International Capital Flows: A Role for Demography?

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NYU STERN

Capital inflows: sign of success?

- Larry Summmers, IMF, October 3, 2004:

> *There is a standard set of things that finance ministers of countries with significant current account deficits say. Perhaps the sharpest formulation is: "We live in a country that capital is trying to get into. Would you rather live in a country that capital is trying to get out of?"*

Capital inflows: portent of peril?

- Daniel Gross, *New York Times*, May 8, 2005:

  [US] imbalances are eerily reminiscent of recent economic crises. Could we see a perfect storm [for the US economy]? If so, what would it look like?

  - ⋆ *Nouriel Roubini estimates that long-term interest rates in the US could rise by 200 basis points over a few months and the value of the dollar would fall.*
  - ⋆ *Said Barry Eichengreen: "The result would not be a full-blown financial crisis most likely, but it would still be a major recession."*
  - ⋆ *Adds Jeffrey Frankel, "some of us have been warning of this hard-landing scenario for more than 20 years."*

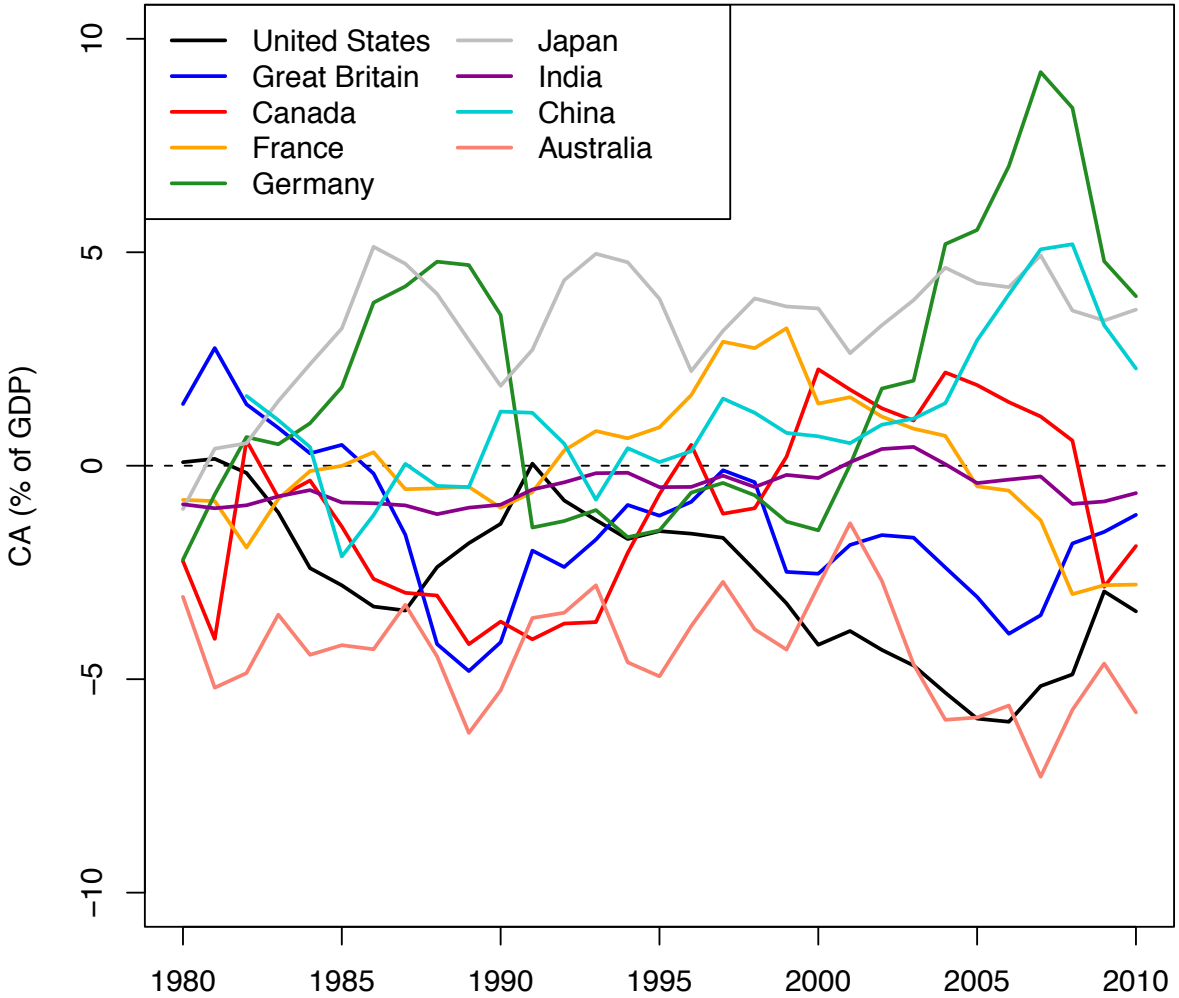
Overview

- Facts about capital flows
- Facts about demography
- A model
- Preliminary results

