Financial Integration, Financial Deepness and Global Imbalances

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The enigma of global imbalances

FACT 1

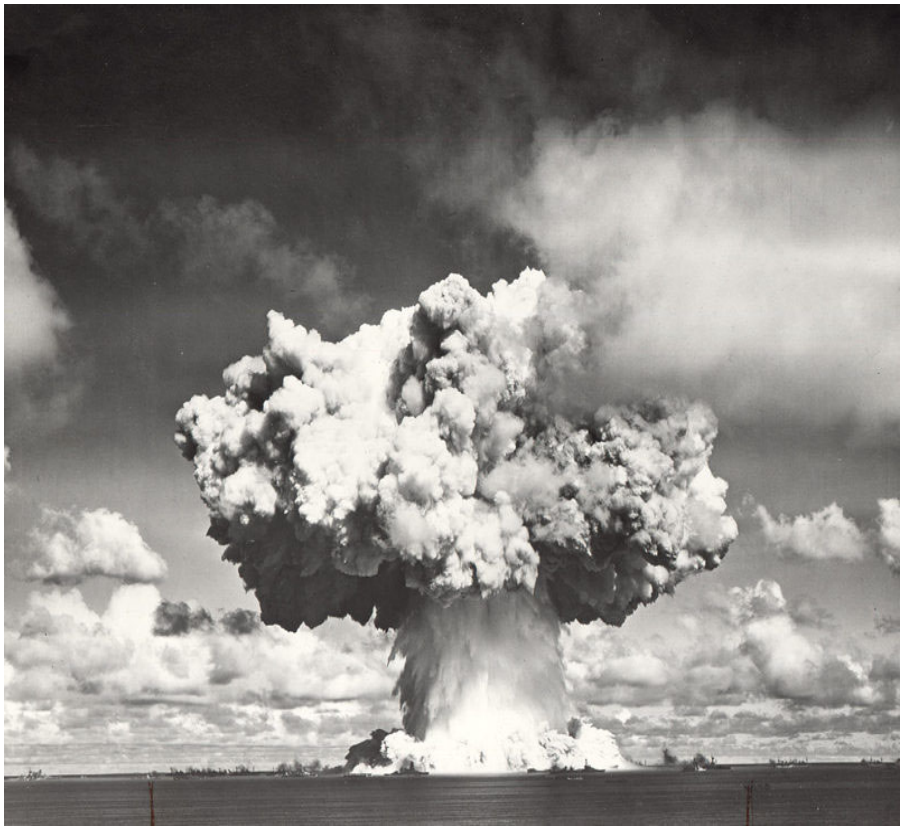
U.S. *net foreign assets* falling steadily since 1983 to -8% of world GDP in 2006

(U.S. *CA* hit historical low of -2% of world GDP in 2006)

FACT 2

U.S. *net factor payments* steady at 0.4-0.5% of U.S. GDP

Economists' views on global imbalances



Our view and main findings

- Financial liberalization in the 80s and 90s ***was*** a global phenomenon,….
- …but financial development ***was not***, even amongst large industrial countries
- Liberalization in an environment with financial heterogeneity causes a secular decline in *NFA,* a persistent surplus in *NFP*, and *CA* deficits in the most financially developed country
- Is this a benign outcome?
  - No crisis, all solvency conditions hold
  - …but less financially developed countries are worse off, and welfare costs are large and unevenly distributed

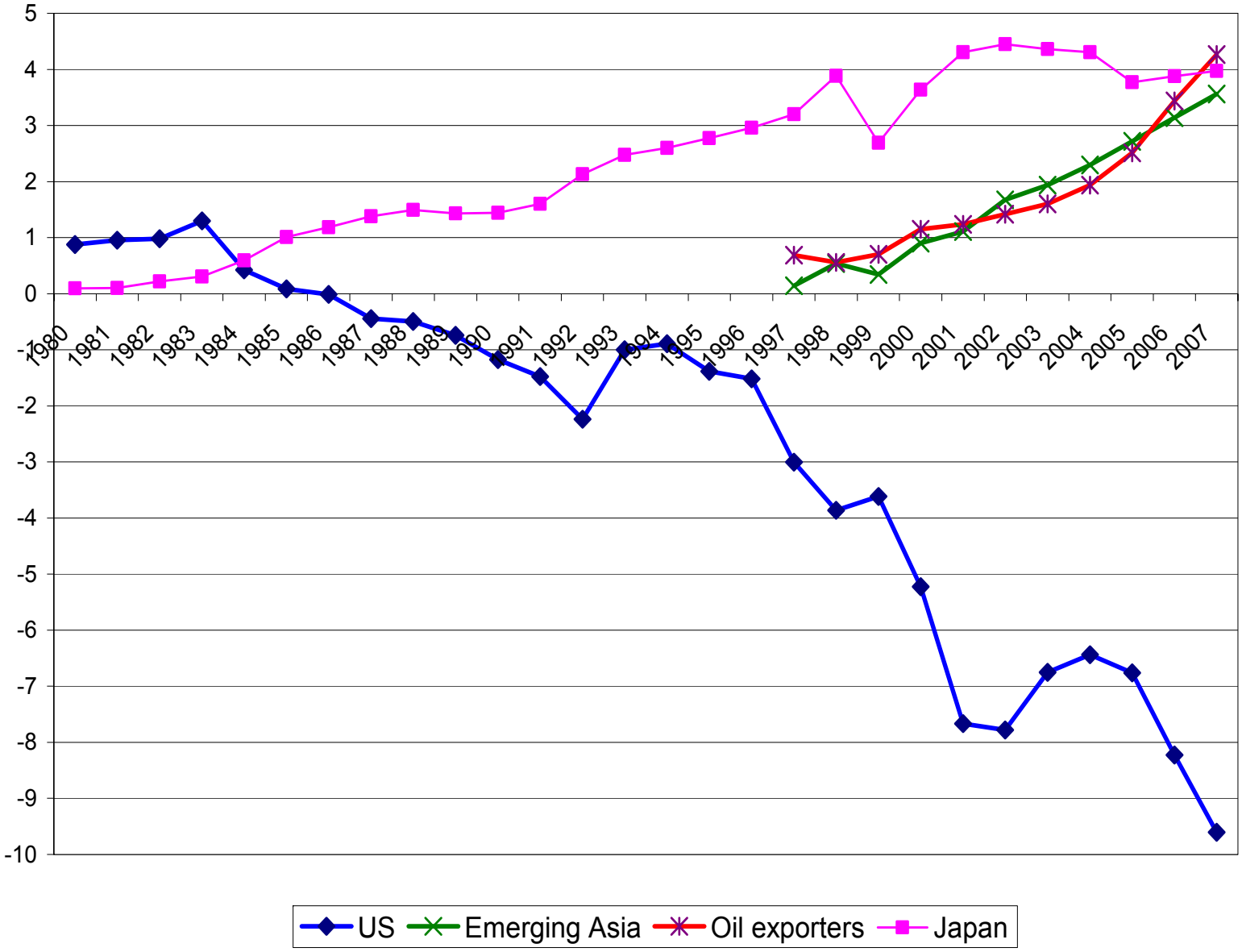
What do we do?

- Provide suggestive empirical evidence showing that:
  1. Imbalances emerged as financial integration started
  2. Large differences in fin. structures existed and have not changed
  3. External accounts negatively correlated with financial development
- Develop open-economy Bewley model of savings & market incompleteness (Ayagari (94), Carroll (97), Huggett (93)) to ask:
  - Can financial heterogeneity explain Facts 1 & 2?
  - Are the imbalances temporary and “sustainable”?
  - Are policies aimed to reduce them desirable?
- Similar to Willen (04) and Caballero et. al (06), but we emphasize demand side, uncertainty and financial integration

