Financial Globalization without Financial Development

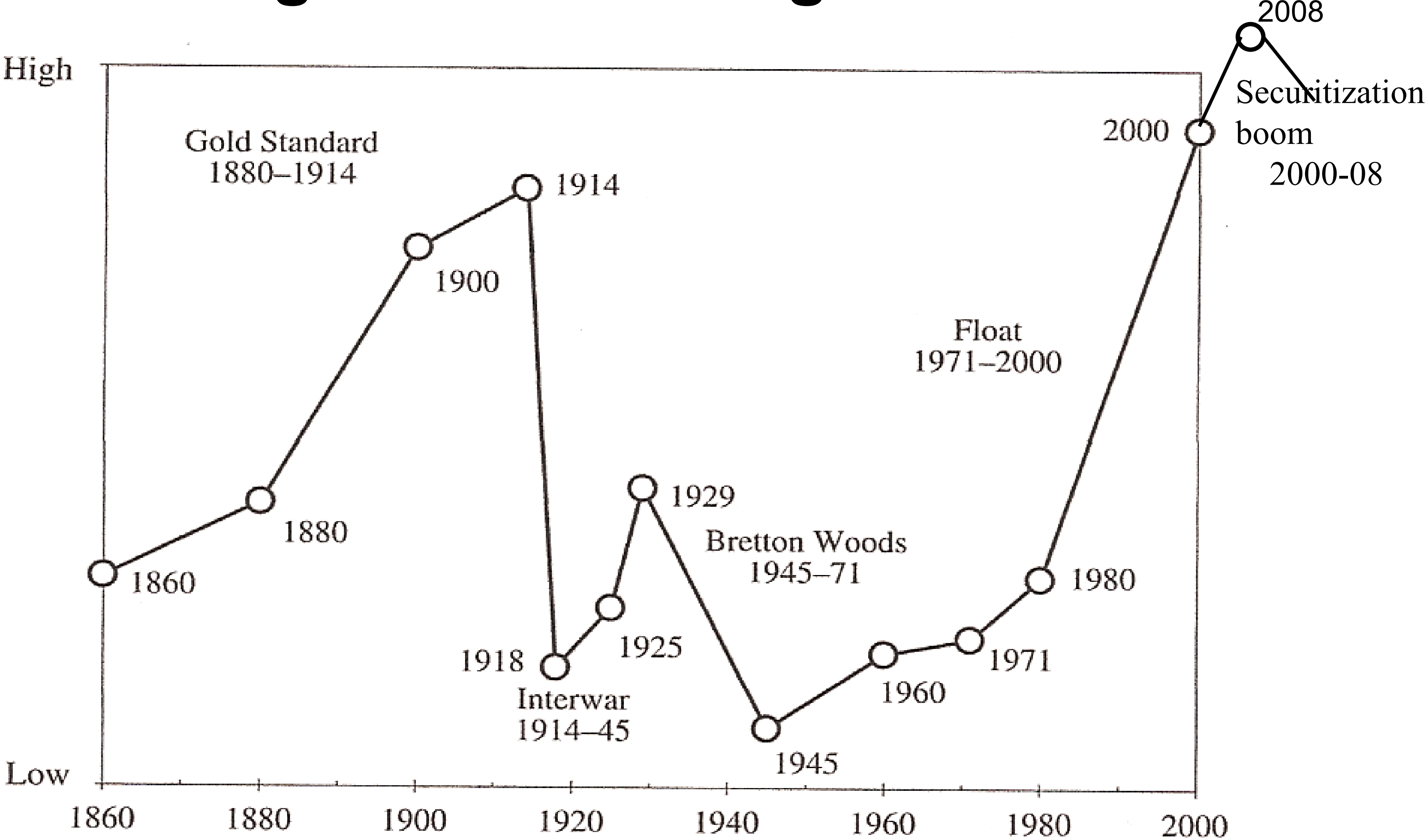
(International Macroeconomics with Heterogeneous Agents and Incomplete Markets)

Layout of the presentation

1. Financial globalization and global imbalances: facts & questions
2. Modeling capital flows with heterogeneous agents and incomplete markets
3. Quantitative implications for global imbalances
4. Introducing financial crises
5. Policy implications and conclusions

Financial Globalization and Global Imbalances: Facts and Questions

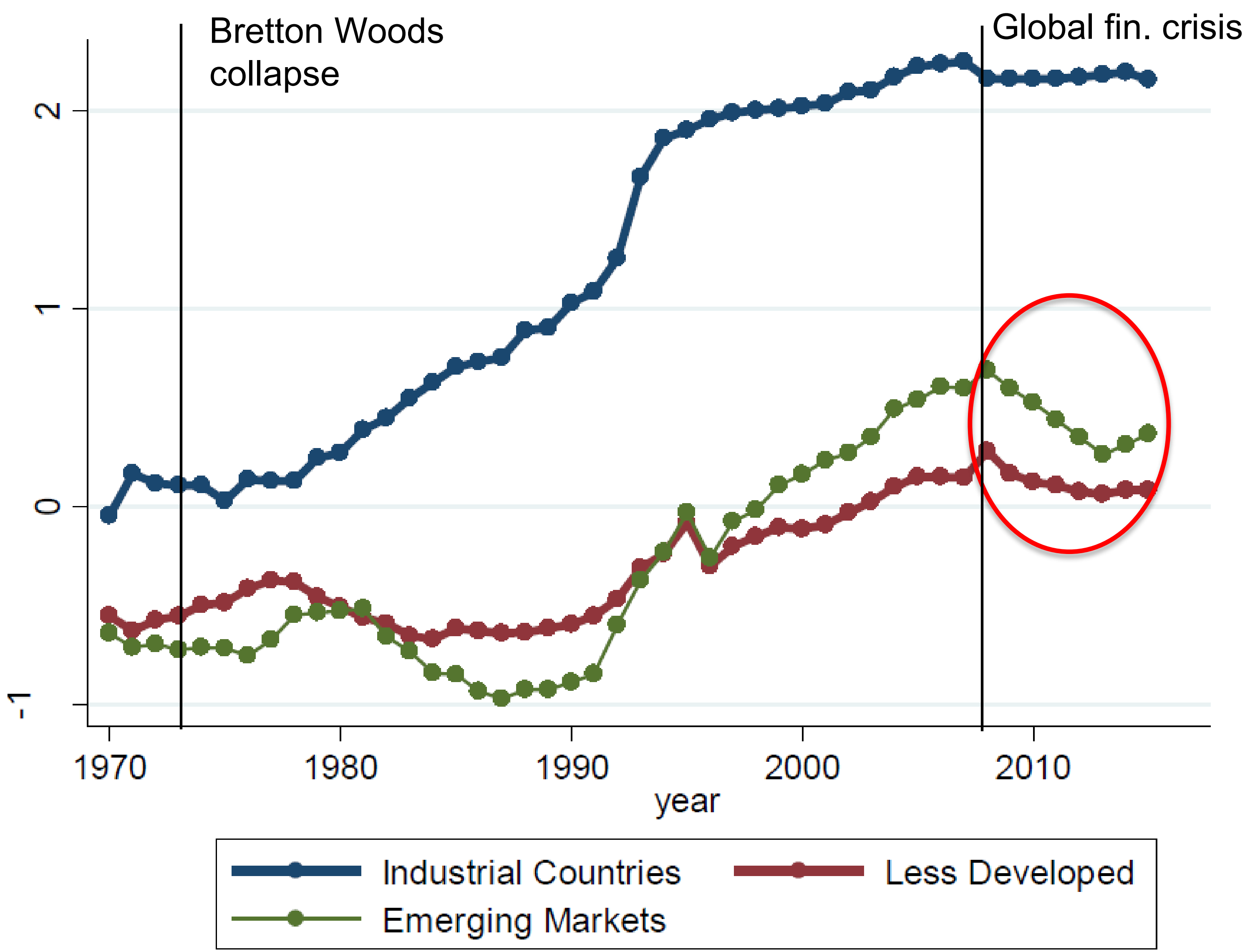
Ages of financial globalization



Obstfeld & Taylor's (05) "introspection" capital mobility index (updated)

25 years of financial globalization

(Chinn-Ito financial de-jure openness index, 1970-2015)



The promises

- Improved risk sharing
- Enhanced financial intermediation
- Efficient world allocation of capital
- Increased growth, reduced volatility
- Increased social welfare

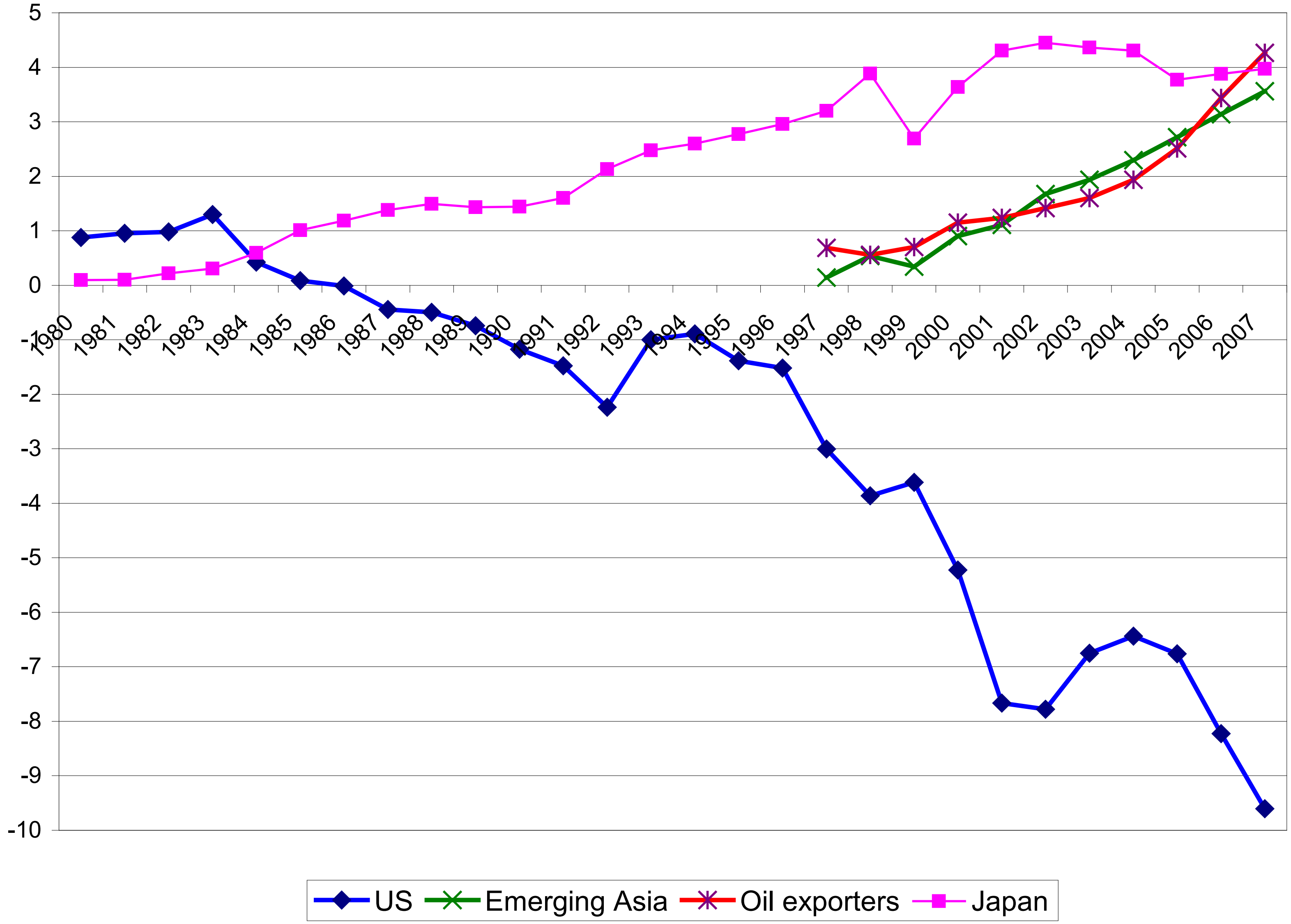
The record

- Weak evidence of improved risk sharing
- No evidence of permanent growth effects, but micro data show inflows go to more productive firms
- No change in long-run volatility
- Limited evidence of financial development
- A decade of financial debacles in EMs, 2008 global financial crisis, Eurozone crisis
- **Large global imbalances**

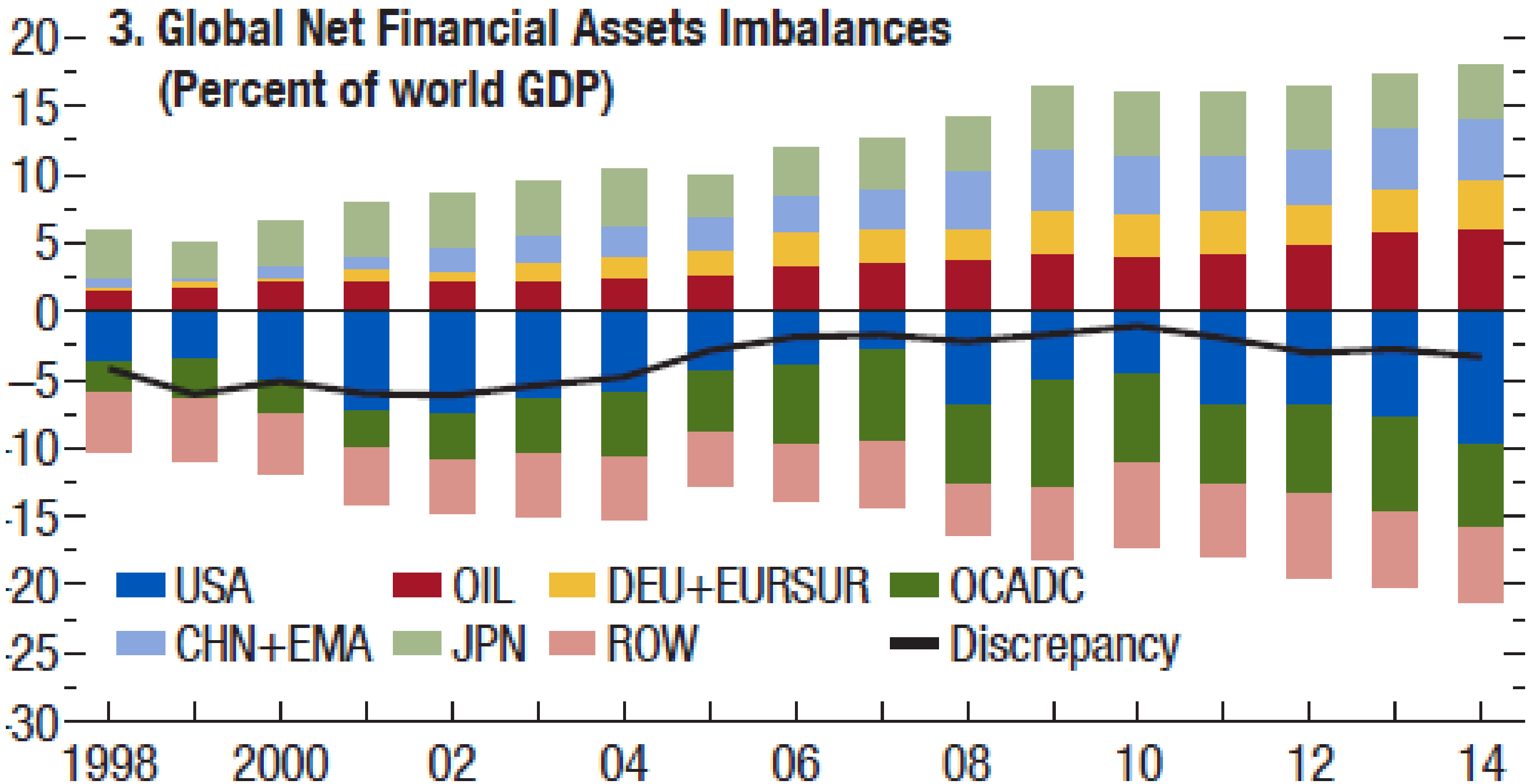
The global imbalances phenomenon

1. Large secular decline in NFA of the U.S.
2. U.S. portfolio: risky assets leveraged on debt
3. Buildup of foreign reserves in EMs (less financially developed)
4. Low interest rates in the U.S., high financing costs in EMs
5. Growing credit and leverage ratios of U.S. households and government

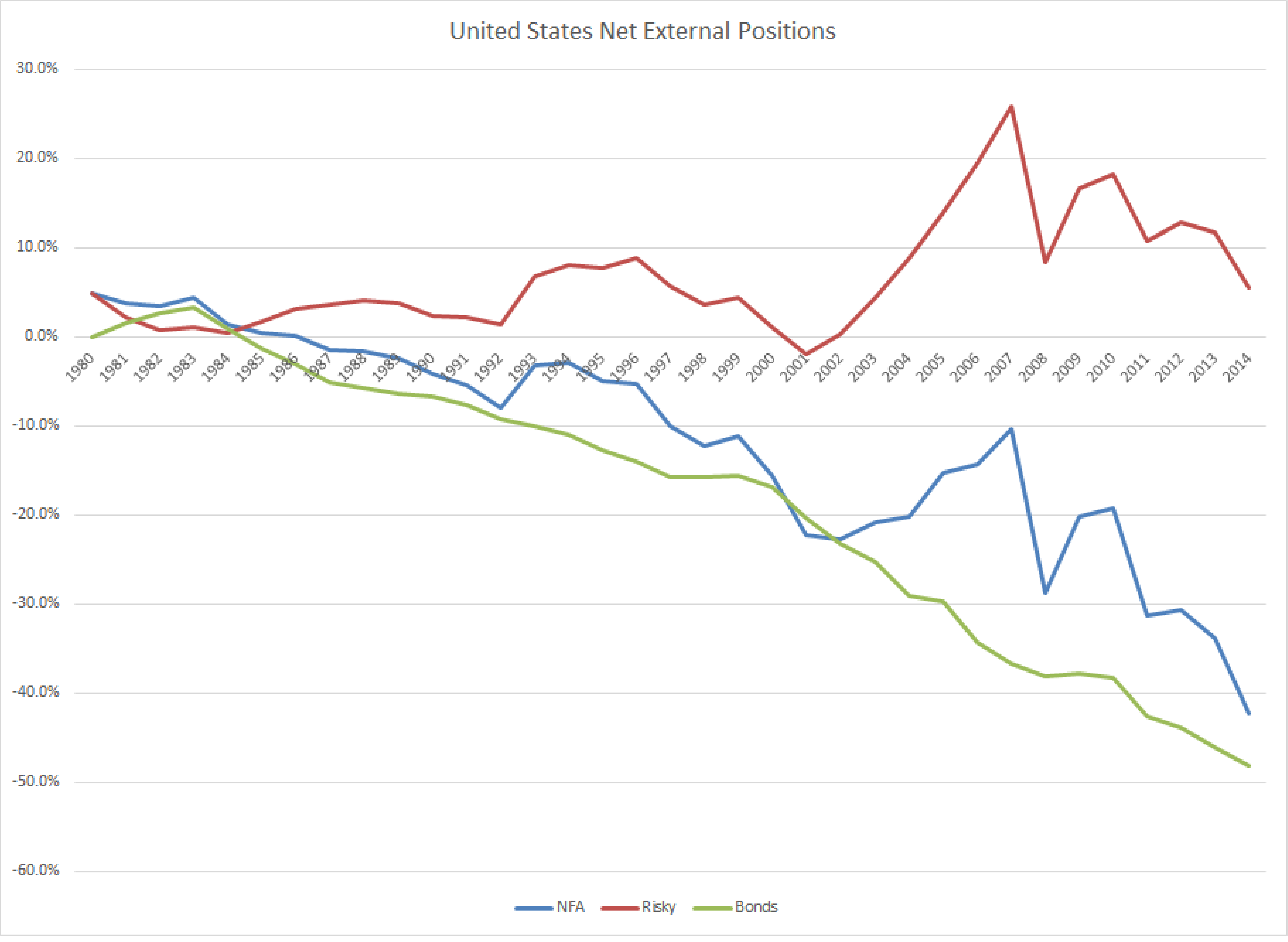
NFA positions as a share of world GDP



Global imbalances persist



Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CHN+EMA = China and emerging Asia (Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand); DEU+EURSUR = Germany and other European advanced surplus economies (Austria, Denmark, Luxembourg, Netherlands, Sweden, Switzerland); OCADC = other European countries with precrisis current account deficits (Greece, Ireland, Italy, Portugal, Spain, United Kingdom, WEO group of emerging and developing Europe); OIL = Norway and WEO group of emerging market and developing economy fuel exporters; ROW = rest of the world.