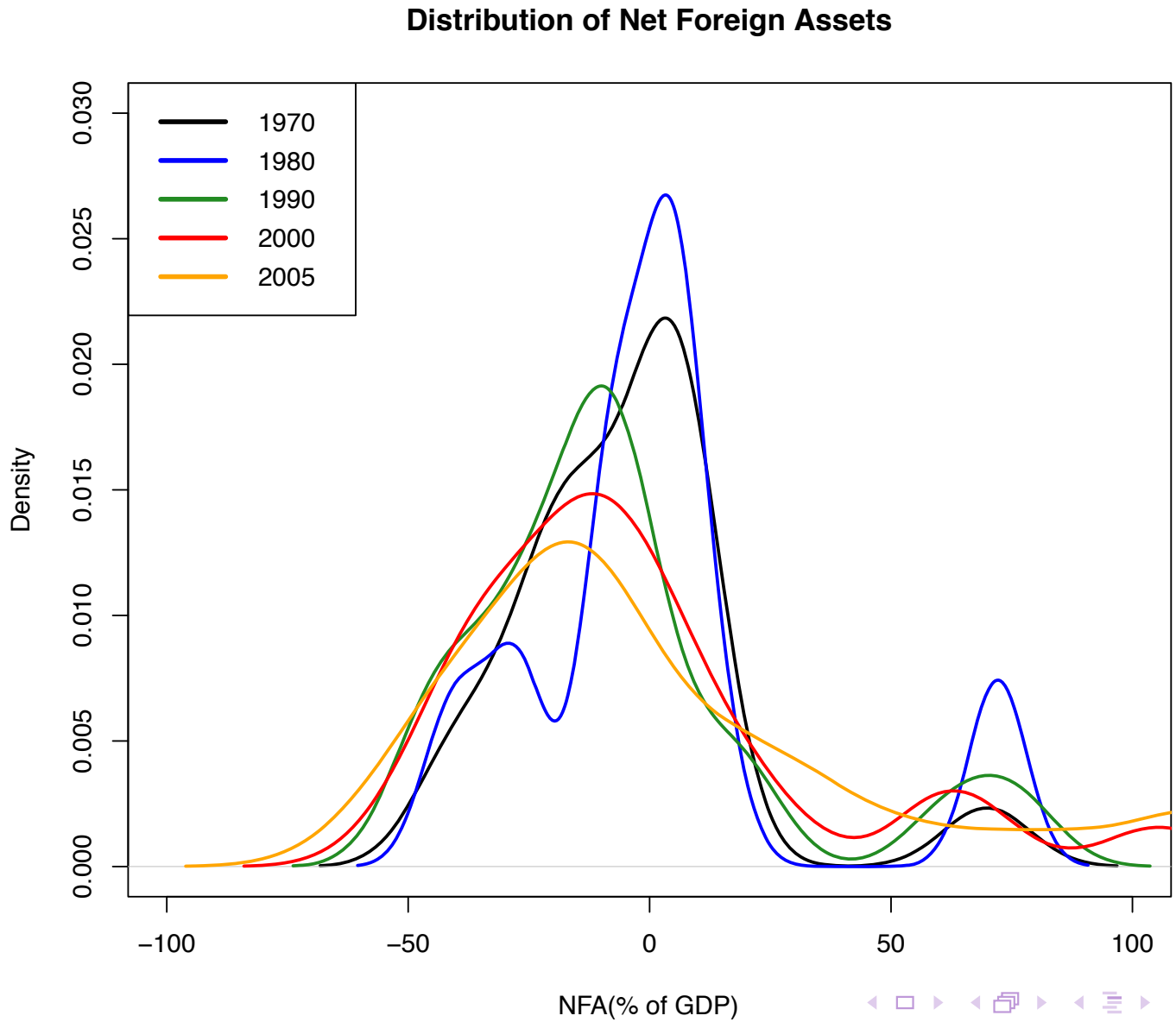
Facts about capital flows

- What drives them?
  - Business cycles
  - Institutions
  - Taxes and legal restrictions
  - Commodity prices (oil)
  - Political risk
  - Exchange rates
  - Anything that affects saving or investment
- Some data to get us thinking...

