# International Credit Flows, Pecuniary Externalities and Capital Controls

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# Motivation

- Old "Washington consensus" in decline
  - Free trade:       flow of goods/services                intratemporal
  - Free finance:     flow of capital                         intertemporal
- <u>When</u> does full capital account liberalization reduce (capital controls improve) welfare? – theoretical guidance

# Motivation

- Old "Washington consensus" in decline
    - Free trade:        flow of goods/services                intratemporal
    - Free finance:      flow of capital                        intertemporal
- When does full capital account liberalization reduce (capital controls improve) welfare? – theoretical guidance

1.  Sudden stop runs due to liquidity mismatch
    - Technological illiquidity:    irreversibility (adjustment costs)
    - Market illiquidity:            redeployability/specificity – not in this paper
    - Funding illiquidity:          short-term debt, "hot money"
        - Type of capital flow matters: FDI, portfolio flows (equity), long-term debt

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2. "Terms of trade hedge" (Cole-Obstfeld) can be undermined when
   - Industry's output is not easily substitutable. Consumers cannot easily find substitutes
   - No strong competitors in other countries
     - Natural resources: oil, copper for Chile,
     - Hard drives in Thailand, Bananas in Ecuador

# Main results

Risk sharing ↑ ● FB

Capital allocation →
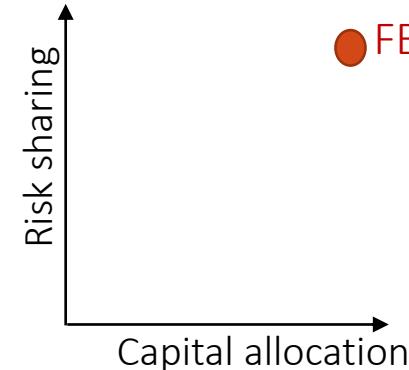
- **Inefficiencies (constrained) in equilibrium**
  1. Capital misallocation/inefficient production
  2. Insufficient risk sharing of country risk
- **Trade-off between capital allocation and risk sharing**
  - "Terms of trade hedge"
- **When are short-term credit flows excessive?**
  - When can capital controls (financial liberalization) be welfare enhancing (reducing)?
  - Pecuniary externalities
    - Output price – terms of trade
    - Capital price – fire-sale externality
- **Sudden stops (two types) – new form**
  - Amplification of fundamental shocks
  - Runs due to sunspots
- **Bailout/Restructuring**
  - Can be Pareto improving if one country is sufficiently balance sheet impaired
  - Reduces output good price

# Model setup - symmetric

- Preferences
  - Same preference discount rate $r$
  - (Constant relative) risk aversion
- Two output goods $y^a$ and $y^b$
  - imperfect substitutes
  - (Constant) elasticity of substitution $s$

$$y_t = \left[ \frac{1}{2} (y_t^a)^{\frac{s-1}{s}} + \frac{1}{2} (y_t^b)^{\frac{s-1}{s}} \right]^{s/(s-1)}$$

- (Comparative) advantages:

|  | Good $a$ | Good $b$ |
|---|---|---|
| Country A | $\bar{a}k_t$ | $\underline{a}k_t$ |
| Country B | $\underline{a}k_t$ | $\bar{a}k_t$ |

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# Two country/sector model

- Capital evolution for
  - $dk_t = (\Phi(\iota_t) - \delta)k_t dt + \sigma^A k_t dZ_t^A$  in country $A$
  - $dk_t = (\Phi(\iota_t) - \delta)k_t dt + \sigma^B k_t dZ_t^B$  in country $B$
    - $\Phi$ concavity – technological illiquidity
    - Single type of capital
    - Investment in composite good

- Shocks are
  - Two dimensional
    - Affect global capital stock $dZ_t^A + dZ_t^B$
    - Redistributive (initial shock + amplification) $\Rightarrow$ affects wealth share, $\eta_t$
      - Example: Apple vs. Samsung lawsuit

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# Market structures

| Markets | Trade | | Finance | |
|---|---|---|---|---|
| | Output $y^a, y^b$ | Physical capital $K$ | Debt | Equity |
| Complete Markets<br>Full integration/First Best | X | X | X | X |
| Open credit account<br>(equity home bias) | X | X | X | |
| Closed credit account | X | X | | |

Add taxes/capital controls

intratemporal          intertemporal

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# Market structures

1. Complete markets ⇒ First best
2. Incomplete markets (equity home bias)
   - Levered short-term debt financing
   - Sudden stops: (varying technological illiquidity)
     - Amplification
     - Runs due to sunspots
3. Closed capital account: capital controls (no equity, no debt)
4. Welfare analysis

# 1. Complete markets: First Best Remarks

- Perfect capital allocation + perfect risk sharing


- Prices are constant and independent of shocks
- Economy shrinks/expands with (multiplicative) shocks
- Elasticity of substitution, $s$, has no impact on prices

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# Market structures

1. Complete markets ⇒ First best

2. Incomplete markets (equity home bias)
   - Levered (short-term) debt financing
   - Sudden stops: (varying technological illiquidity, irreversibility)
     - Amplification
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4. Welfare analysis

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# 2. State variable: 3 regions

- **Wealth share $\eta$**
  - Three regions

| | | Full specialization | |
|---|:---:|:---:|:---:|
| $A$ produces | $a$ | $a$ | $a, b$ |
| $B$ produces | $a, b$ | $b$ | $b$ |

$$0 \qquad\qquad\qquad\qquad 1/2 \qquad\qquad\qquad\qquad 1 \qquad \eta$$

  - Symmetric

$$\psi_t^{Aa} = \eta_t$$
$$\psi_t^{Bb} = 1 - \eta_t$$
$$\psi_t^{Ba} = \psi_t^{Ab} = 0$$

- Numerical: $r = 5\%, \overline{a} = 14\%, \underline{a} = 4\%, \delta = 5\%, \kappa = 2, \sigma^A = \sigma^B = 10\%$



