T. W. SCHULTZ LECTURE

MARKUS BRUNNERMEIER

based on

A MACRO-MODEL WITH A FINANCIAL SECTOR + …

WITH YULIY SANNIKOV

Chicago, June 3rd, 2010

Motivation

- Financial crises occur periodically, Kindleberger (1993)
  - Spirals and adverse feedback loops
  - Spillovers
    - Across financial institutions
    - To real economy
  - Deflationary pressure, Fisher (1933)
- Current macro approach
  - Many DSGE models use representative agents, ignore **financing frictions** and **spillover effects**
  - Models with a financial sector (e.g. Bernanke-Gertler-Gilchrist) log-linearize near steady state, miss instability below steady state (due to **non-linear dynamics**)
  - Monetary effects are often due to price stickiness
  - Price stability vs. financial stability analyzed in different frameworks

Main messages

- Macro-framework with financial sector at the center
- Paper today:
  - Non-linear amplification effects due to volatility dynamics and precautionary motive
  - Asset price correlation in times of crisis
  - Spillover effects
- Money paper:
  - Endogenous role of money
  - Interaction between outside money and inside money
  - Deflationary spirals during financial crisis

Heterogeneous agents + some literature

- Productive
  - BGG
  - Kiyotaki-Moore
  - He-Krishnamurthy
  - Moll
- Less patient
- Less risk averse
  - Garleanu-Pedersen
- More optimistic
  - Geanakoplos

Limited direct lending due to frictions

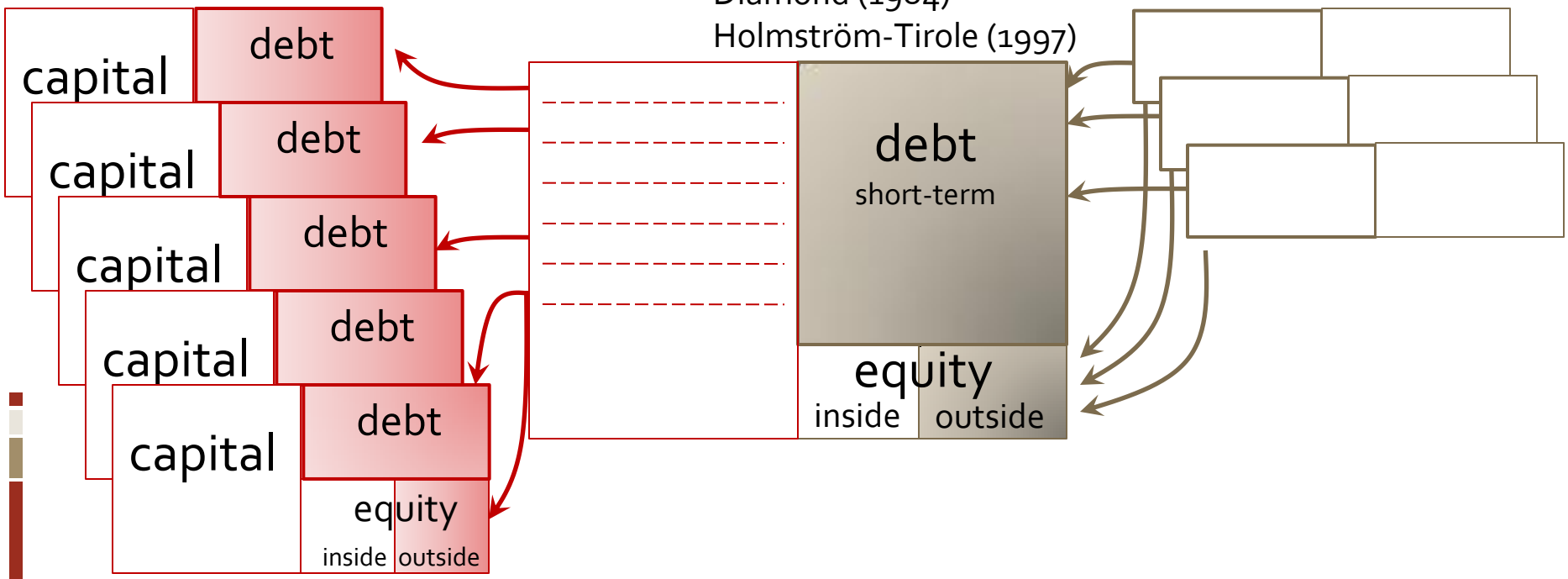
- Less productive
- More patient
- More risk averse
- More pessimistic

Model outline

- Productive
- Intermediary
  - Monitoring

    Diamond (1984)

    Holmström-Tirole (1997)
- Less productive



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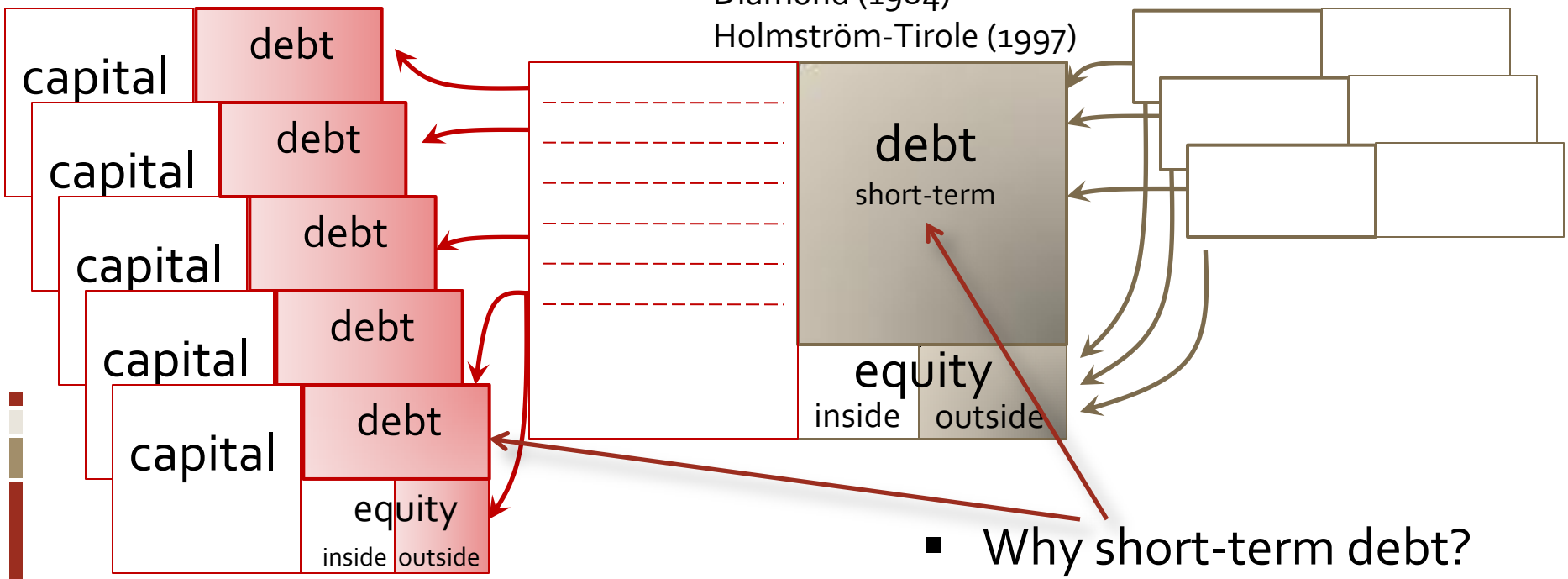
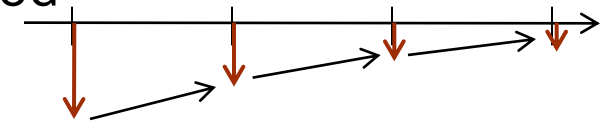


- Why short-term debt?
  - Less info-sensitive
  - Maturity rat race

    Brunnermeier-Oehmke

Some Literature … on amplification

- Bernanke-Gertler (1989)
  - Overlapping generations model, but with persistence
  - Bad shocks erode net worth of young entrepreneurs, who cut back on investments, leading to low productivity and low net worth of entrepreneurs in the next period



- Kiyotaki-Moore (1997), BGG (1999)
  - Infinitely-lived agents
  - KM: Leverage bounded by margins-KM; BGG: bankruptcy costs
  - Stronger amplification effects through prices (low net worth reduces leveraged institutions' demand for assets, lowering prices and further depressing net worth)
- Brunnermeier-Pedersen (2009)
  - Volatility effect due to higher margins/haircuts

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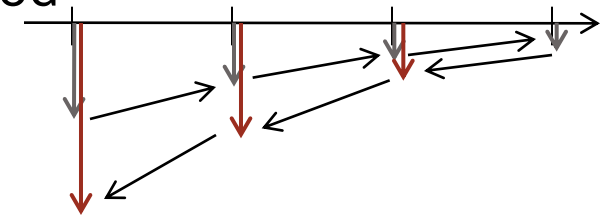

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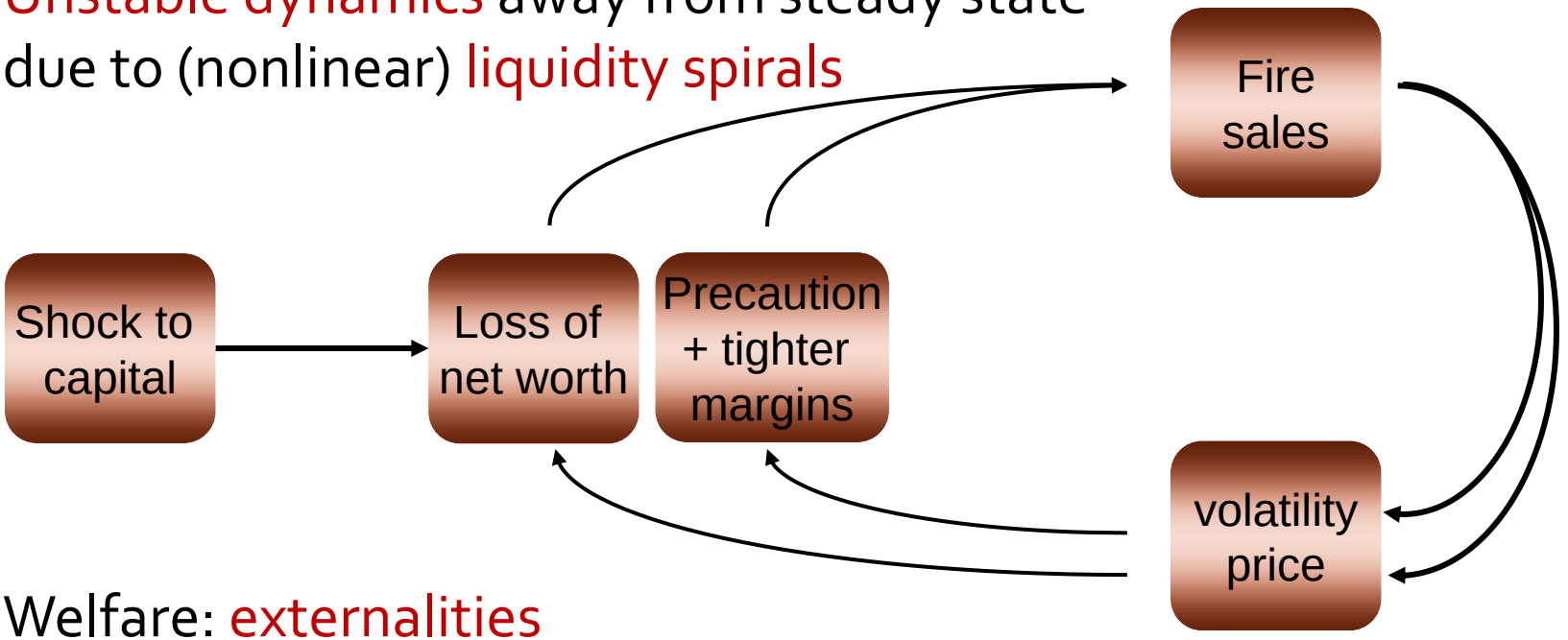
Preview of amplification & externalities