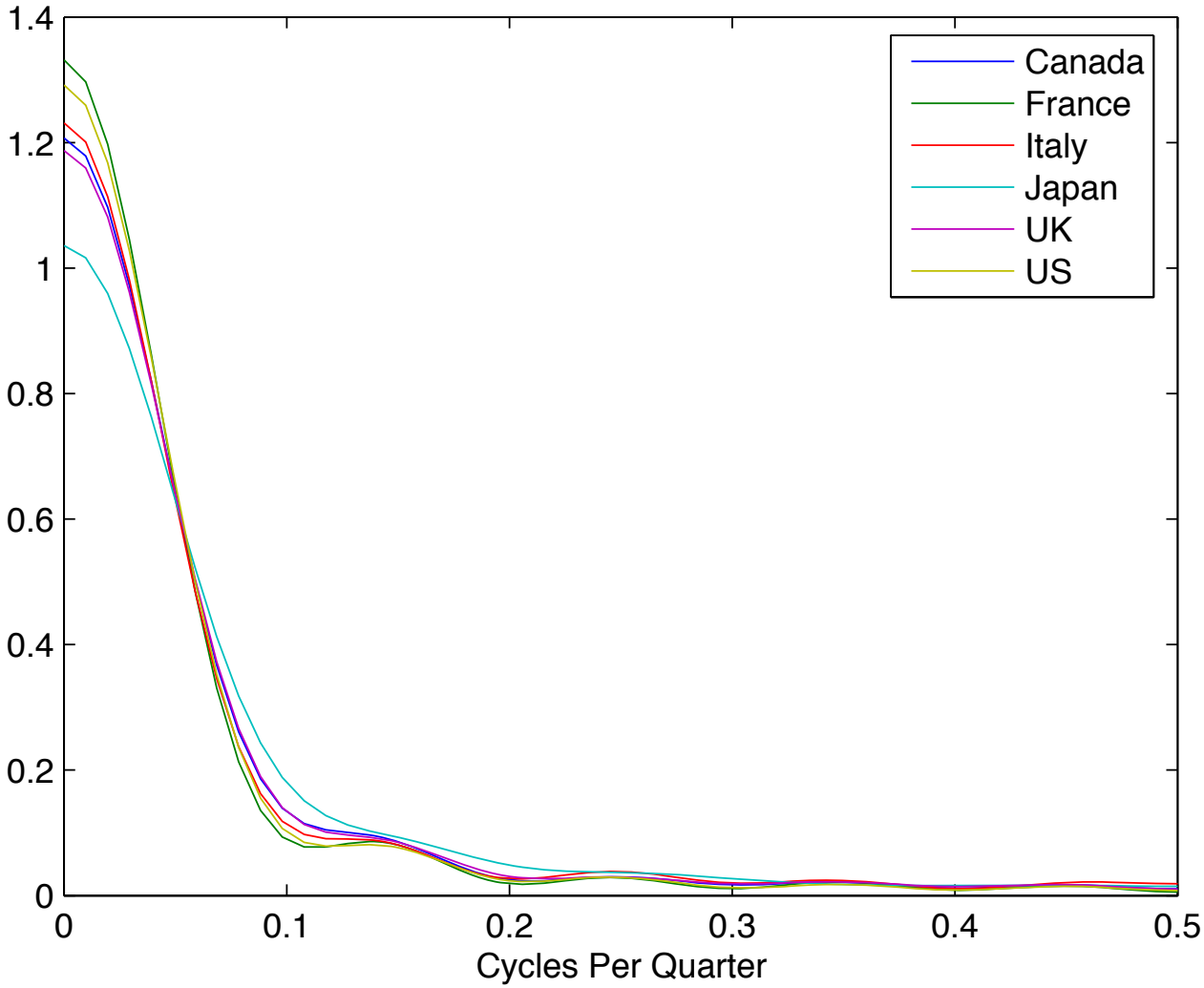
Facts: current accounts



Facts: net foreign assets



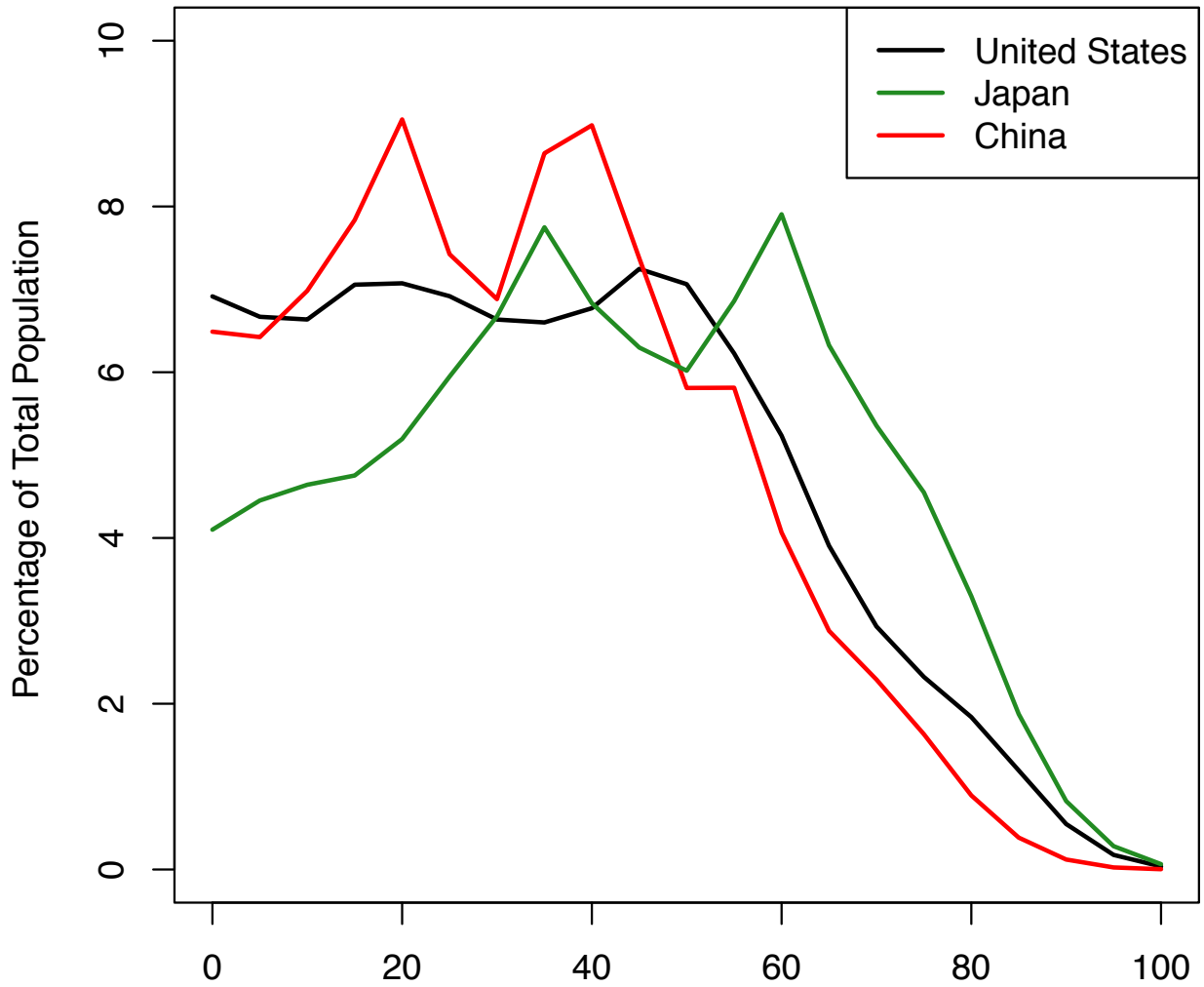