United States Net External Positions
30.0%
20.0%
10.0%
0.0%
-10.0%
-20.0%
-30.0%
-40.0%
-50.0%
-60.0%
1980
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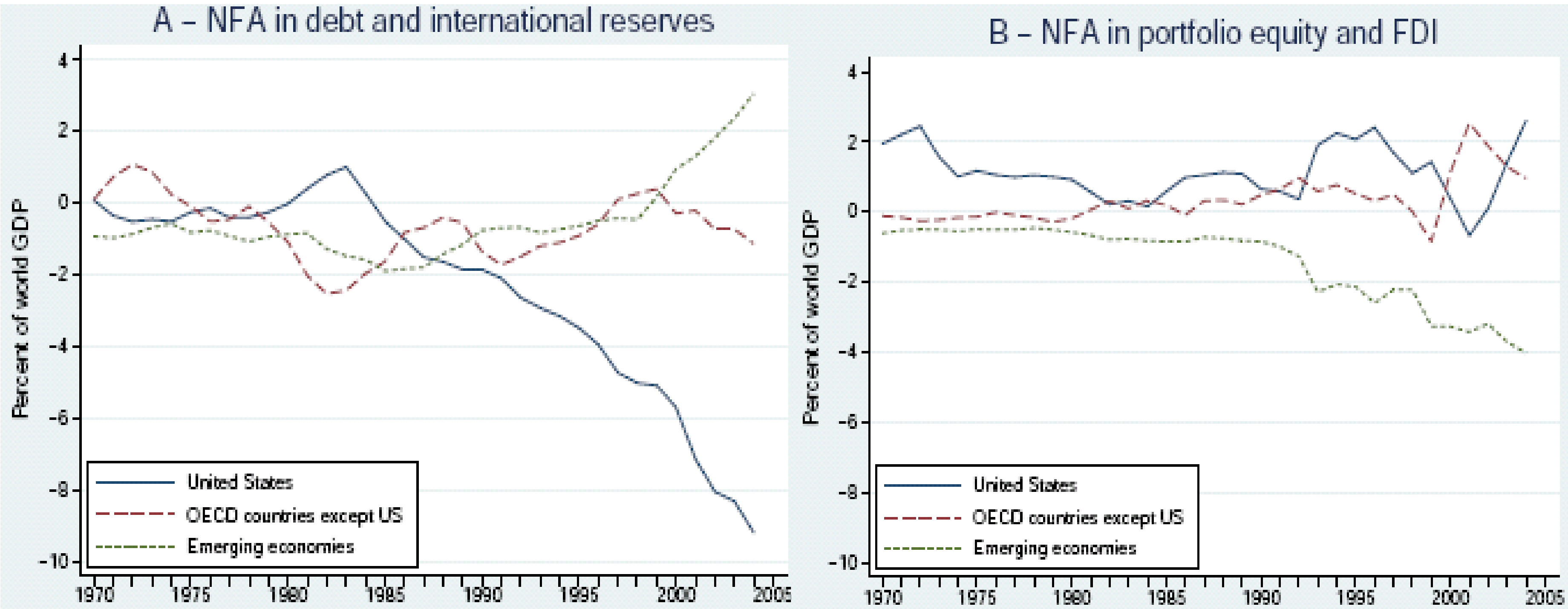
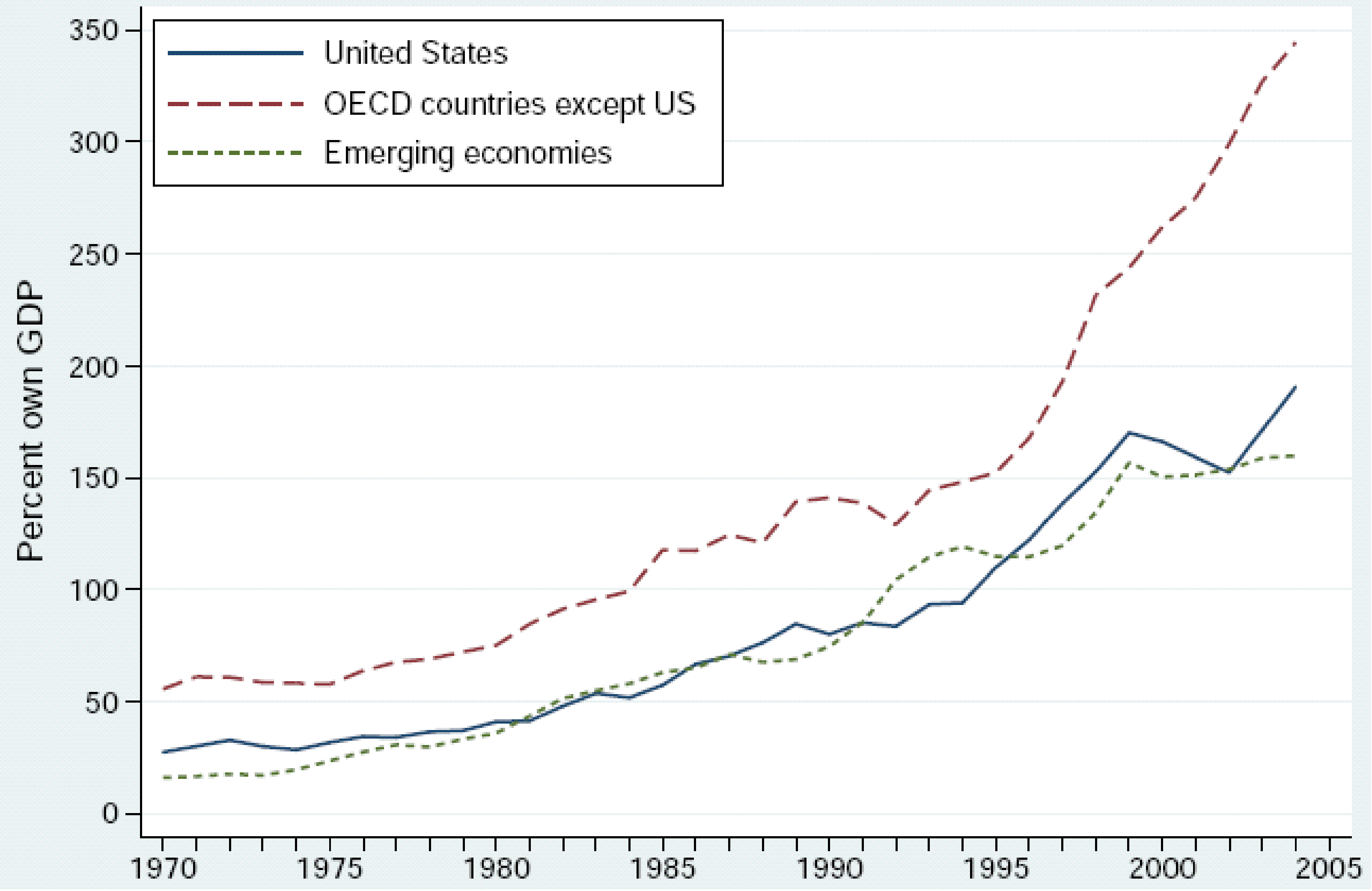
2012
2013
2014
NFA
Risky
Bonds

Portfolio structure of NFA positions

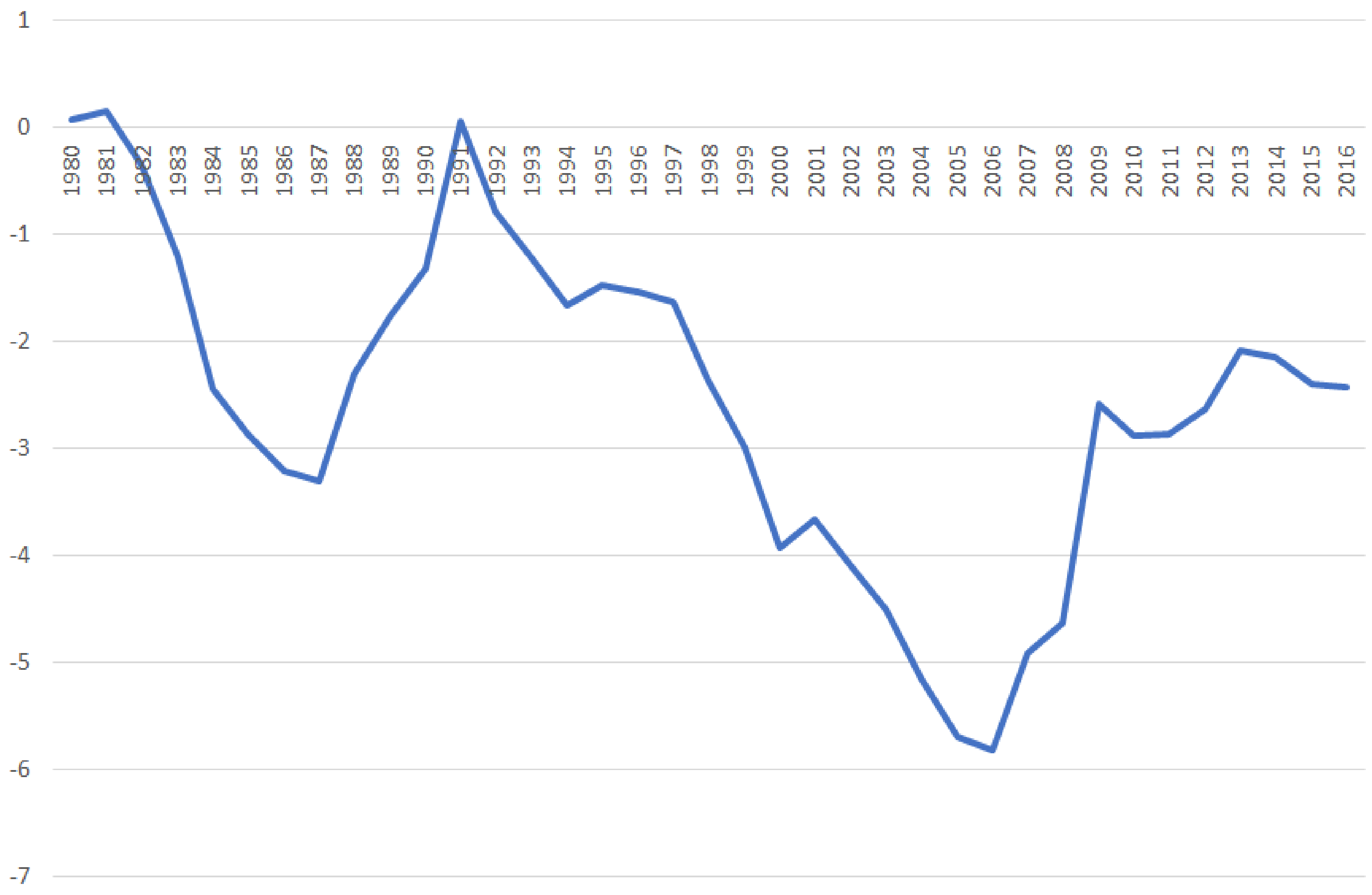


Gross stocks of foreign assets & liabilities

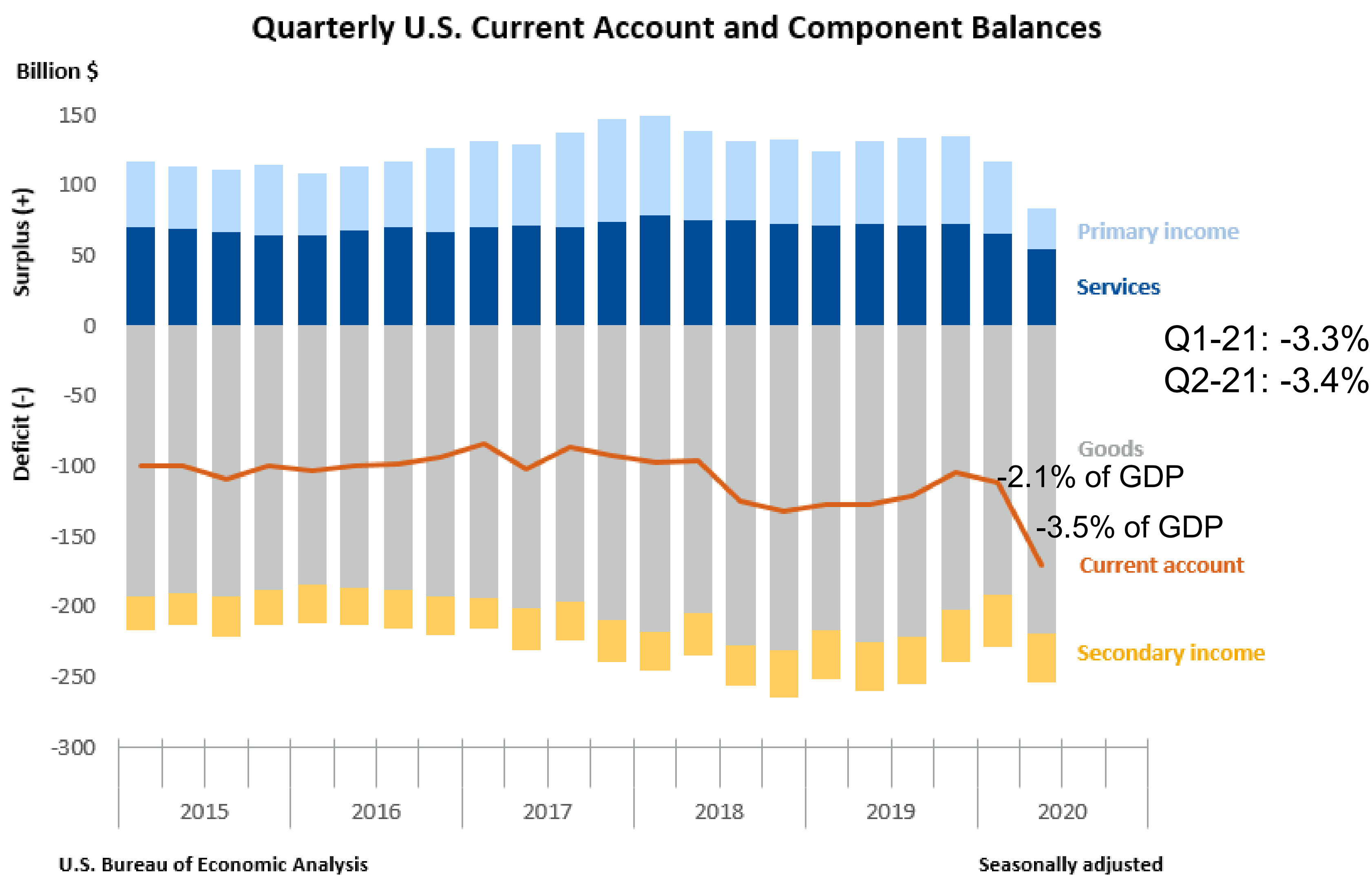
(de-facto globalization)