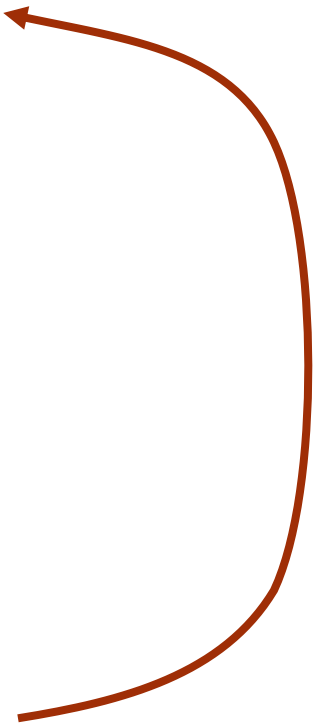
1. Unstable dynamics away from steady state due to (nonlinear) liquidity spirals



2. Welfare: externalities
   - within financial sector: When levering up, institutions ignore that their fire-sales depress prices for others --- inefficient pecuniary externality
   - to real economy
3. Asset prices become more correlated in crisis
3. Securitization can lead to excessive leverage

Preview of the "money paper"

- As intermediaries' net worth declines
- Intermediation + *inside money* shrinks
  - Economic activity declines
- Value of *outside money* rises - deflation
- Intermediaries are doubly hit
  - Asset side: asset values decrease
  - Liability side: real debt value increases
- Deflationary spiral

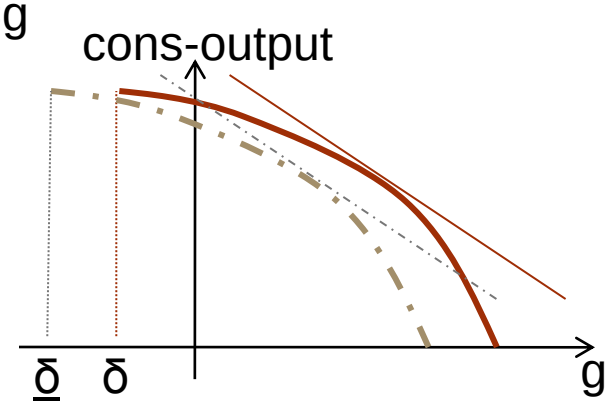


Roadmap

- Motivation and Preview
- Non-linear amplification
  - volatility dynamics + precautionary hoarding
- Money effect: deflationary spiral
- Externalities
  - Competitive = social planners' solution in baseline model
  - Within financial sector (Mod. 1: *speculative HH*)
  - Towards real economy (Mod. 2: *labor sector*)
- Asset pricing implication (Mod. 3: *idio-shocks*)
- Defaultable debt and securitization (Mod.4: *idio-jumps*)

Model details

- Preferences
  - Risk neutral but consumption ≥ 0 for all agents
  - Discount rate: r for households, ρ ≥ r for experts
- Output $y_t = a\, k_t$ (easily manipulated)
- Capital $dk_t = \underbrace{(\Phi(i_t/k_t) - \delta)}_{=g} k_t\, dt + \sigma\, k_t\, dZ_t$ ← Brownian macro shock (exogenous risk)



- Investment
  - Internal: i_t positive or negative (partial reversibility= technological liquidity)
  - External: purchase or sell capital k_t at price p_t
- Endogenous price process for capital

$$dp_t/p_t = \mu_t^p\, dt + \sigma_t^p\, dZ_t$$

Fire-sale price – w/o speculation

- Less productive households
  - face depreciation of $\underline{\delta} > \delta$ and
  - cannot speculate (added later)
- liquidation value:
  - $p_t \geq \underline{p}$

$$\underline{p} = \max_i \frac{a - i^*}{r - (\phi(i^*) - \underline{\delta})}$$

$:=\underline{g}(\underline{p})$

Capital structures

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- Intermediary
  - Monitoring

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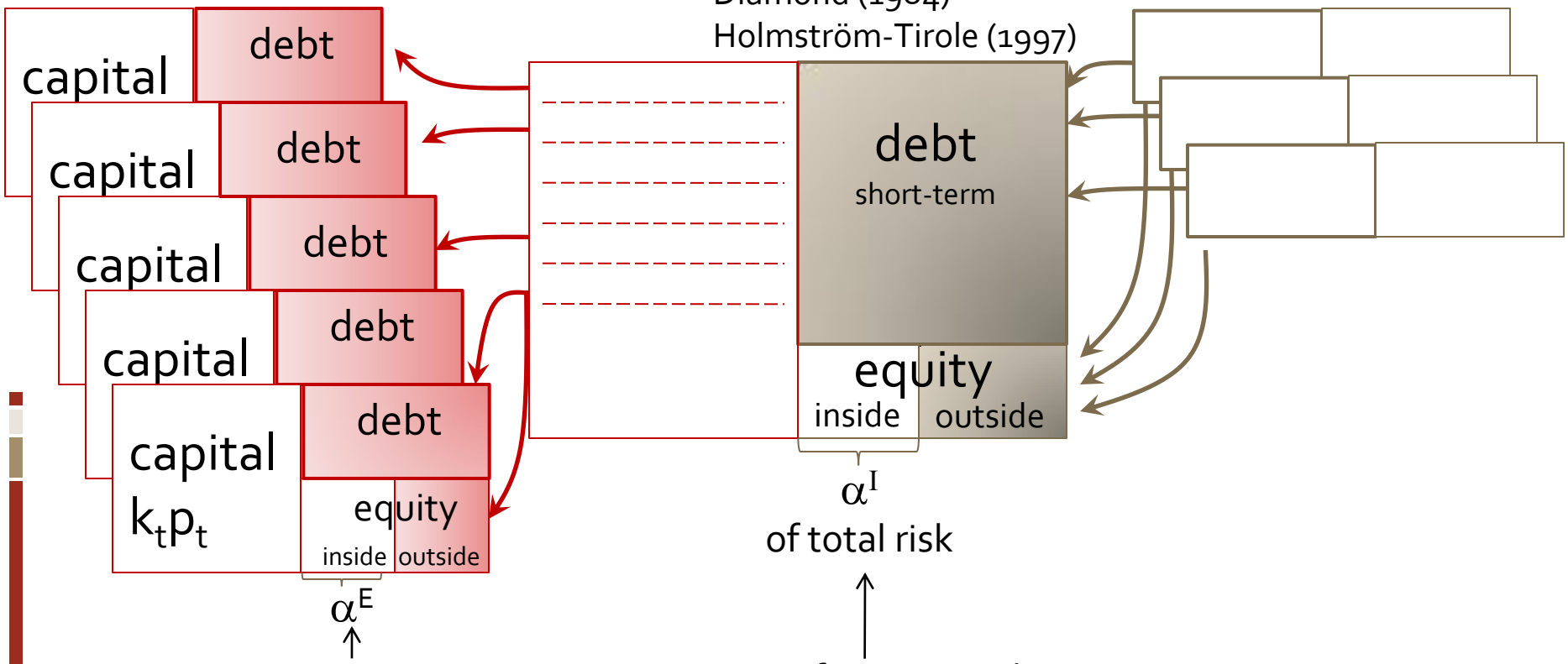
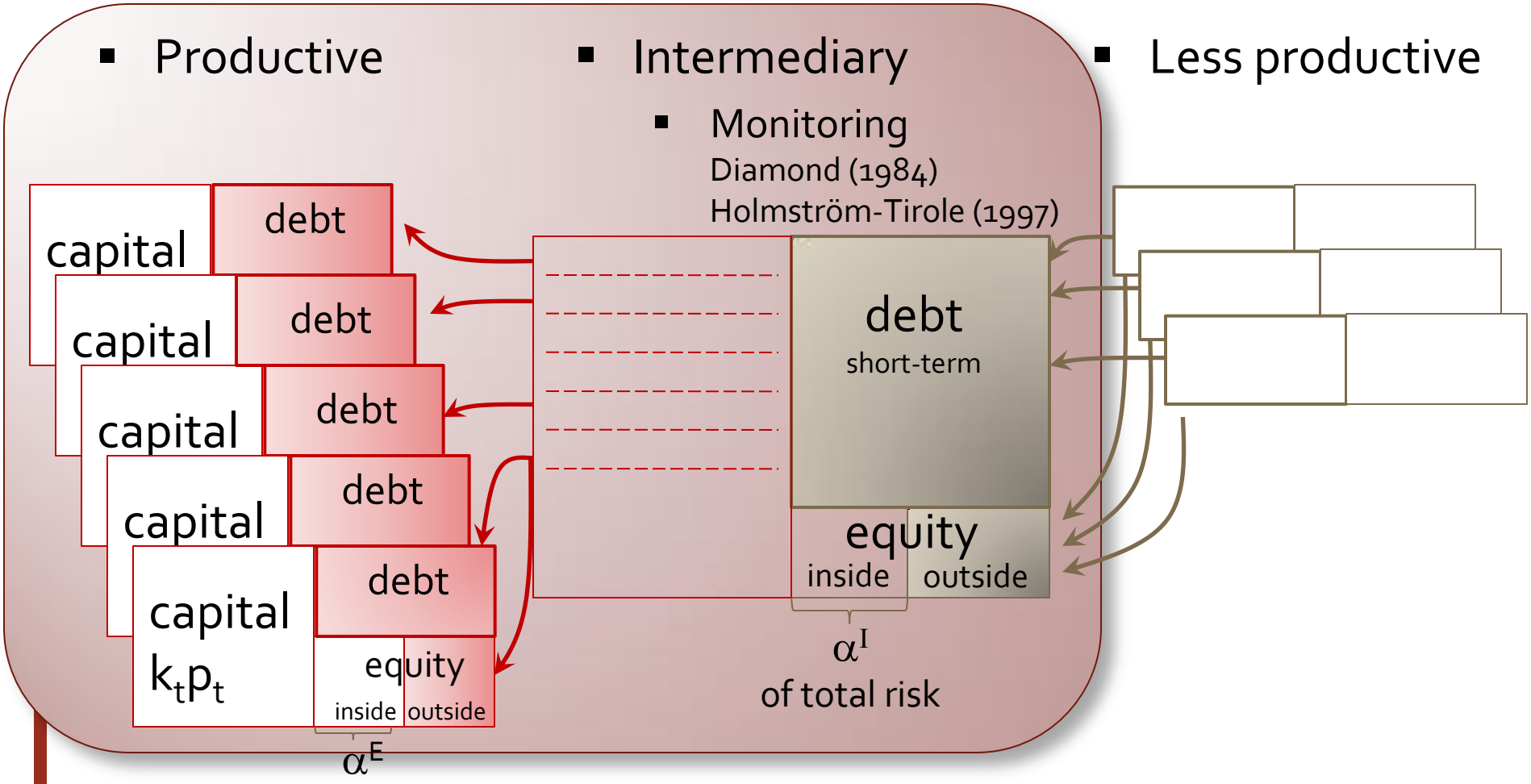