Facts: current account spectrum



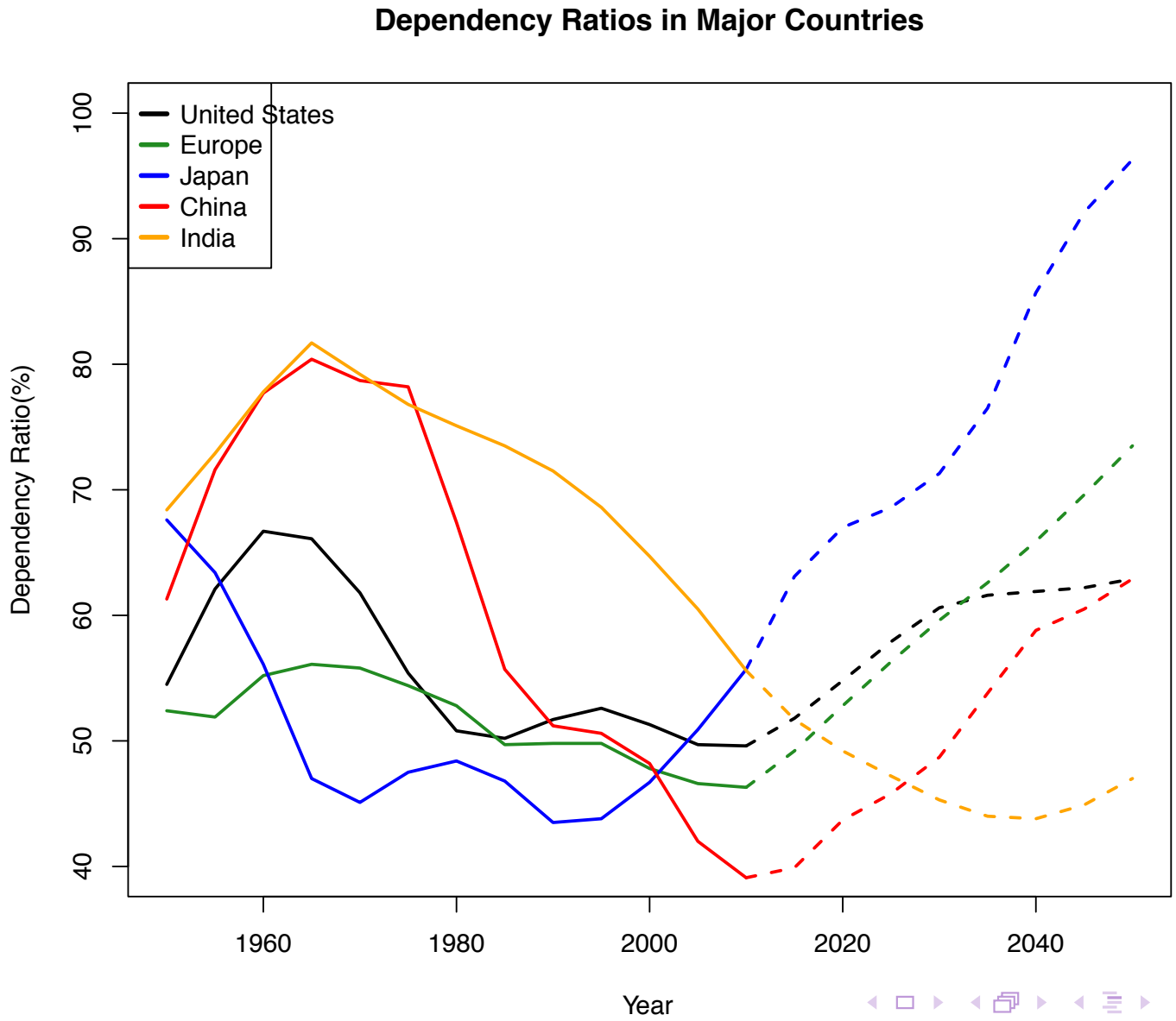
Facts: summary

- Capital flows are persistent
- Demography inherently persistent, too
- $\Rightarrow$ Could it play a role in capital flows?