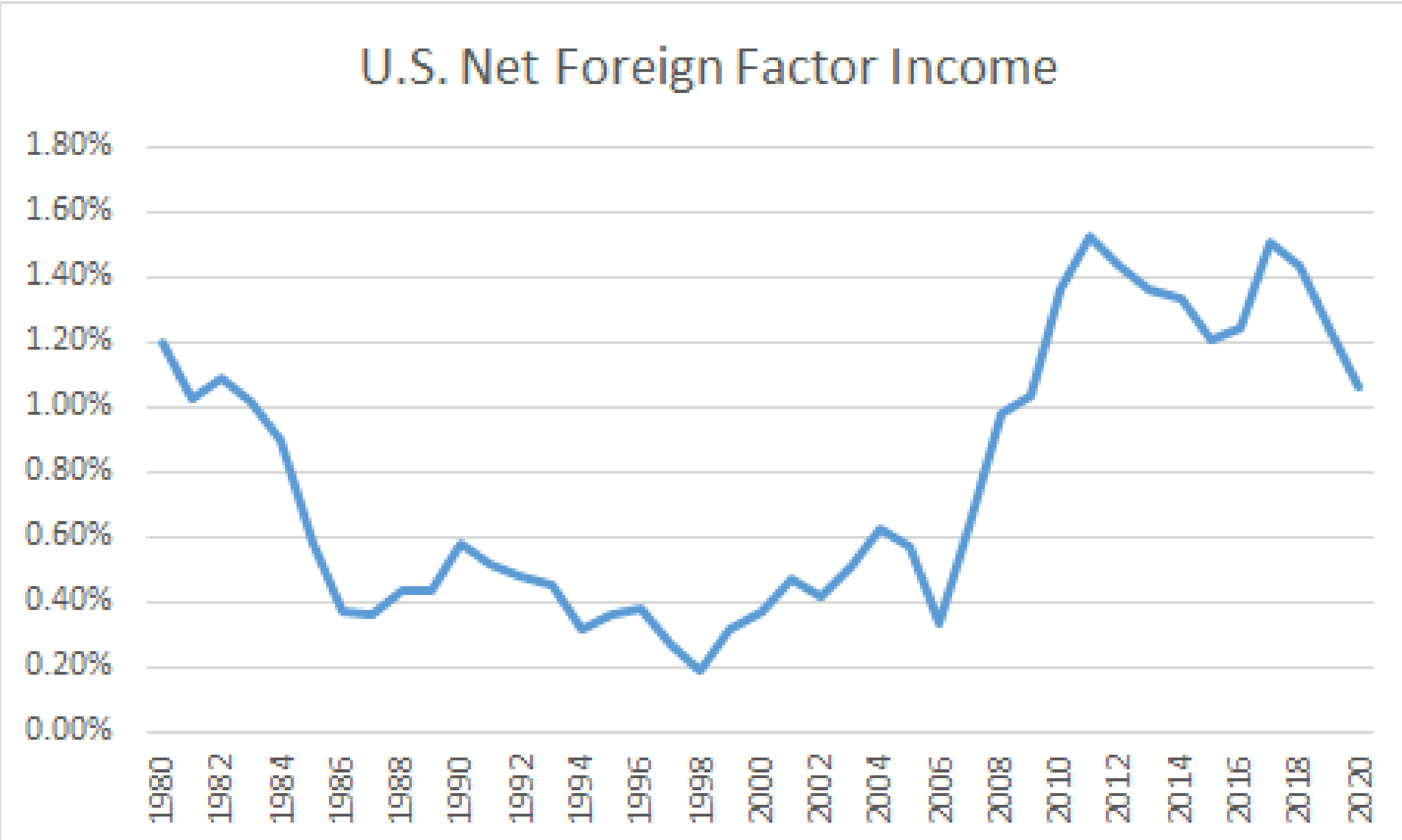
U.S. Current Account Deficit: 1980-2016



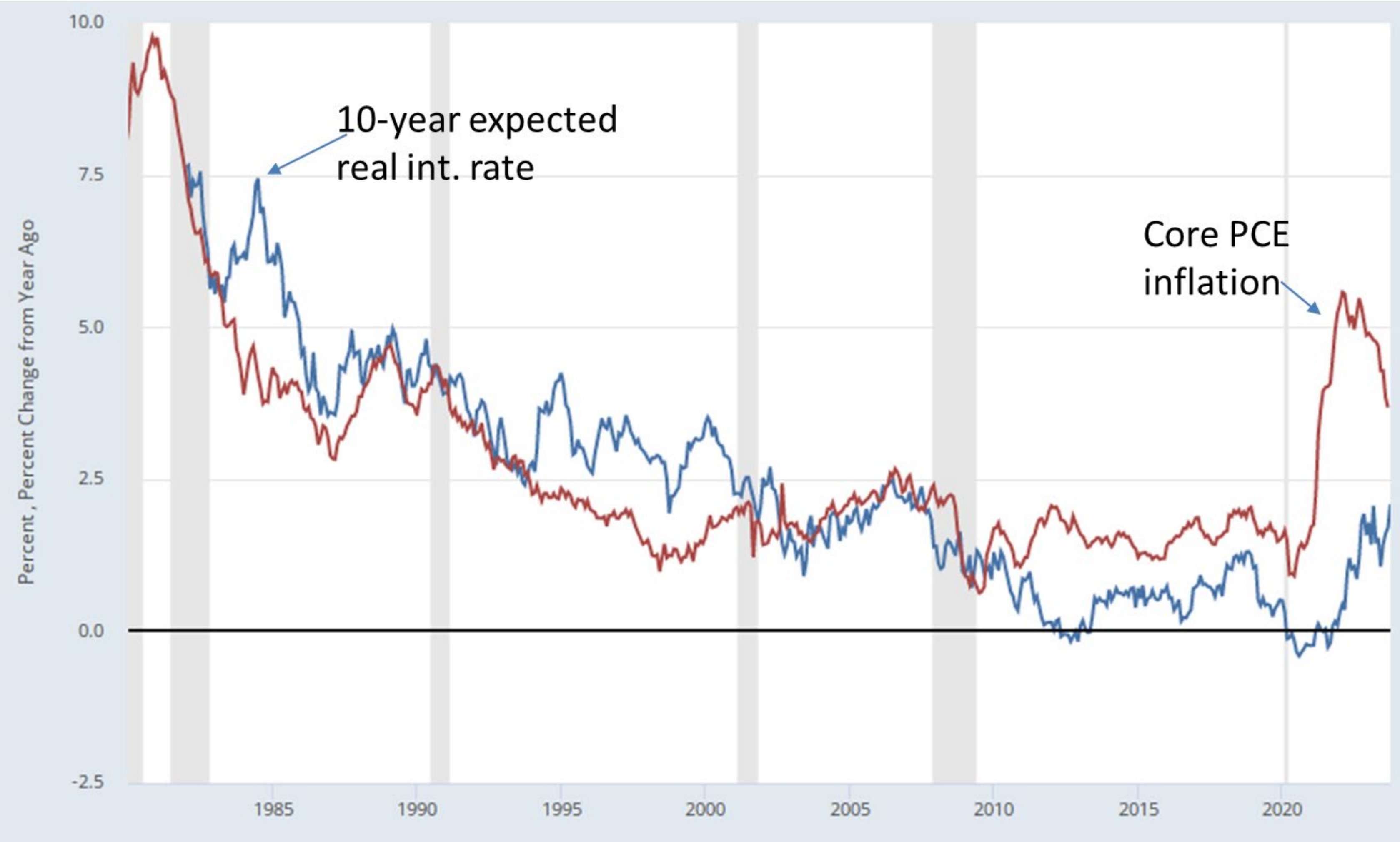
…and it widened with COVID



Net factor payments increased since GFC

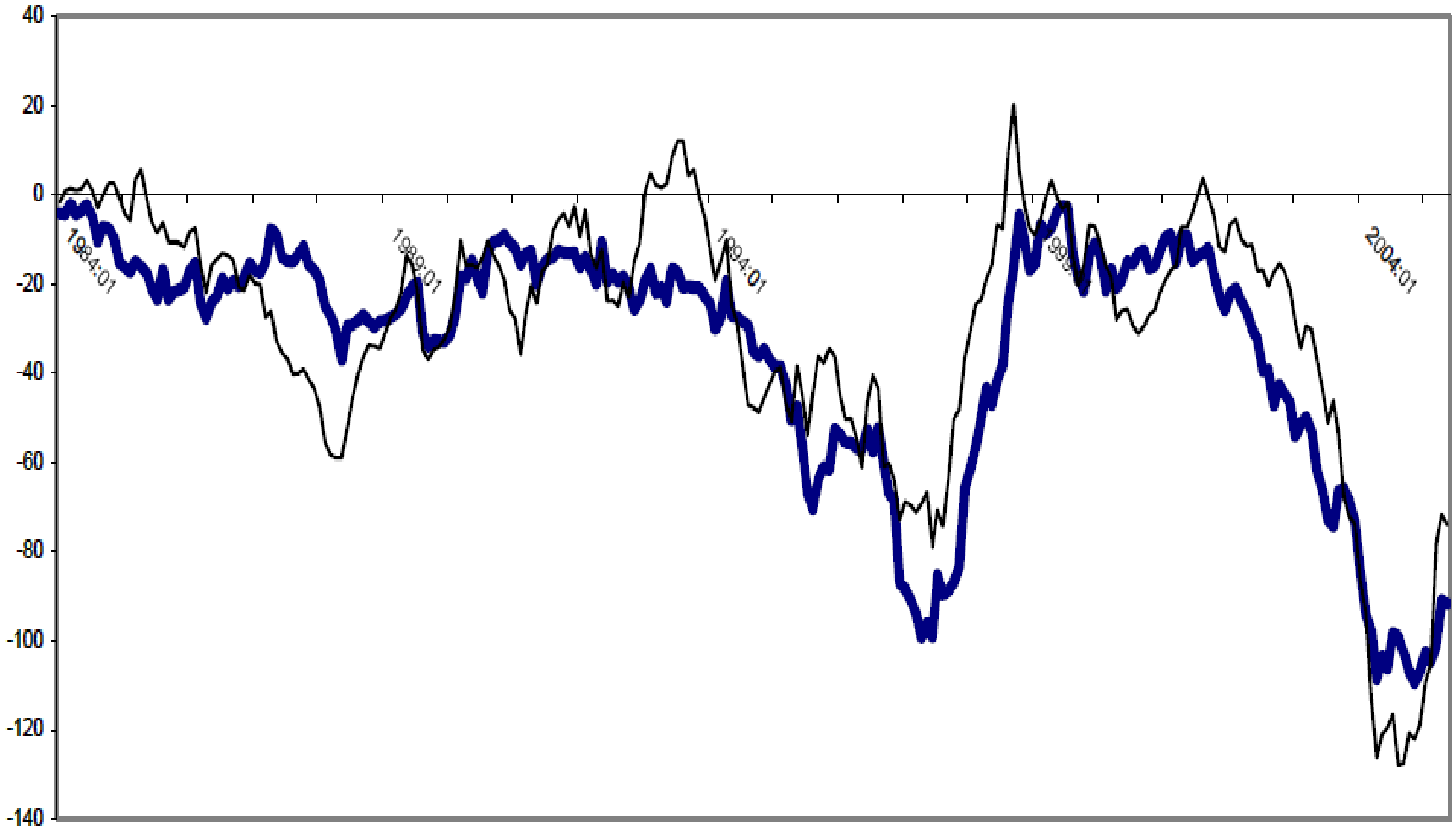


U.S. real interest rate and inflation



Interest rate effect of foreign T-bill purchases

(basis points for 10-year T-bills, Warnock & Warnock (2006))



$$i_{t,10} = a + b\pi^e_{t+10} + (1-b)ff_t + c(\pi^e_{t+1} - \pi^e_{t+10}) + d(rp_t) + e(y^e_{t+1}) + f(deficit_{t-1}) + g(foreign_t) + \varepsilon_t$$

where π^e_{t+10} and π^e_{t+1} are 10-year- and 1-year-ahead inflation expectations; ff_t is the federal funds rate; rp_t is an interest rate risk premium; y^e_{t+1} is expected real GDP growth over the next year; $deficit_{t-1}$ is the structural budget deficit (scaled by lagged GDP); and $foreign_t$ is 12-month foreign official flows into U.S.

Global Imbalances facts

Fact 1: The Wealth Fact

U.S. NFA falling since 1983 to -10% of *world* GDP in 2014 (*CA* at historical low of -2% WGDP in 2006)

Fact 2: The Portfolio Fact

Net equity+FDI position at 4% of *U.S. GDP* on average since 1983

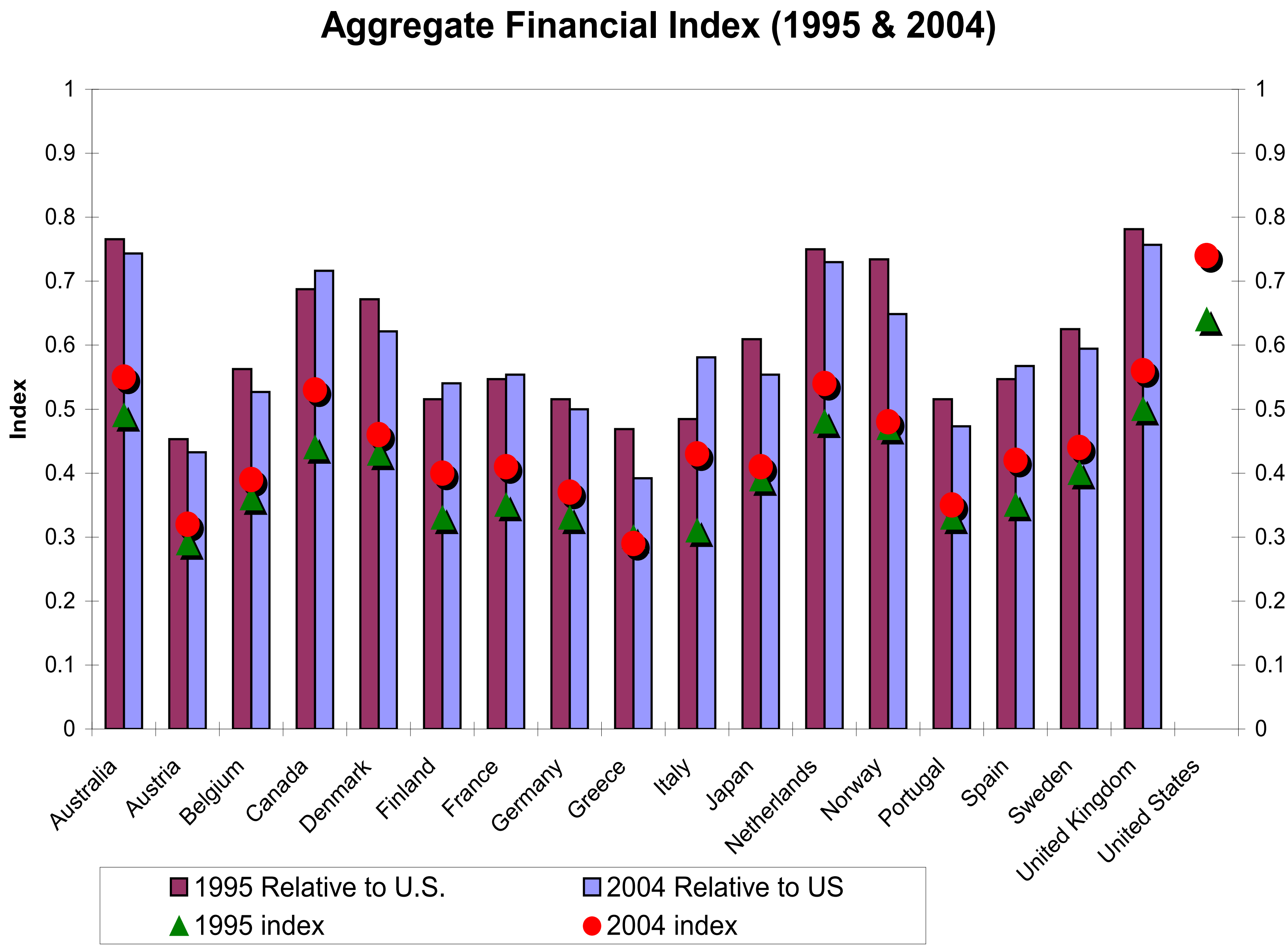
Fact 3: The Interest Rate Fact

52% of long-term Tbills owned by foreign residents by 2005, lowering 10-year yield by up to 120 b. pts.

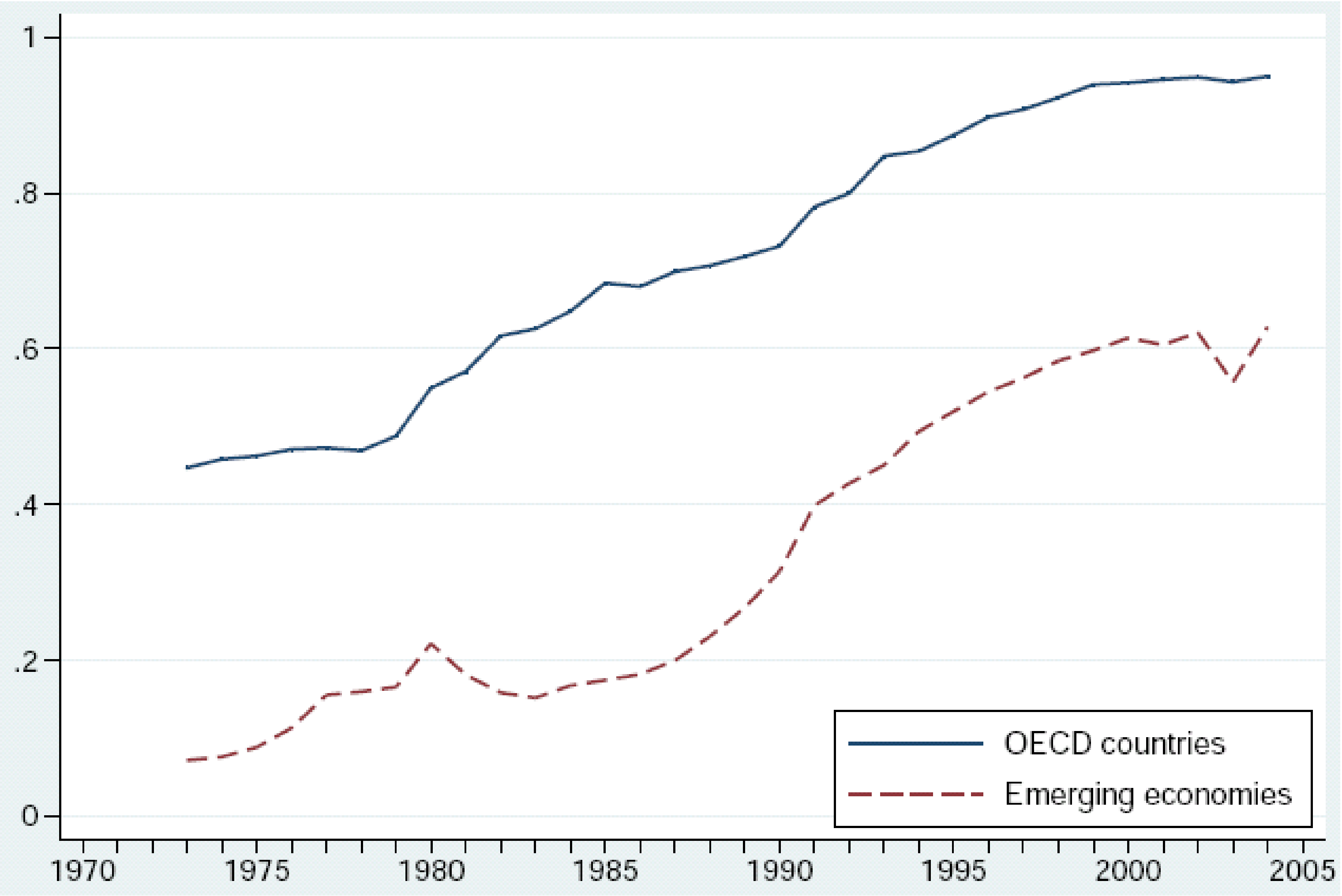
The key questions and our answers

- What caused the global imbalances?
  - *Financial globalization without financial development*
- Are they sustainable?
  - *Yes, but can be a bumpy ride (Sudden Stops)*
- Should we care?
  - *Definitely. Risk of financial crises, but also*
  - *…financial globalization without financial development has negative welfare effects!*

Financial development or the lack thereof



Financial liberalization index
(Abiad, Detragiache and Tressel (2007).



Modeling International Capital Flows with Heterogeneous Agents & Incomplete Markets

"*Financial Integration, Financial Development & Global Imbalances*"

(Mendoza, Quadrini & Rios-Rull JPE, 2009)

Three modifications to Bewley models

1. Multiple countries (global asset markets)
2. Varying degrees of asset market incompleteness (NSC assets to Arrow secs.)
3. Portfolio choice

- New approach to modeling international capital flows and effects of financial integration
  - Does not require asymmetries in income processes, discount rates, K/Y ratios, etc.

Analytical framework

- Countries1 & 2 inhabited by a continuum of agents, each maximizing:

$$E_0\left[\sum_{t=0}^{\infty}\beta^t\,\frac{c_t^{1-\sigma}}{1-\sigma}\right]$$

- Stochastic, idiosyncratic endowment w_t
- Fixed agg. supply of productive asset traded at price P_t, used for individual production:

$$y_{t+1} = z_{t+1}k_t^{\nu}$$

$$R_t(k_t, z_{t+1}) = \frac{\left(P_{t+1} + \nu z_{t+1}k_t^{\nu-1}\right)}{P_t}$$

  - $z_{t+1} \equiv$ Idiosyncratic "investment" shock
  - $k_t \equiv$ Asset used in production
  - ν < 1: dec. returns in home production (fixed supply of managerial capital, indivisible but mobile across countries)

Financial structure

- Contingent claims deliver $b(s_{t+1})$ units of goods, so an individual's wealth is:

$$a(s_{t+1}) = w_{t+1} + k_t P_{t+1} + z_{t+1} k_t^v + b(s_{t+1})$$

- Individual budget constraint

$$a_t = c_t + k_t P_t + \sum_{s_{t+1}} q(s_t, s_{t+1}) b(s_{t+1})$$

- No aggregate uncertainty implies:

$$q(s_t, s_{t+1}) = g(s_t, s_{t+1}) \,/\, (1 + r_t)$$

  - *r* is the eq. risk-free interest rate and *g(.)* the joint Markov trans. prob matrix of the shocks

Financial development

- Limited liability: $a(s_j) \geq 0$

- Limited enforcement of financial contracts:

$$a(s_j) \geq a(s^{worst}) + (1-\phi)\left[\left(w_j + z_j k^v\right) - \left(w^{worst} + z^{worst} k^v\right)\right]$$

  - For all s_j in the Markov realization matrix
  - ϕ^i applies to C. i residents, wherever they own assets (verification of diversion requires verification of c^i)
  - $\phi^i = \Phi \geq 1$ such that constraint does not bind implies complete markets
  - $\phi^i = 0$ allows only non-state-contingent bonds

Contracts with limited enforcement

- Enforceability constraint derived from an optimal contract in an environment in which:
  1. Incomes are observable but not verifiable
  2. Agents can divert $1\text{-}\phi^i$ of endowment and output
  3. There is limited liability

- Incentive compatibility constraint:

$$V_t(s_j, a(s_j)) \geq V_t\left(s_j, a(s^{worst}) + (1-\phi)\left[\left(w_j + z_j k^v\right) - \left(w^{worst} + z^{worst} k^v\right)\right]\right)$$

so strict monotonicity of *V* implies:

$$a(s_j) \geq a(s^{worst}) + (1-\phi)\left[\left(w_j + z_j k^v\right) - \left(w^{worst} + z^{worst} k^v\right)\right]$$

Individual optimization problem

$$V_t^i(s,a) \quad = \quad \max_{c,k,b(s')} \left\{ U(c) + \beta \sum_{s'} V_{t+1}^i\Big(s', a(s')\Big) g(s,s') \right\}$$

subject to

$$a_t = c_t + k_t P_t^i + \sum_{s_{t+1}} b(s_{t+1}) q_t^i(s_t, s_{t+1}),$$

$$a(s_{t+1}) = w_{t+1} + k_t P_{t+1}^i + z_{t+1} k_t^\nu + b(s_{t+1})$$

$$a(s_j) - a(s_1) \quad \geq \quad (1 - \phi^i) \cdot \Big[(w_j + z_j k_t^\nu) - (w_1 + z_1 k_t^\nu) \Big]$$

$$a(s_j) \quad \geq \quad 0$$

Equilibrium

- Given ϕ^i and an initial wealth distribution $M_t^i(s,k,b)$ for each country $i \in\{1,2\}$, a recursive equilibrium is defined by sequences of policy functions $\{c_\tau^i(s,a), k_\tau^i(s,a), b_\tau^i(s,a,s')\}$, value functions $\{V_\tau^i(s,a)\}$, prices $\{P_\tau^i, r_\tau^i, q_\tau^i(s,s')\}$, and distributions $\{M_\tau^i(s,k,b)\}$, for $\tau=t,\ldots,\infty$, such that:

(i) $\{c_\tau^i(s,a), k_\tau^i(s,a), b_\tau^i(s,a,s')\}$ solve opt. problems with $\{V_\tau^i(s,a)\}$ as associated value functions

(ii) Prices satisfy: $q_\tau^i = g(s,s')/(1+r_\tau^i)$

(iii) $\{M_\tau^i(s,k,b)\}$ is consistent w. $M_t^i(s,k,b)$, $\{c_\tau^i(s,a), k_\tau^i(s,a), b_\tau^i(s,a,s')\}$

(iv) Asset markets clear for all $\tau \geq t$ under one of two conditions:

AU: Autarky: each $i \in\{1,2\}$ satisfies

$$\int_{s,k,b} k_\tau^i(s,a) M_\tau^i(s,k,b) = 1, \quad \int_{s,k,b,s'} b_\tau^i(s,a,s') M_\tau^i(s,k,b) g(s,s') = 0$$

FI: Financial integration:

$$\sum_{i=1}^2 \int_{s,k,b} k_\tau^i(s,a) M_\tau^i(s,k,b) = 2 \qquad \sum_{i=1}^2 \int_{s,k,b,s'} b_\tau^i(s,a,s') M_\tau^i(s,k,b) g(s,s') = 0$$

Theoretical analysis

- **Case 1**: Endowment shocks only
  - Can explain Facts 1 and 3, but not 2
- **Case 2**: Production shocks only
  - Can explain Fact 2 (may not explain Facts 1 and 3)
- **Case 3**: Endowment and production shocks
  - Can explain both facts

Case 1: Endowment shocks only

Autarky with $\phi=0$ (*Bewley case*)

$$b(w_1) = \ldots = b(w_N) = b,$$

$$U'(c) = \beta(1+r_t)EU'(c(w')) + (1+r_t)E\lambda(w')$$

$$U'(c) = \beta R_{t+1}(k,\ \bar{z})EU'(c(w')) + R_{t+1}(k,\ \bar{z})E\lambda(w')$$

$$R_{t+1}(k,\ \bar{z}) = 1 + r_t \qquad P_t = P_{t+1} = \nu\bar{z}/r. \qquad \beta(1+r_t) < 1$$

Autarky with $\phi=\Phi$ (*Arrow secs. case*)

$$U'(c) = \beta(1+r_t)U'(c(w')) + (1+r_t)\lambda(w') \quad \forall w'$$

$$U'(c) = \beta R_{t+1}(k,\ \bar{z})EU'(c(w')) + R_{t+1}(k,\ \bar{z})E\lambda(w')$$