Microfoundation of capital structures

- *Assumption:* value of assets $p_t k_t^i$ is contractable, k_t^i not
- Agency problem of entrepreneur
  - Can take projects w/NPV<0, private benefit b(*m*)<1 per \$1 destroyed
  - *m* is amount of monitoring by intermediary
  - Incentive constraint: $\alpha^E \geq b(m)$, binds in equ. $\Rightarrow \alpha^E(m)$
- Agency problem of intermediary
  - Save monitoring cost c(*m*) per \$1 if shirking
  - Incentive constraint: $\alpha^I \geq c(m)$
- Solvency constraint: $n_t \geq 0$ (implied by IC constraints)
- Assume c(*m*) + b(*m*) is a constant for all *m*
  entrepreneurs' & intermediaries' net worth are substitutes
  - Special case: if entrepreneurs' net worth =0, then *m* s.t. b(*m*)=0

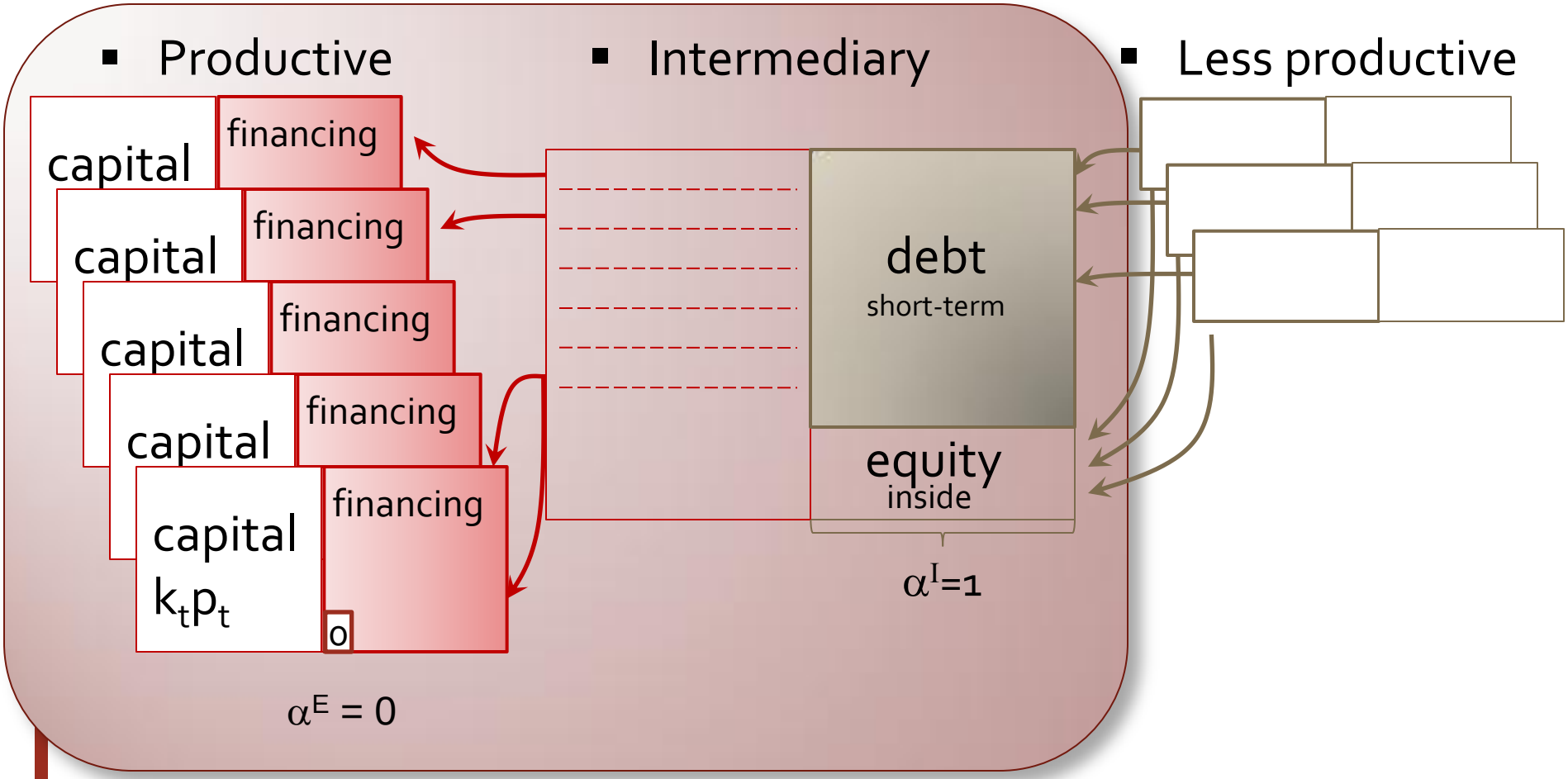
Merging productive HH & Intermediaries



$$\alpha := \alpha^E + \alpha^I \geq b(m) + c(m)$$

"merged experts"

Merging productive HH & Intermediaries



- Productive entrepreneurs have no capital, $\alpha^E = 0$

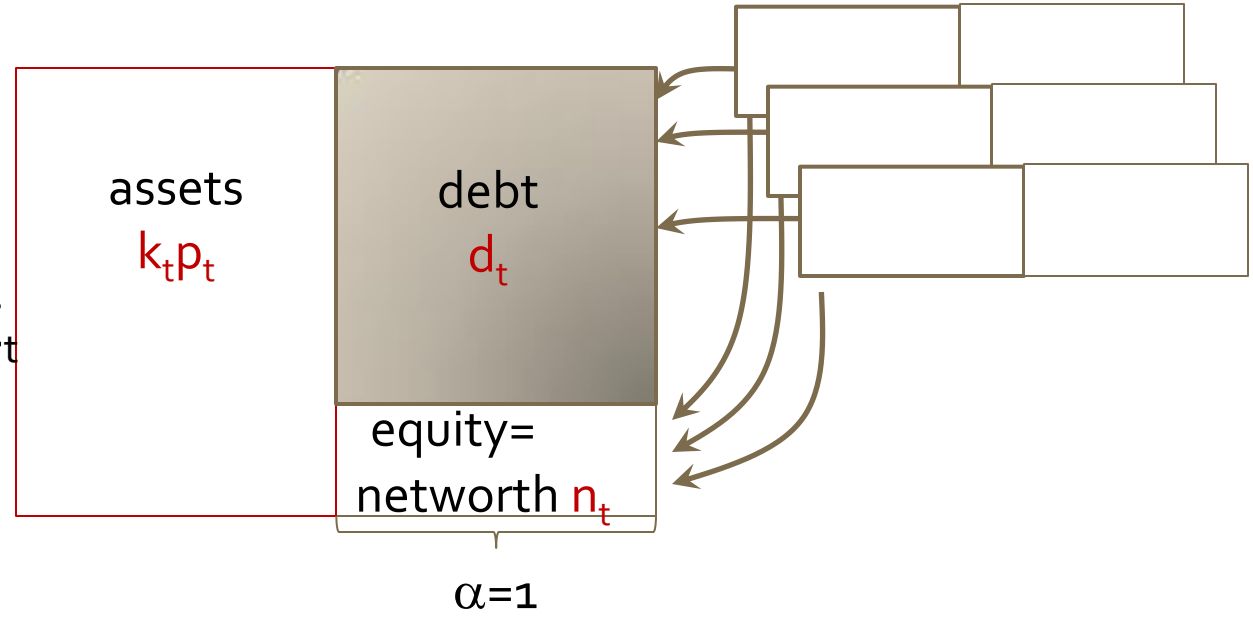
  Perfect monitoring required, b(m)=0
- Intermediary can't issue outside equity, $\alpha^I = 1$ (appropriate choice of b(m), c(m))

Balance sheet dynamics

- Productive
- Intermediary
- Less productive

$$dk_t/k_t=(\Phi(i_t/k_t)-\delta)dt+\sigma dZ_t$$

$$dp_t/p_t=\mu_t^p\,dt+\sigma_t^p\,dZ_t$$



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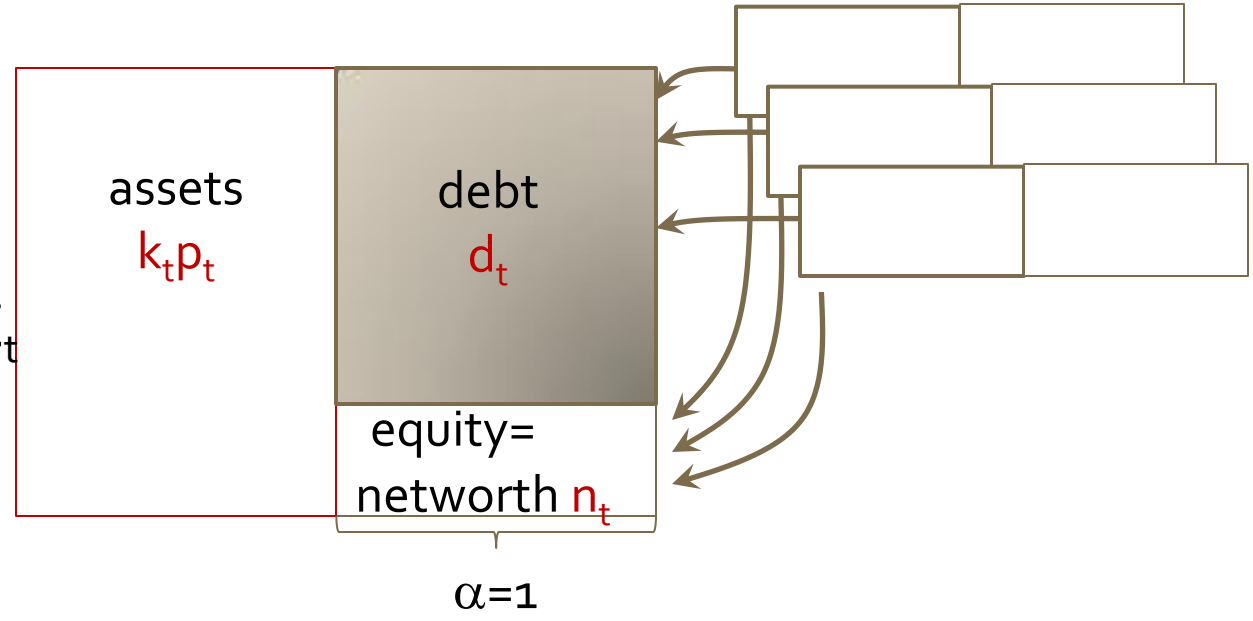

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Product rule of Ito's Lemma:

$$d(X_t Y_t) = dX_t\, Y_t + X_t\, dY_t + \sigma_X\, \sigma_Y\, dt$$

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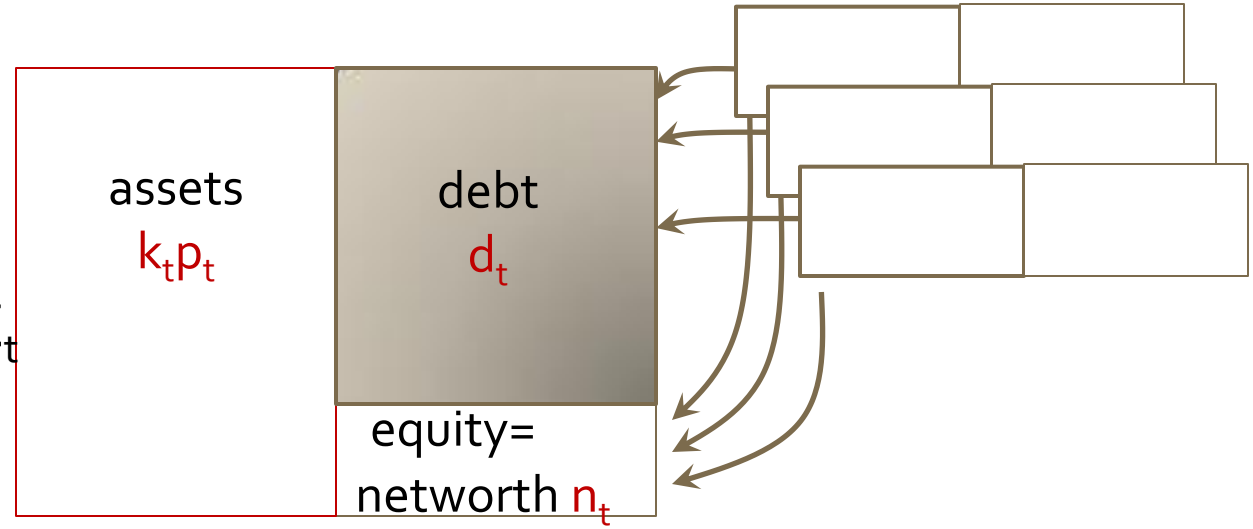