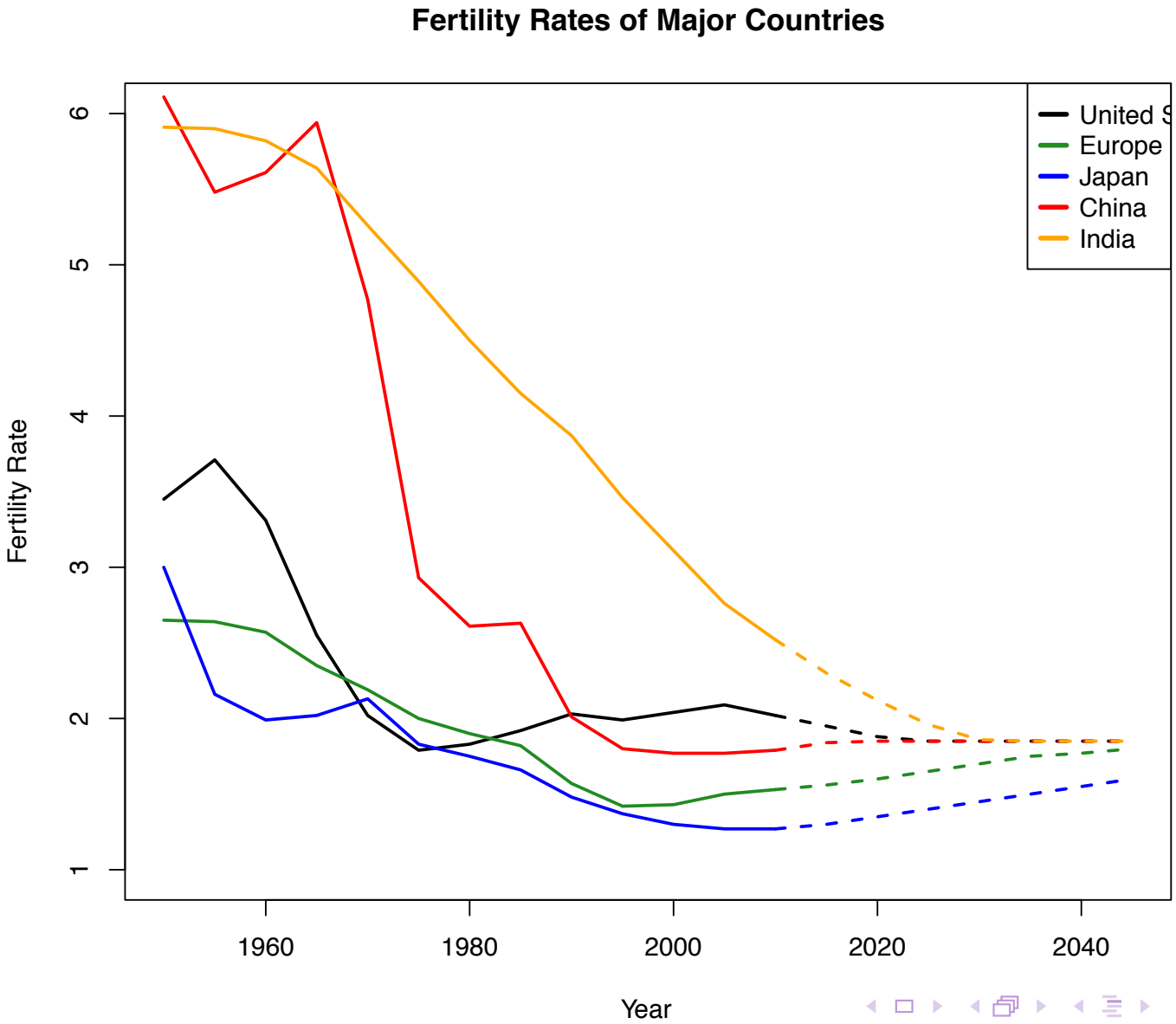
Facts: age distributions



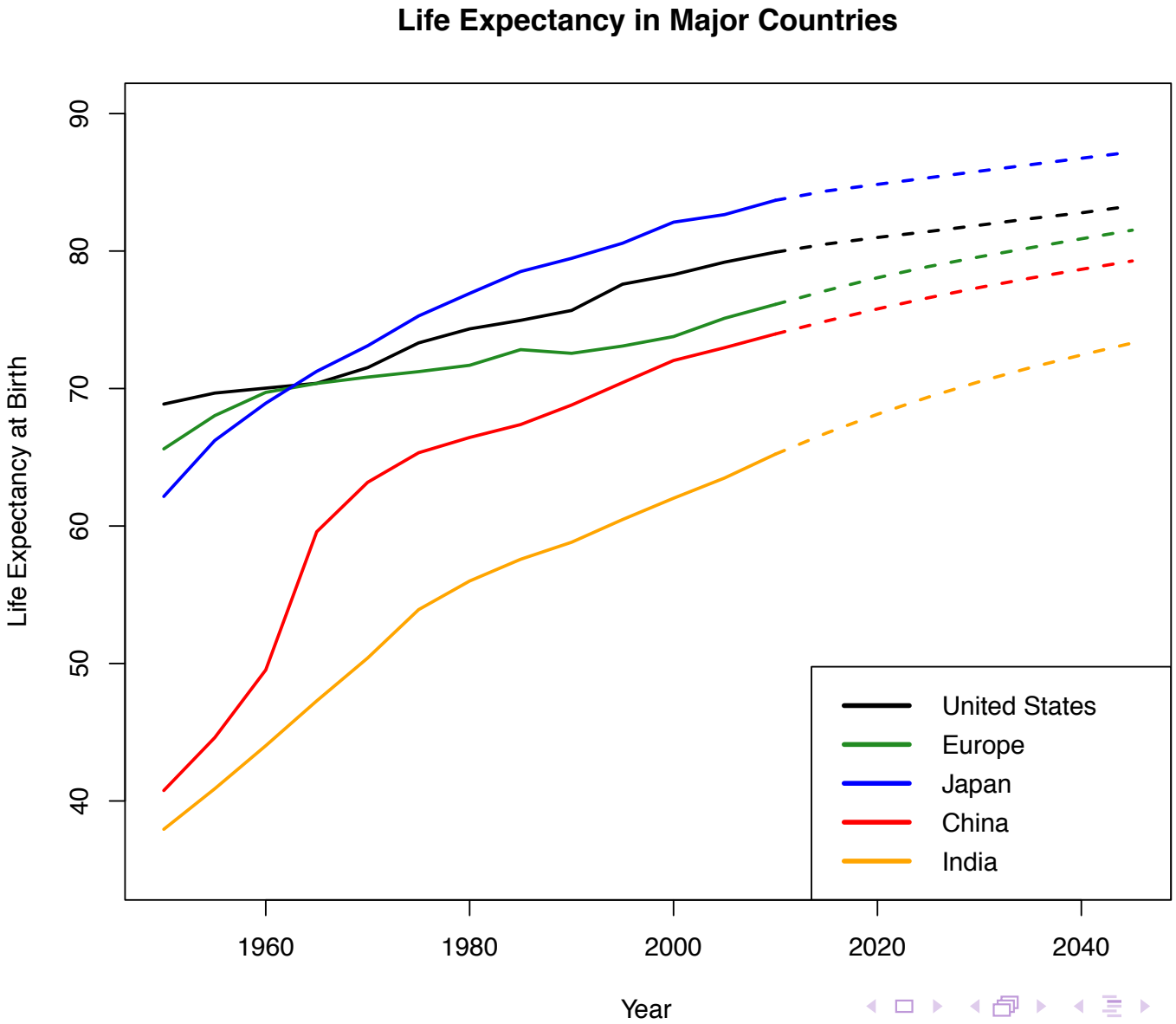
Facts: dependency ratios



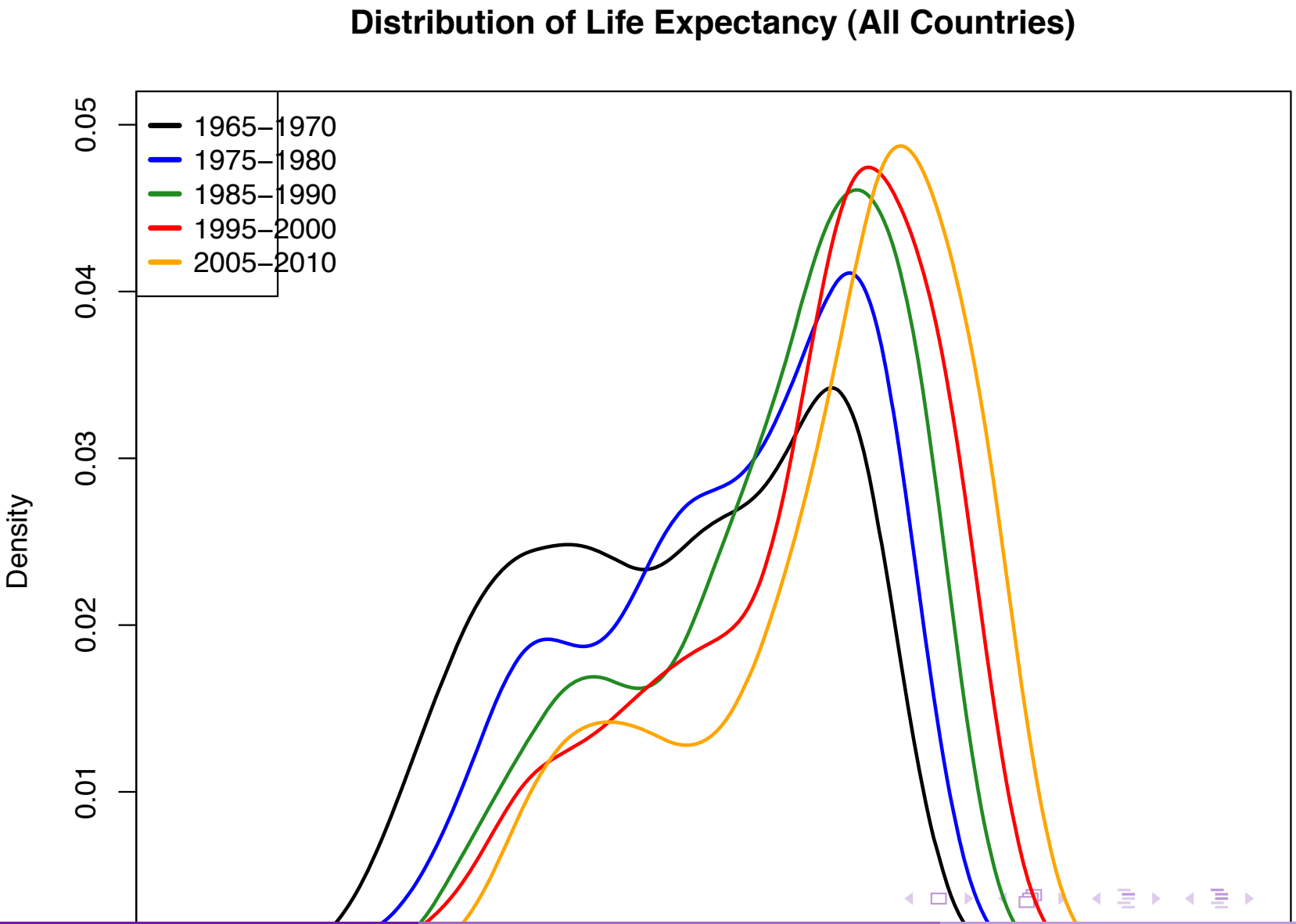
Facts: fertility



Facts: life expectancy



Facts: life expectancy



Model: overview

- One-good world
- National production functions
- Unrestricted international capital flows
- **Overlapping generations**
  - Life-cycle saving
  - Fertility, mortality, immigration tied to data
  - Fixed retirement age (65)
- Result: demographic differences generate capital flows

Model: overlapping generations

- Each country consists of overlapping generations of agents who live up to I periods, with age denoted by $i \in \{1, \ldots, I\}$.
  - At each date, there are I different cohorts alive.
  - Individuals remain children for I_0 periods in which they do not work, consume, or save.
  - On reaching adulthood, they do all of these things