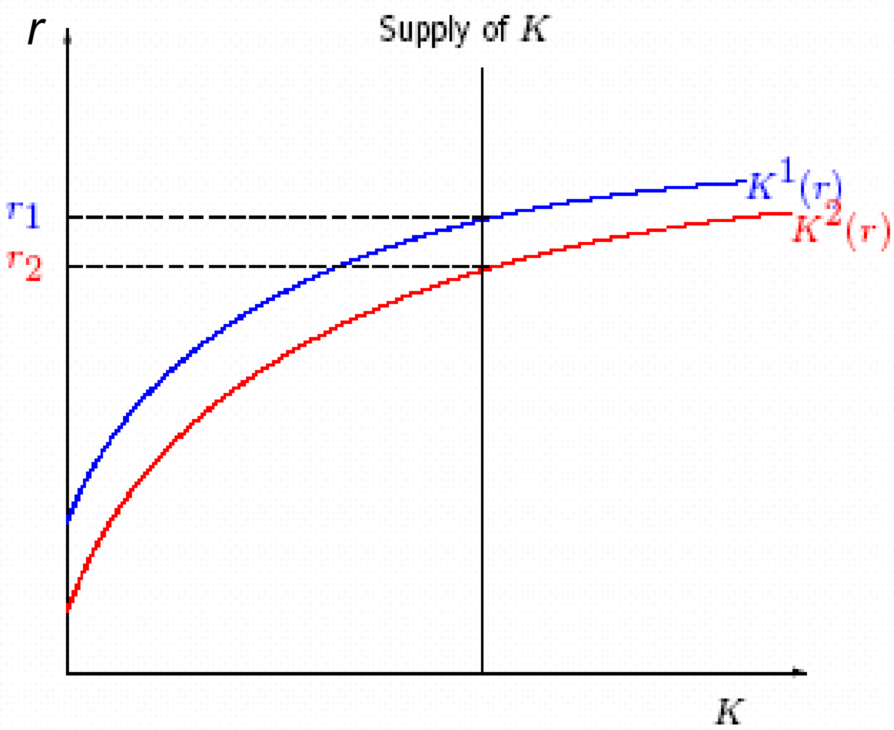
$$R_{t+1}(k,\ \bar{z}) = 1 + r_t \qquad P_t = P_{t+1} = \nu\bar{z}/r. \qquad \beta(1+r_t) = 1$$

Case 1: Equilibrium with Financial Integration of the Bewley and Arrow Economies

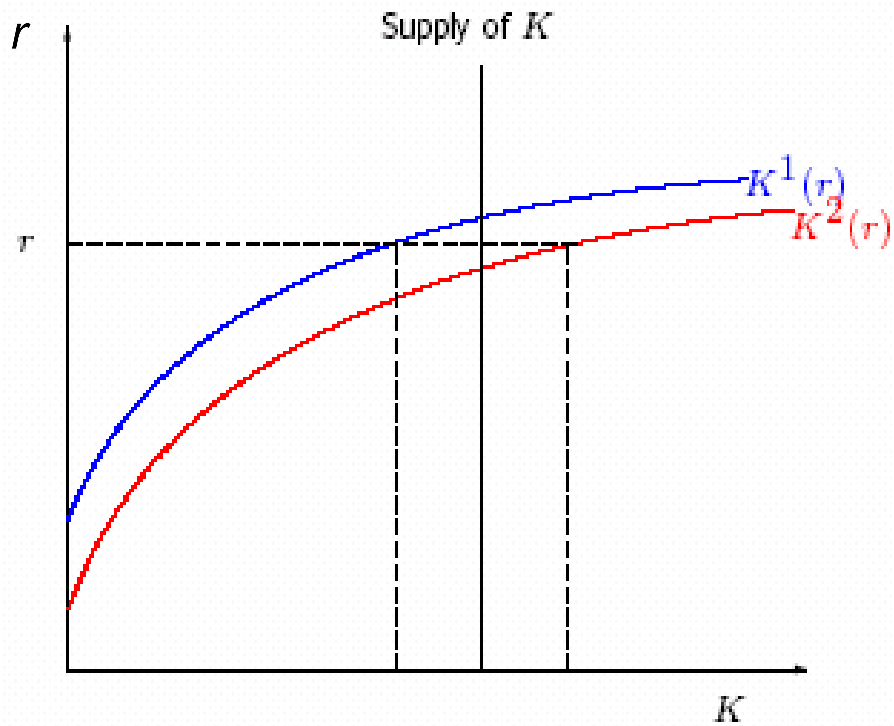
- Prop. 1: Financial integration with $\phi^1 = \Phi$ and $\phi^2 = 0$ implies that at steady state C. 1 features:
  1. Negative NFA, due to precautionary savings incentive in C. 2
  2. Zero foreign prod. asset holdings, due to arbitrage against riskless return
  3. Interest rate lower than $1/\beta$, otherwise C. 2's NFA goes to ∞

- Generalizes to any (ϕ^1,ϕ^2) such that $0 \leq \phi^2 < \phi^1 \leq \Phi$
  - $\phi^2 < \phi^1$ (weaker enforcement in C. 2) lowers NFA in C. 1 and yields equilibrium interest rate below C. 1' autarky rate

Financial autarky v. financial globalization
(A Bewley approach to Metzler's diagram)



a) Autarky



b) Mobility

Case 2: Investment shocks only

φ=0

(*Bewley case*)

$$b(z_1) = \ldots = b(z_N) = b$$

$$U'(c) = \beta(1 + r_t)E[U'(c(z'))] + (1 + r_t)E[\lambda(z')]$$

$$U'(c) = \beta E[U'(c(z'))R_{t+1}(k, z')] + E[\lambda(z')R_{t+1}(k, z')]$$

$$ER_{t+1}(k, z') - (1 + r_t) = -\frac{\text{Cov}\,[R_{t+1}(k, z'), U'(c(z'))]}{EU'(c(z'))}$$

$$\beta(1+r_t) < 1 \qquad ER_{t+1}(k, z') > 1 + r_t$$

φ=Φ

(*Arrow secs. case*)

$$U'(c) = \beta(1 + r_t)U'(c(z')) + (1 + r_t)\lambda(z') \quad \forall z'$$

$$U'(c) = \beta ER_{t+1}(k, z')U'(c(z')) + E\lambda(z')R_{t+1}(k, z')$$

$$\beta(1+r_t) = 1 \qquad ER_{t+1}(k, z') = 1 + r_t$$

Case 2: Equilibrium with Financial Integration

- Prop. 2: If $\phi^1 = \Phi$ and $\phi^2 = 0$, C. 1 holds negative NFA position in the steady state with financial integration, has positive NPA, and faces an interest rate lower than (a) $1/\beta$ and (b) mean return on foreign prod. assets
  - C. 2 agents demand higher premium on asset returns because of imperfect insurance, C. 1 agents buy assets in C. 2
  - Equity premium implies interest rate lower than risky returns

- Leverage buildup: Country with deeper financial markets invests in foreign high-return assets and finance this with debt.

- Results do not generalize to any $0 \leq \phi^2 < \phi^1 \leq \Phi$
  - If $\phi^2 < \phi^1 < \Phi$, C. 1 still buys some of C. 2's risky asset, but by taking more risk it can stimulate enough precautionary savings to yield positive NFA.

Modifications for quantitative analysis

- N countries, heterogeneous in $a(s_j) \geq \underline{a}^i$
- Divisible managerial capital A, so GNI is:

$$y_{t+1} = \sum_{\ell=1}^{N} z_{\ell,t+1} A_{\ell,t+1}^{1-\nu} k_{\ell,t}^{\nu} \qquad with \quad \sum_{\ell=1}^{N} A_{\ell,t+1} = 1$$

  – Financial integration now allows risk diversification

  – We can now determine *gross* and *net* FA positions

  – Markov states: $s_t = [w_t, z_{1,t}, \ldots, z_{N,t}]$

  – Net worth: $$a_t = c_t + \sum_{\ell=1}^{N} k_{\ell,t} P_{j,t} + \sum_{s_{t+1}} b(s_{t+1}) q_t^i(s_t, s_{t+1})$$

  – Budget const.: $$a(s_{t+1}) = w_{t+1} + \sum_{\ell=1}^{N} \left[k_{\ell,t} P_{\ell,t+1} + z_{\ell,t+1} A_{\ell,t}^{1-\nu} k_{\ell,t}^{\nu} \right] + b(s_{t+1})$$

Individual optimization problem

$$V_t^i(s,a) \;=\; \max_{A_\ell,k_\ell,b(s')} \left\{U(c) + \beta \sum_{s'} V_{t+1}^i\Big(s', a(s')\Big) g(s,s')\right\}$$

subject to

$$A_\ell \in [0,1],\ \sum_{\ell=1}^{N} A_\ell = 1$$

$$a(s_j) \geq \underline{a}^i$$

$$a(s_j) - a(s_1) \geq (1-\phi^i)\cdot\left[w^j - w^1 + \textstyle\sum_{\ell=1}^{N}(z_{\ell,t+1}^j - z_{\ell,t+1}^1)A_{\ell,t}^{1-\nu}k_{\ell,t}^{\nu}\right]$$

$$a_t = c_t + \sum_{\ell=1}^{N} k_{\ell,t}P_{j,t} + \sum_{s_{t+1}} b(s_{t+1})q_t^i(s_t,s_{t+1})$$

$$a(s_{t+1}) = w_{t+1} + \sum_{\ell=1}^{N}\left[k_{\ell,t}P_{\ell,t+1} + z_{\ell,t+1}A_{\ell,t}^{1-\nu}k_{\ell,t}^{\nu}\right] + b(s_{t+1})$$

Global market clearing conditions

- Global market for <u>each</u> country's prod. asset:

$$\sum_{i=1}^{N} \int_{s,A,k,b} k^i_{\ell,\tau}(s,a) M^i_\tau(s,A,k,b) = \mu^\ell$$

  - Asset prices not equalized unless shocks are perfectly correlated

- Global market of state contingent claims:

$$\sum_{i=1}^{N} \int_{s,A,k,b,s'} b^i_\tau(s,a,s') M^i_\tau(s,A,k,b) g(s,s') = 0$$

Solution method

- Transform agent's problem into equivalent problem with a single riskless bond and "residual income processes"
- Define conditional expected value of s.c. claims:

$$\bar{b}_t = \sum_{s_{t+1}} b(s_{t+1}) g(s_t, s_{t+1})$$

- Rewrite contingent claims in terms of a synthetic n.s.c. bond and the "*pure insurance*" component of s.c. claims:

$$b(s_{t+1}) = \bar{b}_t + x(s_{t+1}) \qquad \sum_{s_{t+1}} x(s_{t+1}) g(s_t, s_{t+1}) = 0$$

- Rewrite law of motion of wealth:

$$a(s_{t+1}) = w_{t+1} + \sum_{j=1}^{I} \left[k_{j,t} P^j_{t+1} + z_{j,t+1} A^{1-\nu}_{j,t} k^{\nu}_{j,t} \right] + \bar{b}_t + x(s_{t+1})$$

- Agents desire maximum insurance, so enforcement constraint holds with equality:

$$a(s_n) = a(s_1) + (1-\phi) \cdot \left[w_n - w_1 + \sum_{j=1}^{I} (z_{j,n} - z_{j,1}) A_{j,t}^{1-\nu} k_{j,t}^{\nu} \right]$$

- Rewrite the enforcement constraint as:

$$x(s_n) - x(s_1) = -\phi \cdot \left[w_n - w_1 + \sum_{j=1}^{I} (z_{j,n} - z_{j,1}) A_{j,t}^{1-\nu} k_{j,t}^{\nu} \right]$$

for all $n \in \{2, .., N\}$

- Using the above and $\sum_{n} x(s_n) g(s_t, s_n) = 0$ we obtain:

$$x(s_n) = -\phi \cdot W_n(s_t) - \phi \cdot \sum_{j=1}^{I} Z_{j,n}(s_t) \cdot A_{j,t}^{1-\nu} k_{j,t}^{\nu}$$

- ….where

$$W_n(s_t) = w_n - \sum_{\ell} g(s_t, s_\ell) w_\ell$$

$$Z_{j,n}(s_t) = z_{j,n} - \sum_{\ell} g(s_t, s_\ell) z_{j,\ell}$$

- So we can define residual incomes as follows:

$$\tilde{w}_n(s_t) = w_n - \phi \cdot W_n(s_t)$$

$$\tilde{z}_{j,n}(s_t) = z_{j,n} - \phi \cdot Z_{j,n}(s_t)$$

  - ϕ = 0: no insurance, residual incomes same as original incomes
  - ϕ = 1 and i.i.d shocks: expected income is time & state invariant (full insurance)
  - Use residual incomes to rewrite law of motion of wealth in terms of risky assets and a n.s.c. bond

Equivalent optimization problem

$$V_t^i(s,a) \quad = \quad \max_{A,k,b(s')} \left\{ U(c) + \beta \sum_{s'} V_{t+1}^i\Big(s', a(s')\Big) g(s,s') \right\}$$

subject to

$$A_j \in [0,1], \; \sum_{j=1}^{I} A_j = 1$$

$$a(s_j) \geq \underline{a}^i$$

$$a_t = c_t + \sum_{j=1}^{I} k_{j,t} P_t^j + \frac{\bar{b}_t}{1+r}$$

$$a(s_n) = \tilde{w}_n(s_t) + \sum_{j}^{I} \left[k_{j,t} P_{t+1}^j + \tilde{z}_{j,n}(s_t) \cdot A_{j,t}^{1-\nu} k_{j,t}^{\nu} \right] + \bar{b}_t$$

Calibration for two-country baseline

- $\beta = 0.925$ to yield 3.3 world wealth-income ratio
- CRRA coefficient: $\sigma = 2$
- C1 is U.S., 30% of world GDP, μ^1=0.3
- Financial structure:

$$\phi^1 = 0.35, \quad \phi^2 = 0, \quad \underline{a}^1 = \underline{a}^2 = 0$$

- Individual earnings process set to U.S. estimates:

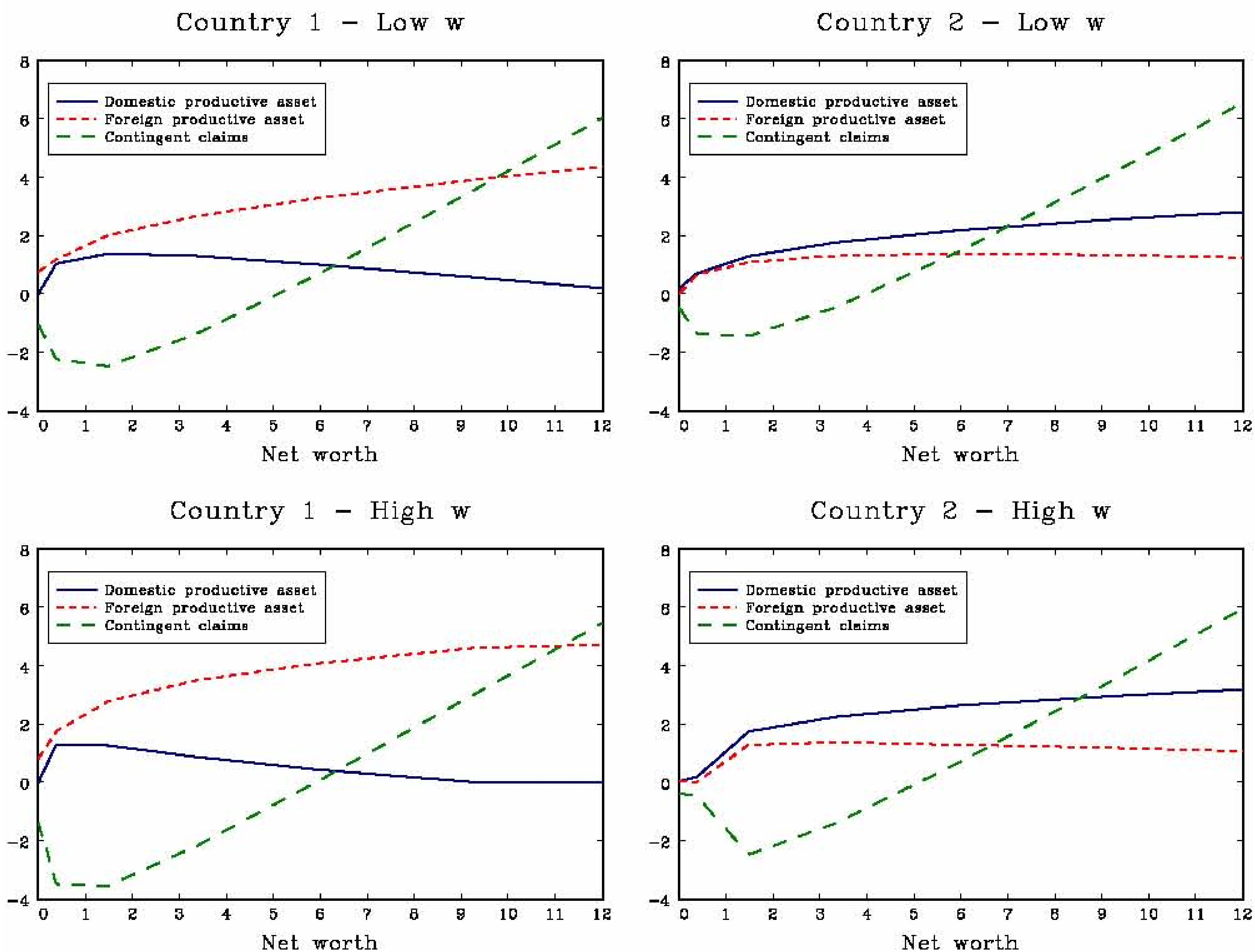
$$w = \bar{w}(1 \pm \Delta_w) \quad \bar{w} = 0.85 \quad \Delta_w = 0.6, \quad g(w, w') = 0.95$$

- Production:

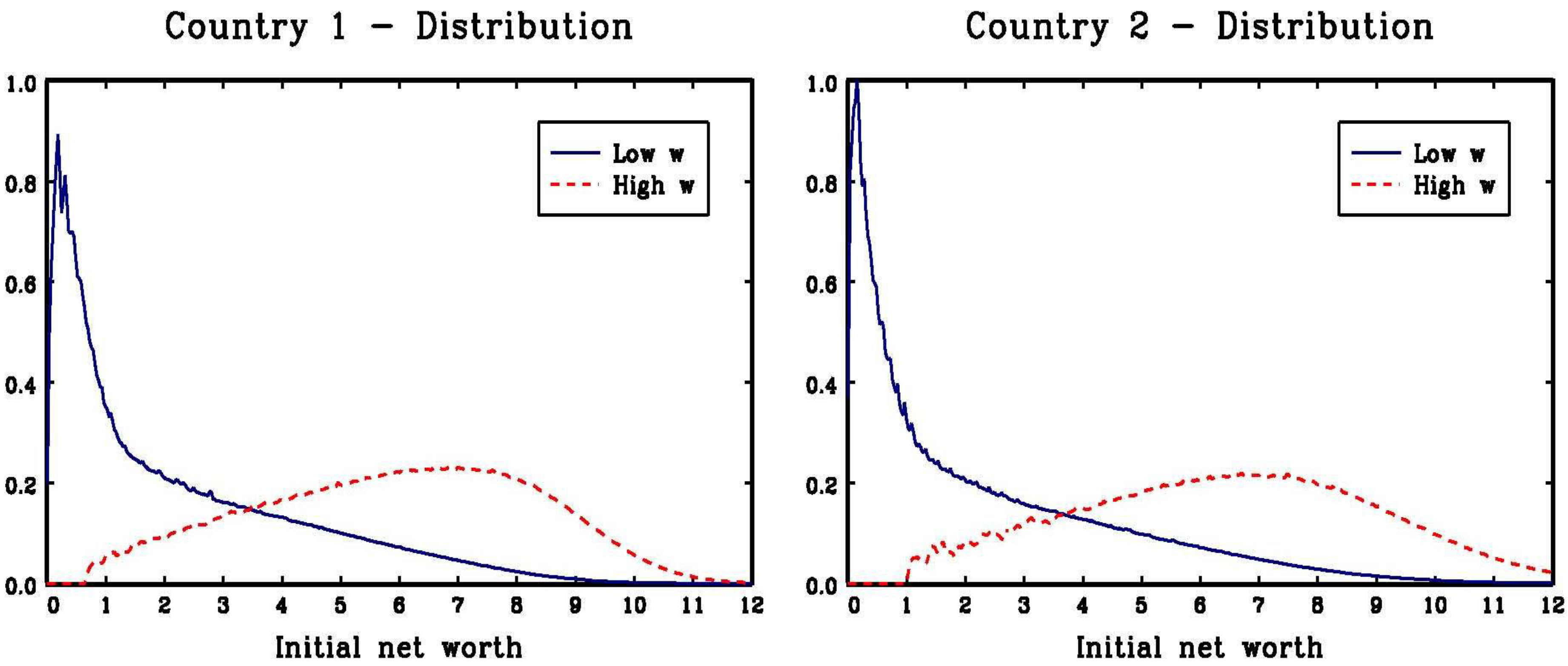
$$y = \overline{z}k^{\nu}, \quad \nu = 0.75, \quad y = \overline{z}k^{\nu} = 0.15$$

z is i.i.d. with ±2.5 deviations from mean (returns vary -6% to 14%)