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$$dp_t/p_t= \mu_t^p\, dt+\sigma_t^p\, dZ_t$$

$$d(k_t p_t) = (\Phi(i_t/k_t) - \delta + \mu_t^p + \sigma\sigma_t^p)\,(k_t p_t)dt + (\sigma + \sigma_t^p)\,(k_t p_t)dZ_t$$

exogenous endogenous risk

$$dd_t = (r\, d_t - a\, k_t + i_t)\, dt + dc_t$$

$$dn_t = d(k_t p_t) - dd_t =$$

$$dn_t = rn_t dt + ak_t dt - i_t dt - k_t p_t\,[(\Phi(i_t/k_t) - \delta + \mu_t^p + \sigma\sigma_t^p)\, dt + (\sigma + \sigma_t^p)\, dZ_t] - dc_t$$

Equilibrium

- Aggregate variables N_t, K_t
- State variable $\eta_t = N_t/K_t$

1. Internal investment
   - Entrepreneur takes price p_t as given

$$\max_{i_t} p_t k_t (\Phi(i_t/k_t) - \delta) - i_t$$

FOC: $p_t \Phi'(i_t/k_t) - 1 = 0$ (Tobin's q)

$\Rightarrow \iota(p_t) = i_t/k_t$, rate of investment per unit of capital

   - $g(p_t) := \Phi(i_t/k_t) - \delta$ = (optimized) growth rate of capital
   - Note : $g(p_t) = -\infty$ for $p_t < (a - i^*)/(r - \underline{g})$: capital is sold to unproductive HH

2. External investment — k_t
   - Given price process — $dp_t/p_t = \mu_t^p dt + \sigma_t^p dZ_t$
   - Solvency constraint — $n_t \geq 0$
3. When to consume? — dc_t
4. Market clearing: — Total demand = K_t

dynamic optimization + market clearing

Intuition – main forces at work

- Investment:
  - *Scale up*
    - Scalable profitable investment opportunity
    - Higher leverage (borrow at r)
  - *Scale back*
    - Precaution: - don't exploit full (GE) debt capacity – "dry powder"
      - Ultimately, stay away from fire-sales at $\underline{p}_t$
      - Debt can't be rolled over if $d > k_t \underline{p}_t$ (note, price is depressed)
    - Ways to scale back:
      - Internal disinvestment, limited by $\Phi(.)$
      - External disinvestment, sale of assets (price impact *f*(others' leverage))
- Consumption
  - Consume *early* and borrow $r < \rho$
  - Consume *late* to overcome investment frictions

External investment & consumption

- Price $p(\eta_t)$
- Intermediary's value function $f(\eta_t)n_t$

linear in n_t

$$dn_t = rn_t dt + ak_t dt - i_t dt - k_t p_t [(\Phi(i_t/k_t) - \delta - \mu_t^p + \sigma\sigma_t^p) dt + (\sigma + \sigma_t^p) dZ_t] - dc_t$$

- solve for equilibrium $p(\eta_t)$ and $f(\eta_t)$

- Bellman equation

=0 if $f(\eta_t)>1$

$$\rho f(\eta_t)n_t = \max_k E[dc + d(f(\eta_t)n_t)] = \ldots$$

  - Optimal "external investment/trading strategy" k_t (as a function of η_t and n_t)

Solving …

- Bellman equation: $\rho f(\eta_t) n_t \, dt = \max_k E[d(f(\eta_t) n_t)]$ (when $f(\eta)>1$)

  $E[d(f(\eta_t) n_t)] = \mu_t^f n_t \, dt + f'(\eta_t) \, \sigma_t^\eta \, k_t p_t \, (\sigma + \sigma_t^p) \, dt +$
  $f(\eta_t) \, (r \, n_t + (a - \iota(p_t)) \, k_t + k_t p_t \, (g(p_t) - r + \mu_t^p + \sigma\sigma_t^p))$

  - FOC: $(a-\iota(p_t))/p_t + g + \mu_t^p + \sigma\sigma_t^p - r = - f'(\eta_t)/f(\eta_t) \, \sigma_t^\eta \, (\sigma+\sigma_t^p)$

    expected excess return on capital

    risk premium from precautionary motive

  - Using FOC, Bellman equation simplifies to
    - $(\rho - r) \, f(\eta_t) = \mu_t^f$
- Derive μ_t^p, μ_t^f, σ_t^η, σ_t^p in terms of p', p'', f', f'' to obtain ODE for $p(\eta)$ and $f(\eta)$

Solving …

1. $$\frac{a-\iota(p_t)}{p_t}+g(p_t)+\mu_t+\sigma\sigma_t^p-r=-\frac{f'(\eta_t)}{f(\eta_t)}\sigma_t^\eta(\sigma+\sigma_t^p)$$

where

$$\mu_t^p=\frac{p'(\eta_t)[(r-g(p_t)+\sigma^2)(\eta_t-p_t)+a-\iota(p_t)]+\frac{1}{2}(\sigma_t^\eta)^2p''(\eta_t)}{p_t(1-p'(\eta_t))} \quad \Rightarrow$$

$$\sigma_t^p=\frac{p'(\eta_t)\sigma(p_t-\eta_t)}{p_t(1-p'(\eta_t))}$$

$$\sigma_t^\eta=\frac{\sigma(p_t-\eta_t)}{1-p'(\eta_t)}$$

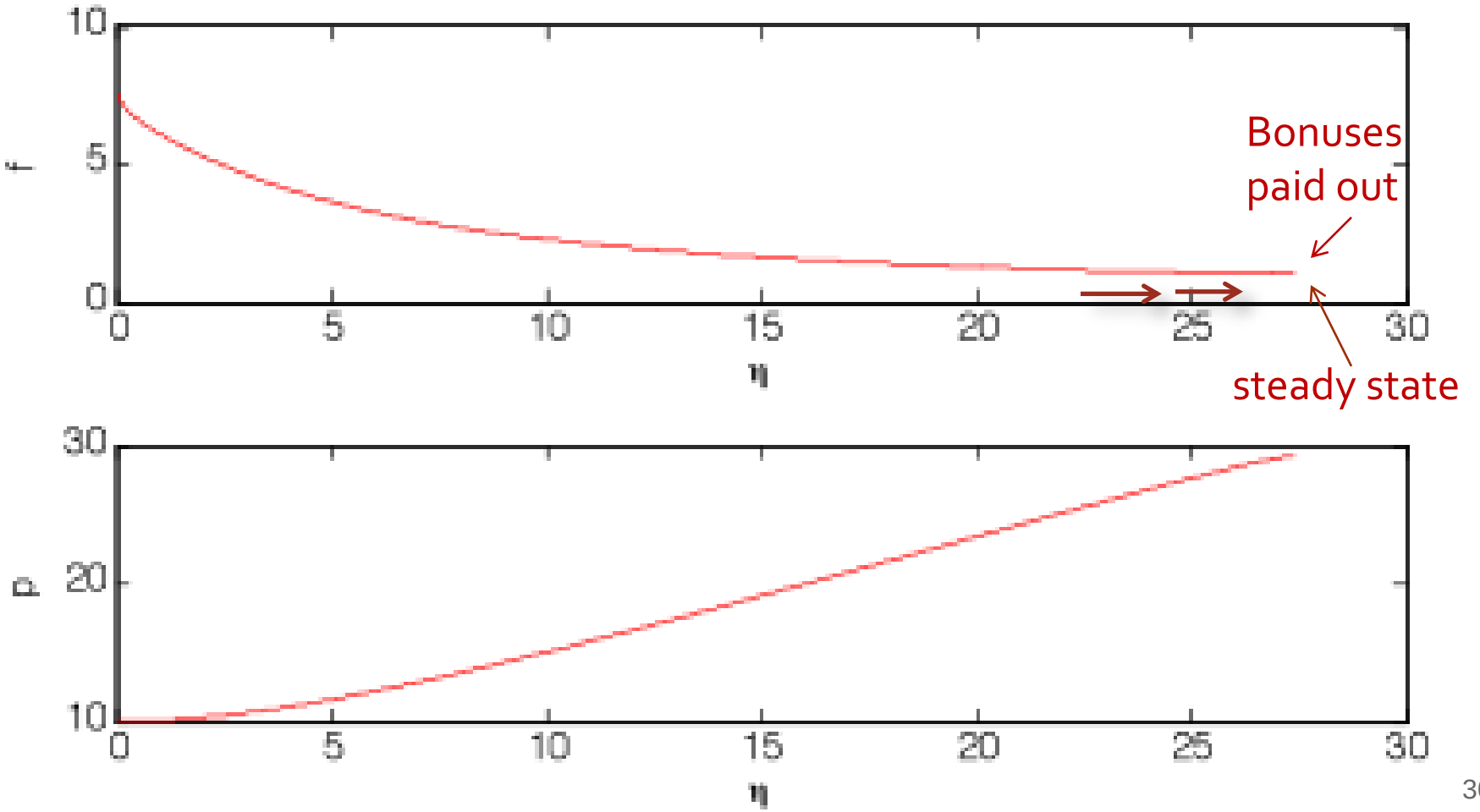
2. $$(\rho-r)f(\eta)=f'(\eta)((r-g(p_t)+\sigma^2)(\eta-p_t)+a-\iota(p_t)+p_t\mu_t^p)+\frac{1}{2}(\sigma_t^\eta)^2f''(\eta_t)$$

from $(\rho-r)\,f(\eta)=\mu_t^f$

- 4 boundary conditions: $p(0)=\underline{p}$, $p'(\eta^*)=0$, $f(\eta^*)=1$, $f'(\eta^*)=0$
- Solve for $p(\eta)$, $p'(\eta)$, $p''(\eta)$, $f(\eta)$, $f'(\eta)$, $f''(\eta)$

Equilibrium

- Boundary conditions: $p(0) = \underline{p}$, $p'(\eta^*) = 0$, $f(\eta^*) = 1$, $f'(\eta^*) = 0$