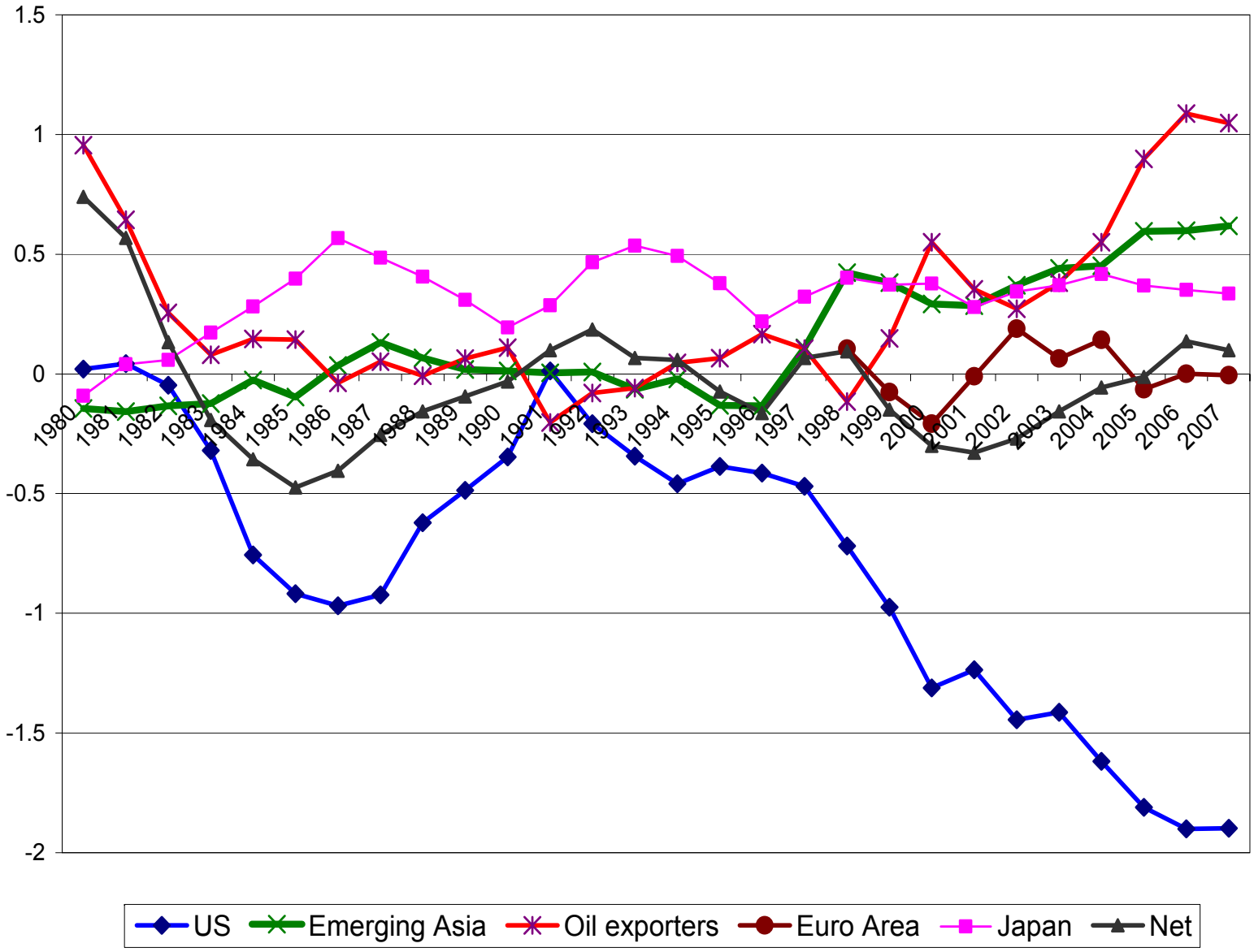
Plan

1. Show empirical evidence
2. Describe Bewley model with financial heterogeneity and two forms of idiosyncratic risk (endowment, investment)
3. Examine three cases:
   a) Endowment risk only: Explains Fact 1 (large, persistent fall in NFA)
   b) Investment risks only: Explains Fact 2 (positive NFP)
   c) Both risks: Explains Facts 1 and 2
4. Study welfare implications
5. Conclude

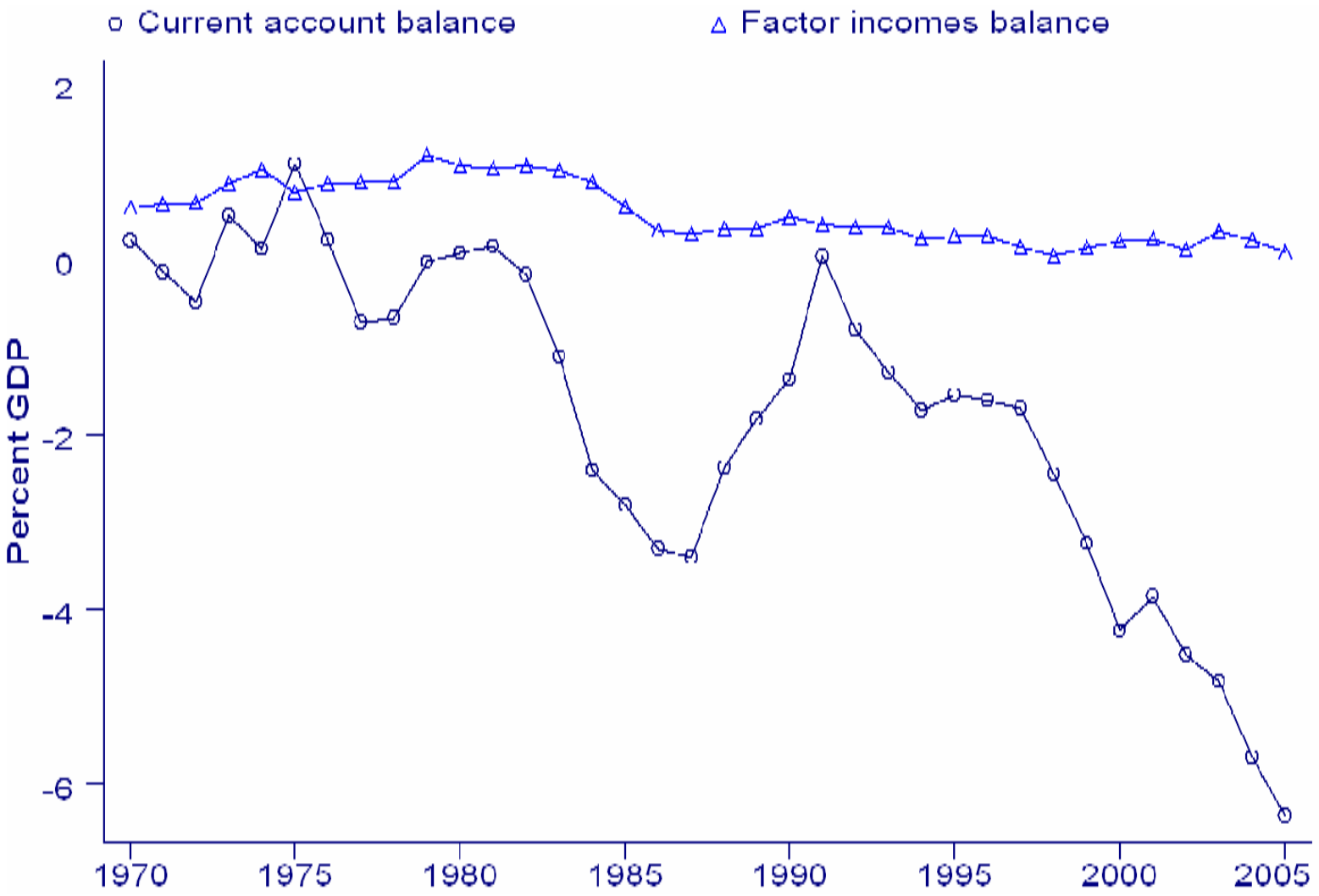
Net Foreign Assets as a Share of World GDP



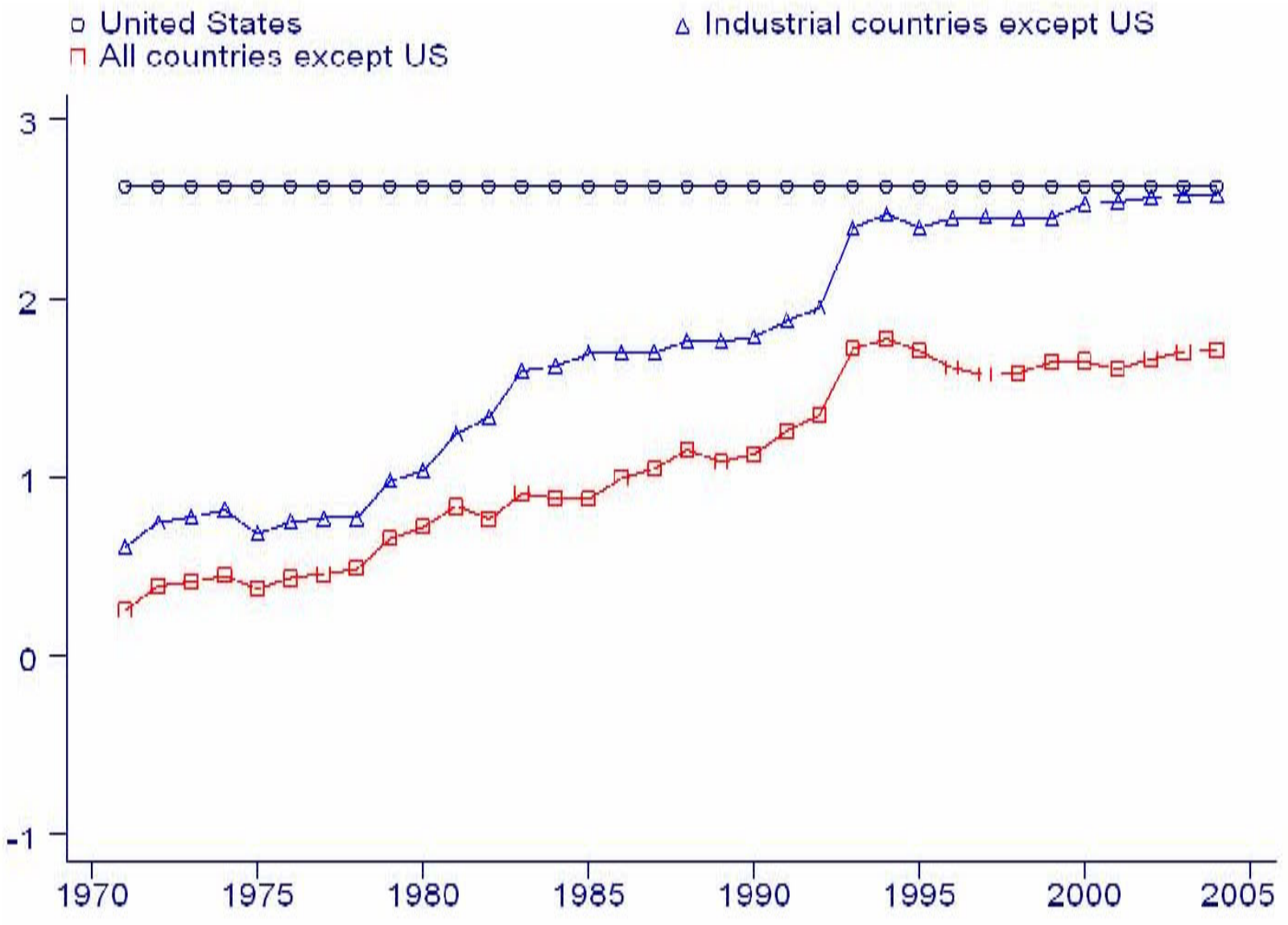
Current Account Balances as a Share of World GDP