Decision rules under financial integration
(gross asset positions & net claims position)

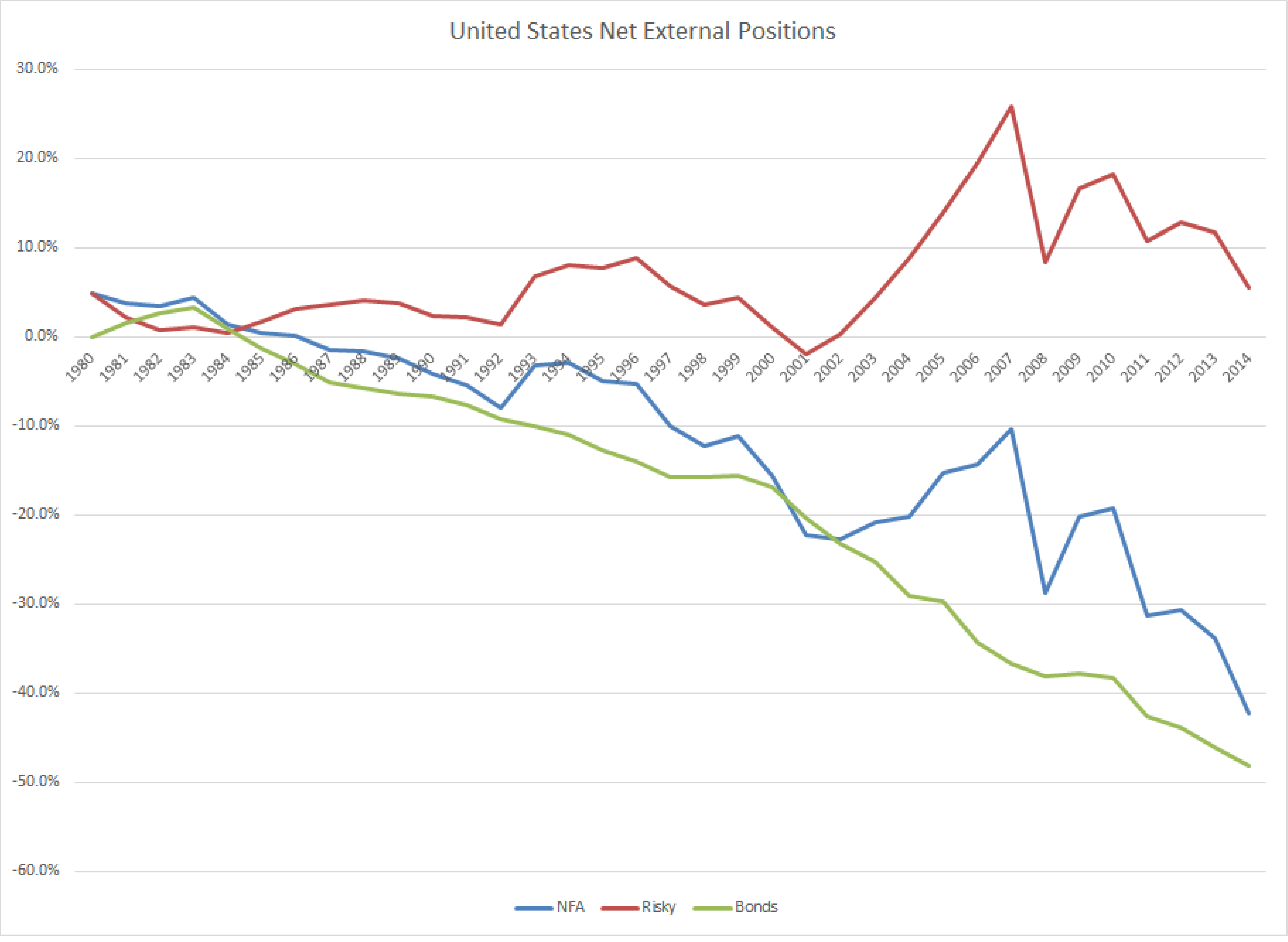


Long-run wealth distributions under financial integration



Comparing long-run positions: both shocks

	Autarky		Capital mobility	
	C1	*C2*	*C1*	*C2*
Prices of productive assets	3.08	3.40	3.38	3.22
Returns on productive assets	4.80	4.30	4.41	4.58
Interest rate	3.25	2.60	3.05	3.05
Net foreign asset positions	-	-	-51.39	22.12
Productive assets	-	-	37.41	-16.10
Bonds	-	-	-88.80	38.22
Gross holdings of productive assets				
Domestic	1.00	1.00	0.24	0.61
Foreign	-	-	0.91	0.33


United States Net External Positions
30.0%
20.0%
10.0%
0.0%
-10.0%
-20.0%
-30.0%
-40.0%
-50.0%
-60.0%
1980
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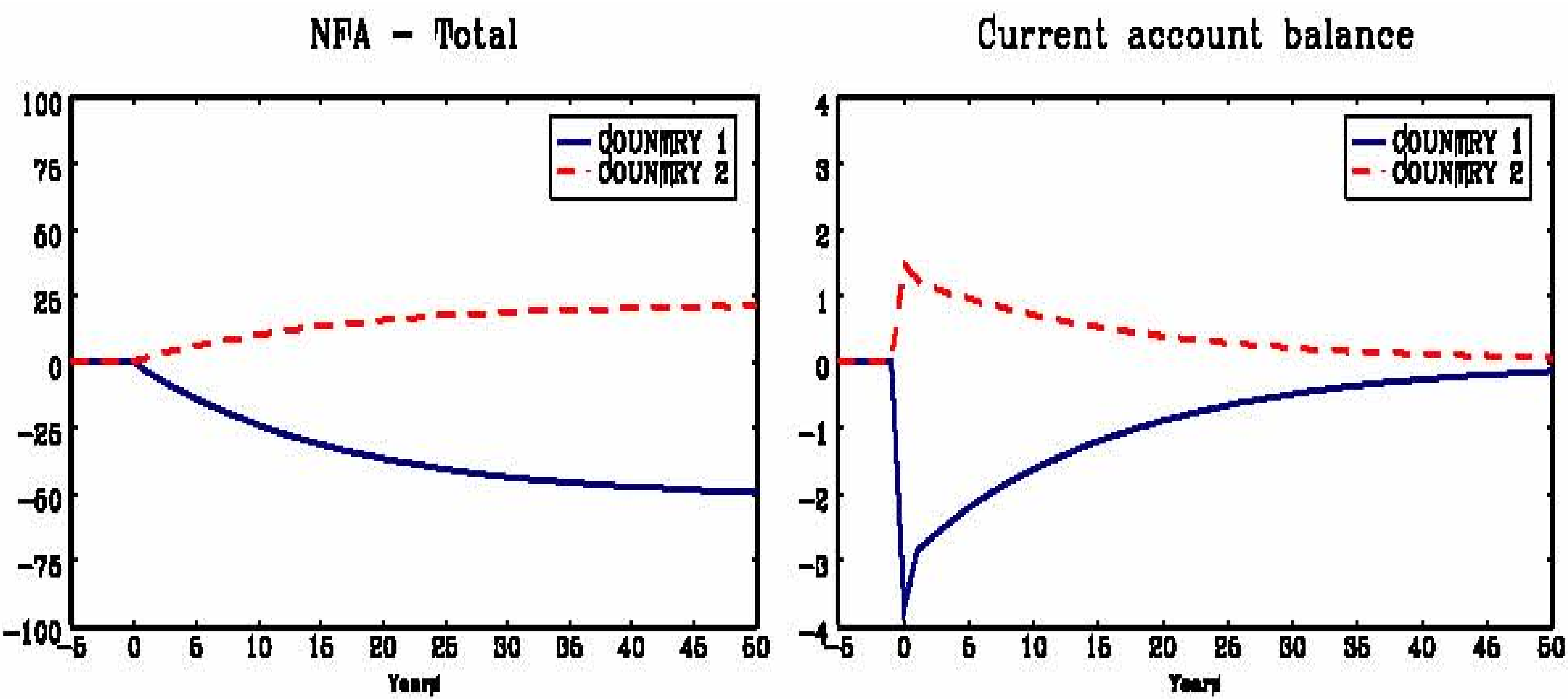
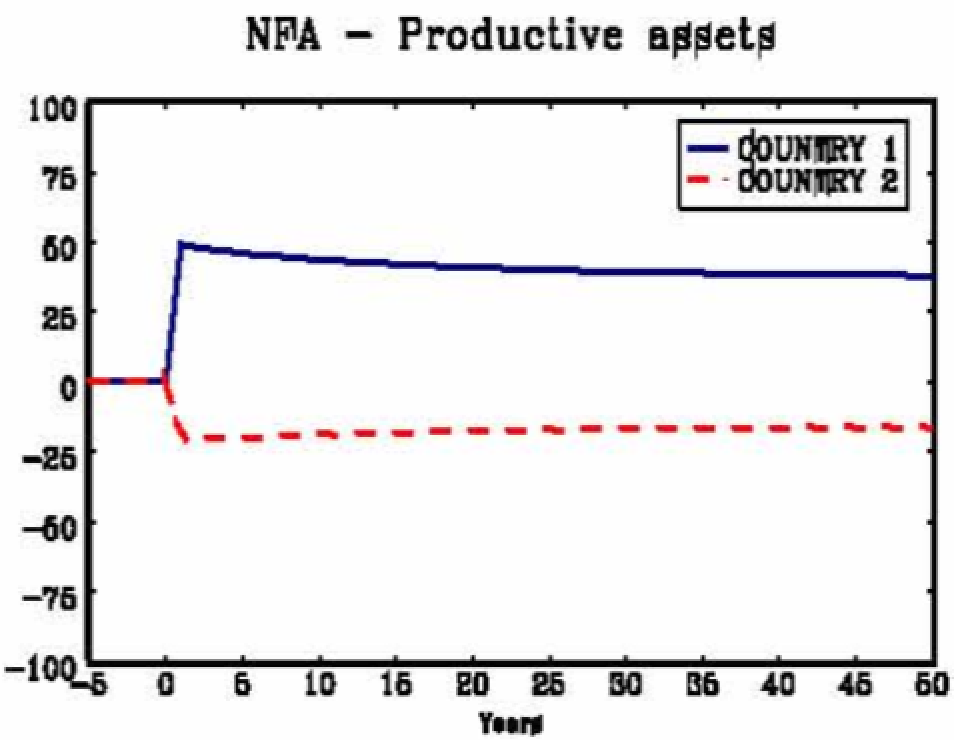
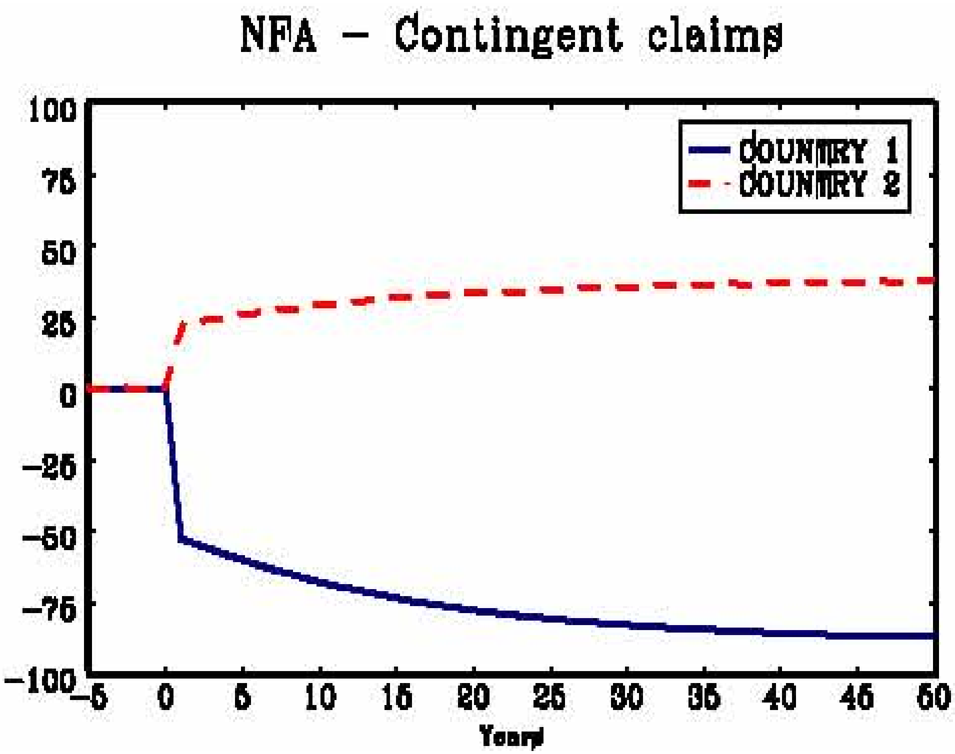
2009
2010
2011
2012
2013
2014
NFA
Risky
Bonds

Transitional dynamics: NFA & Current Account



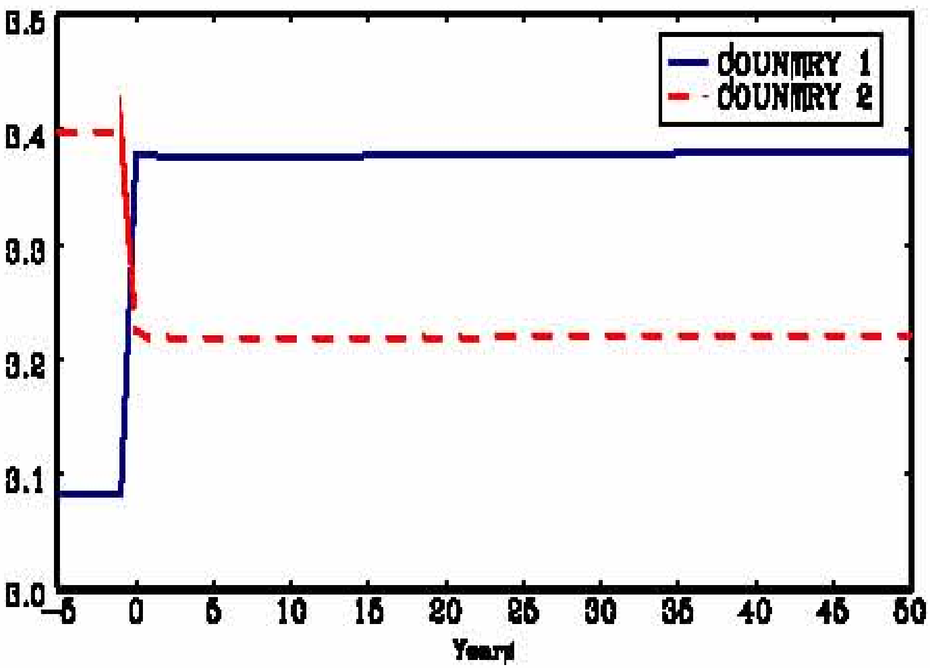
Transitional dynamics: NFA portfolios



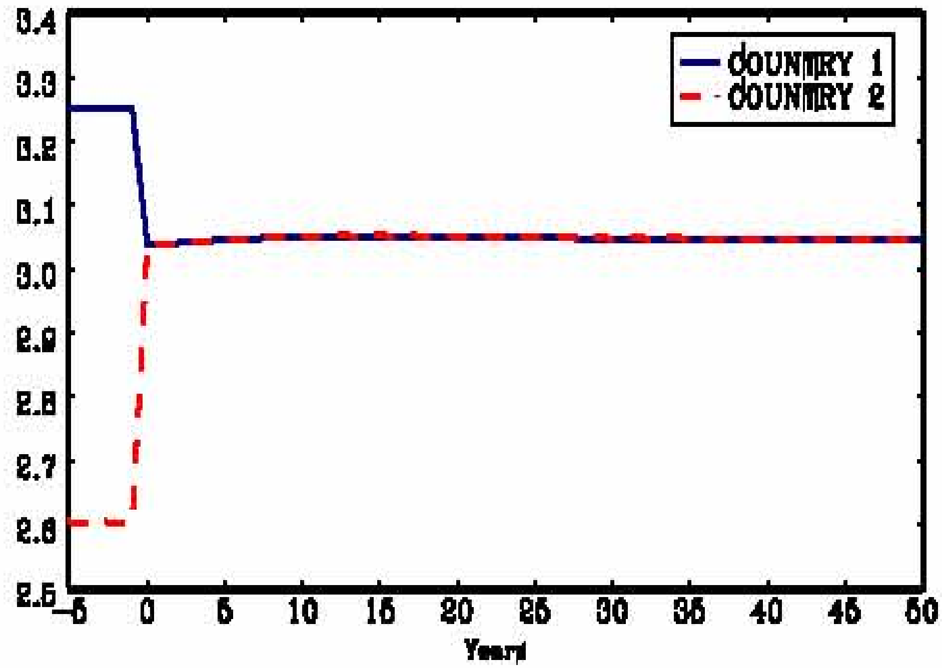


Transitional dynamics: asset prices

Prices of productive assets



Interest rates



Correlated investment shocks

	Autarky		Capital mobility	
	C1	*C2*	*C1*	*C2*
A) Shocks are partially correlated (correlation=0.5)				
Prices of productive assets	3.08	3.40	3.34	3.26
Returns on productive assets	4.81	4.30	4.32	4.57
Interest rate	3.25	2.60	2.92	2.92
Net foreign asset positions	-	-	-47.69	20.54
Productive assets	-	-	60.29	-25.97
Bonds	-	-	-107.98	46.50
B) Shocks are perfectly correlated (correlation=1)				
Prices of productive assets	3.08	3.40	3.28	3.28
Returns on productive assets	4.81	4.30	4.26	4.59
Standard deviation of returns	8.11	11.76	7.27	12.50
Interest rate	3.25	2.48	2.83	2.83
Net foreign asset positions	-	-	-43.67	18.52
Productive assets	-	-	82.36	-34.92
Bonds	-	-	-126.03	53.44

Residence v. source-based enforcement

1. C.1 residence, C.2 source (on foreign holdings)

$$a(s_j) - a(s_1) \geq (1-\phi^2) \cdot \left[w^j - w^1 + (z_2^j - z_2^1) A_{2,t}^{1-\nu} k_{2,t}^{\nu} \right] + (1-\phi^1)(z_1^j - z_1^1) A_{1,t}^{1-\nu} k_{1,t}^{\nu}$$

2. C.1 source (on foreign holdings), C2 residence

$$a(s_j) - a(s_1) \geq (1-\phi^1) \cdot \left[w^j - w^1 + (z_1^j - z_1^1) A_{1,t}^{1-\nu} k_{1,t}^{\nu} \right] + (1-\phi^2)(z_2^j - z_2^1) A_{2,t}^{1-\nu} k_{2,t}^{\nu}$$

3. C.1 & C.2 foreign holdings enforced at $\tilde{\phi} = (\phi^1 + \phi^2)/2$

$$a(s_j) - a(s_1) \geq (1-\phi^1) \cdot \left[w^j - w^1 + (z_1^j - z_1^1) A_{1,t}^{1-\nu} k_{1,t}^{\nu} \right] + (1-\tilde{\phi})(z_2^j - z_2^1) A_{2,t}^{1-\nu} k_{2,t}^{\nu}$$

4. C.1 & C.2 source-based on foreign holdings (1. and 2.)

Country 1 *or* Country 2 source based

	Autarky		Capital mobility	
	$C1$	$C2$	$C1$	$C2$
A) Source based only for residents of C2				
Prices of productive assets	3.08	3.40	3.47	3.20
Returns on productive assets	4.81	4.30	4.43	4.54
Interest rate	3.25	2.60	2.97	2.97
Net foreign asset positions	-	-	-54.98	23.67
Productive assets	-	-	4.36	-1.88
Bonds	-	-	-59.34	25.55
B) Source based only for residents of C1				
Prices of productive assets	3.08	3.40	3.43	3.19
Returns on productive assets	4.81	4.30	4.52	4.57
Interest rate	3.25	2.60	3.10	3.10
Net foreign asset positions	-	-	-51.16	22.07
Productive assets	-	-	10.41	-4.49
Bonds	-	-	-61.57	26.56

Source based in both countries

	Autarky		Capital mobility	
	C1	C2	C1	C2
D) Partially source based for residents of both countries				
Prices of productive assets	3.08	3.40	3.45	3.20
Returns on productive assets	4.81	4.30	4.48	4.55
Interest rate	3.25	2.60	3.03	3.03
Net foreign asset positions	-	-	-52.21	22.50
Productive assets	-	-	5.07	-2.18
Bonds	-	-	-57.28	24.68
C) Source based for residents of both countries				
Prices of productive assets	3.08	3.40	3.50	3.17
Returns on productive assets	4.81	4.30	4.54	4.53
Interest rate	3.25	2.60	3.02	3.02
Net foreign asset positions	-	-	-54.02	23.31
Productive assets	-	-	-22.13	9.55
Bonds	-	-	-31.89	13.76

Heterogeneity in ϕ and $\underline{a}$

	Autarky		Capital mobility	
	C1	*C2*	*C1*	*C2*
A) Differences in $\underline{a}$ only: $\underline{a}^1 = -1$, $\underline{a}^2 = 0$, $\phi^1 = \phi^2 = 0.35$				
Prices of productive assets	2.96	3.40	3.39	3.16
Returns on productive assets	4.94	4.30	4.56	4.56
Interest rate	3.02	2.60	3.00	2.85
Net foreign asset positions	-	-	-65.81	28.31
Productive assets	-	-	-13.96	6.01
Bonds	-	-	-51.85	22.30
B) Differences in both: $\underline{a}^1 = -1$, $\underline{a}^2 = 0$, $\phi^1 = 0.35$, $\phi^2 = 0$				
Prices of productive assets	2.74	3.40	3.25	3.09
Returns on productive assets	5.42	4.30	4.59	4.77
Interest rate	3.68	2.60	3.18	3.18
Net foreign asset positions	-	-	-105.25	45.30
Productive assets	-	-	35.89	-15.45
Bonds	-	-	-141.14	60.75

Three-country case with differences in growth and volatility

	Autarky			Capital mobility		
	C1	C2	C3	C1	C2	C3
Prices of productive assets	2.65	2.95	3.84	2.85	2.82	2.87
Returns on productive assets	5.63	5.05	3.60	5.10	5.10	5.81
Interest rate	3.96	3.53	1.24	3.68	3.68	3.68
Net foreign asset positions	-	-	-	-76.89	-0.23	117.07
Productive assets	-	-	-	29.68	29.54	-120.70
Bonds	-	-	-	-106.57	-29.77	237.77
Gross holdings of productive assets						
Country 1	1.00	1.00	1.00	0.33	0.32	0.19
Country 2	-	-	-	0.57	0.57	0.21
Country 3	-	-	-	0.20	0.20	0.19

Notes: The heterogeneous parameters are $\phi = (0.5, 0.5, 0)$, $\underline{a} = (-1, 0, 0)$, $\beta = (0.925, 0.925, 0.863)$, $\Delta_w = (0.6, 0.6, 0.9)$, $\Delta_z = (2.5, 2.5, 3.75)$, $\mu = (0.3, 0.5, 0.2)$. See also Table 1.