wealth share
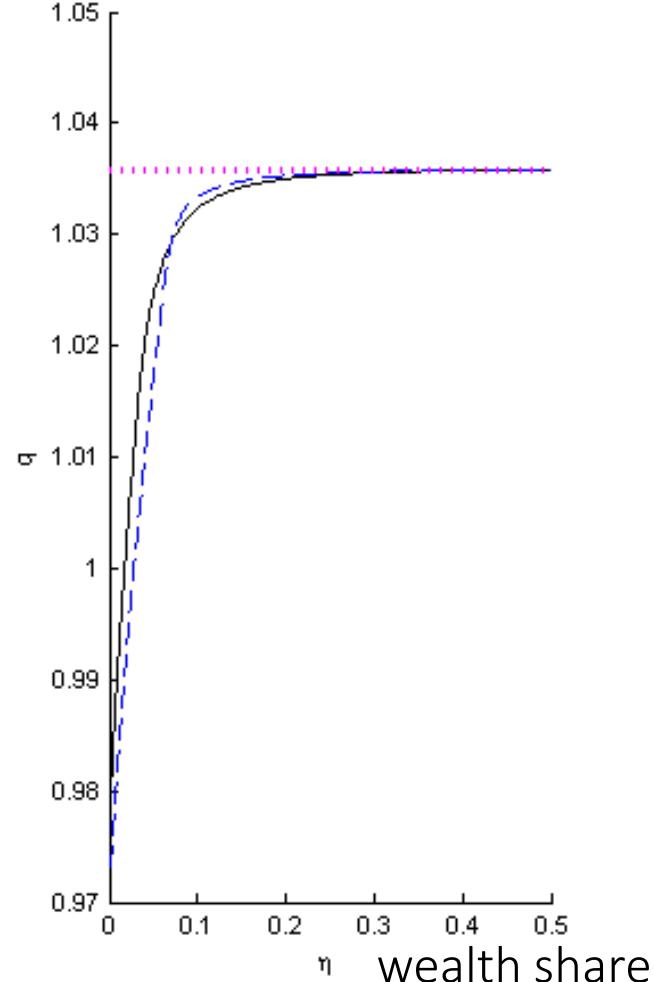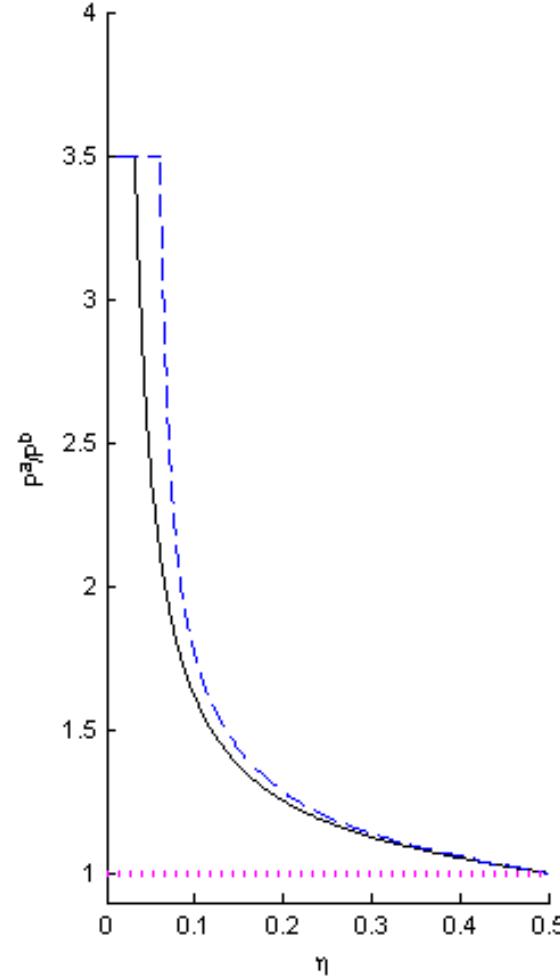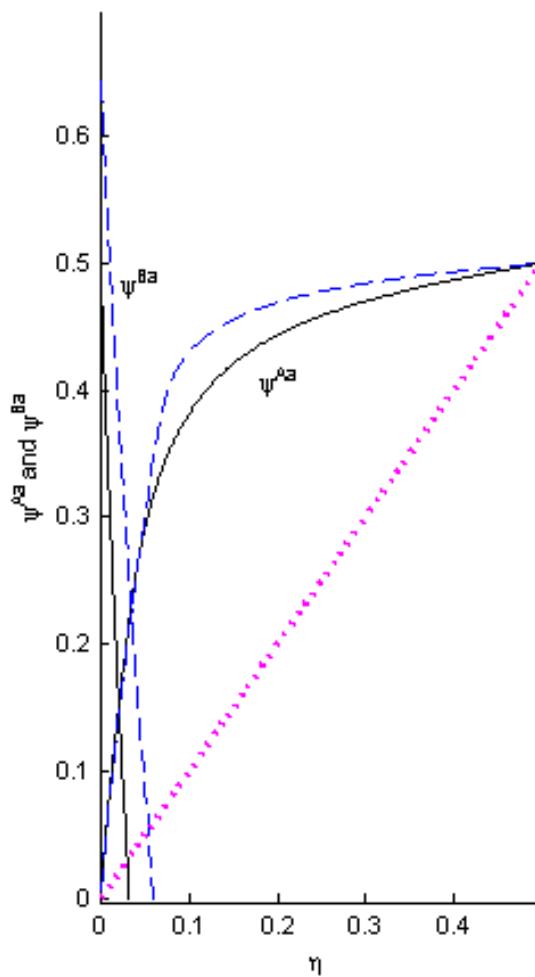
- Three different elasticities of substitution: $s = \{.5, 1, \infty\}$

# TOT: Supply vs. demand shock

- Supply versus demand shock

  TOT improve for $A$ as $\eta_t$ declines for $\eta_t \in [\bar{\eta}, .5)$
  can be due to
  - $dZ^A < 0$:   Negative <u>supply shock</u>           World recession
  - $dZ^B > 0$:   Positive <u>demand shock</u>      World boom

- TOT: Output price

- ...but fire-sale of (physical) capital stock $k_t$

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# 2. Stability, Phoenix Miracle for different $s$