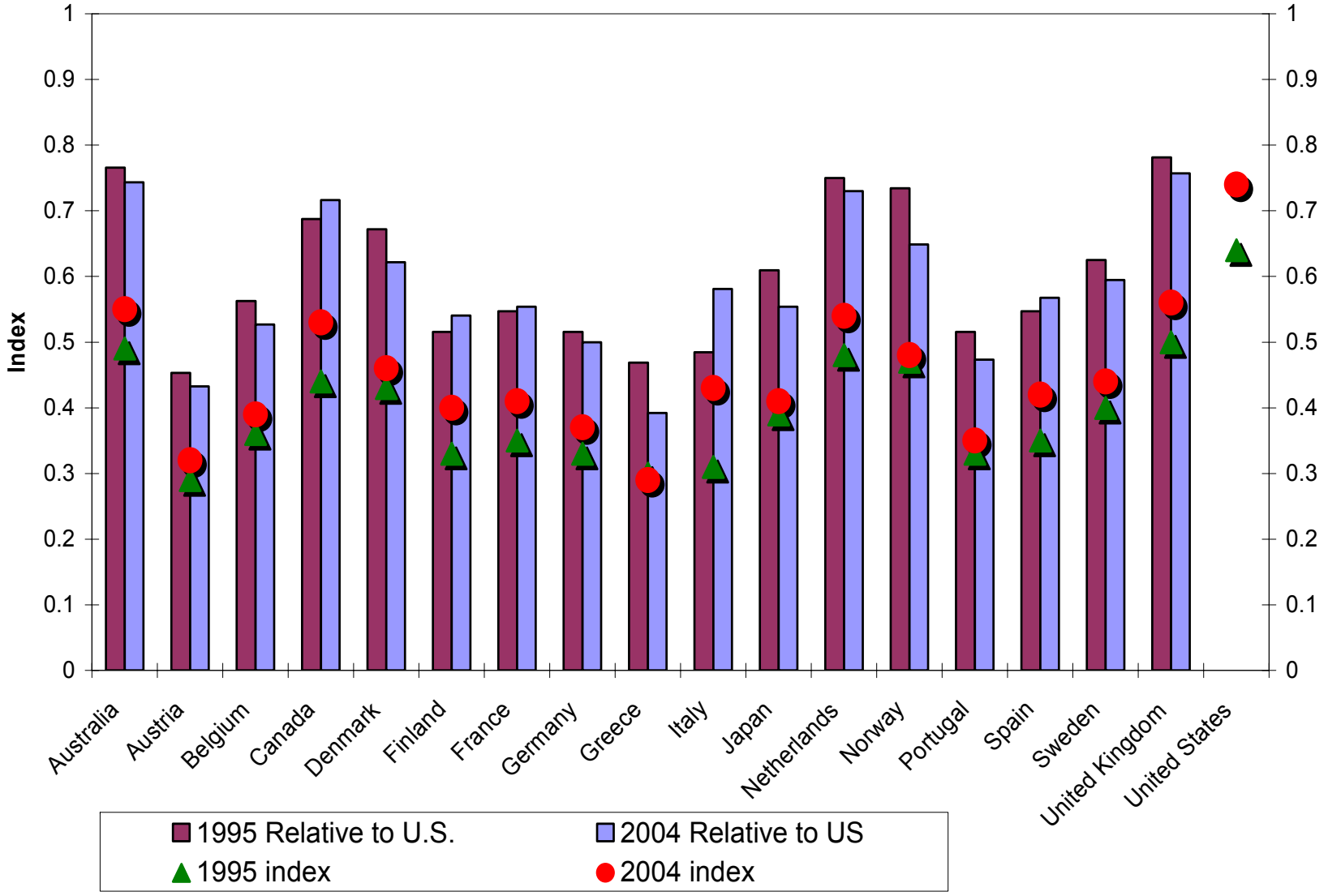
U.S. current account & factor income balances



Chinn-Ito financial openness index

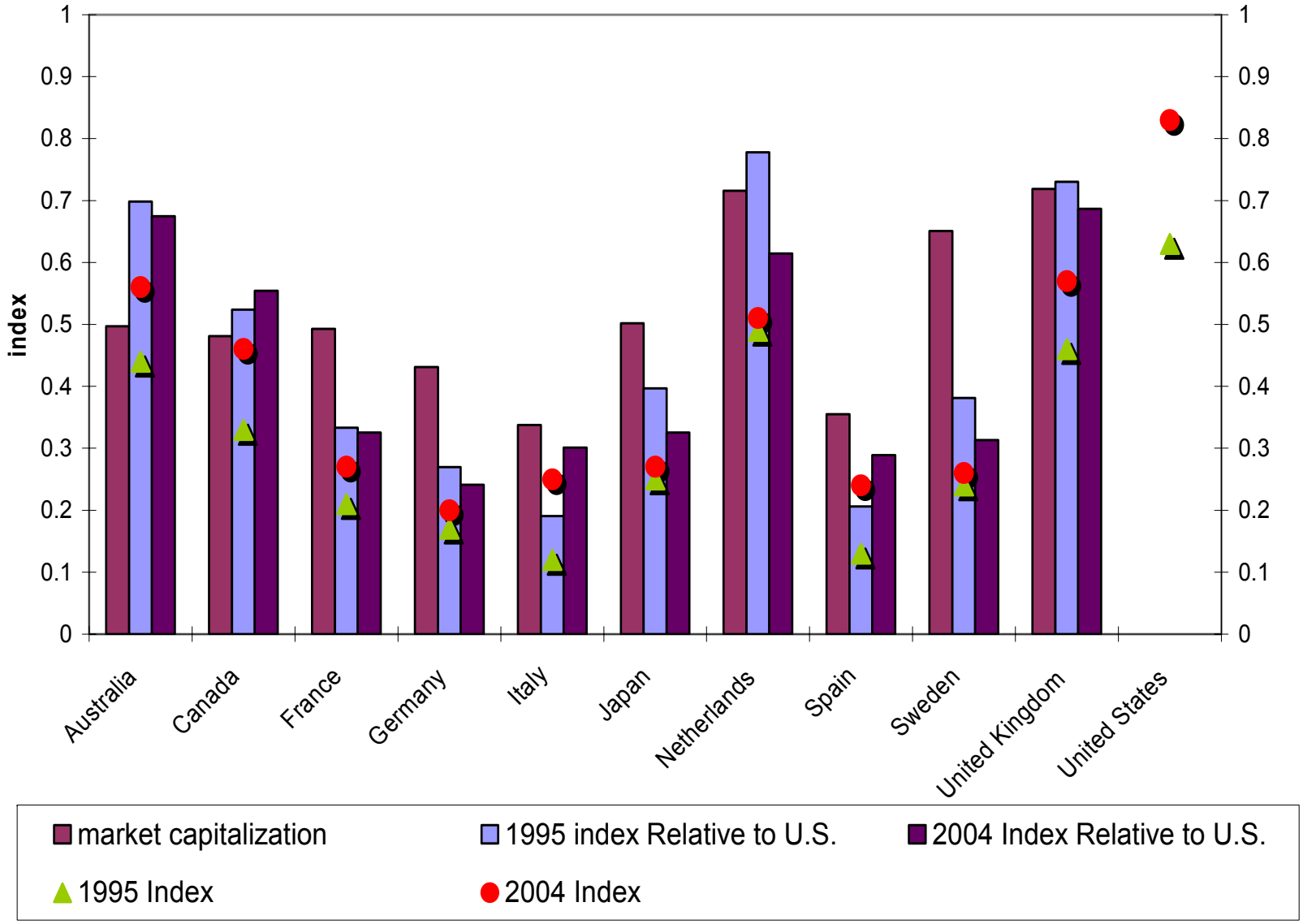


Aggregate Financial Index (1995 & 2004)