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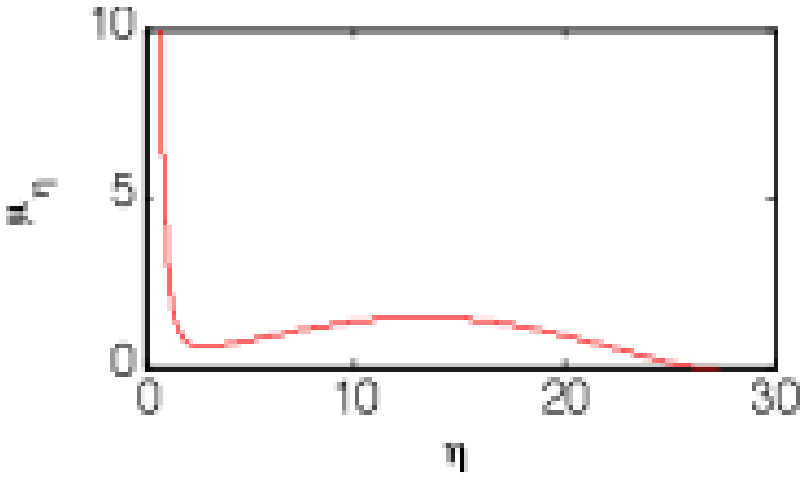
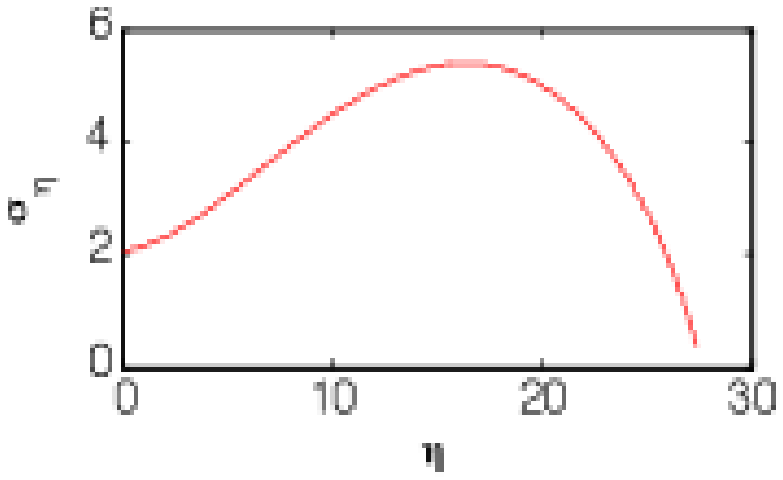
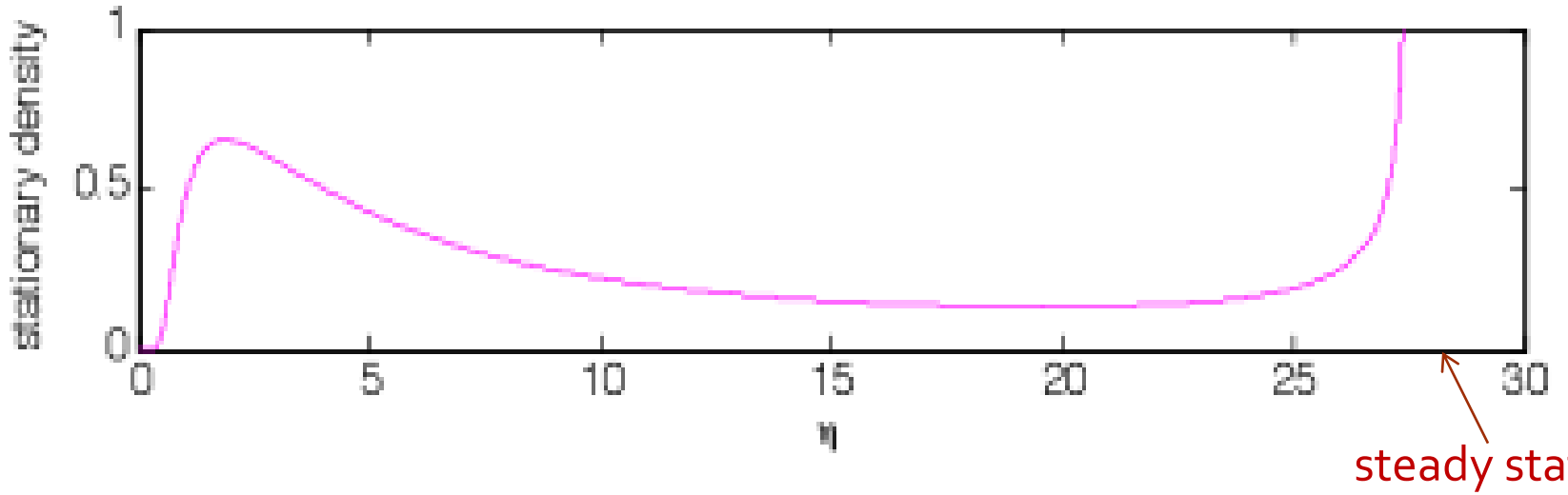




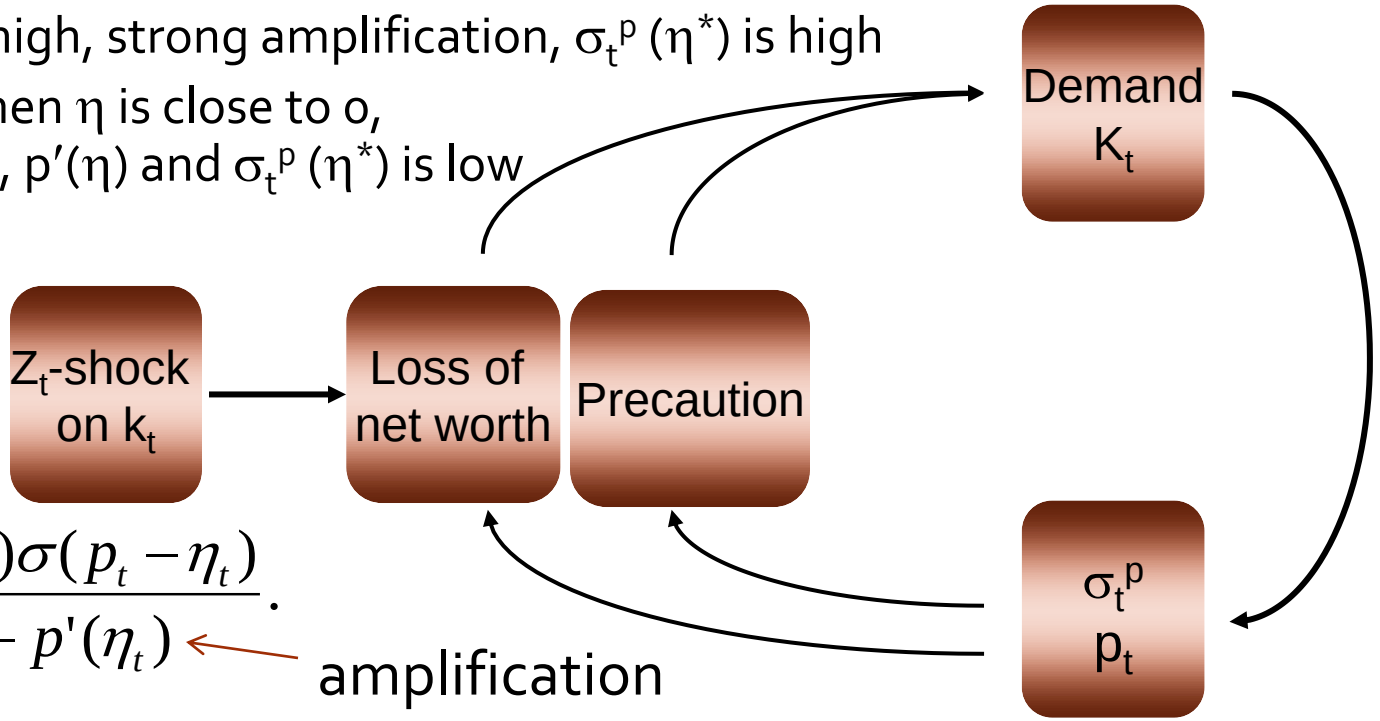


Dynamics near and away from steady-state

- **Steady state:** experts unconstrained

Note difference to BGG/KM

  - Bad shock leads to lower payout rather than lower capital demand
  - $p'(\eta^*) = 0$, $\sigma_t^p(\eta^*) = 0$
- **Below steady state:** experts constrained
  - Negative shock leads to lower demand
  - $p'(\eta^*)$ is high, strong amplification, $\sigma_t^p(\eta^*)$ is high
  - … but when η is close to 0, $p \approx \underline{p}(\eta_t)$, $p'(\eta)$ and $\sigma_t^p(\eta^*)$ is low



$$\sigma_t^p = \frac{p'(\eta_t)\sigma(p_t - \eta_t)}{1 - p'(\eta_t)}.$$

amplification

Roadmap

- Motivation
- Non-linear amplification
  - volatility dynamics + precautionary hoarding
- Money effect: deflationary spiral
- Externalities
  - Competitive = social planners' solution in baseline model
  - Within financial sector (Mod. 1: *speculative HH*)
  - Towards real economy (Mod. 2: *labor sector*)
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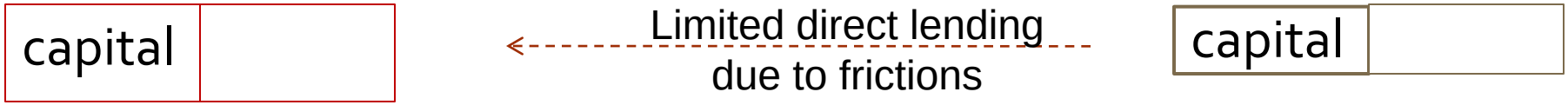
Money

- More productive
- Less productive



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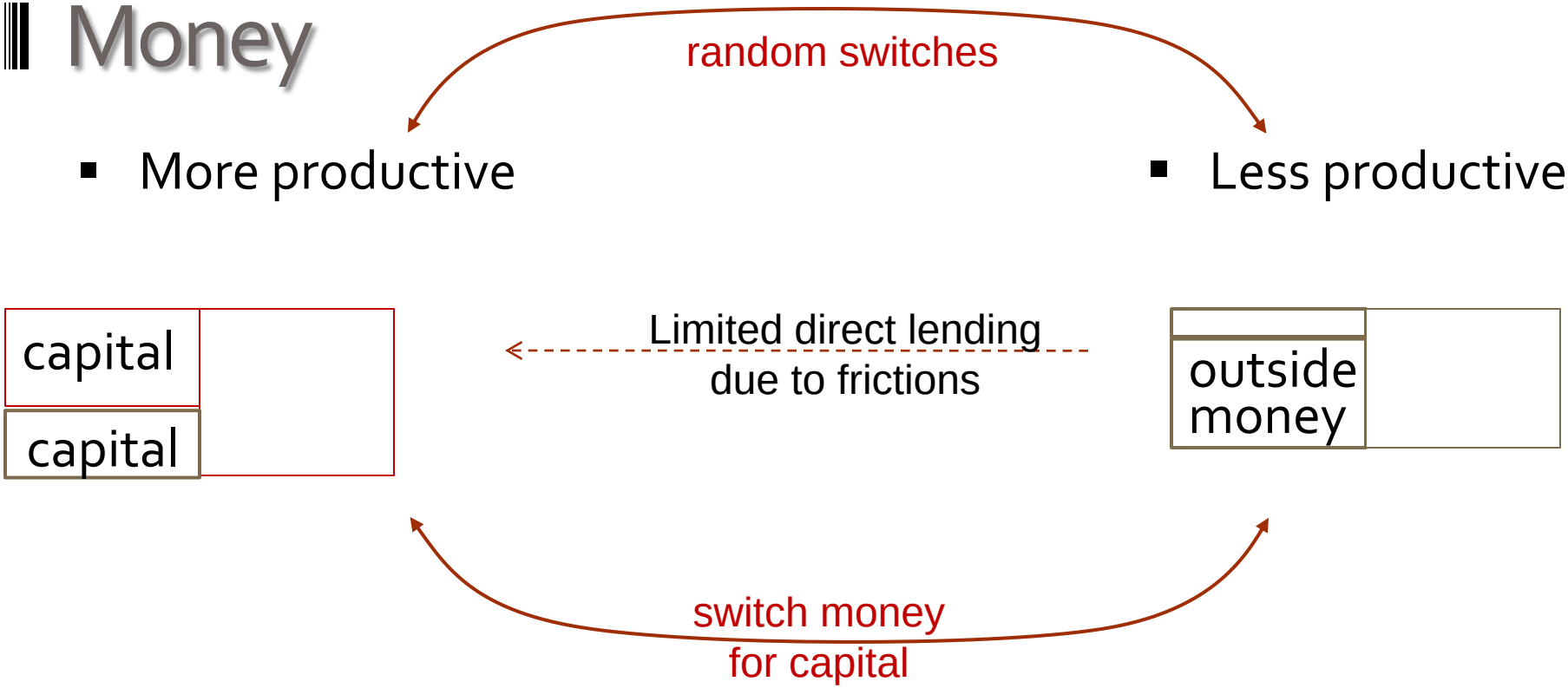