- Stationary distribution        drift                    volatility



Masspoint at {0,1}

Phoenix miracle

wealth share
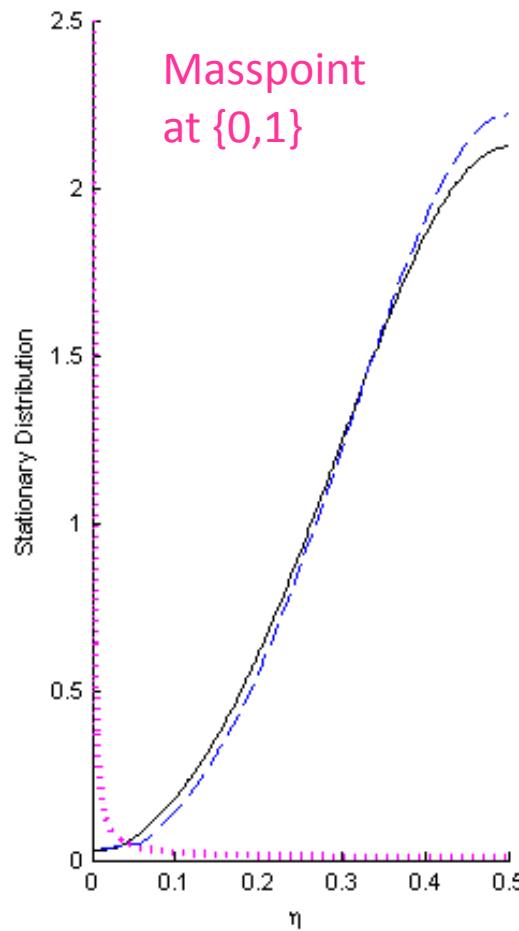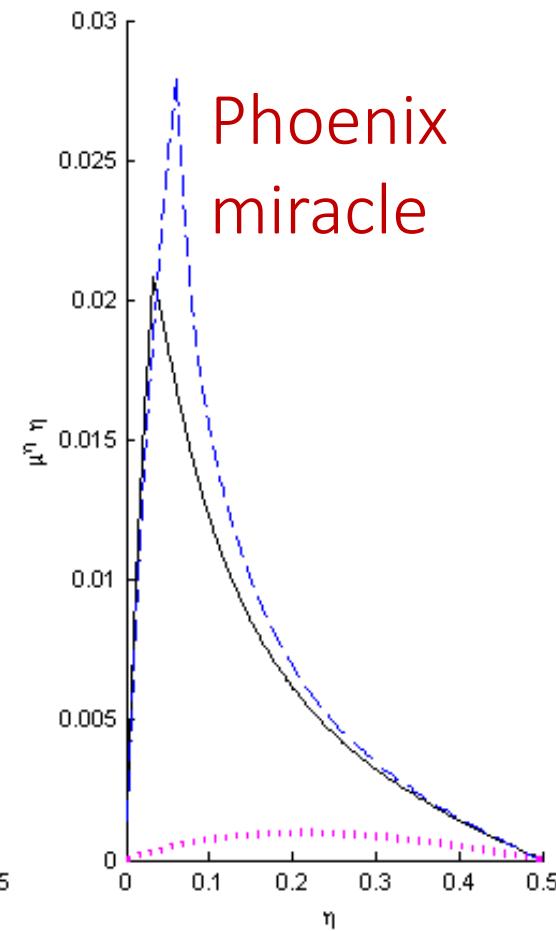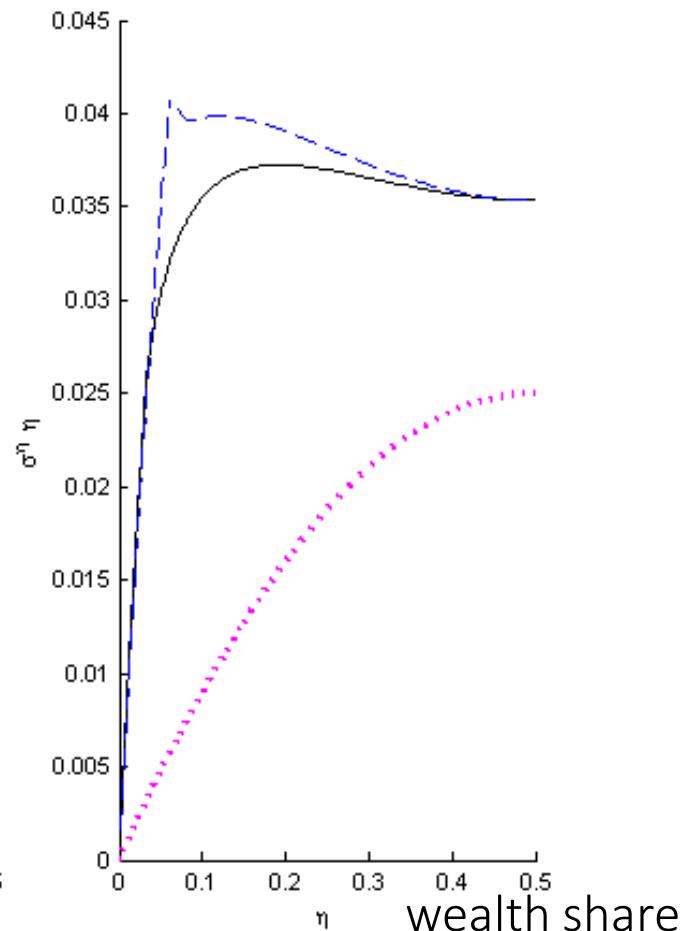
- Three different elasticities of substitution: $s = \{.5, 1, \infty\}$
- Difference to Cole & Obstfeld 1994: persistence of capital, $\delta < \infty$

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# Overview

1. Complete markets ⇒ First best
2. Incomplete markets (equity home bias)
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     - Amplification
     - Runs due to sunspots
3. Closed capital account: capital controls (no equity, no debt)
4. Welfare analysis

# 2. Amplification

$$\sigma_t^{\eta^A} = \frac{\frac{\psi_t^{Aa}}{\eta_t}(1-\eta_t)}{1 - [\psi_t^{Aa} - \eta_t]\frac{q'(\eta_t)}{q(\eta_t)}} \sigma^A$$

# 2. Amplification

leverage

$$\sigma_t^{\eta^A} = \frac{\boxed{\frac{\psi_t^{Aa}}{\eta_t}}(1-\eta_t)}{1 - [\psi_t^{Aa} - \eta_t]\frac{q'(\eta_t)}{q(\eta_t)}}\sigma^A$$

- Leverage effect $\quad \psi_t^{Aa}/\eta_t$

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Market illiquidity
(price impact)

- Leverage effect $\quad \psi_t^{Aa}/\eta_t$

- Loss spiral $\quad 1/\{1 - [\psi_t^{Aa} - \eta_t]\frac{q'(\eta_t)}{q(\eta_t)}\}$ $\quad$ (infinite sum)

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leverage

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- Leverage effect $\quad \psi_t^{Aa}/\eta_t$

- Loss spiral $\quad 1/\{1 - [\psi_t^{Aa} - \eta_t]\frac{q'(\eta_t)}{q(\eta_t)}\}$ (infinite sum)

- Technological illiquidity $(\kappa, \delta) \Rightarrow$ market illiquidity $q'(\eta)$
  - (dis)investment adjustment cost

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# 2. Technological $(\kappa, \delta) \Rightarrow$ market illiquidity $q'(\eta)$