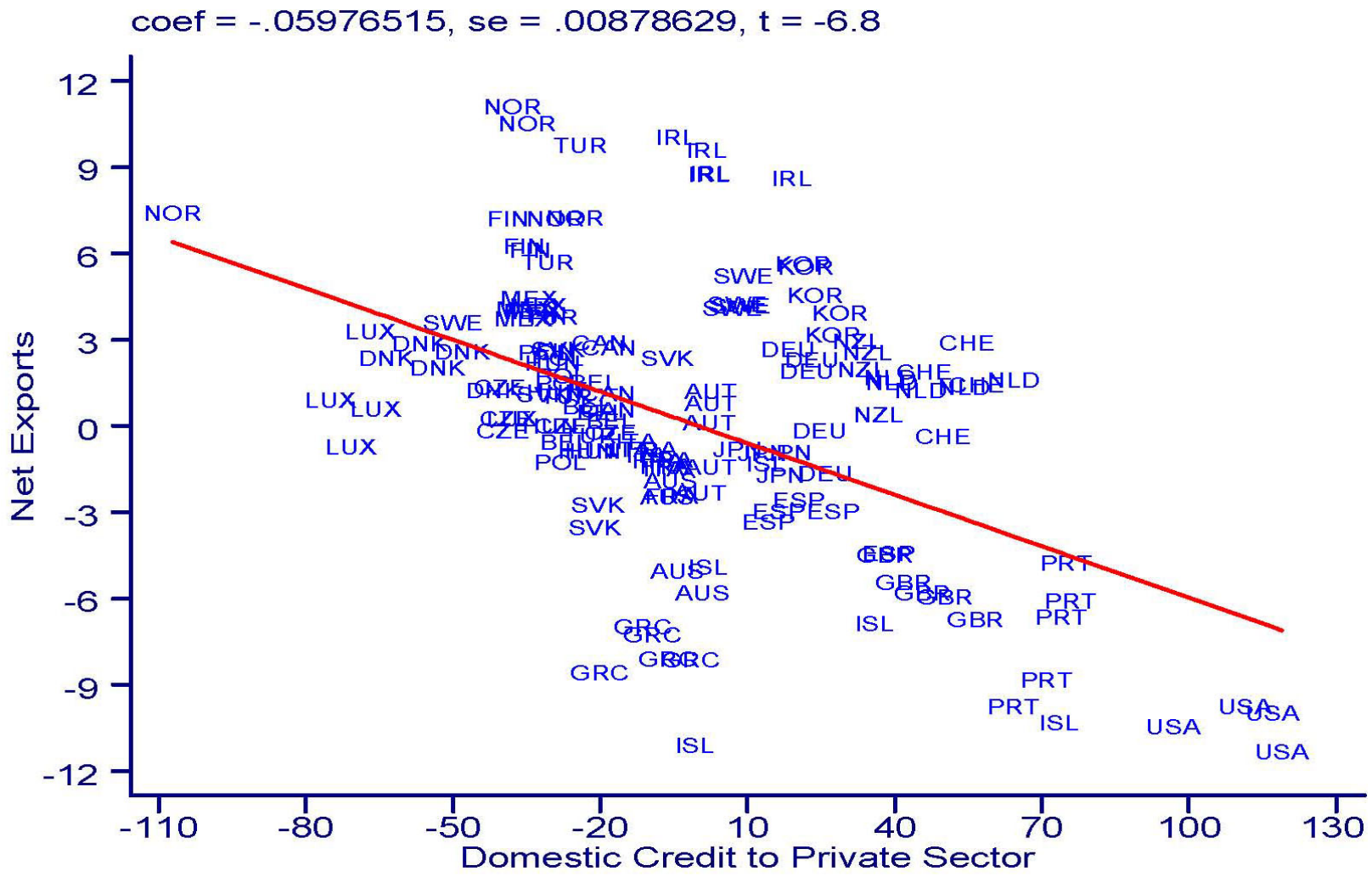
Note: Aggregate financial index is an average of indexes that measure traditional bank intermediation, new financial intermediation, and financial markets characteristics (see Appendix 4.1 of IMF (2006) for details)

New Financial Intermediation Index & Market Capitalization



Note: Market capitalization includes private equity and bond markets and is measured as a ratio to GDP. New Financial Intermediation Index is an average of indexes of non-bank financial intermediation (see Appendix 4.1 of IMF (2006) for details)

Net exports and private sector credit



External accounts and private sector credit

$$NEX_{it} = \alpha_0 + \alpha_1 \cdot CREDIT_{it} + \alpha_2 \cdot CGDP_{it} + \varepsilon_{it}$$

	Net Exports			Current Account		
	2000-2004	*1995-2004*	*1990-2004*	*2000-2004*	*1995-2004*	*1990-2004*
CREDIT	-0.0598	-0.0509	-0.0457	-0.0349	-0.0269	-0.0224
	*(0.0088)**	*(0.0068)**	*(0.0056)**	*(0.0099)**	*(0.0069)**	*(0.0055)**
CGDP	0.00063	0.00058	0.00054	0.00041	0.00039	0.00035
	*(0.00004)**	*(0.00003)**	*(0.00003)**	*(0.00005)**	*(0.00004)**	*(0.00003)**
CONSTANT	-8.287	-7.589	-6.867	-7.053	-6.713	-6.073
	*(0.950)**	*(0.688)**	*(0.539)*	*(1.121)**	*(0.722)**	*(0.538)**
R^2	0.633	0.525	0.468	0.353	0.318	0.285
Obs.	144	289	432	145	289	428

Model: Preferences and stochastic shocks

- I countries, each with a continuum of agents maximizing:

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma}$$

- Agents receive stochastic, idiosyncratic endowment w_t
- Productive asset in fixed supply and traded at price P_t
- Each agent can use the asset in production:

$$y_{t+1} = z_{t+1} k_t^{\nu} \qquad R_t(k, \bar{z}) = \left(P_{t+1} + \nu \bar{z} k^{\nu-1}\right)/P_t$$

  - $z_{t+1} \equiv$ Idiosyncratic investment shock
  - $k_t \equiv$ Asset used in production
  - Markov transition probability for shocks $s \equiv (w,z)$ is $g(s_t, s_{t+1})$

Model: Financial structure

- Contingent claims deliver $b(s_{t+1})$ units of consumption goods
  - No aggregate uncertainty: price of one unit of consumption contingent on s_{t+1} is $q_t^i(s_t, s_{t+1}) = g(s_t, s_{t+1})/(1+r_t^i)$
- An individual agent's wealth is:

$$a_t = w_t + k_{t-1} P_t + z_t k_{t-1}^{\nu} + b(s_t)$$

- Limited liability implies: $a(s_j) \geq 0$
- *"Enforceability constraints"* limit set of state contingent claims

$$a(s_j) - a(s_1) \geq (1 - \phi^i) \cdot \left[w_j - w_1 + (z_j - z_1) k_t^{\nu} \right]$$

  - ϕ^i characterizes financial structure for all residents regardless of where they own assets
  - $\phi^i = \Phi \geq 1$ implies complete markets, $\phi^i = 0$ allows only *nsc* assets

Optimal contract with enforceability constraints

- The enforceability constraints are derived endogenously from optimal credit contracts in an environment in which:

1. Endowments and output are observable but not verifiable
2. Agents can divert $1\text{-}\phi^i$ of endowment and output
3. There is limited liability

- Incentive compatibility requires:

$$V_t\left(s_j\,,\,a(s_j)\right) \;\geq\; V_t\left(s_j\,,\,a(s_1)+(1-\phi)\cdot[w_j-w_1+(z_j-z_1)k^\nu]\right)$$

and strict monotonicity of the value function implies then:

$$a(s_j) \geq a(s_1)+(1-\phi)\cdot\left[w_j-w_1+(z_j-z_1)k^\nu\right]$$

Individual optimization problem

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

subject to

$$a = c + kP_t^i + \sum_{s'} b(s') q_t^i(s,s')$$

$$a(s') = w' + kP_{t+1}^i + z'k^\nu + b(s')$$

$$a(s_j) \geq 0$$

$$a(s_j) \geq a(s_1) + (1-\phi) \cdot \left[w_j - w_1 + (z_j - z_1) k^\nu \right]$$

Equilibrium

- Given ϕ^i and an initial agent distribution $M_t^i(s,k,b)$ for each country $i \in\{1,...,I\}$, 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) Policy functions 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 with $M_t^i(s,k,b)$, $\{c_\tau^i(s,a),k_\tau^i(s,a),b_\tau^i(s,a)(s')\}$, and $g(s,s')$
  - (iv) Asset markets clear for all $\tau \geq t$ under one of two conditions:

    AU: Under autarky, each $i \in\{1,...,I\}$ satisfies:

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

    FI: Under financial integration:

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

Case 1: Endowment shocks only

(consistent with Fact 1 but not Fact 2)

