult can borrow entirely against purchased empty firm, depositors are those holding the non-fundamental value of the empty firm through the intermediary

back

Equilibrium: Recursive Representation

variables in terms of wealth in the economy at the end of time t

$$W_t = w_t + w_t^A, \qquad n_t \equiv \frac{w_t^A}{W_t}, \qquad z_t \equiv \frac{b_t}{W_t}.$$

wealth of adult at $t+1$ in terms of wealth at t

$$1 - n_t$$

wealth of young at $t+1$ in terms of wealth at t

$$\frac{1-\alpha}{\alpha} U_\theta(\rho_{t+1}) n_t$$

Equilibrium: Non-Fundamental Dynamics

Proposition

The non-negative stochastic process $\{z_t\}_{t=0}^{\infty}$ *and the sequence* $\{n_t, \rho_{t+1}\}_{t=0}^{\infty}$, *are an equilibrium if*

(a) *expected return of non-fundamental asset*

$$\mathbb{E}_t(z_{t+1}) = \frac{z_t}{1 - n_t + \frac{1-\alpha}{\alpha} U_\theta(\rho_{t+1}) n_t}$$

(b) *asset market clearing*

$$\theta U_\theta(\rho_{t+1}) n_t + z_t = 1 - n_t + n_t G(\rho_{t+1})$$

(c) *intergenerational wealth distribution*

$$n_{t+1} = \frac{1 - n_t}{1 - n_t + \frac{1-\alpha}{\alpha} U_\theta(\rho_{t+1}) n_t}$$

Non-Fundamental Equilibrium: Numerical Simulation

numerical simulation of non-fundamental dynamics in global economy

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numerical simulation of non-fundamental dynamics in global economy

- distribution G is Uniform in $[\underline{a}, \bar{a}]$
- parameters: $\alpha = .73$, $\underline{a} = .5$, $\bar{a} = 1.5$, $\theta = .36$, $\phi = .6$
- non-fundamental state: $p = .15$ and $r = .05$
- new asset supply: $z_t^A = 0.002$ and $\tilde{z}_t^A = 0.001$ when $\omega_t = NF$
- no SSE in autarky, GSSE is $z^* = .08$
- allocation of non-fundamental risk on deposits: $\mu = .5$, $\varphi = \tilde{\varphi} = .5$

caveats:

agents do not take probability of non-fundamental asset creation into account

one specific realization of investors' sentiments shocks reported

back

Non-Fundamental Equilibrium: Numerical Simulation