- Adjustment of (physical) capital stock becomes more difficult as $\kappa$ increases,
- Three cases
  - $\kappa = 0 \Rightarrow q = 1$
  - $\kappa = 2$
  - $\kappa_{\iota<0} = 100$ and $\kappa_{\iota>0} = 2$
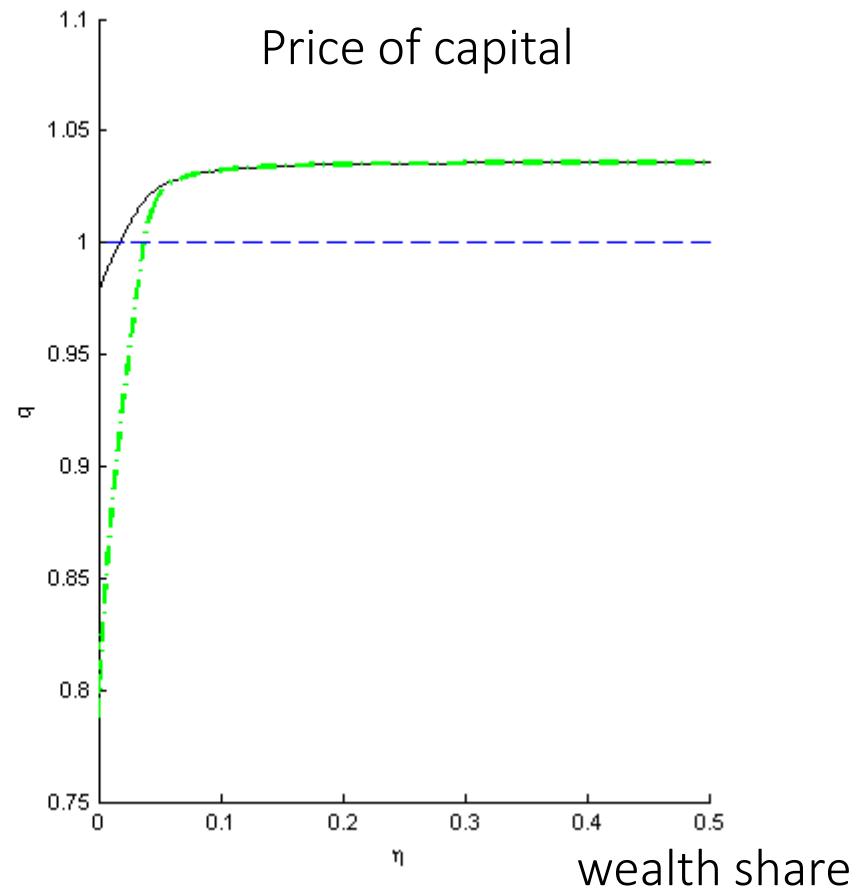
Price of capital

wealth share

# Sudden stops: amplification & runs

## ▪ Sudden stop

- Adverse fundamental triggers percentage decline in debt that exceeds percentage decline in net worth; $\frac{\partial(\psi^{Aa}-\eta)}{\partial\eta}\frac{\eta}{\psi^{Aa}-\eta} > 1$
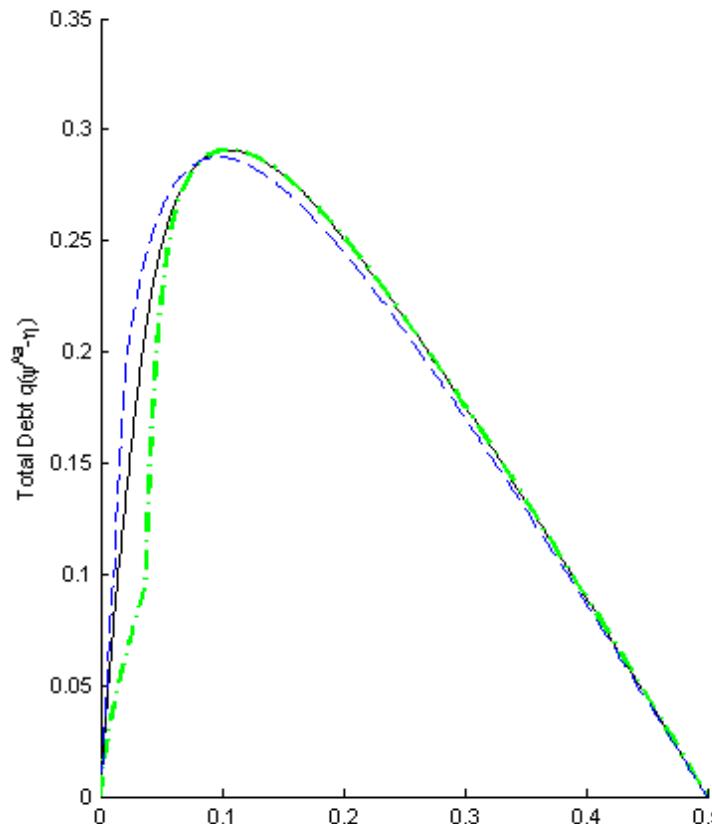
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- Adverse **fundamental triggers** percentage decline in debt that exceeds percentage decline in net worth; $\frac{\partial(\psi^{Aa}-\eta)}{\partial\eta}\frac{\eta}{\psi^{Aa}-\eta} > 1$

- An unanticipated **sunspot triggers** a sudden capital price drop from $q$ to $\tilde{q}$, accompanied by a drop in $\eta$ to $\tilde{\eta}$.

$$\tilde{q} = \frac{\max\{\eta q + \psi^{Aa}(\tilde{q}-q), 0\}}{\tilde{\eta}}$$

hyperbola

# Sudden stop due to sunspot
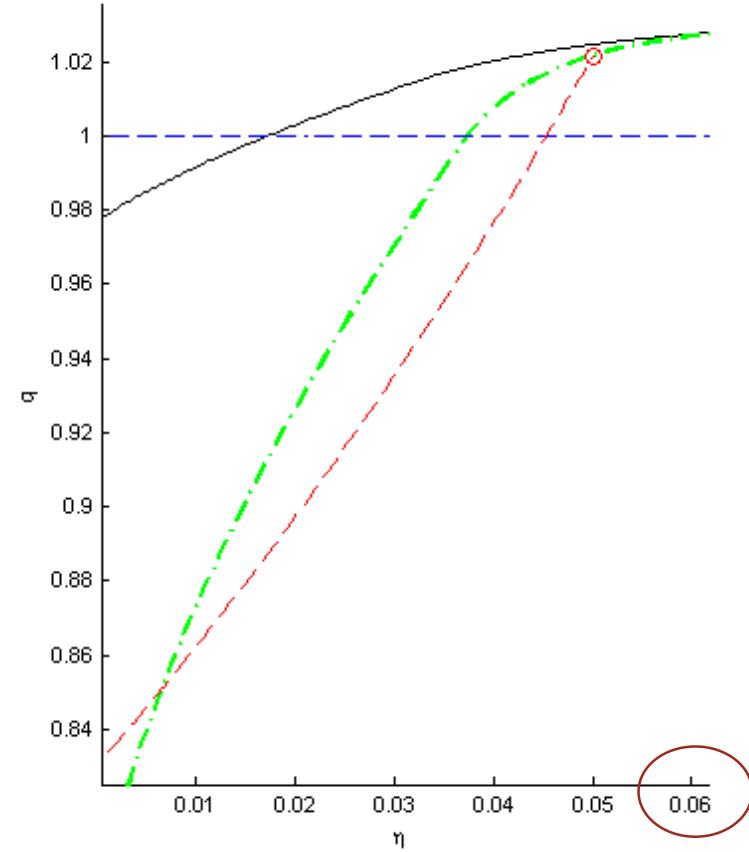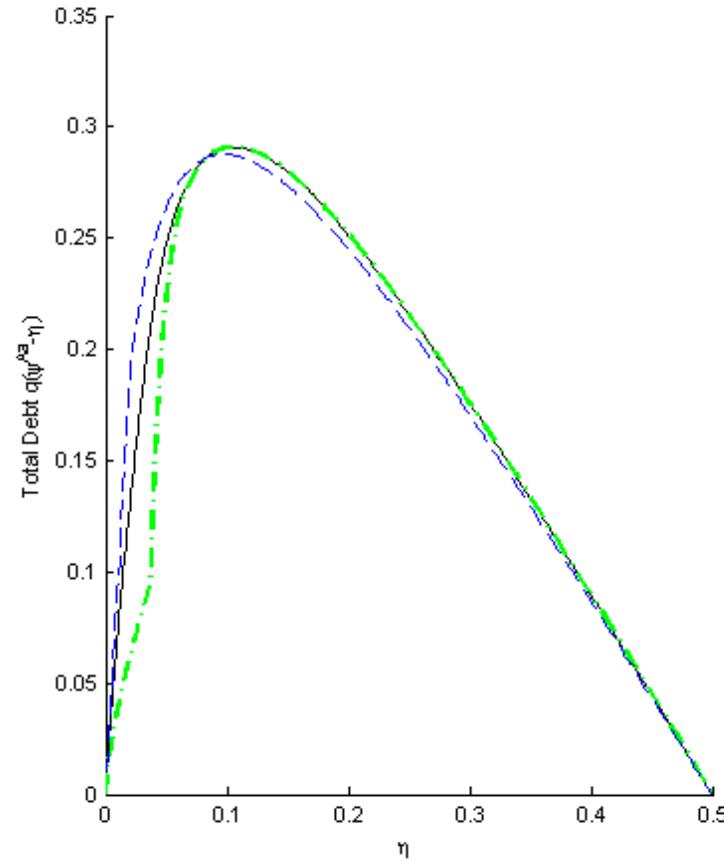
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     - Amplification
     - Runs due to sunspots