$\underline{\phi = 0}$

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

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

$$U'(c) = \beta R(k,\bar{z})EU'(c(w')) + R(k,\bar{z})E\lambda(w')$$

$$R_t(k,\bar{z}) = 1 + r_t \qquad \beta(1+r_t) < 1$$

$\underline{\phi = \Phi}$

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

$$U'(c) = \beta R_t(k,\bar{z})EU'(c(w')) + R_t(k,\bar{z})E\lambda(w')$$

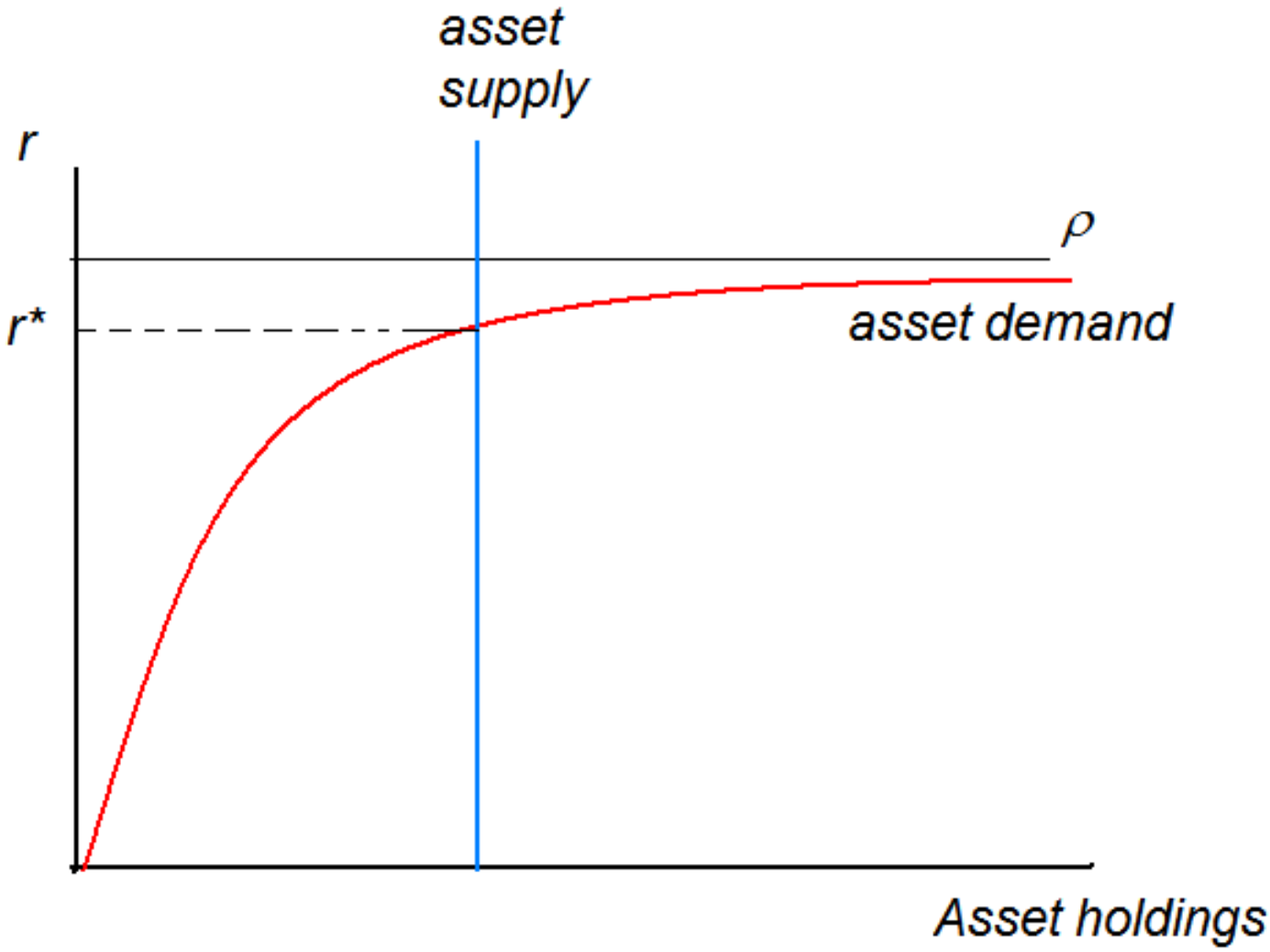
$$R_t(k,\bar{z}) = 1 + r_t \qquad \beta(1+r_t) = 1$$

Case 1: Endowment shocks only

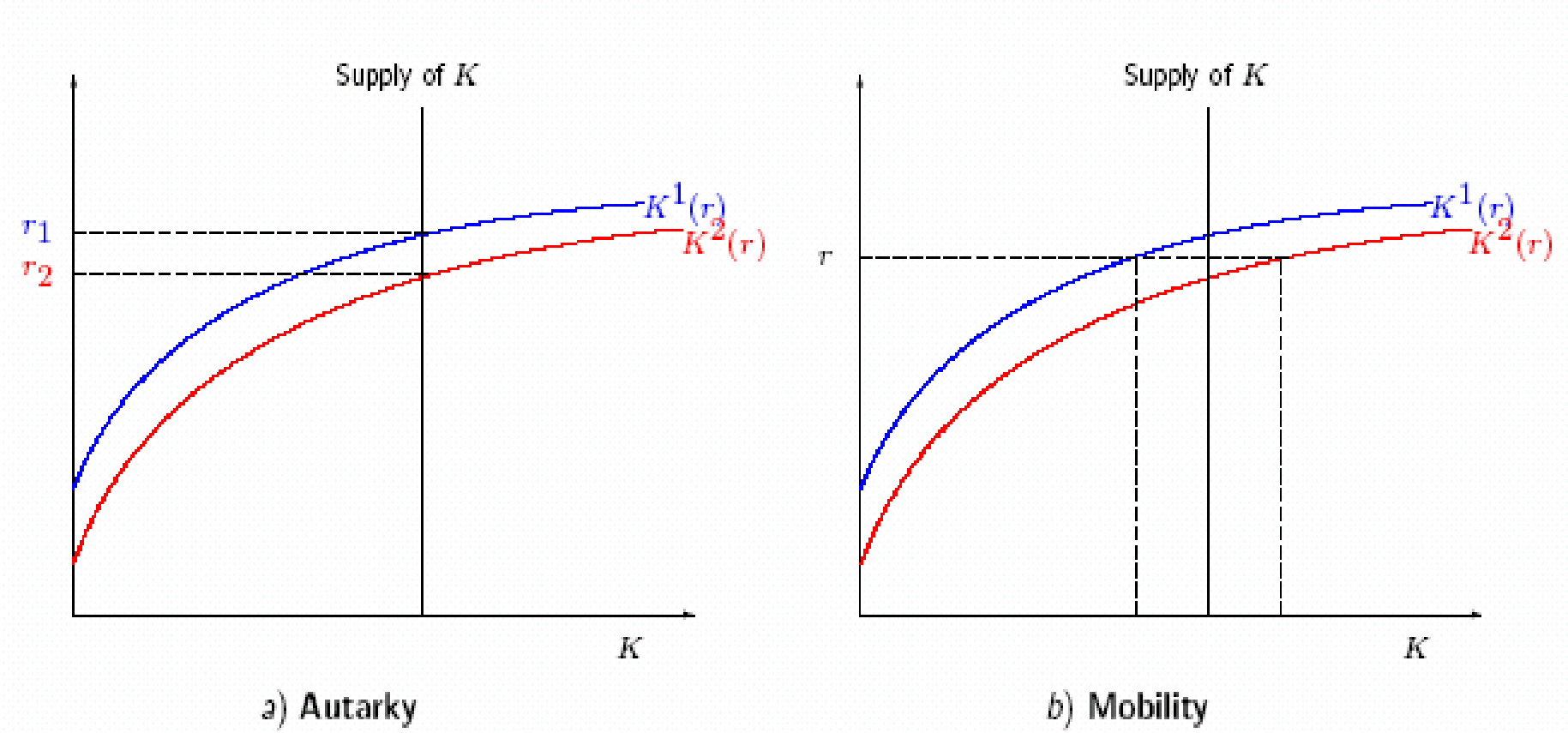
- Proposition 1: Financial integration of two countries with $\phi^1 = \Phi$ and $\phi^2 = 0$ implies that at steady state Country 1 features:
  1. Negative NFA, due to precautionary savings incentive in C. 2
  2. Zero foreign prod. asset holdings, due to arbitrage of riskless return
  3. An interest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

- Results generalize for any (ϕ^1,ϕ^2) such that $0 \leq \phi^2 < \phi^1 \leq \Phi$
  - $\phi^2 < \phi^1$ (weaker enforcement in Country 2) lowers NFA in Country 1 and yields equilibrium interest rate below Country 1' autarky rate

Case 1: Closed-economy equilibrium



Case 1: Equilibria under Autarky & financial integration



Case 1: Calibration for quantitative analysis

- Discount factor: $\beta = 0.94$
- CRRA coefficient: $\sigma = 2.5$
- Endowment process (earnings process from Aiyagari, 94):

$$w = \overline{w}(1 \pm \Delta_w)$$

$$\overline{w} = 0.85 \quad \Delta_w = 0.5, \quad g(w, w') = 0.75$$

- Production:

$$y = \overline{z}k^{\nu}$$

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

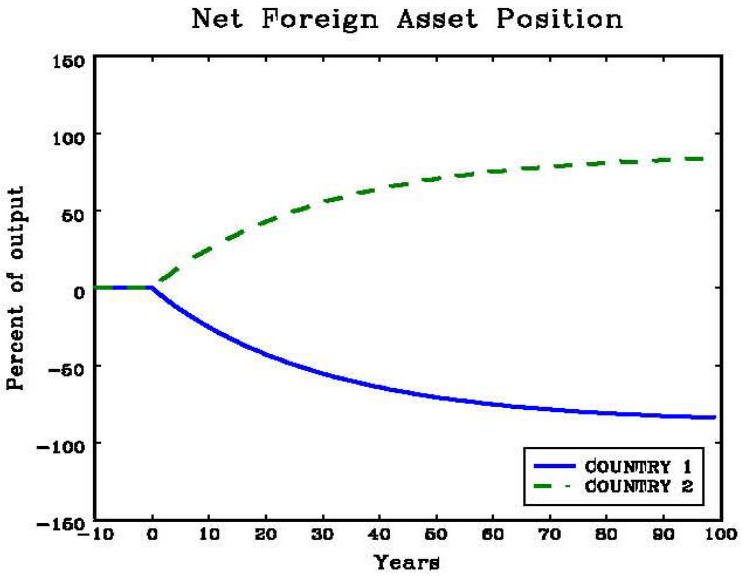
- Financial structure: $\phi^1 = 0.6$ $\phi^2 = 1$
  - Country 1 is 40% “more developed” than Country 2 in line with IMF (2006) financial markets index (U.S. v. average)