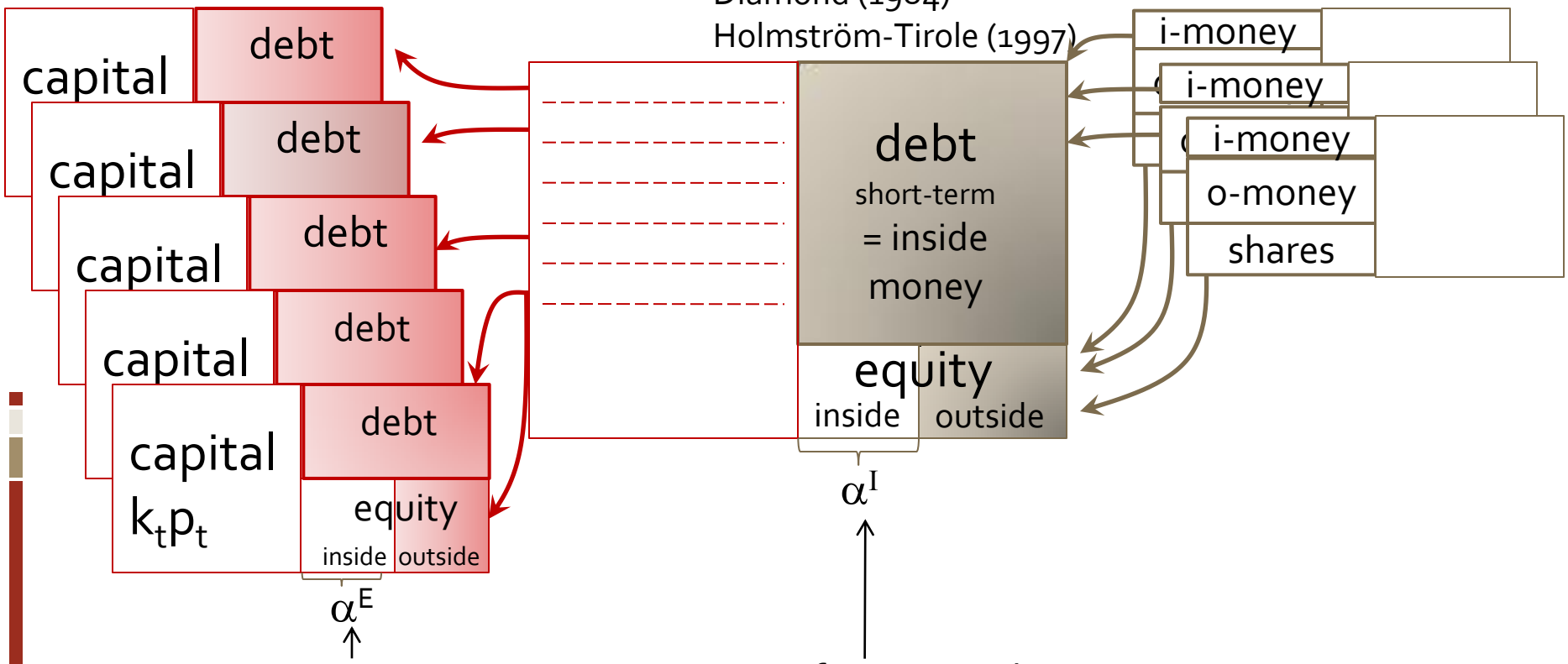
- More capital is in "productive hands"
- Notice difference to Bewley economy
  - Productivity shocks vs. endowment shocks
  - Capital is not dominating money

Intermediation + inside money

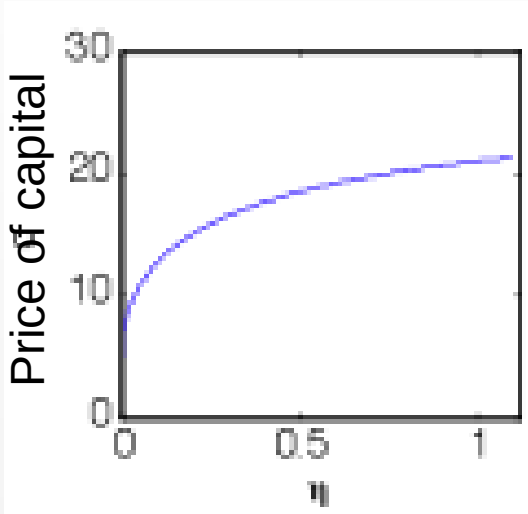
- Productive
- Intermediary
  - Monitoring

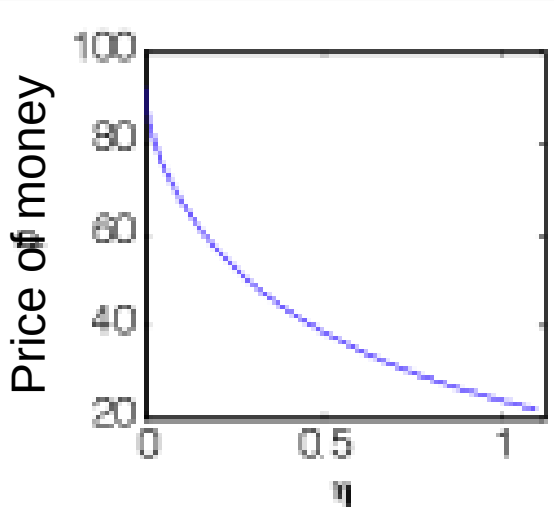
Diamond (1984)
Holmström-Tirole (1997)

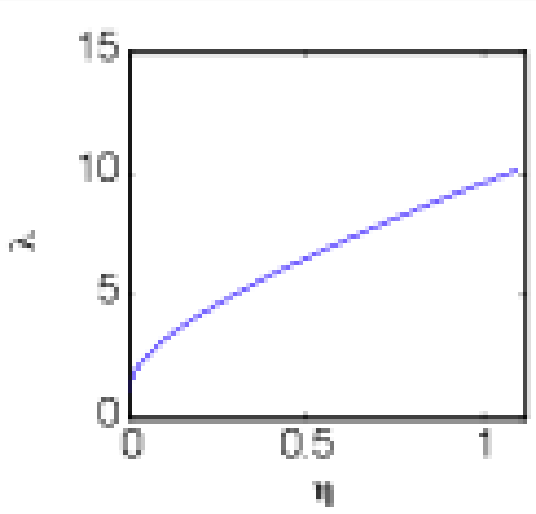
- Less productive

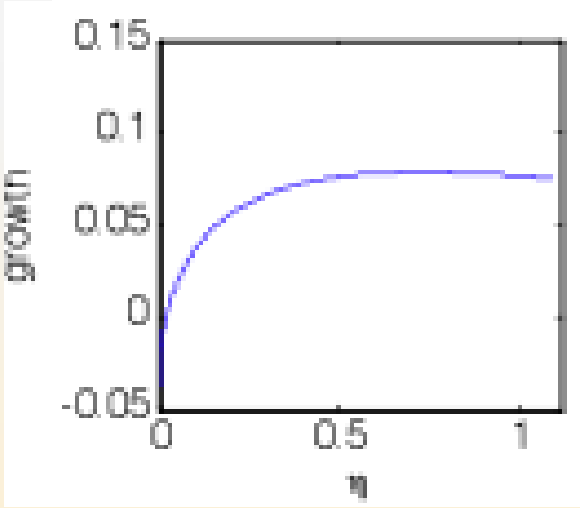


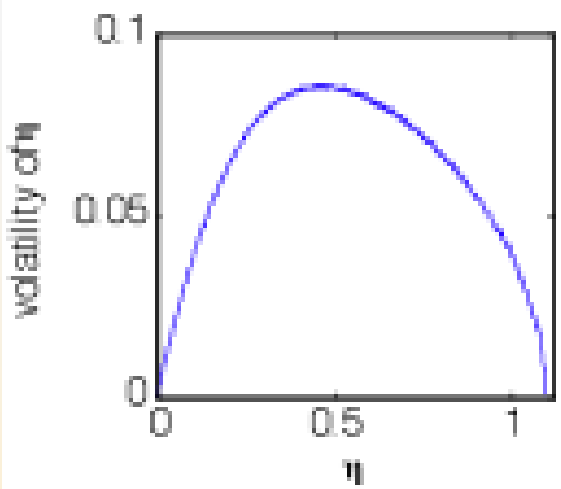
Extra: Money model (with two types)

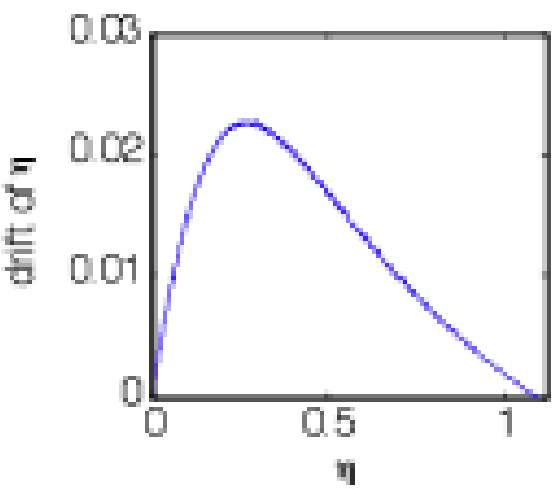












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Externalities

… so far there are no externalities

Proposition. The competitive equilibrium in this economy is equivalent to the optimal policy by a monopolist expert.

Sketch of proof. (1) Write Bellman equation for monopolist. (2) Define price $p_t = 1/\Phi'(i_t/k_t)$. (3) Show that prices etc. are as in competitive eq.

Intuition: In competitive equilibrium experts do affect prices by their choices (payout and investment), but they are isolated from prices because they don't trade given equilibrium prices.