3. Closed capital account: capital controls (no equity, no debt)

4. Welfare analysis

# Market structures

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|---|---|---|---|---|
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| **Complete Markets** Full integration/First Best | X | X | X | X |
| **Open credit account** (equity home bias) | X | X | X | |
| **Closed credit account** | X | X | | |

Add taxes/capital controls

intratemporal       intertemporal

# 3. Credit account: open vs. closed
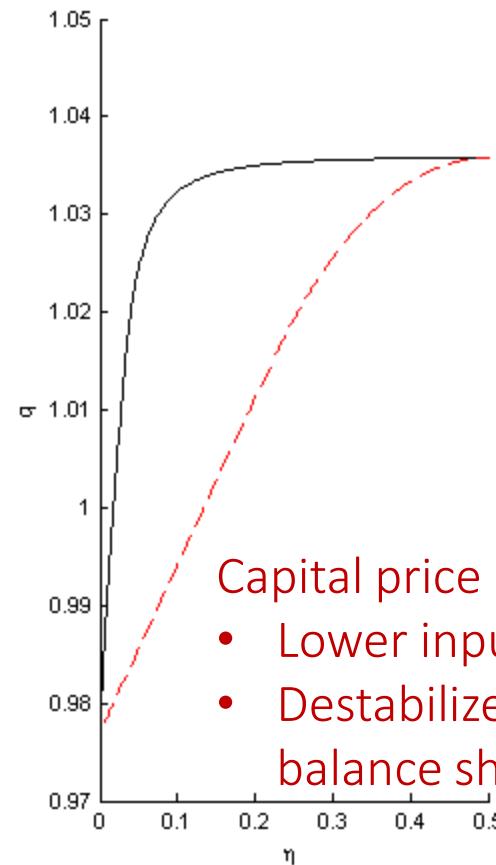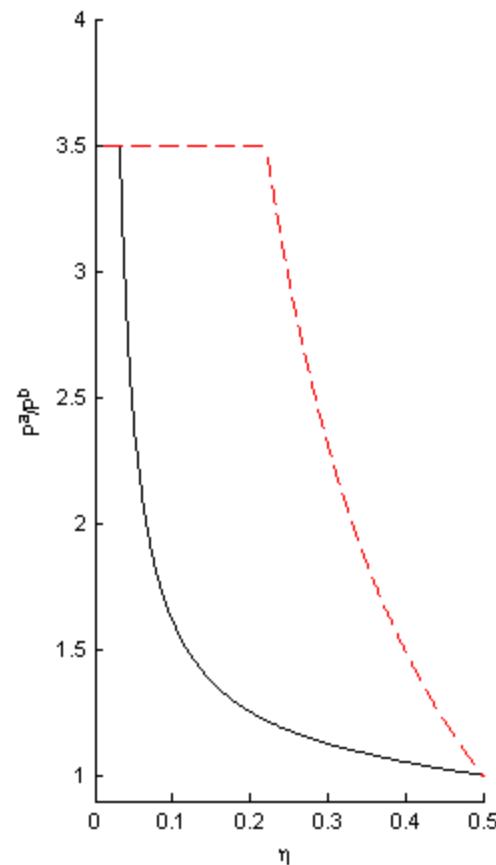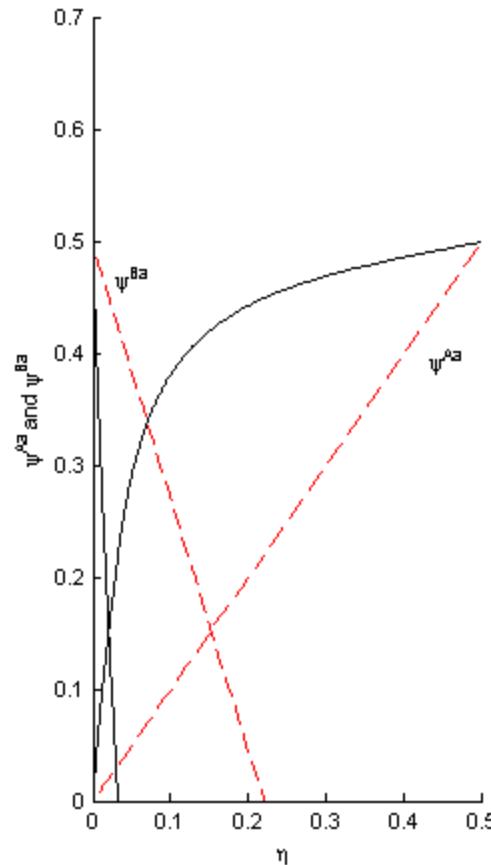
- $r = 5\%, \overline{a} = 14\%, \underline{a} = 4\%, \delta = 5\%, \kappa = 2, \sigma^A = \sigma^B = 10\%,\ s = 1$



Capital price lower
- Lower input price
- Destabilizes balance sheet

# 3. Credit account: open vs. closed

- $r = 5\%, \overline{a} = 14\%, \underline{a} = 4\%, \delta = 5\%, \kappa = 2, \sigma^A = \sigma^B = 10\%, \ s = 1$