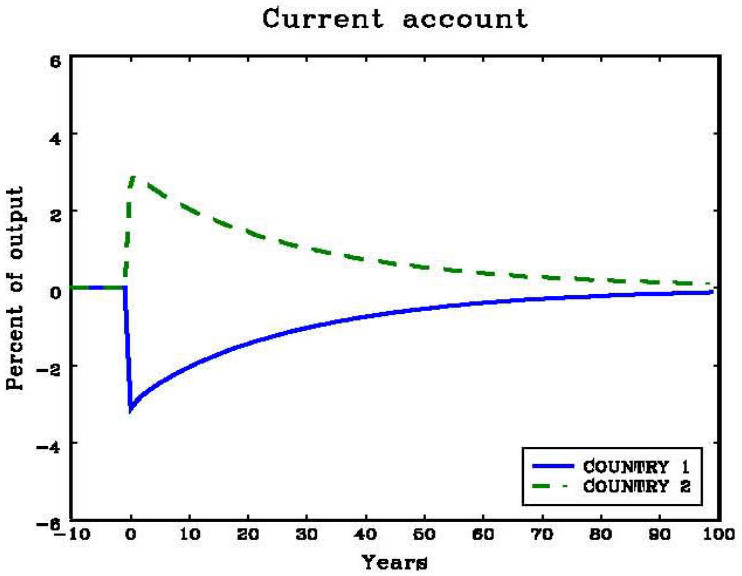
Case 1: Steady state equilibrium

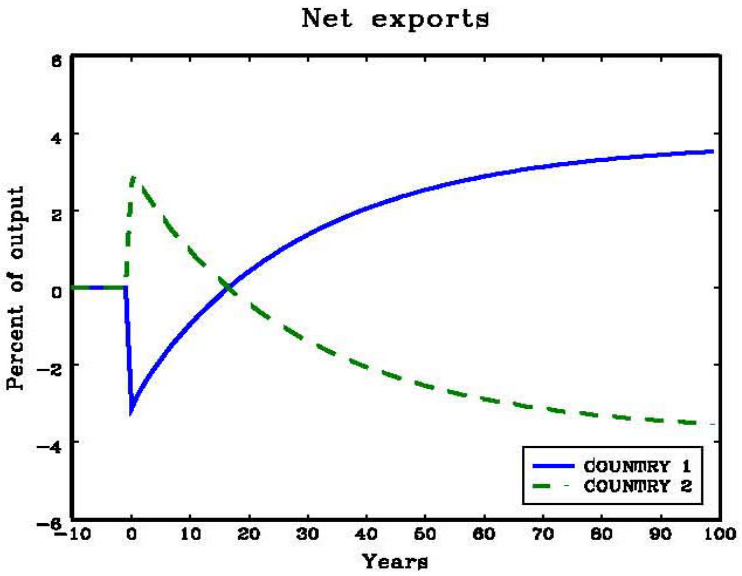
	Autarky		Capital mobility	
	Country 1	*Country 2*	*Country 1*	*Country 2*
Asset price	3.16	3.78	3.46	3.46
Interest rate	4.7	3.97	4.3	4.3
Foreign asset position	-	-	-87.3	87.3
Current account	-	-	0.0	0.0
Net exports	-	-	3.6	-3.6
Net factor payments	-	-	-3.6	3.6

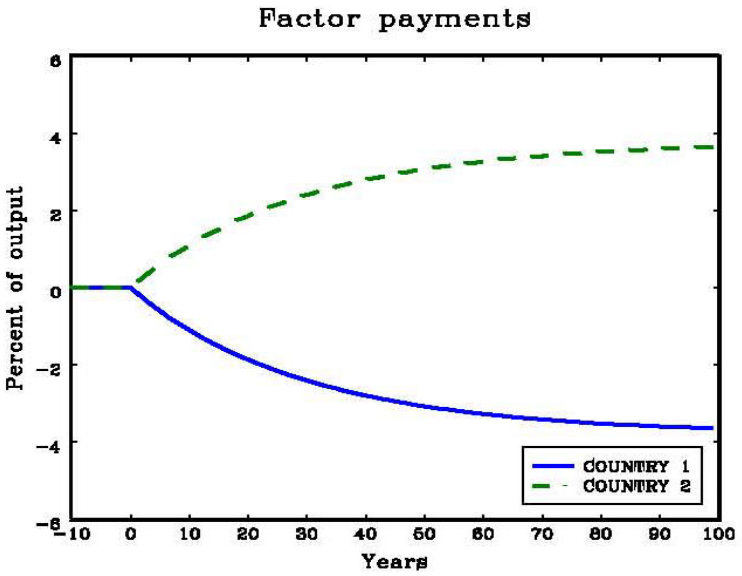
Flow and stock variables are in percentage of output

Case 1: Transitional dynamics









Case 2: Production shocks only

(consistent with Fact 2 but not Fact 1)

$\underline{\phi=0}$

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

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

$$U'(c) = \beta EU'(c(z'))R_t(k,z') + E\lambda(z')R_t(k,z')$$

$$\beta(1+r_t) < 1 \qquad ER_t(k,z') > 1+r_t$$

$\underline{\phi=\Phi}$

$$U'(c) = \beta(1+r_t)U'(c(z')) + (1+r_t)\lambda(z'), \qquad \forall\, w'$$

$$U'(c) = \beta ER_t(k,z')U'(c(z')) + E\lambda(z')R_t(k,z')$$

$$\beta(1+r_t) = 1 \qquad ER_t(\bar{k},z') = 1+r_t$$

z is i.i.d. with deviations from mean of a factor of 4

Case 2: Two-country implications

- Proposition 2: Suppose $\phi^1 = \Phi$ and $\phi^2 = 0$. In the steady state with financial integration, Country 1 has negative NFA, a positive position in foreign productive assets, and faces an interest rate lower than (a) $1/\beta$ and (b) the mean return on foreign productive assets
  - Country 2 agents demand higher premium on asset returns because of imperfect insurance, Country 1 agents buy assets in Country 2
  - Equity premium implies interest rate lower than risky returns
- Countries with deeper financial markets invest in foreign (high return) assets and finance the investment with debt.
- Results do not generalize for any $0 \leq \phi^2 < \phi^1 \leq \Phi$
  - If $\phi^2 < \phi^1 < \Phi$, Country 1 still buys some of Country 2's risky asset, but by taking more risk it can stimulate enough precautionary savings to make its foreign borrowing smaller than the value of risky assets held abroad.

Case 2: Steady state equilibrium

	Autarky		Capital mobility	
	Country 1	*Country 2*	*Country 1*	*Country 2*
Asset price	1.79	1.57	1.72	1.72
Interest rate	5.19%	3.40%	4.70%	4.70%
Foreign asset position	-	-	15.5%	-15.4%
Foreign bonds	-	-	-47.7%	46.9%
Foreign risky asset	-	-	63.3%	-62.4%
Current account	-	-	0.0%	0.0%
Net exports	-	-	-2.8%	2.8%
Net factor payments	-	-	2.8%	-2.8%

Flow and stock variables are in percentage of output

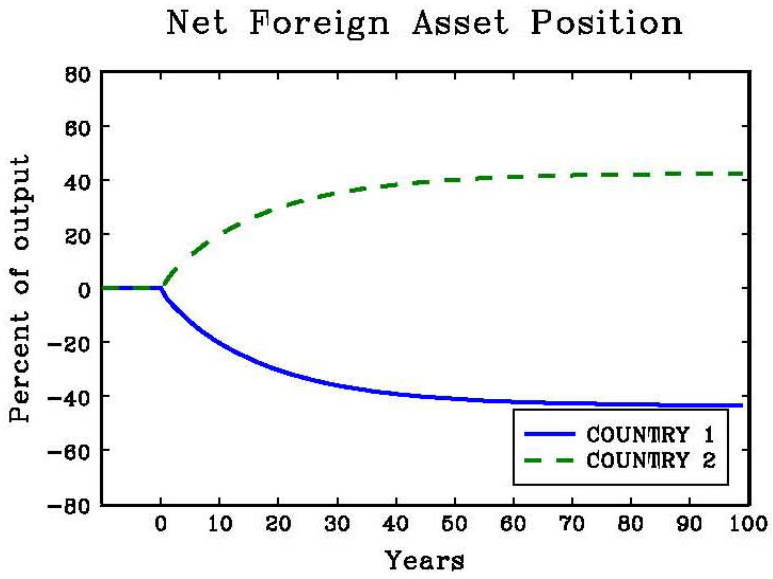
Case 3: Production & endowment shocks

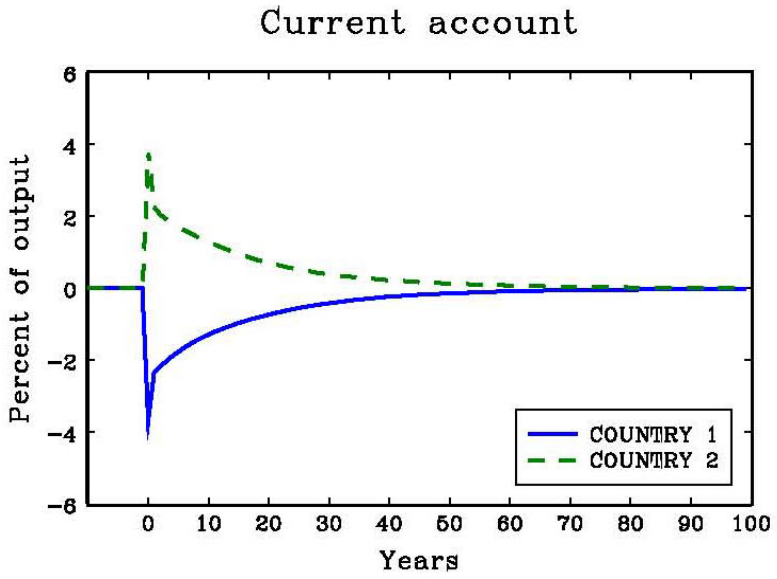
(consistent with Facts 1 & 2)