Modification 1: speculative households

- So far fixed liquidation value at $\underline{p} = a/(r + \underline{g})$… now households can **sell back** to experts

c-earnings

$$p_t \geq \frac{a - \underline{i}^*}{\left(r - \underline{g}(\underline{p})\right) - \mu_t^p - \sigma\sigma_t^p}$$

quality when experts hold fraction $\psi_t < 1$ of assets

capital gains/losses, $E[d(k_t p_t)]$

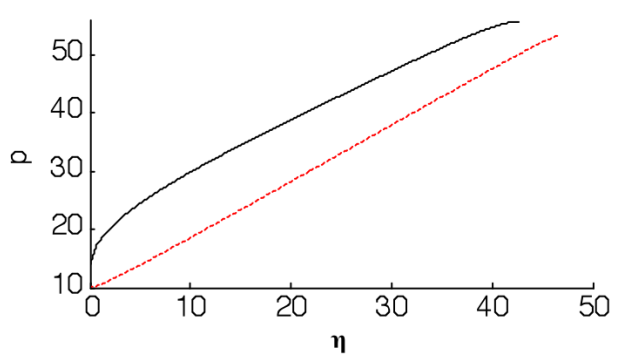
  - Break even for HH
  - depreciation rate is $\underline{\delta} > \delta$
  - $p_t \geq \underline{p}(\eta)$

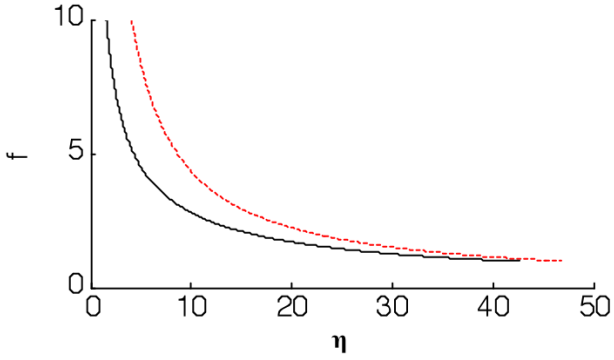
- In equilibrium households pick up assets when financial sector suffers losses, i.e. η_t becomes small
- Introduce: "Some" households with limited capital, s.t. f>1
- Fire sale externalities (within financial sector) – when levering up, experts hurt prices that other experts can sell to households in the event of a crisis

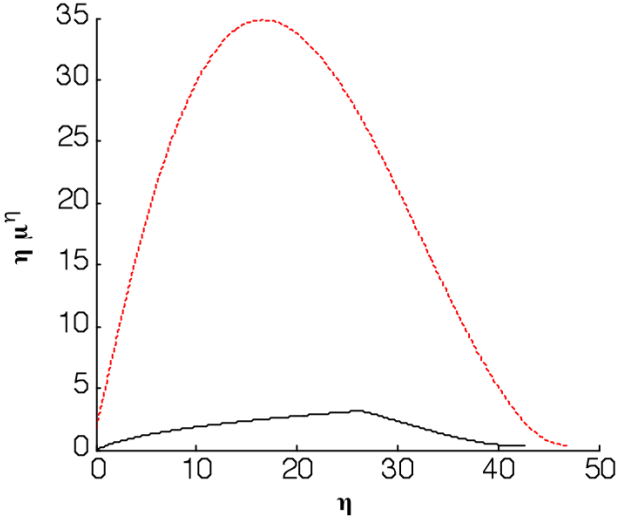
Speculative vs. non-spec households

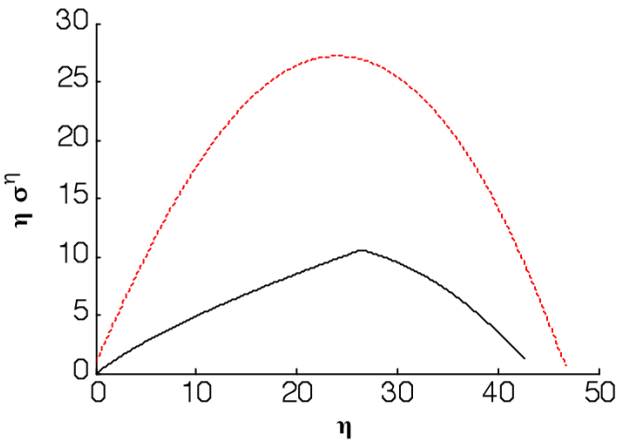
- a –i=1, ρ=.06, r=.05,
- g=.04, $\underline{\delta}$=.05, σ=.1

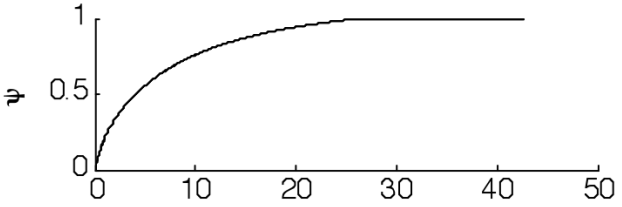
- η* = 42.6 vs. 46.8
- p(η*) = 55.7 vs. 53.2

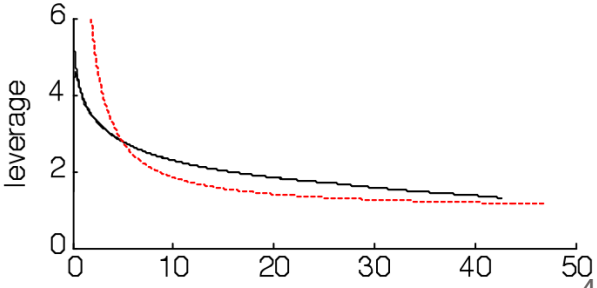




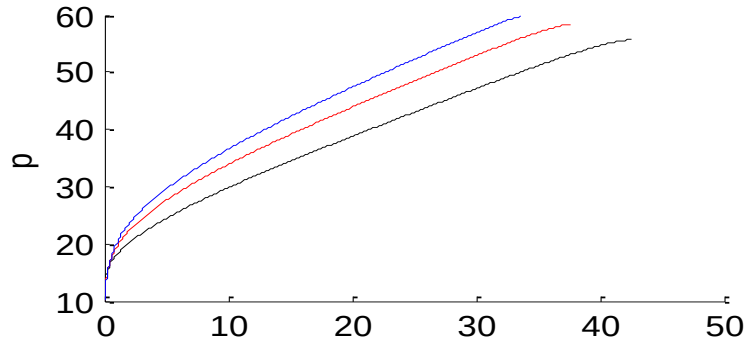


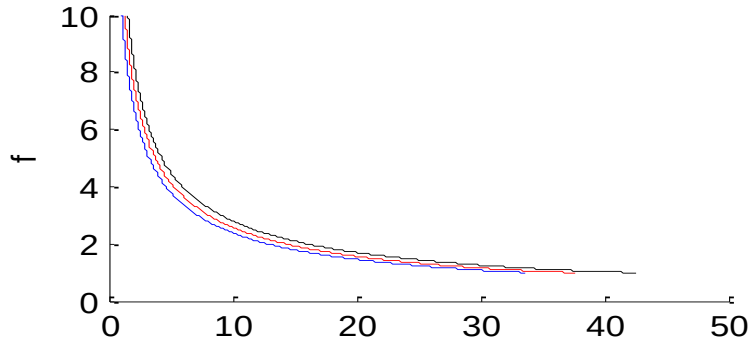


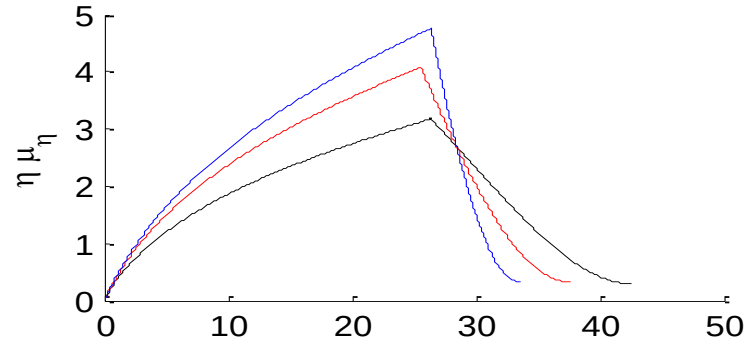


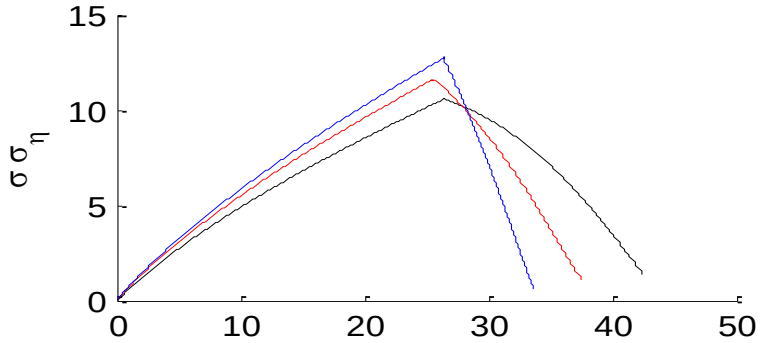


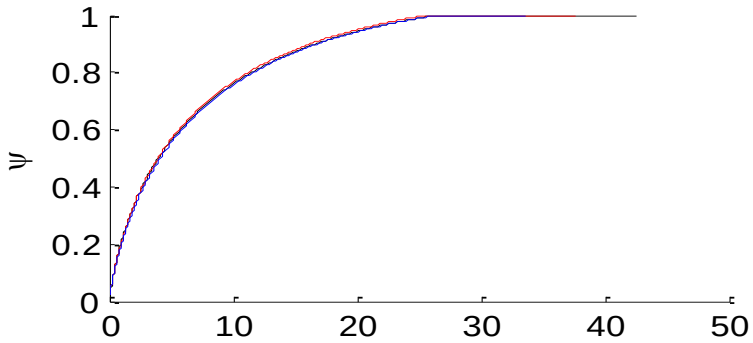
Comparative Static on σ (.025, .05, .1)