More stability
Less growth

Phoenix miracle
slightly smaller

Stability
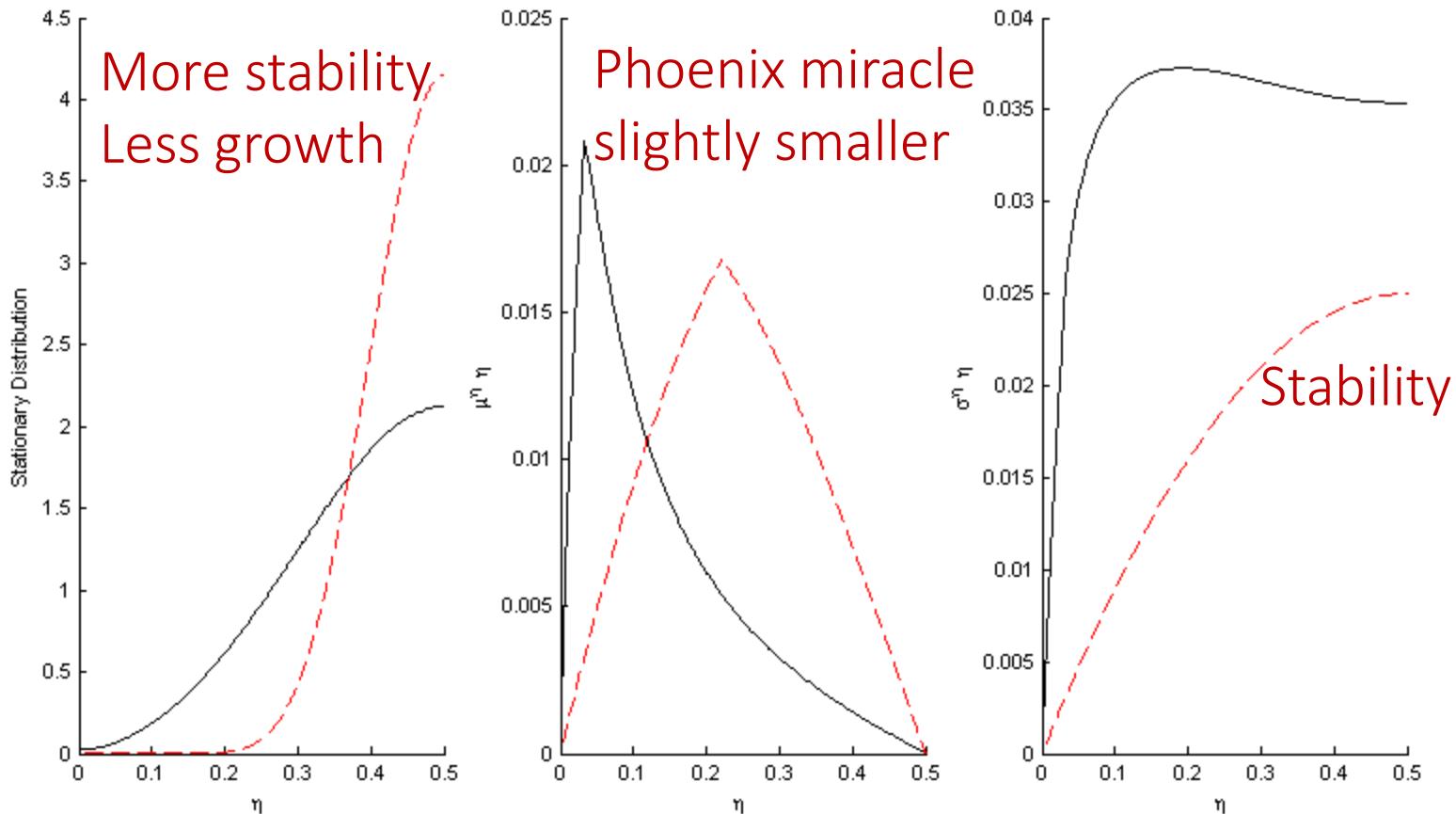
# Overview

1. Complete markets ⇒ First best
2. Incomplete markets (equity home bias)
3. Closed capital account: capital controls (no equity, no debt)
4. Welfare analysis
   - Pecuniary externalities
   - Welfare calculations + Pareto improving redistributions

# 4. When are credit flows excessive?

- Constrained inefficiency (in incomplete market setting) due to pecuniary externalities
  - Price of capital: fire sale externality if leverage is high
  - Price of output good: "terms of trade hedge" restrained competition
    - Price taking behavior undermined this hedge

shock

automatic hedge

↑ Price taking
↓ behavior

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Complete market insurance

shock

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Complete market insurance

shock

| Price | Intention | Depends on |
|---|---|---|
| Capital price (input) | Buy cheaper but capital losses on existing $k_t$ | Adjustment cost, $\Phi(\iota), \kappa$ |
| Output price | Sell output more expensive | Elasticity of substitution, $s$ |
| Interest rate | Borrow cheaper | Intertemporal preference |

# 4. Welfare comparison

- $r = 5\%, \overline{a} = 14\%, a = 4\%, \delta = 5\%, \kappa = 2, \sigma^A = \sigma^B = 10\%,$