Welfare effects: individual v. aggregate

- Individual welfare effect on agent "j":

$$E_0 \sum_{t=0}^{\infty} \beta^t u\left(c_t^{FA}(1+g^j)\right) = E_0 \sum_{t=0}^{\infty} \beta^t u\left(c_t^{FI}\right)$$

$$(1+g^j)^{1-\sigma} V^{FA}(\varepsilon, a) = V_0^{FI}(\varepsilon, a)$$

  - There is a distribution of individual welfare effects associated with each country's wealth distribution
  - Calculations include transitional dynamics

- Aggregate welfare effect on country "i": social welfare function weights each individual equally (utilitarian)

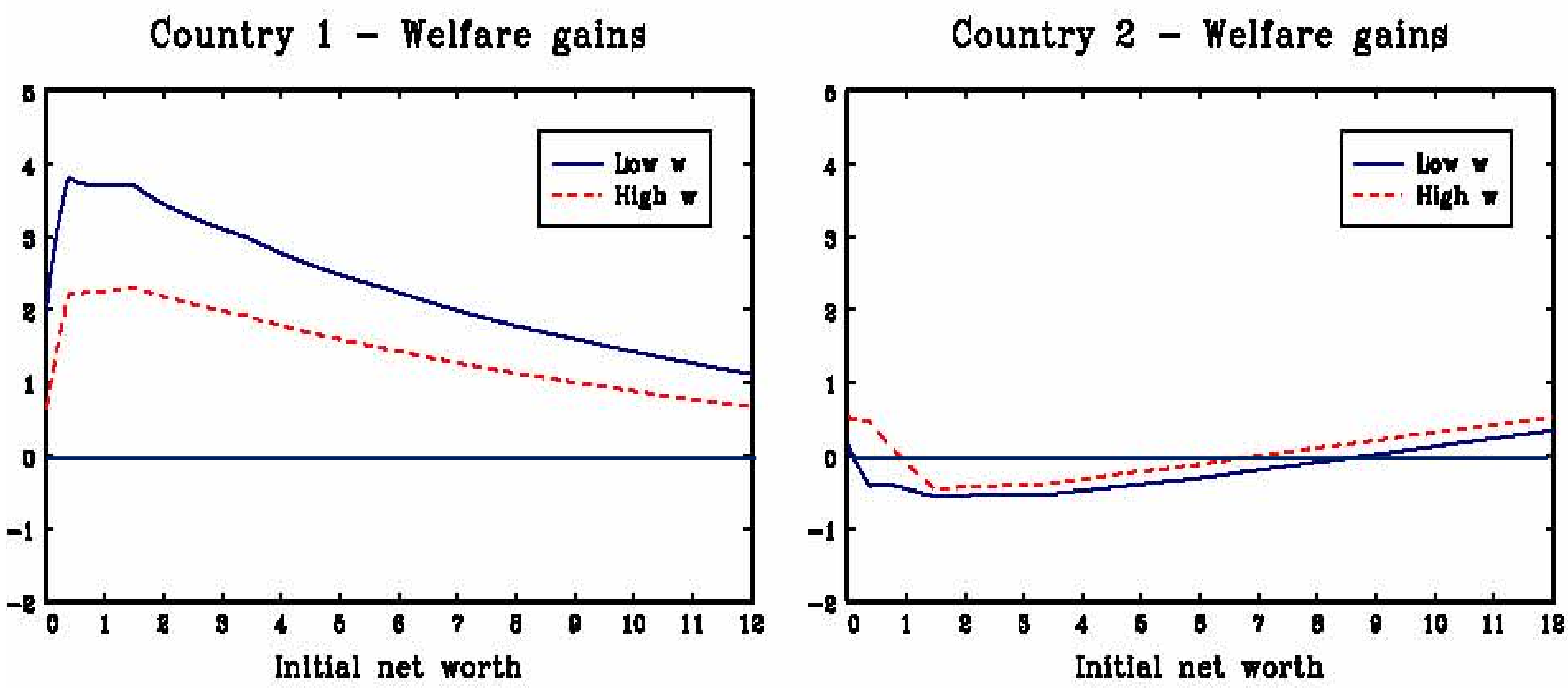
$$(1+G^i)^{1-\sigma} \int_{\varepsilon,a} V^{FA}(\varepsilon, a) M^i(\varepsilon, a) = \int_{\varepsilon,a} V_0^{FI}(\varepsilon, a) M^i(\varepsilon, a)$$

Welfare results in the first *MQRR* model

(mean welfare effects)

Model version	Country 1	Country 2
Baseline model	2.63%	-0.27%
Correlated inv. Shocks		
0.5	2.18%	-0.49%
1	1.77%	-0.60%
Source-based enforcement		
Source for C. 2	2.67%	-0.38%
Source for C. 1	2.87%	-0.05%
Partially for both	2.71%	-0.22%
Full for both	2.80%	-0.11%
Heterogeneity in ϕ and $\underline{a}$		
$\underline{a}$ only	2.99%	-0.46%
both	4.50%	-0.89%

Welfare effects across individuals



Introducing Capital Accumulation

"On the Welfare Implications of Financial Globalization without Financial Development"
(Mendoza, Quadrini & Rios-Rull ISOM, NBER 2008)

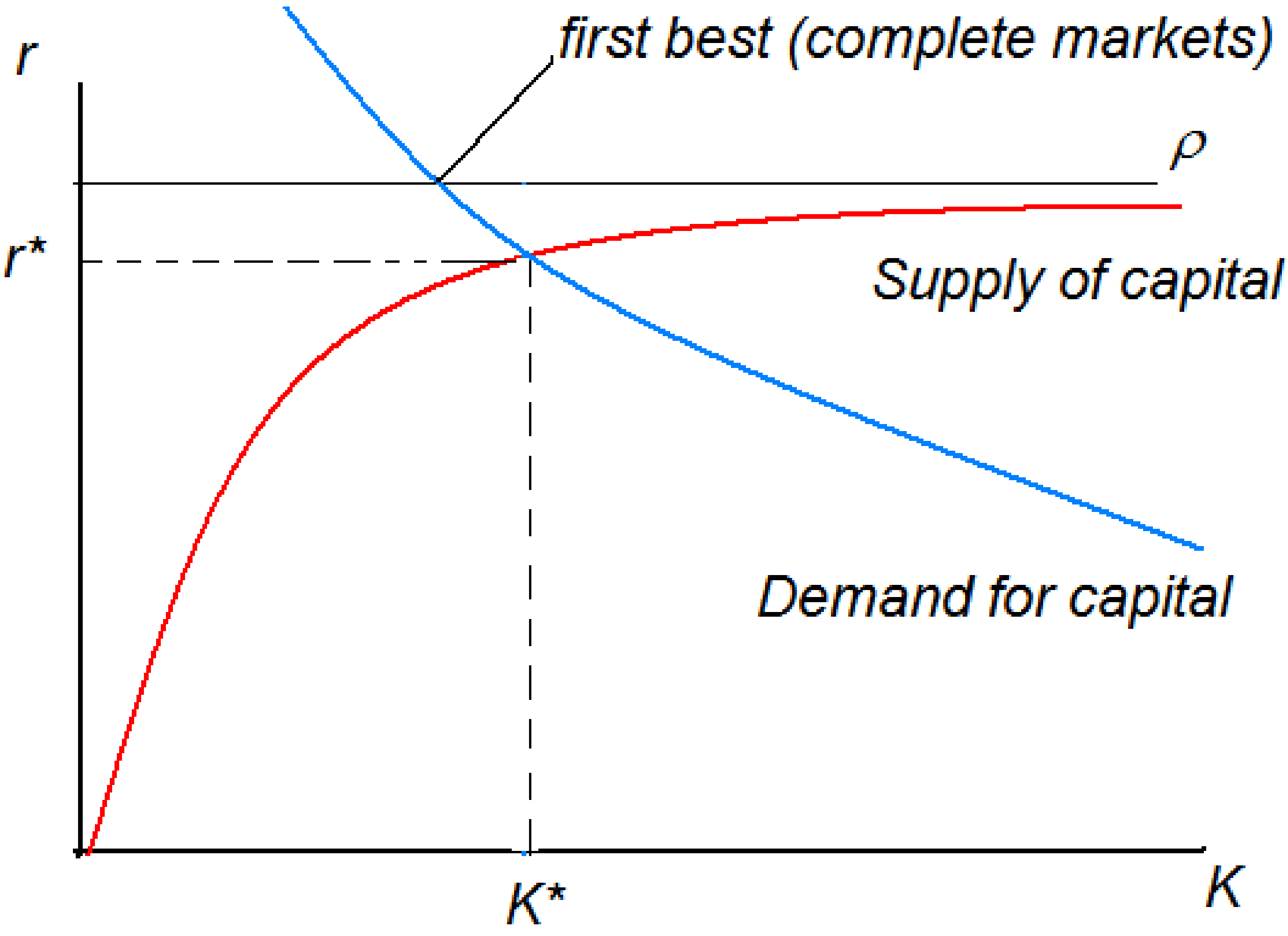
MQRR with capital accumulation

- Budget constraint: $a_t = c_t + \varphi(K_t, k_{t+1}) + k_{t+1} + b_{t+1} / (1 + r_t)$
- Net worth: $a_t = \varepsilon_t w_t + F(k_t, l_t) - l_t w_t + b_t$
- Financial development constraint: $a_{t+1} \geq \underline{a}^i$
- Idiosyncratic earnings shocks ε_t
- Adjusted output $F(k_t, l_t) = y_t + (1 - \delta) k_t$
- Individual production $y_t = A\left(k_t^\theta l_t^{1-\theta}\right)^\upsilon, \quad 0 < \theta, \upsilon < 1$
- Adjustment costs $\varphi(K_t, k_{t+1}) = \phi\left[\left(k_{t+1} / K_t\right) - 1\right]^2$

Normative analysis

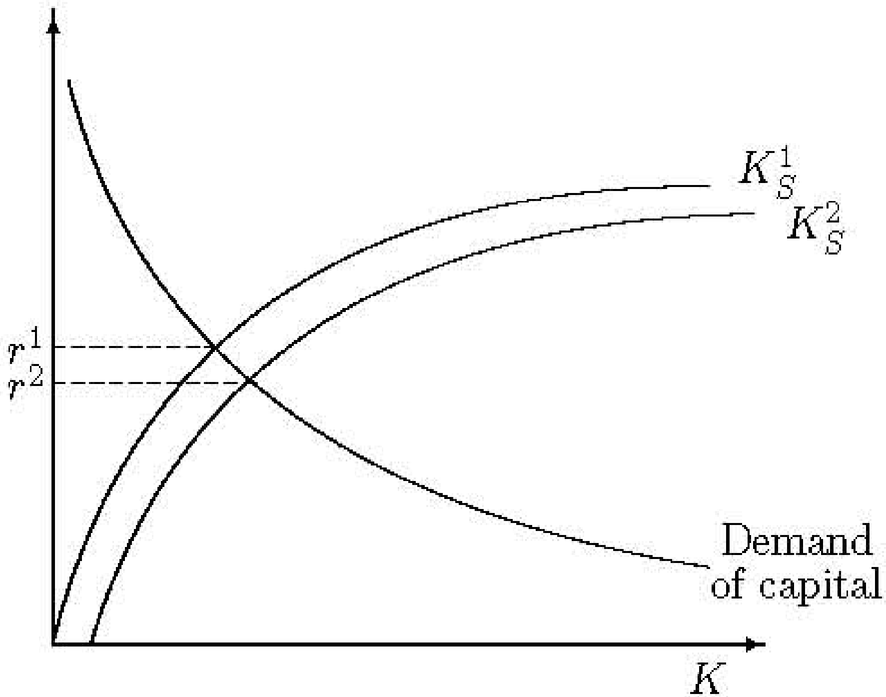
- How does FG without FD affect welfare & wealth distribution?
- Key ingredient: differences in ability to insure individual risk drive wealth dynamics & **distort fixed investment**
- Findings:
  1. Agg. welfare gain (loss) in more (less) fin. developed
  2. Increased wealth inequality in more fin. developed
  3. The poor of the less fin. developed are hurt the most!
  4. Distortions on capital accumulation make matters worse (capital flows from poor to rich country)

Autarky equilibrium & overinvestment

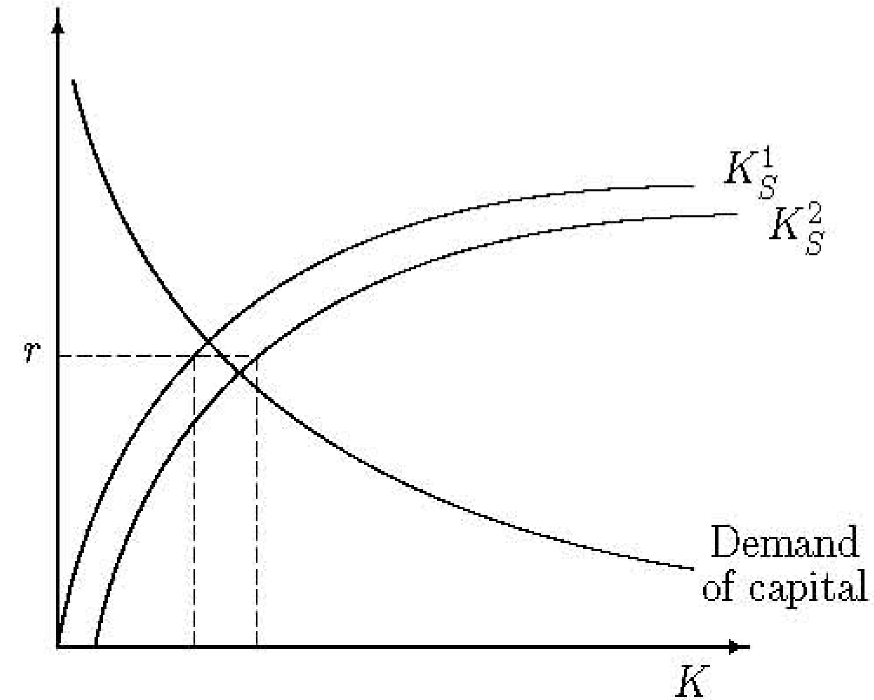


Financial autarky v. financial globalization

$$\underline{a}^2 > \underline{a}^1$$



Financial autarky



Financial globalization

Similar to a policy- or productivity-induced gain (loss) in Country 1 (Country 2), but as a byproduct of financial globalization!

Calibration

- Two countries: C. 1=U.S., C. 2=rest of OECD + EMs
  - Population shares: US: 6.4% OECD+: 93.6%
  - TFP captures world GDP shares: US: 31% OECD+: 69%
  - Set $\underline{a}^1 = -2.6, \quad \underline{a}^2 = -0.02$ to match 2005 priv. sector credit/GDP

    US: 195% OECD+: 119%

- Production: υ = 0.9, θ = 0.289 so capital share is 36%

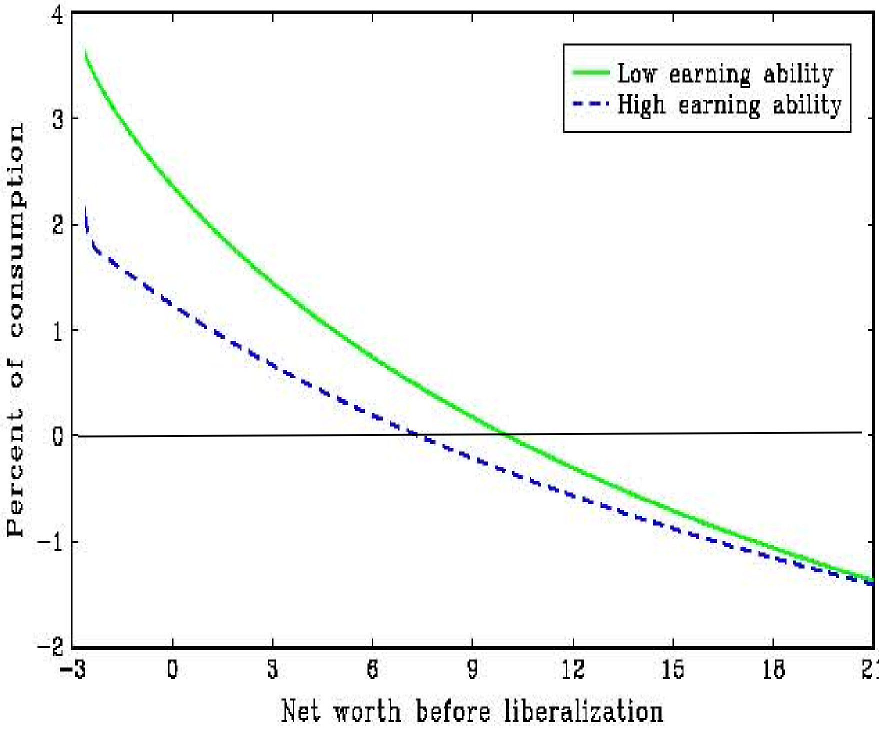
- Investment: δ = 0.06, ϕ = 0.6 (Kehoe & Perri 02)

- Preferences: σ = 2, β = 0.949 (to match K/y = 3)

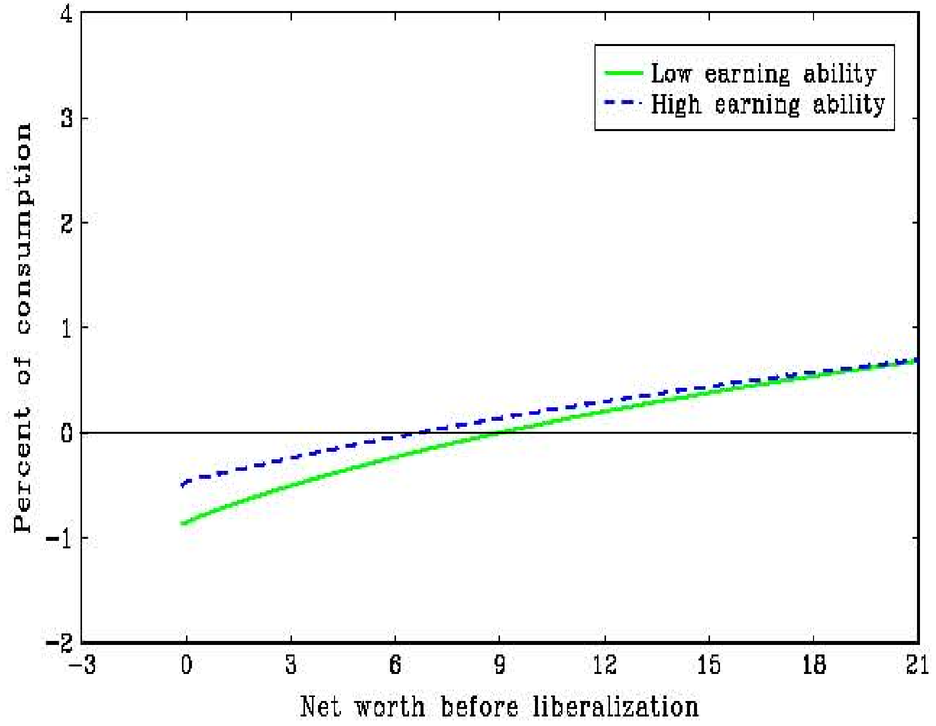
- Two-point Markov process matches log earnings in US:

$$\varepsilon = \overline{\varepsilon}(1 \pm \Delta_{\varepsilon}) \quad \overline{\varepsilon} = 0.85 \quad \Delta_{\varepsilon} = 0.6 \quad \pi(\varepsilon, \varepsilon') = 0.975 \quad \sigma_{\varepsilon} = 0.3 \quad \rho_{\varepsilon} = 0.95$$