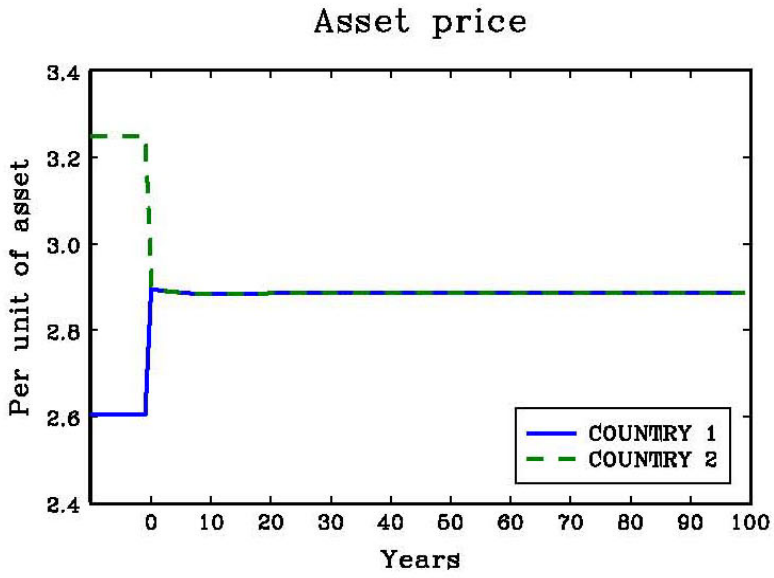
Steady state equilibrium

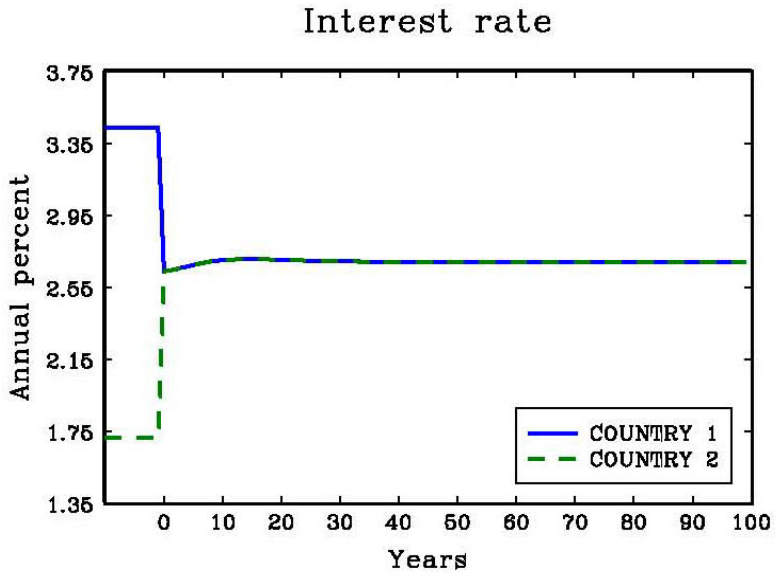
	Autarky		Capital mobility	
	Country 1	*Country 2*	*Country 1*	*Country 2*
Asset price	2.60	3.25	2.89	2.89
Interest rate	3.44%	1.71%	2.69%	2.69%
Return on risky asset	5.70%	4.47%	4.75%	5.63%
Foreign asset position	-	-	-43.4%	42.6%
Foreign bonds	-	-	-143.0%	140.6%
Foreign risky asset	-	-	99.6%	-98.0%
Current account	-	-	0.0%	0.0%
Net exports	-	-	-0.9%	0.9%
Net factor payments	-	-	0.9%	-0.9%