Full specialization

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Full specialization
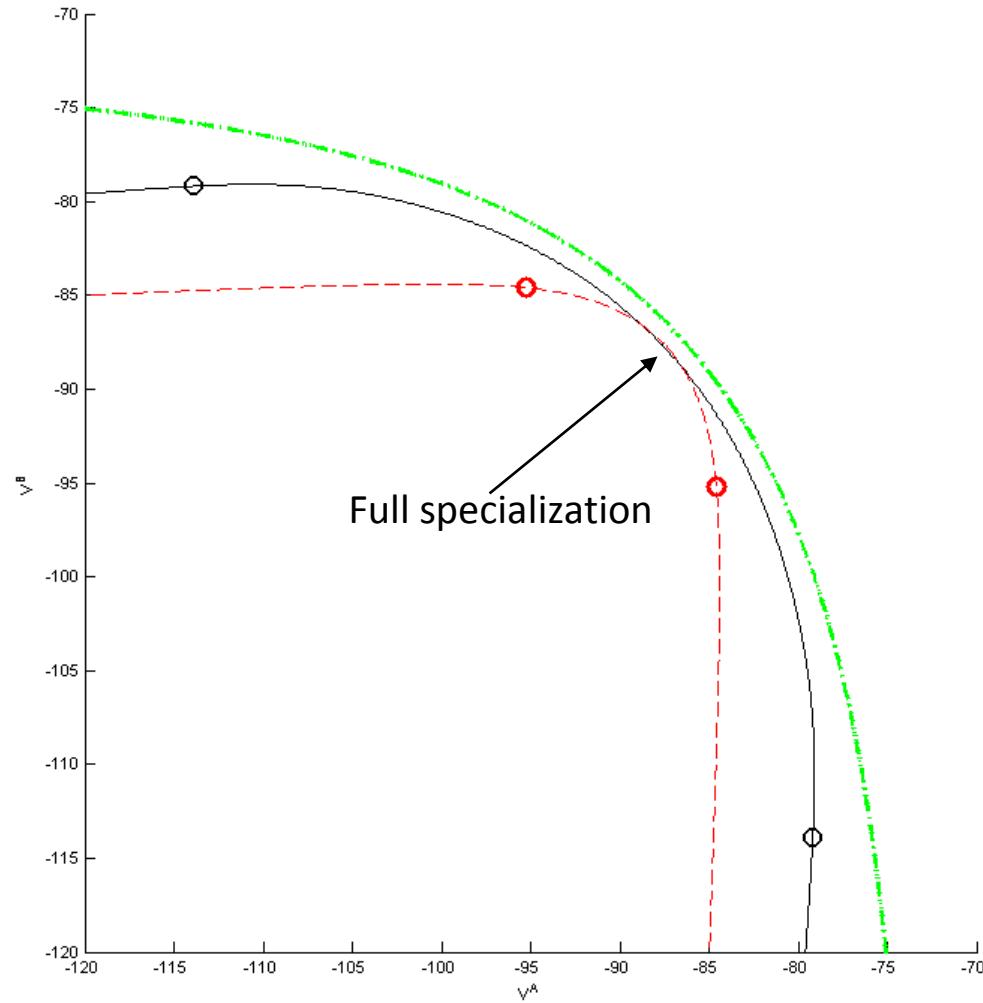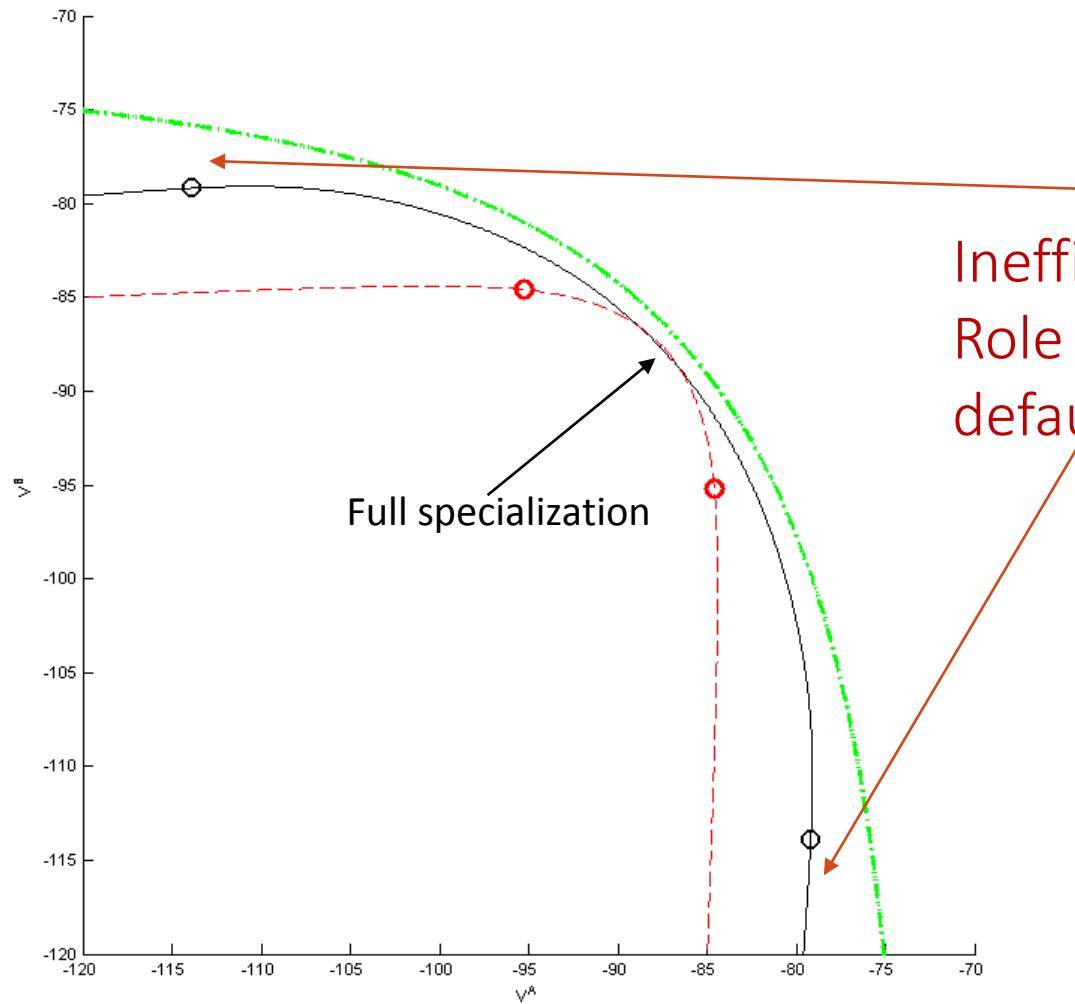
Inefficiency at the extremes:
Role for redistributive Policy
default/bail-out/debt-relief