Welfare effects distributions



Country 1



Country 2

Aggregate Welfare Effects

Full model: **Country 1: +1.7%** **Country 2: -0.41%**

Constant K: **Country 1: +2.2%** **Country 2: -0.74%**

Unilateral redistributive policy

- Unanticipated uniform tax on net worth at t = 0 in C. 2 to finance uniform lump-sum transfers

$$T^i = \int_{\varepsilon,a} \tau^i a M^i(\varepsilon, a)$$

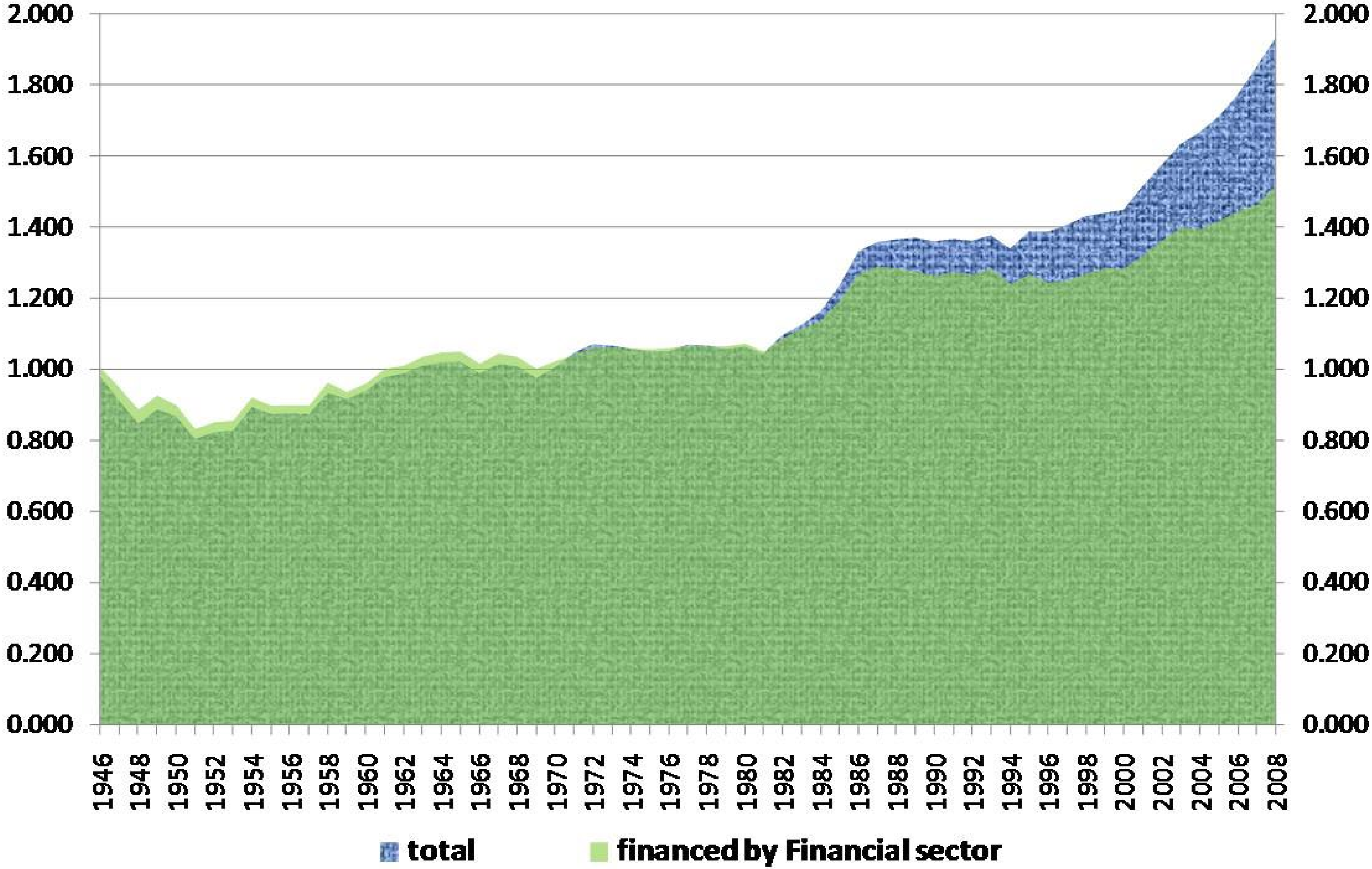
Tax Rate	Initial wealth gini after redistribution in country 2	Welfare gains country 1	Welfare gains country 2
0.0%	0.482	1.67	-0.41
1.0%	0.477	1.64	-0.20
2.5%	0.470	1.61	0.12
5.0%	0.458	1.56	0.62

Globalization of financial crises

"Financial Globalization, Financial Crises & Contagion"

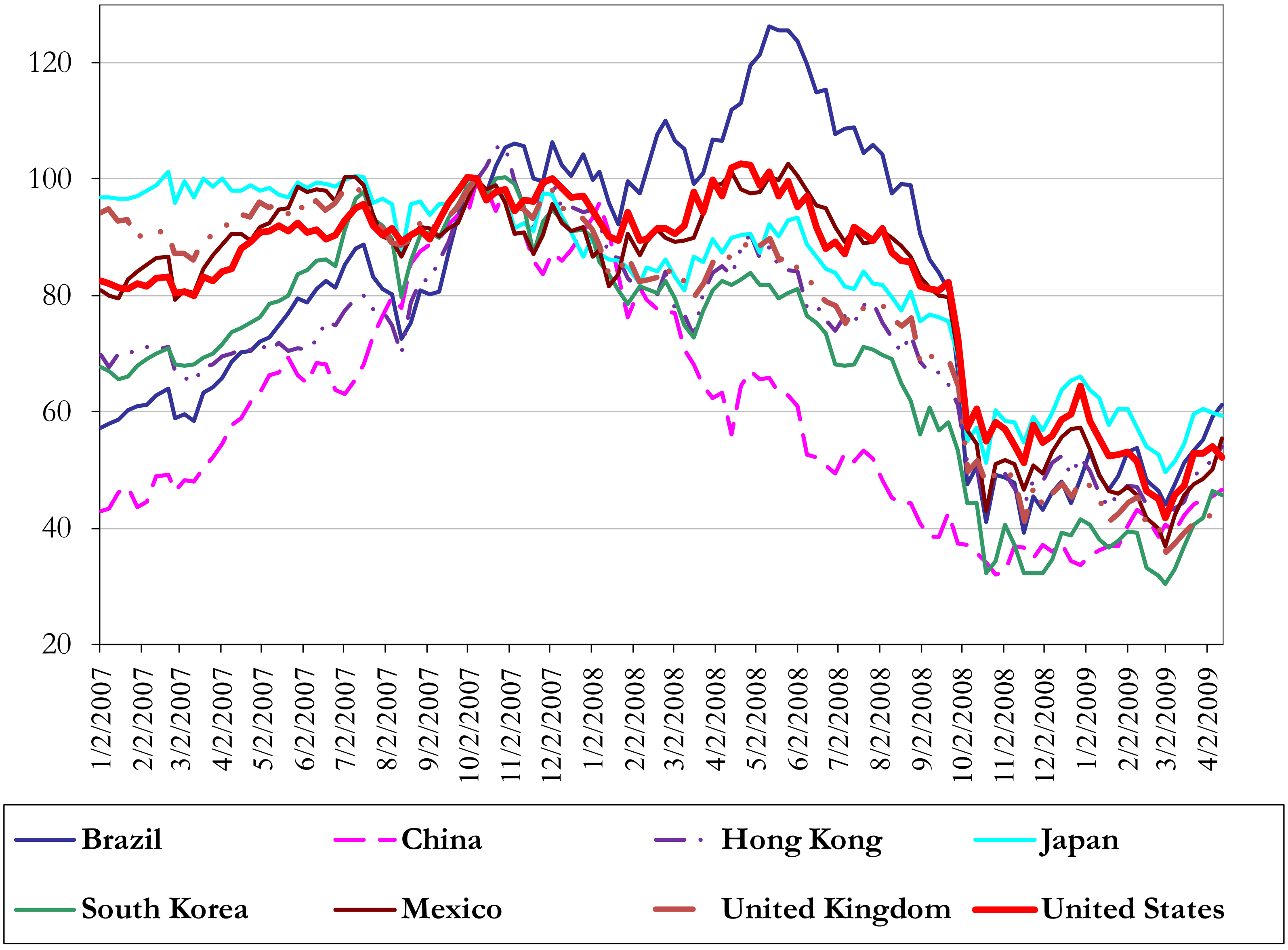
(E. Mendoza and V. Quadrini, JME, 2010)

Net Credit Liabilities of U.S. Domestic Nonfinancial Sectors in percent of GDP

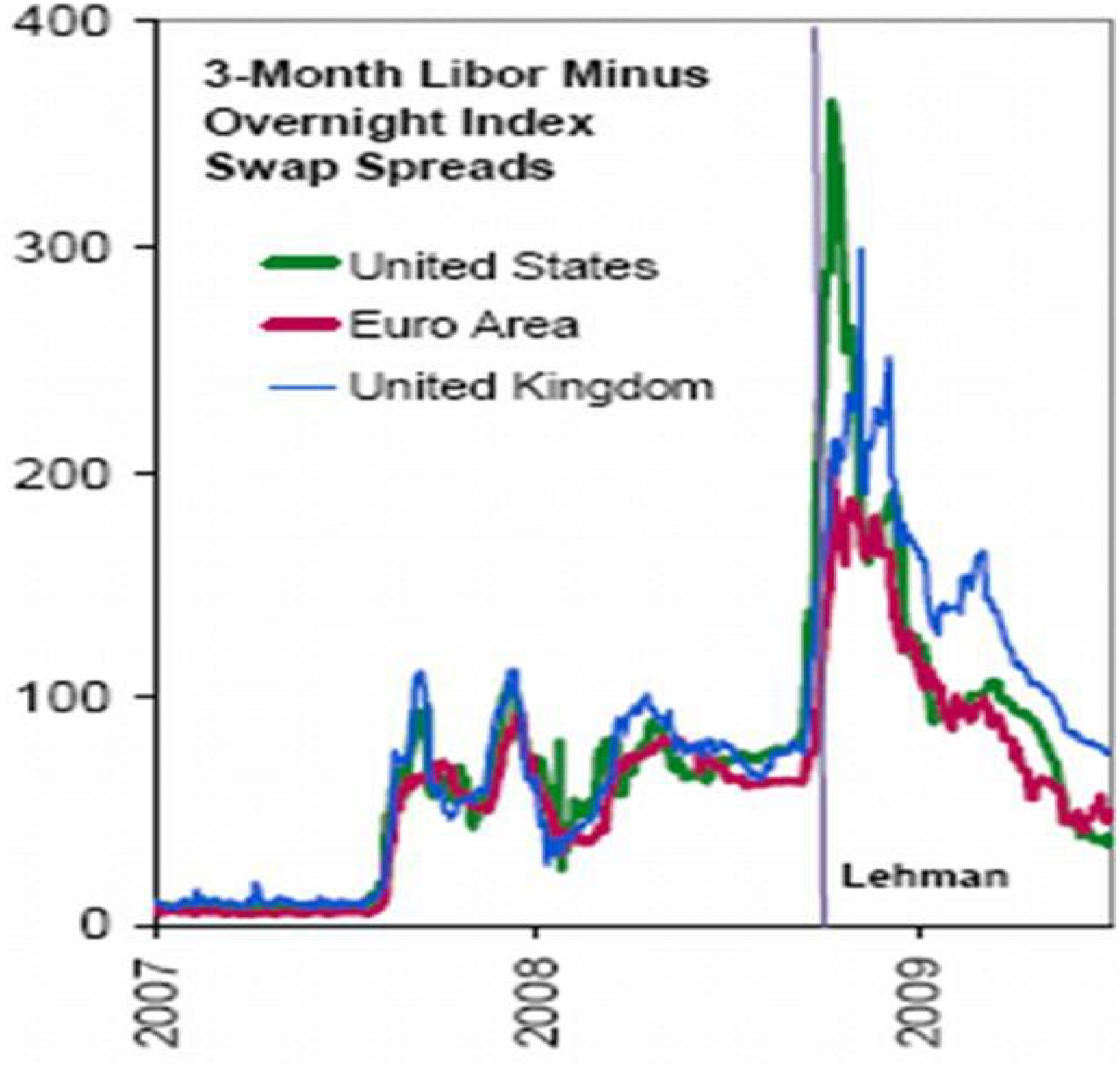


Stock markets crashed globally

(indexes re-based at Dow Jones maximum)



Bank spreads surged globally



Strategy and findings

- Propose a model in which FG without domestic FD causes surge in U.S. credit (MQRR, *JPE* 09)
- Introduce financial intermediation with MtoM capital requirements and "securitization"
- Study implications of a "small shock" to FI's capital in one country
  1. Fisherian deflation with large amplification
  2. Global spillovers
  3. Financial heterogeneity matters for amplification
  4. Relaxing MtoM weakens the crash

Introduce financial intermediation

- Split agents into "savers," (**S**) "producers" (**P**) and financial intermediaries" (**FI**)
- **S**: similar to MQRR agents with same frictions
- **P**: rep. firm facing Fisherian collateral constraint (Fisherian deflation), deterministic problem
- **FIs**: take deposits from **S**, extend loans to **P** facing MtoM capital requirements constraint or can circumvent them at a cost (akin to "SIVs")
- Each country has mass μ of agents, ½ are **S**, ½ are **P**, both with CRRA utility

Country i's individual saver's problem

$$V_t^i(w,b) = \max_{c,b(w')} \left\{ U(c) + \beta \sum_{w'} V_{t+1}^i\Big(w', b(w')\Big) g(w,w') \right\}$$

subject to:

(a) Budget constraint:

$$d_t + w_t + b(w_t) = c_t + \sum_{w_{t+1}} b(w_{t+1}) q_t^i(w_t, w_{t+1})$$

(b) Limited enforcement constraint

$$b(w_1) - b(w_j) \le \phi^i \cdot \Big(w_j - w_1\Big)$$

(c) Limited liability constraint

$$w_j + b(w_j) \ge 0$$

Since shocks are purely idiosyncratic, contingent claims prices still satisfy:

$$q_t^i(w_t, w_{t+1}) = g(w_t, w_{t+1})/(1 + r_t^i)$$

Country i's representative producer's problem

$$W_t^i(k,l) \;=\; \max_{c,k',l'}\left\{U(c)+\beta W_{t+1}^i\left(k',l'\right)\right\}$$

Subject to:

(a) Budget constraint (deterministic prices)

$$w^p + kP_t^i + F(k) + \frac{l' - \varphi_t^i(l')}{1+r_t^i} = c + l + k'$$

$$F(k_{t+1}) = Ak_{t+1}^{\nu}$$

(b) Limited enforcement/Fisherian constraint

$$l' \leq \psi^i\left[k'P_{t+1}^i + F(k')\right]$$

Optimality conditions of savers and producers

Savers:

$$U'(c_t) \geq \beta(1+r_t)EU'(c_{t+1})$$

Producers:

$$U'(c_t) = \left[\beta U'(c_{t+1}) + \mu_t\right]\left(\frac{1+r_t}{1-\varphi'(l')}\right)$$

$$U'(c_t) = \left[\beta U(c_{t+1}) + \mu_t \psi^i\right]\left(\frac{P_{t+1}+F_k(k_{t+1})}{P_t}\right)$$

Financial intermediaries

- Deposit liabilities

$$B_t = \int_{w_{-1}, b_{-1}, w} \sum_w b_{t-1}^i(w_{-1}, b_{-1}, w) g(w_{-1}, w) M_t(w_{-1}, b_{-1})$$

- Beginning-of-period equity:

$$e_t = \bar{k}^f P_t^i + L_t - B_t$$

- Budget constraint:

$$e_t + \frac{B_{t+1}}{1 + r_t^i} = \bar{k}^f P_t^i + \frac{L_{t+1}}{1 + r_t^i} + d_t$$

- Non-negativity constraint on dividends: $d_t \geq 0.$

Capital requirements

- Subset of loans $\overline{L}_{t+1}$ subject to MtoM capital req.

$$\overline{L}_{t+1} \leq \alpha(e_t - d_t)$$

- Individual bank incurs cost for loans larger than a "threshold "price:"

$$\varphi_t(l_{t+1}) = \begin{cases} \kappa(l_{t+1} - \chi_t^i)^2 & \text{if } l_{t+1} \geq \chi_t^i \\ 0 & \text{otherwise} \end{cases}$$

- Competitive banks minimize costs by choosing highest threshold that keeps dividends non-negative .

$$\chi_t = \alpha(\bar{k}^f P_t + L_t - B_t) = \alpha e_t$$

- Loans at/below this threshold are offered at r and subject to MtoM constraint, and above they have increasing cost

Financial intermediaries' problem

$$\Upsilon_t^i(B,L) = \max_{d\geq 0,B',L'} \left\{ d + \left(\frac{1}{1+r_t^i}\right) \Upsilon_{t+1}^i\left(B',L'\right) \right\}$$

Subject to

$$L - B = \frac{L'}{1+r_t} - \frac{B'}{1+r_t} + d$$

- This determines total loans, the subset $\overline{L}_{t+1}$ of which is subject to the capital requirement, and the complement offered at the increasing cost

Asset market clearing conditions

- Under financial autarky, for each $i \in \{1,2\}$:

$$k_\tau^i(K,L)/2 = \bar{k} - \bar{k}^f$$

$$\int_{w,b,w'} b_\tau^i(w,b,w') M_\tau^i(w,b) g(w,w') = B_\tau^i(B,L)$$

- Under financial integration, across all $i=1,2$

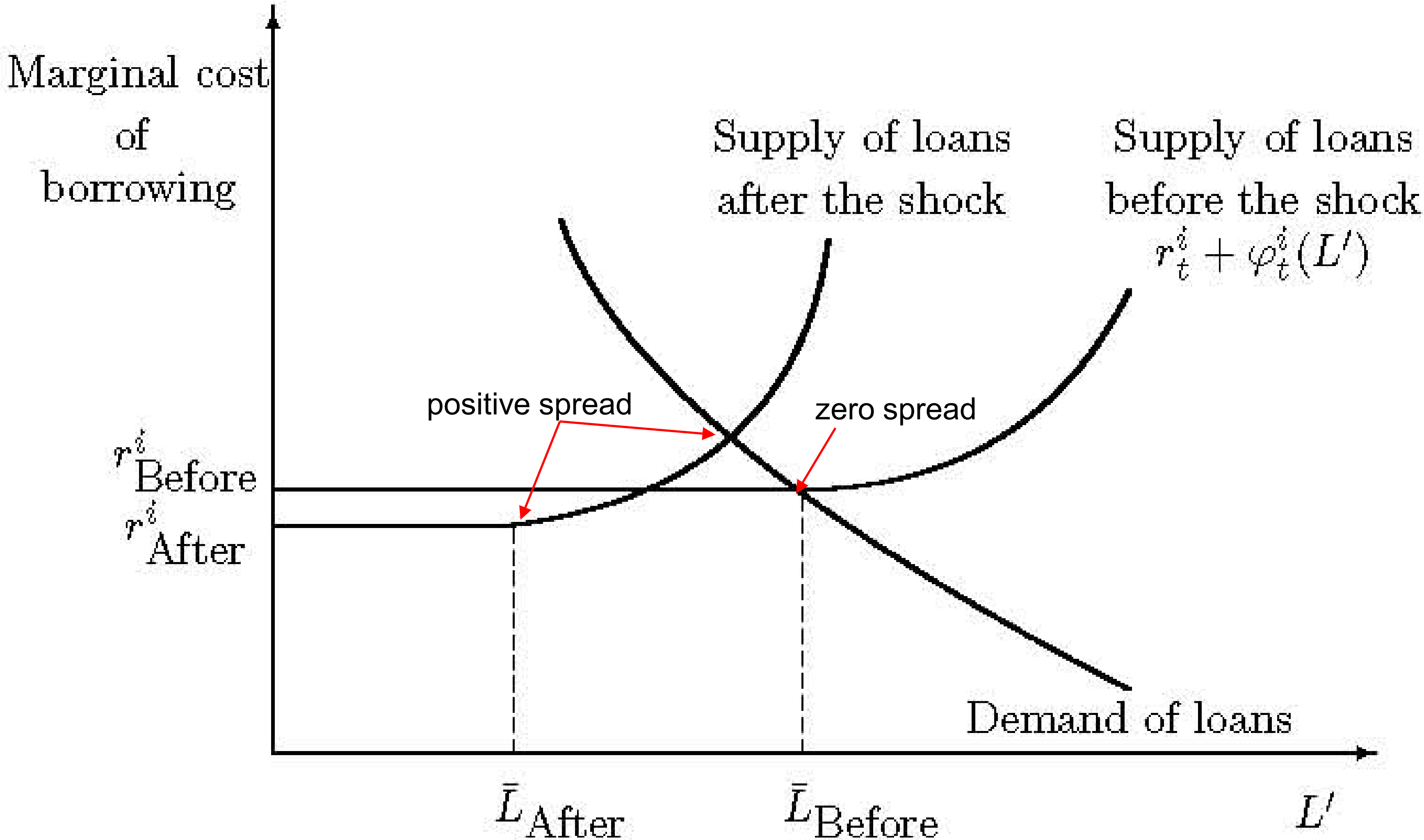
$$\sum_{i=1}^2 k_\tau^i \mu^i = \bar{k} - \bar{k}^f$$

$$\sum_{i=1}^2 \int_{w,b,w'} b_\tau^i(w,b,w') M_\tau^i \mu^i(w,b) g(w,w') = \sum_{i=1}^2 B_\tau^i(B,L) \mu^i$$

$$q_\tau^1 = g(w,w')/(1+r_t^1) = g(w,w')/(1+r_t^2) = q_\tau^2$$

$$P_\tau^1 = P_\tau^2 \qquad \chi_\tau^1 = \chi_\tau^2$$

Credit shocks in the loan market



Quantitative experiments

- Compare FA v. FG steady-state equilibria
  - Show how much FG contributed to credit surge
- Hit with unanticipated, once-and-for all “credit shock” (one-time drop in FI’s equity—e.g. unexpected loss in a small fraction of loans)
  - Show Fisherian amplification and contagion
  - Examine differential effects under FA v. FG
  - Examine importance of financial heterogeneity

Calibration

- $\beta = 0.94, \ \ \sigma = 1$
- C1 is U.S., 30% of world GDP, μ^1=0.3
- Financial structure parameters:

$$\phi^1 = 0.21, \ \ \phi^2 = 0, \ \ \psi^1 = 0.62, \ \ \psi^2 = 0.45, \ \ \kappa = 0.1, \ \ \alpha = 10$$

- Individual earnings process set to U.S. estimates:

$$w = \overline{w}(1 \pm \Delta_w) \quad \overline{w} = w^p = 0.4 \quad \Delta_w = 0.6, \quad g(w, w') = 0.95$$

- Production:

$$y = Ak^{\nu}, \ \ \nu = 0.75, \ \ A = 0.2, \ \ k = 1$$

- Capital stocks:

$$k = 1, \ \ \overline{k} = 1.05, \ \ k^f = 0.05$$

Credit ratios in steady states before and after FG
(shares of output)

	Before FG	After FG 1/
Country 1	169%	195%
Country 2	126%	119%

1/ Calibrated to match 2005 observed shares of credit to GDP from World Bank *World Development Indicators*.