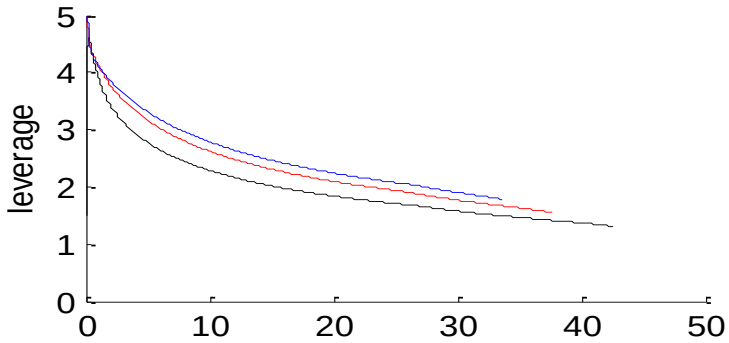








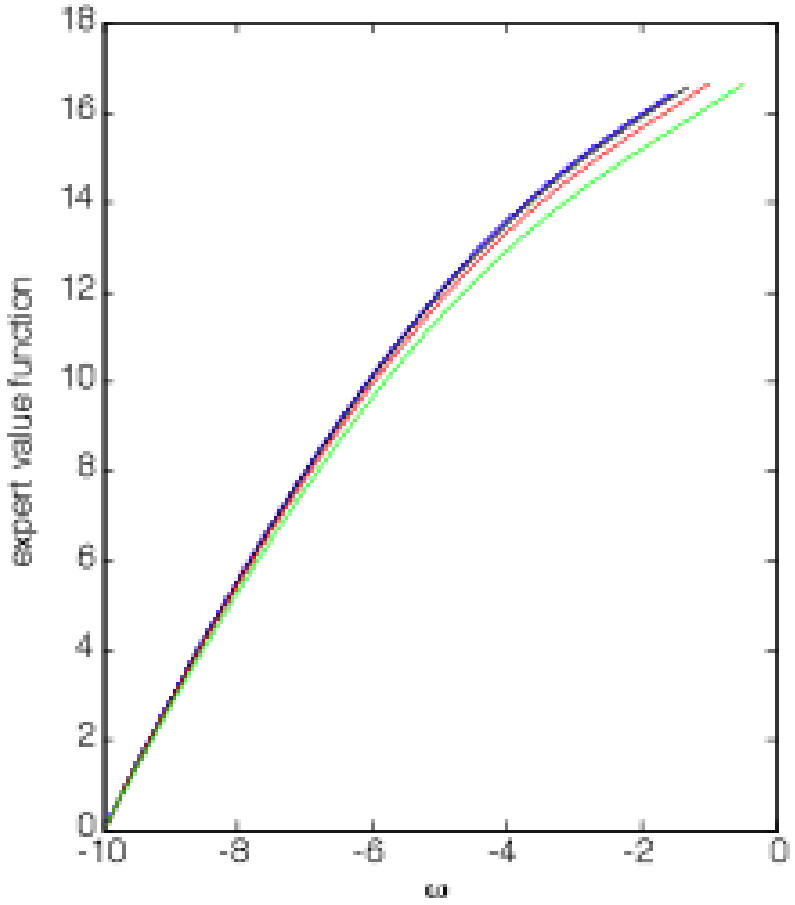


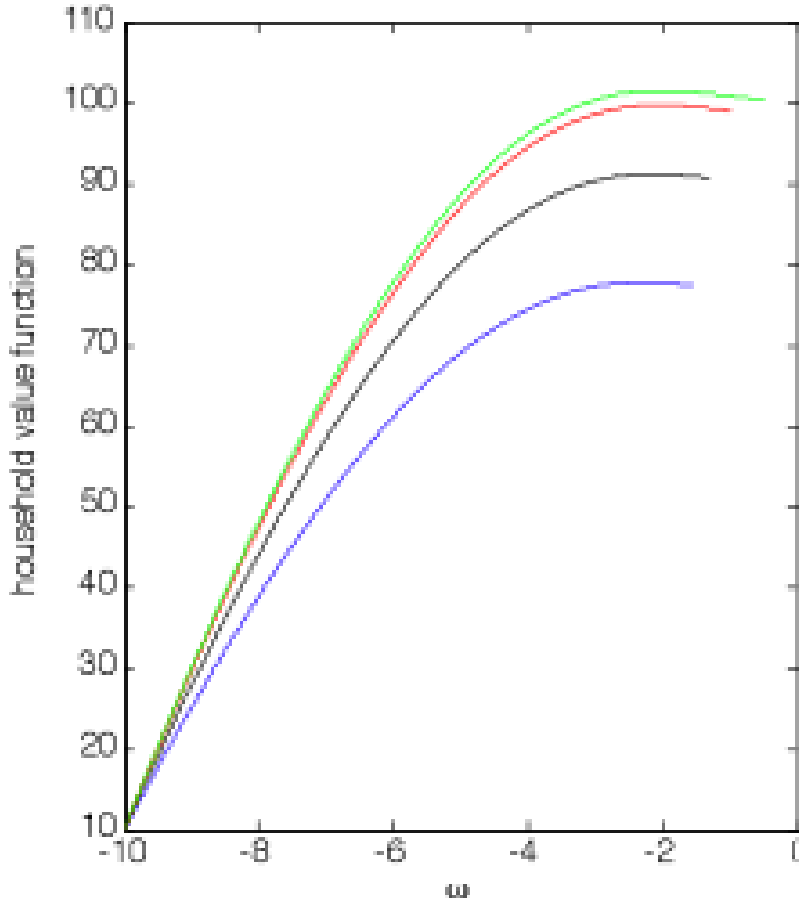


Modification 2: add labor sector

- Fixed labor supply L
- Production Function: $(a' K_t^{\gamma}) k_t^{1-\gamma} l_t^{\gamma}$
- Intermediary i's payoff: $\underbrace{(1-\gamma) a' L^{\gamma}}_{a} k_t$
- Workers' wage w_t: $\gamma a' K_t L^{\gamma-1}$
- Intermediaries' choice of leverage determines K_t
  - Investment decisions
  - (Bonus) payout policy
- Workers' welfare (value function) depends on K_t

Externalities with workers





Roadmap

- Motivation
- Non-linear amplification
  - volatility dynamics + precautionary hoarding
- Money effect: deflationary spiral
- Externalities
  - Competitive = social planners' solution in baseline model
  - Within financial sector (Mod. 1: *speculative HH*)
  - Towards real economy (Mod. 2: *labor sector*)
- Asset pricing implication (Mod. 3: *idio-shocks*)
- Defaultable debt and securitization (Mod.4: *idio-jumps*)

Stochastic Discount Factor

- Capital goods market
  - Intermediaries' SDF: $m_{o,t} = \underbrace{e^{-\rho t}}_{\text{time preference}} \underbrace{f(\eta_t)/f(\eta_o)}_{\text{agency constraint}}$
- Outside equity market
  - Households' SDF: $m_{o,t}^{HH} = e^{-rt}$
    - Note that $m_{o,t} \neq m_{o,t}^{HH}$, since $\underline{\delta} > \delta$
- Derivatives market
  - Volatility smirk of options
  - Index options vs. stock options

Modification 3: asset pricing (cross section)

- Correlation increases with σ^p
  - Extend model to many types j of capital

$$dk_t^j/k_t^j = (\Phi(i_t^j/k_t^j)-\delta)dt+\sigma dZ_t + \sigma' dz^j$$

aggregate shock — uncorrelated shock

  - Experts hold diversified portfolios
    - Equilibrium looks as before, but
    - Volatility of $p_t k_t$ is $\sigma + \sigma^p + \sigma'$
    - For uncorrelated z^j and z^l
      correlation $(p_t^j k_t^j, p_t^l k_t^l)$ is $(\sigma + \sigma^p)/(\sigma + \sigma^p + \sigma')$
      which is increasing in σ^p

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Modification 4: Idiosyncratic losses

$$dk_t^i = g\, k_t^i\, dt + \sigma\, k_t^i\, dZ_t + k_t^i\, dJ_t^i$$

J_t^i is an idiosyncratic compensated Poisson loss process, recovery distribution F and intensity $\lambda(\sigma_t^p)$

$v_t = k_t p_t$ drops below d_t, costly state verification by debt

Review: costly state verification

- Developed by Townsend (1979), used in Diamond (1984), Bernanke-Gertler-Gilchrist (1999)
- Time 0: principal provides funding I to agent
- Time 1: agent's profit $y \sim F[0, y^*]$ is his private information but principal can verify y at cost
- Optimal contract (with deterministic verification) is debt with face value d: agent reports y truthfully and pays d if $y \geq d$, triggers default and pays y if $y < d$
- In our context: intermediary can cause losses (reduce v_t for private benefit); debtholders verify if v_t falls below d_t

Modification 4: Idiosyncratic losses

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- Debtholders' loss rate

$$\lambda(\sigma^p) v \int_0^{\frac{d}{v}} \left(\frac{d}{v} - x\right) dF(x)$$

- Verification cost rate

$$\underbrace{\lambda(\sigma^p) v \int_0^{\frac{d}{v}} cx\, dF(x)}_{C\left(\frac{d}{v}\right)}$$

- Leverage bounded not only by precautionary motive, but also by the cost of borrowing

Asset	Liabilities
$v_t = k_t p_t$	$d_t = k_t p_t - n_t$
	n_t

Equilibrium

- Experts borrow at rate larger than r
- Rate depends on leverage, price volatility
- $d\eta_t$ = diffusion process (without jumps) because losses cancel out in aggregate

Securitization

- Experts can contract on shocks Z_t and J_t^i directly among each other, contracting costs are zero
- In principle, good thing (avoid verification costs)
- Equilibrium
  - experts fully hedge idiosyncratic risks
  - experts hold their share (do not hedge) aggregate risk Z, market price of risk depends on $\sigma_t^f (\sigma + \sigma_t^p)$
  - with securitization, experts lever up more (as a function of η_t) and pay themselves sooner
  - financial system becomes less stable

Conclusion

- Incorporate financial sector in macromodel
  - Higher growth
  - Exhibits instability
    - similar to existing models (BGG, KM) around steady state
    - non-linear liquidity spirals (away from steady state)
- Inside money - intermediaries are hit on both side of balance sheet: Deflation spiral
- Externalities when leverage/payouts are chosen
  - Within financial sector:
    possible fire sales compromise others' balance sheets
  - Towards real economy (workers)
- Securitization helps share idiosyncratic risk, but amplifies systemic risk

Thank you!☺

Differences to Bernanke-Gertler-Gilchrist

BGG

1. "small" aggregate shocks, log-linearization around steady state
2. Price dynamics driven by idiosyncratic shocks and default risk
   - Higher state verification costs when expert capital goes down
3. expert incentives to keep "dry powder" (liquidity/precautionary) are negligible leverage is limited by increase in interest rate spread reflecting expected verification costs
4. Payout/consumption policy is exogenous
5. Countercyclical leverage
   - Experts take on same position after drop in net worth
   - Leverage increases after drop in net-worth
5. Debt vs. Equity
6. No fire-sale externality (not studied)

Brunnermeier-Sannikov

1. Focus on (large) aggregate shocks (idiosyncratic shocks not essential), explore nonlinearities using Bellman equation
2. Asset price drops also due to fire sales
3. Expert's rent depends on state η_t
   Incentive to keep "dry powder" (liquidity)
4. Payout/consumption endogenous (unconstraint at this point)
5. Procyclical leverage: Experts reduce position after drop in net worth
   - Liquidity spirals
6. Securitization
   (debt, inside + outside equity)
7. Fire-sale externality

Differences to Kiyotaki-Moore

KM – (Kiyotaki version)

1. Zero-prob. temporary shock
   - Persistent (**dynamic** loss spiral)
   - Amplified through collateral value
2. Always at the constraint
3. Exogenous payout policy at death
4. Non- vs. productive (leveraged) sector
5. Dual role of durable asset
   1. Production
   2. Collateral
6. Exogenous contract
   - One period contract
   - Debt is limited by collateral value
7. Durable asset doesn't depreciates, capital fully

BruSan

1. Permanent shocks
   - Volatility effects through precautionary motive
   - Loss spiral (level effect)
2. Precautionary cushion away from constraint – size varies
3. Endogenous payout/consumption
4. Investment through leveraged financial sector
5. Dual role of durable asset
   1. Production
   2. Securitization
6. (Partially) optimal contract
   - Dynamic contract
   - Debt is limited due idiosyncratic risk and costly state verification
7. δ-depreciation rate

Differences to He-Krishnamurthy

He-Krishnamurthy

1. Endowment economy
   - GDP growth is exogenously fixed
   - No physical investment
2. No direct investment in risky asset by households
   - Limited participation model
3. Contracting
   - Only short-run relationship (t to $t+dt$)
   - Fraction of return, fee
   - Asset composition (risky vs. risk-free) is not contractable
   - Non-effort lowers *return* by *xdt*
     - x is exogenous,not linked to fundamental
   - Private benefit from shirking
   - No benchmarking
4. Pricing Implications
   - When experts wealth declines, their market power increases, and so does their fee
   - Price impact depends on assumption that household have larger discount rate than experts
5. **Procyclical Leverage**
6. In H-K calibration paper
   1. No fee, households are rationed in their investment
   2. As expert wealth approaches 0, interest rate can go to $-\infty$
   3. Heterogeneous labor income for newborns of ID_t
   4. Non-log utility function

BruSan

1. Production economy
   - GDP growth depends on net-wealth
   - Physical investment
2. Direct investments by all households
3. Contracting
   - (Potential) long-run relationship
   - Fraction of return, fee, size of asset pool
   - Effort increases *fundamental* growth to *gdt*
   - Monetary benefit from shirking
   - No benchmarking
4. Pricing Implication
   - Price drop with state variable
5. Countercyclcial Leverage
   - Entrepreneur take on same position after drop in networth
   - Leverage increases after drop in net-worth