Pareto improving

Intuition:
Other country's output
price is high

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# 4. Welfare comparison

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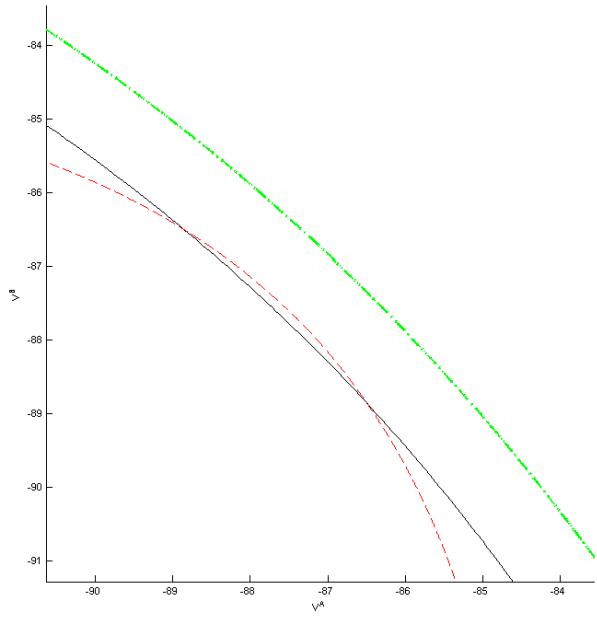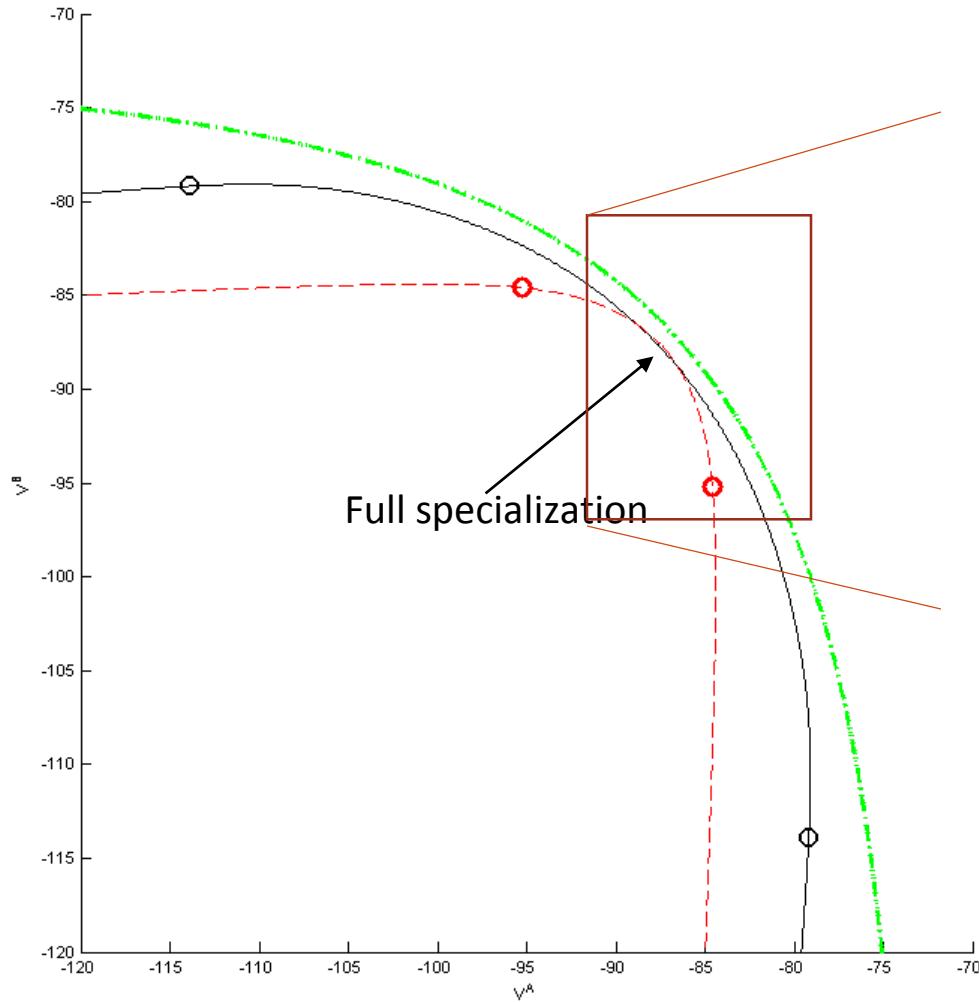
# 4. Welfare comparison

- Any monotone transformation of $\eta$ would be equally good state variable

- Normalization:
take CDF of $\eta$
  - Uniform stationary distribution!

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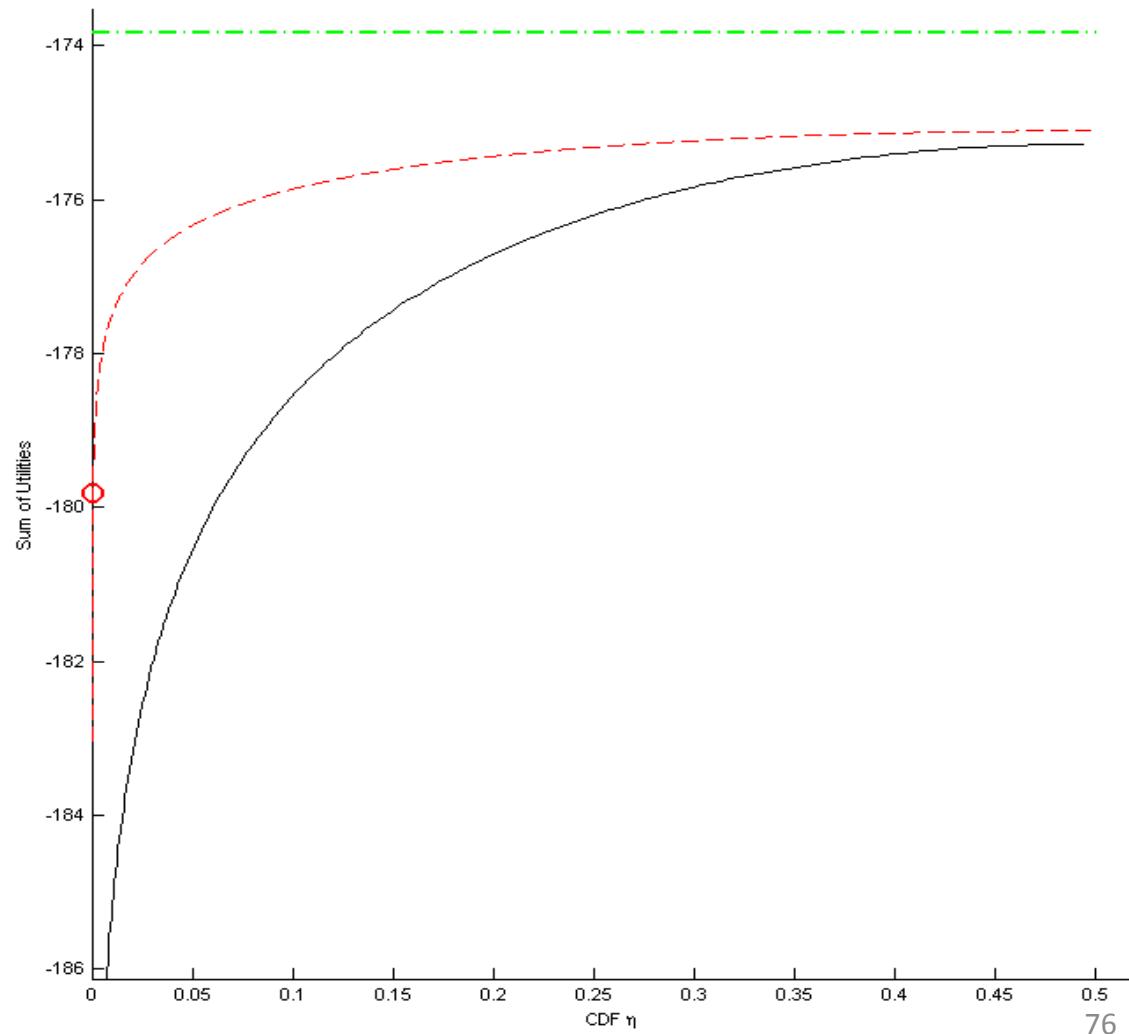
# Conclusion

- **Sudden stops**
  - Amplification of fundamental shock
  - Runs due to sunspots – vulnerability region
- **Phoenix miracle**
- **Tradeoff between capital allocation & risk sharing**
  - "Terms of trade hedge"
- **When are short-term credit flows excessive?**
  - When can capital controls (financial liberalization) be welfare enhancing (reducing)?
  - Pecuniary externality
    - Price of physical capital     fire-sales externality – technological illiquidity
    - Price of output goods:     "terms of trade hedge" externality
- **Bailout/Restructuring
Redistributive policy can be Pareto improving if one country is sufficiently balance sheet impaired**
  - Reduces output good price

positive

normative

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