Transitional dynamics

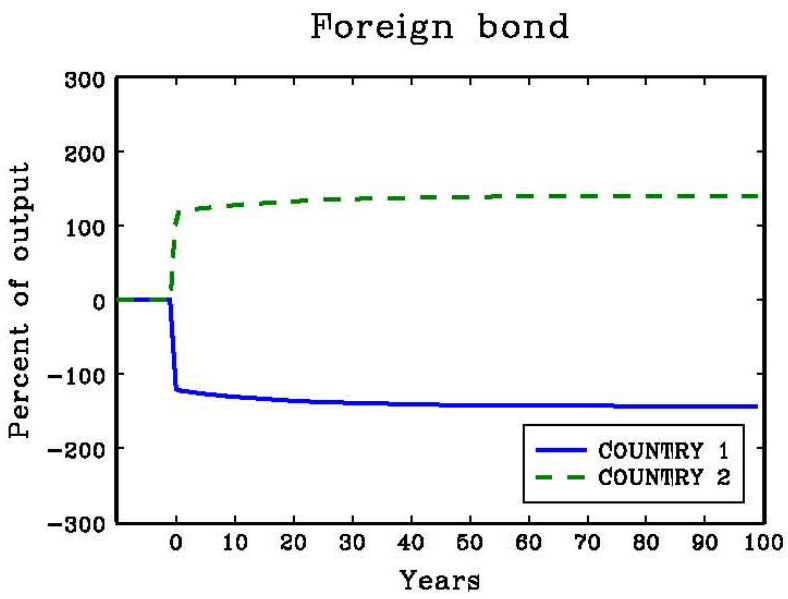


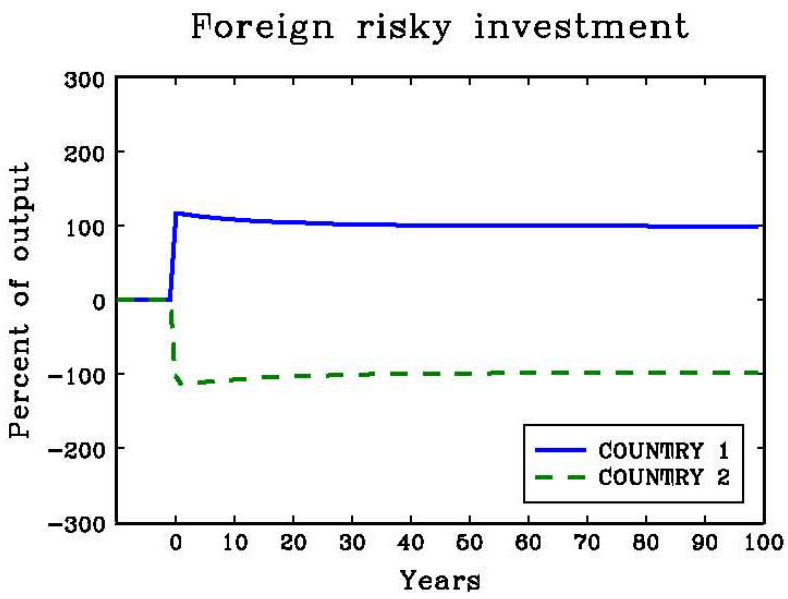


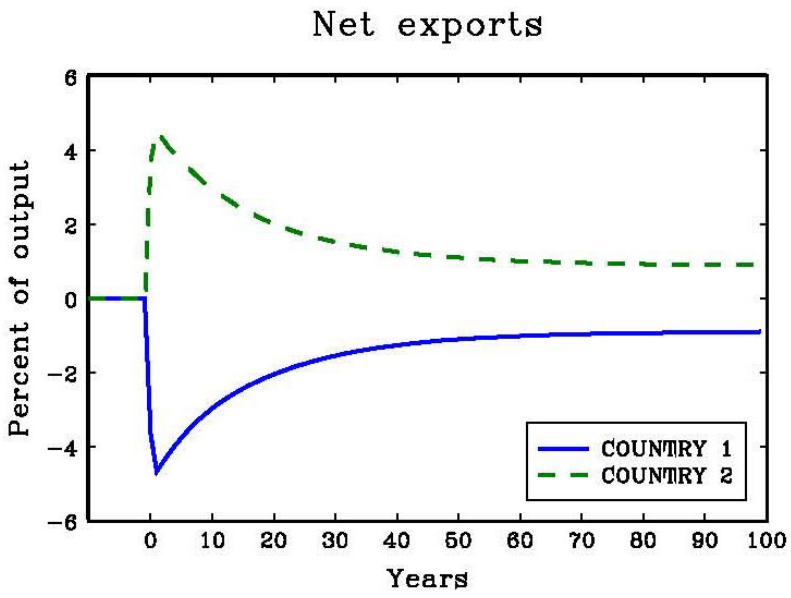


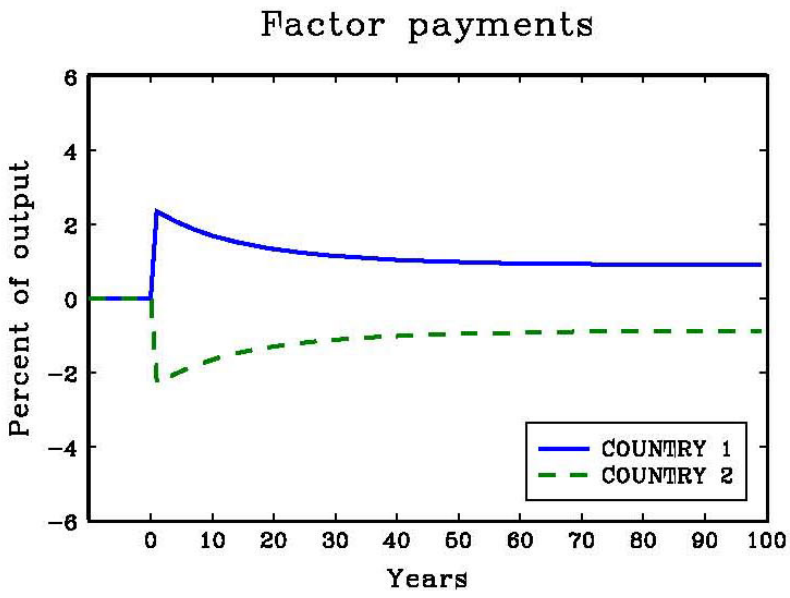


Transitional dynamics









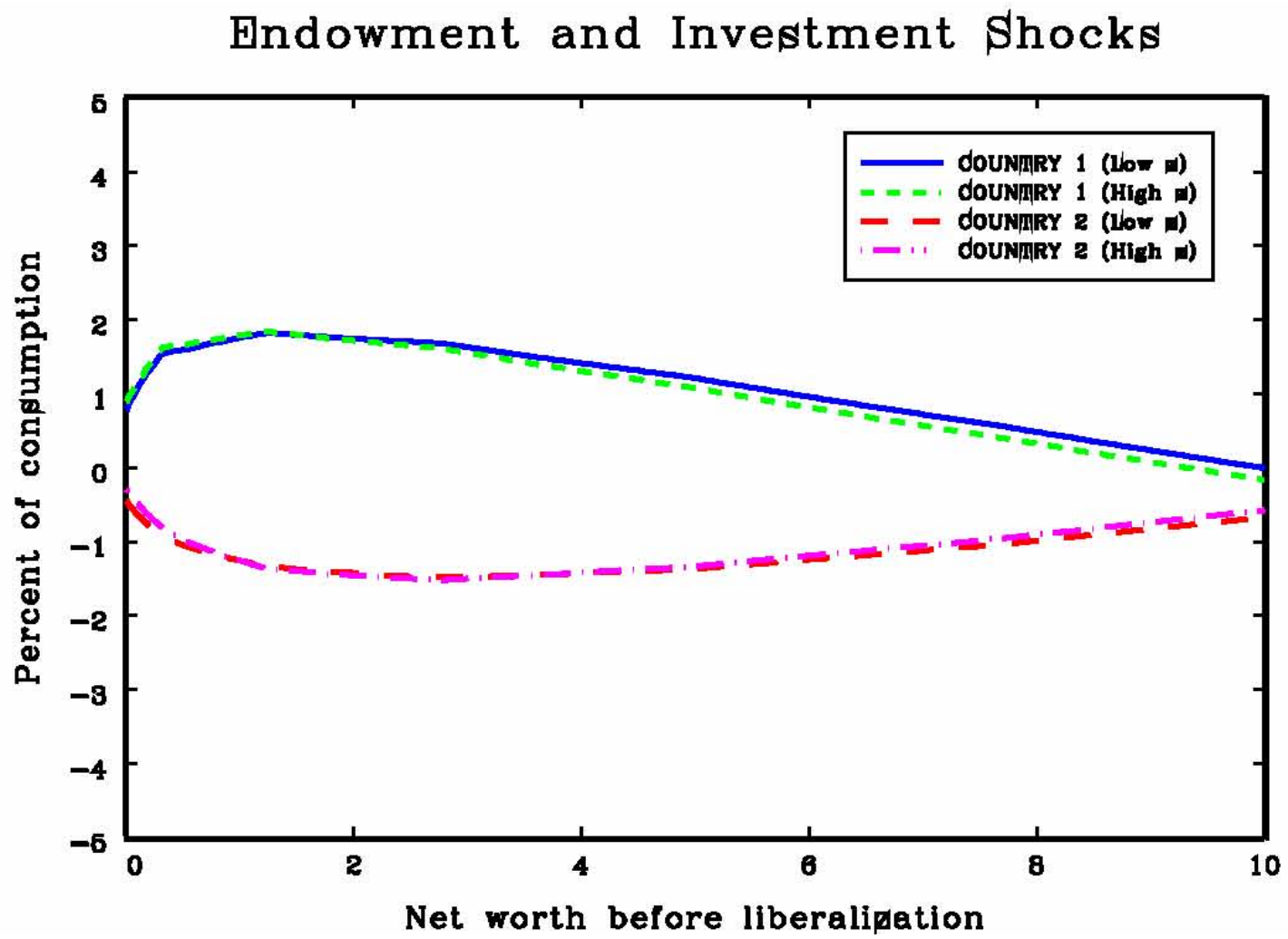
Welfare analysis

- Compensated variation in each agent's consumption that makes them indifferent relative to autarky case
  - Includes transitional dynamics
  - Welfare effects vary with net worth & shocks
- Mean welfare effects at constant weights:

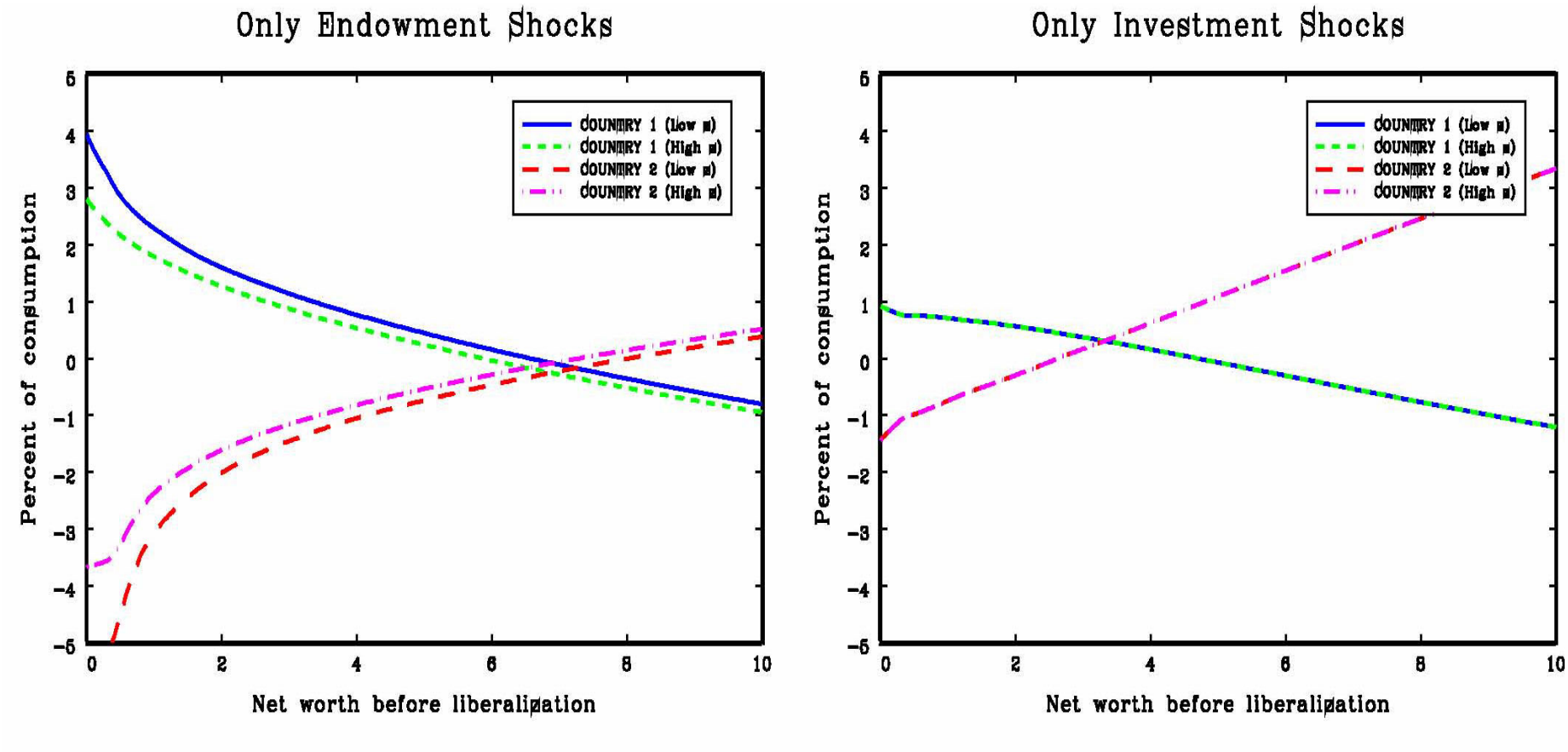
	Case 1	Case 2	Case 3
Country 1	0.88%	0.42%	1.41%
Country 2	-1.16%	-0.25%	-1.25%

- Financial heterogeneity akin to initial savings distortion that differs across countries
  - Fall in interest rate and wealth redistribution favor net debtor
  - Similar to beggar-thy-neighbor argument on taxes on capital flows but due to market incompleteness, not strategic planner

Welfare effects of financial integration



Welfare effects of financial integration



Conclusions

- Integration of heterogeneous capital markets can explain the two key facts of global imbalances
- Quantitative patterns predicted by the model are broadly in line with suggestive empirical evidence
- An argument for sequencing: “micro” reforms affecting enforceability problems before liberalization, or use “macro” liberalization as mechanism to facilitate “micro” reforms
- Extensions:
  - aggregate uncertainty (Asian investment shock, oil exporters)
  - gradual liberalization
  - three countries (Asia holds T-bills, US holds European equities)