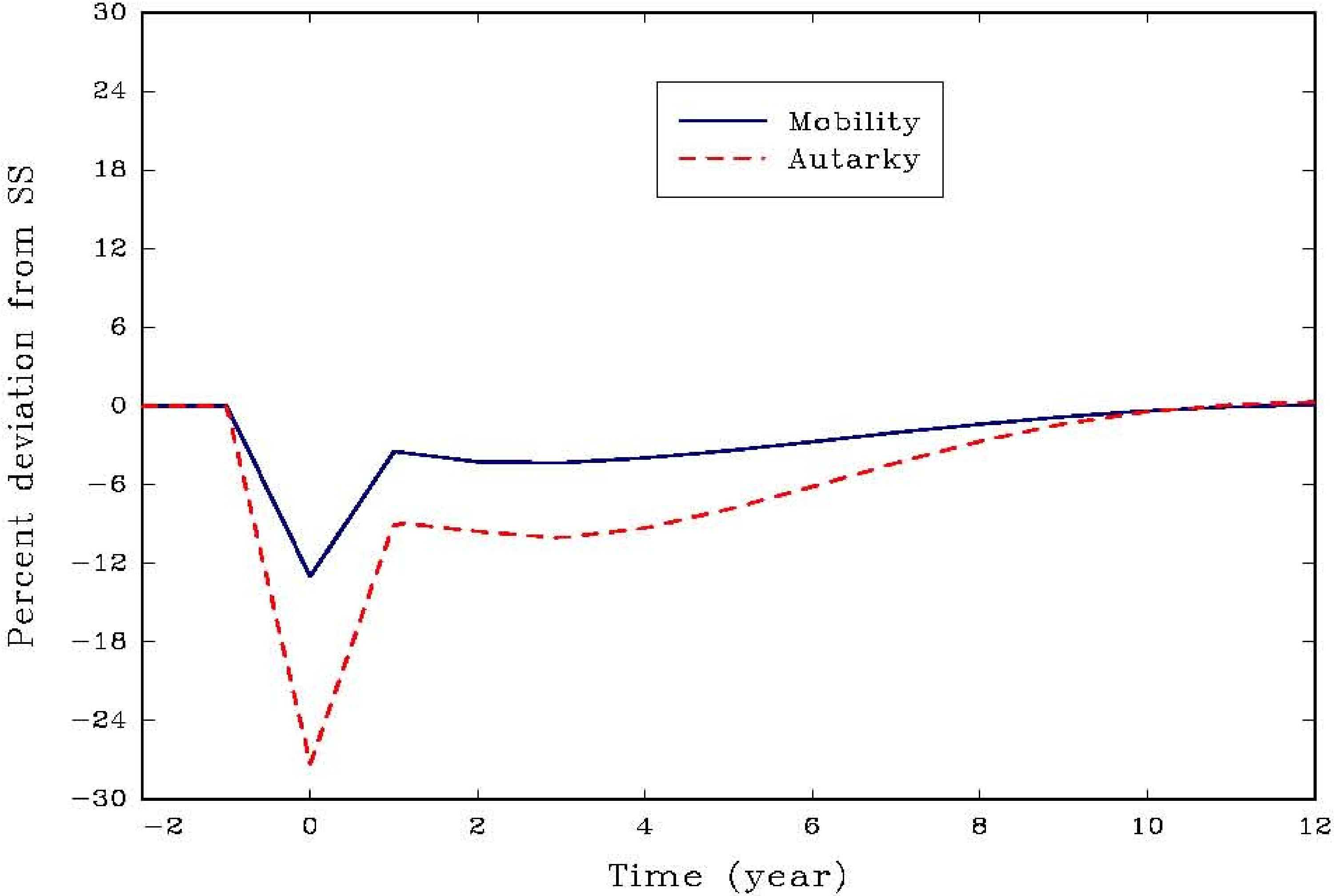
Foreign asset positions in steady state after FG
(shares of output)

	Country 1	Country 2
Net foreign assets 1/	-30%	12%
Net prod. assets	34%	-15%
Foreign borrowing	64%	-27%

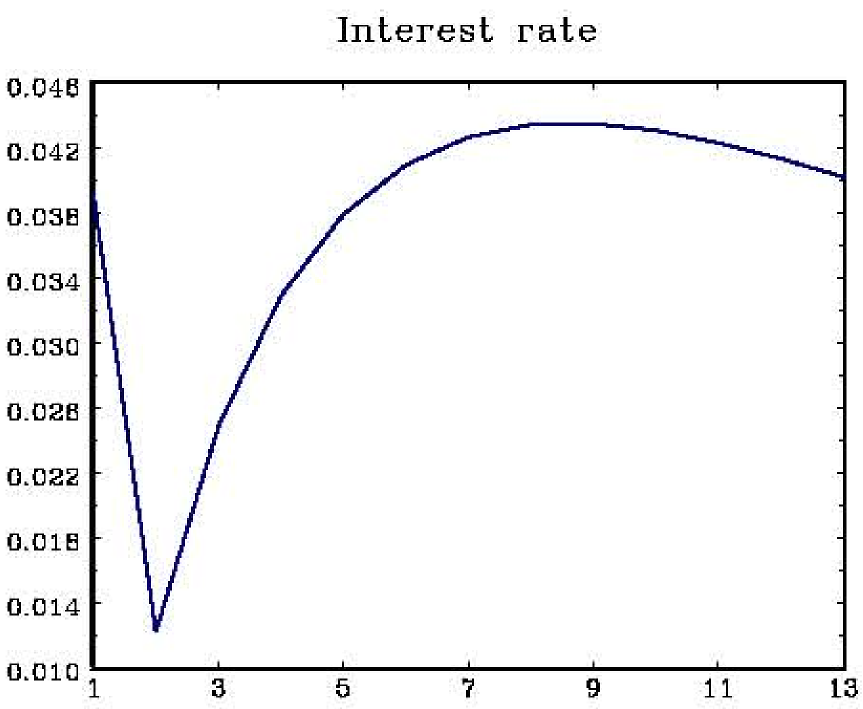
1/ Calibrated to match 2006 NFA positions in Lane-Milesi database.

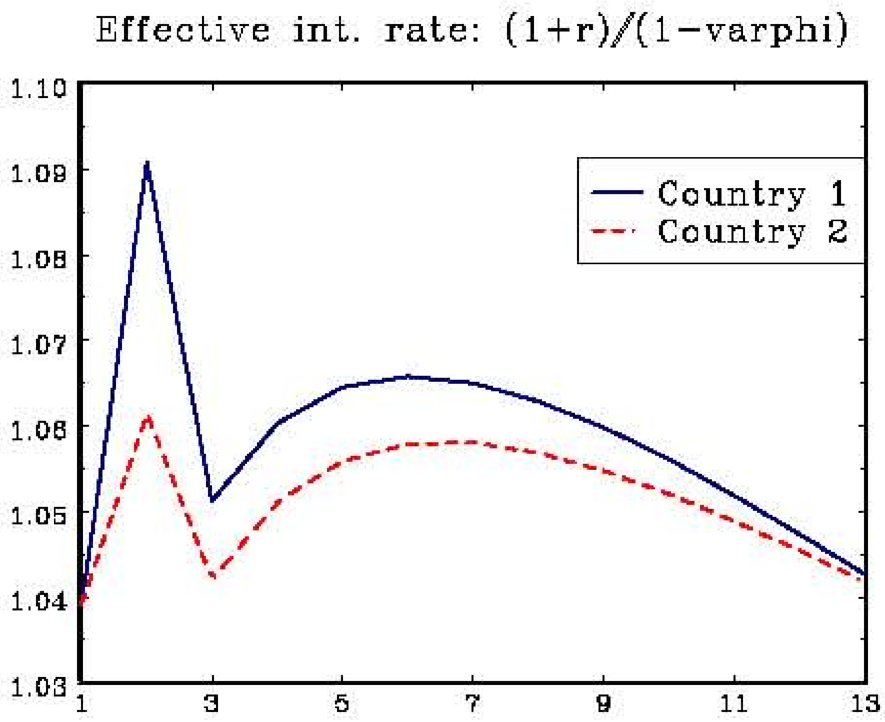
Effect of unexpected credit shock on asset prices

- "Small shock" to C1's banks (1.5% of loans)

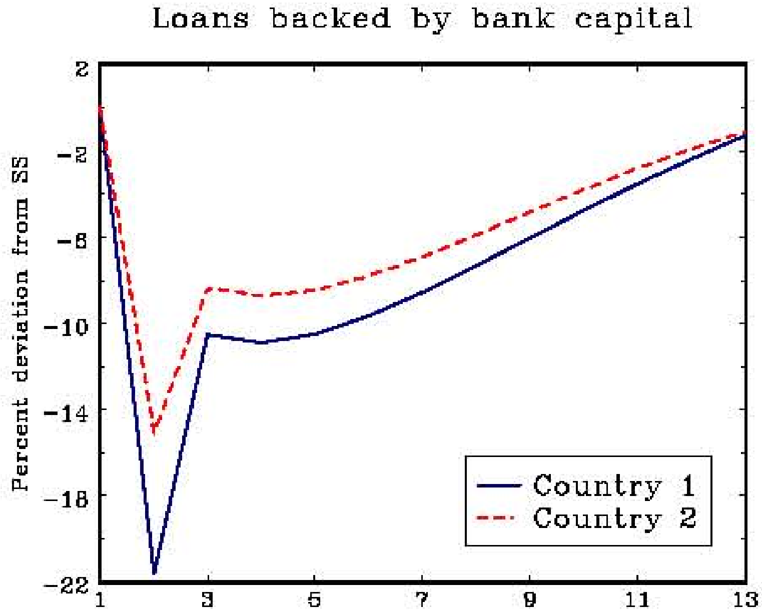


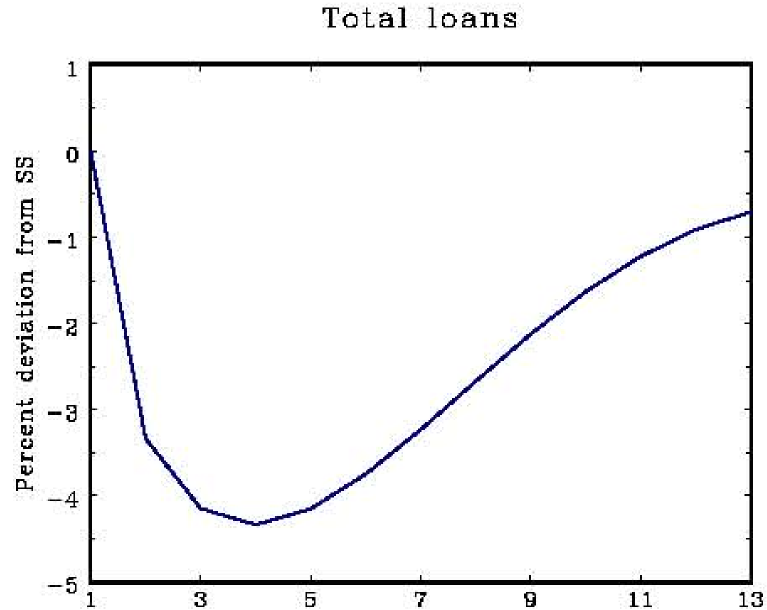
Macro dynamics

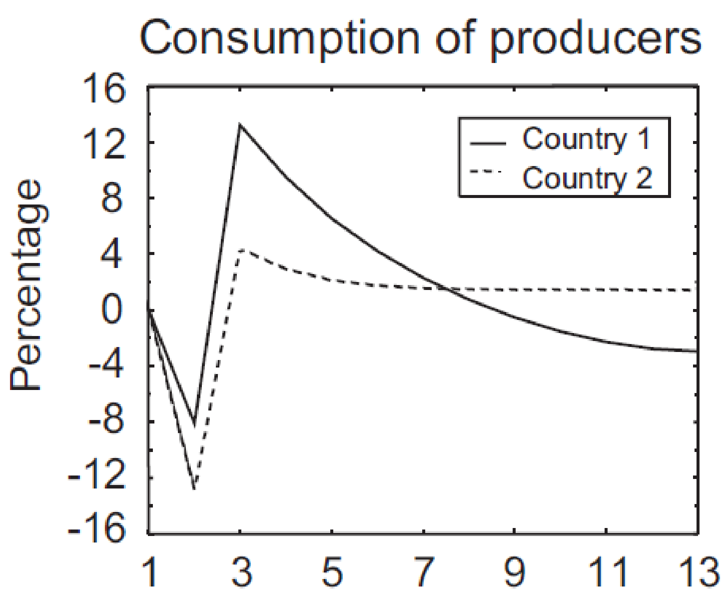




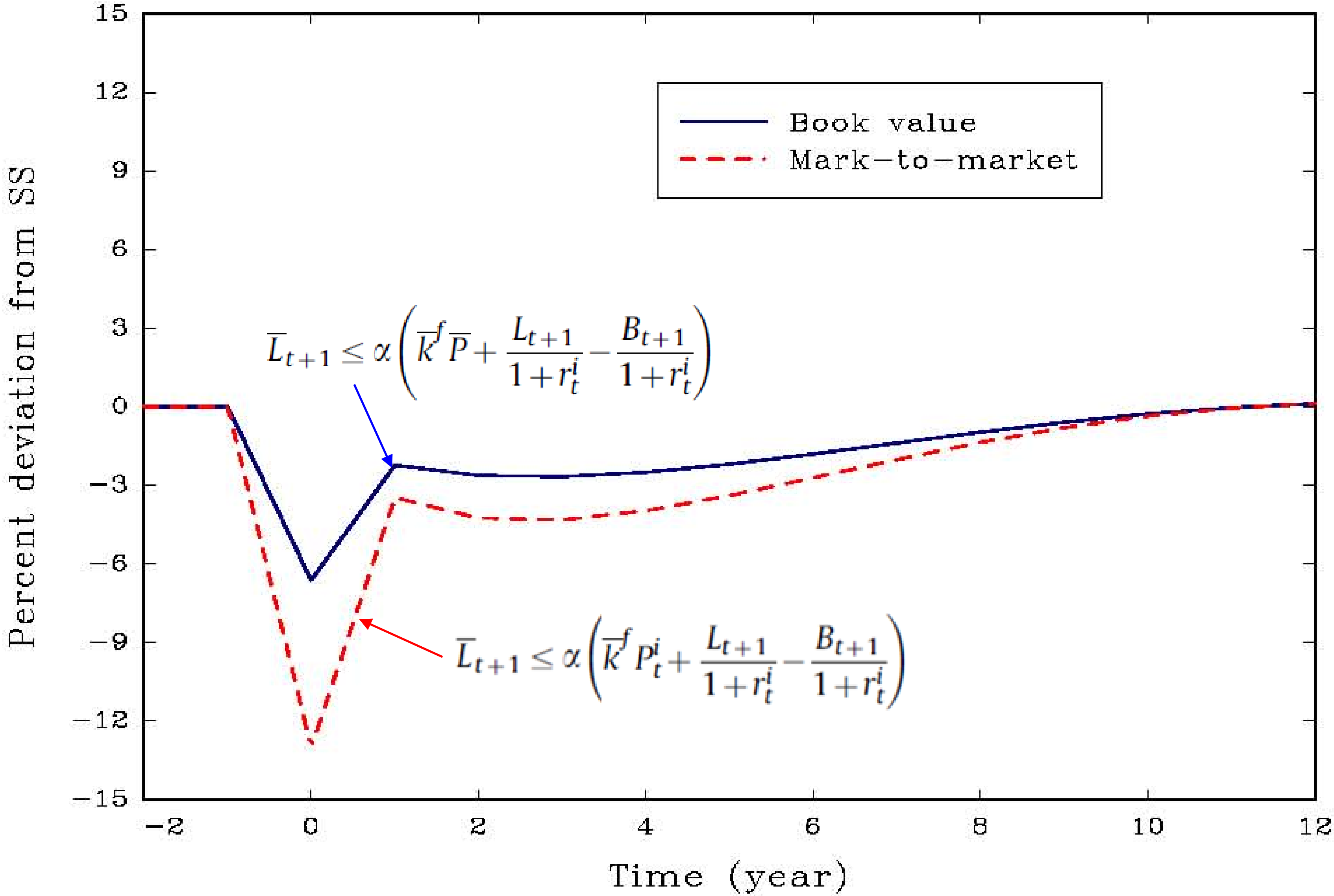
Macro dynamics







Marking to steady-state price



Conclusions & Policy Implications

Financial globalization: reality check

- Expectations: Improved risk sharing, enhanced financial intermediation, efficient allocation of capital, increased growth, reduced volatility ... increased social welfare

- Realities: Weak evidence of improved risk sharing, convergence in FD, or faster growth, reduced long-run volatility. Risk of financial crises, global imbalances

- *Realizing the gains of FG requires development of domestic institutions & financial markets!* (Frankel, Mishkin, Rajan & Zingales, Obstfeld & Taylor)
  – …but how do we get there? (sequencing v. Rajan-Zingales)
  – …in the meantime redistributive policy is worth considering

- Reversal of globalization would trigger dynamics leading to protracted increase in U.S. NFA and higher r*

Additional conclusions

- Growing leverage creates vulnerability to shocks that can trigger debt-deflation dynamics (Mendoza & Quadrini JME 2010)
- Fiscal policy may help alleviate welfare effects
- New mercantilism is only partially right
  - Fin. Globalization can explain surge in reserves
  - Persistent surpluses and undervaluation even without central bank intervention
- Precautionary savings are suboptimal, but can we design better arrangements?
  - Private capital markets ahead of IFOs

Financial instability risks

- FG without FD is very risky
  - Induces large buildup of debt
  - Large, global amplification effects of credit shocks
  - Larger effects with more financial heterogeneity
- MtoM accounting induces significant amplification in response to credit shocks, but MtoM aims to address other distortions (e.g. moral hazard)
- Consider Shiller’s cyclical capital requirements, or temporary relief from MtoM?
- Pecuniary externality favors macroprudential regulation but this poses other challenges