  - Fixed retirement age
- Notation
  - Model includes countries j, agents/cohorts i, dates t
  - Agent variables denoted with lower-case letters, country aggregates with upper case

Model: demography

- The demographic structure of the population depends on fertility, mortality and immigration.
- Survival: the probability of an agent of age i at date t surviving to the next period is $s_{i,t}$. The unconditional probability of reaching age i is $s^i = \prod_{j=1}^{i-1} s_j$.
- Fertility: fertility rates connect the current age distribution to the number of age-1 agents next period.
- Age distribution: Let $x_t \in \mathbb{R}^I$ be the vector of number of members in each cohort in period t.
- Evolution of age distribution: Let $m_t \in \mathbb{R}^I$ be a vector of immigrants by age. If $\hat{\Gamma}_t$ contains fertility and survival rates at time t, the law of motion for the population is

$$x_{t+1} = \hat{\Gamma}_t x_t + m_t.$$

Model: preferences

- Preferences. An agent born at date t has the additive utility function

$$E_{t+I_0}\left\{\sum_{i=I_0+1}^{I}\beta_i s^i u_i\left(c_{i,t}\right)\right\},$$

where $c_{i,t}$ is consumption of agent of age i in period t and β_i is an age-specific discount factor.

- Power utility:

$$u\left(c_{i,t}\right)=\frac{\left(c_{i,t}\right)^{1-\sigma}-1}{1-\sigma},$$

Model: labor supply

- Individuals supply one unit of labor inelastically
- Efficiency units or productivity follow a deterministic function of age. The vector of age specific efficiency units of labor is denoted $\{\epsilon_i\}_{i=1}^{I}$.
- Childhood and retirement are modeled by setting efficiency equal to zero.
- Aggregate labor supply in country j is

$$N_{jt} = x_{it} s_t^i$$

Model: technology

- Countries produce the same good
- Country j time t

$$Y_{j,t} = \theta_{j,t} K_{j,t}^{\alpha} N_{j,t}^{1-\alpha}$$

- Capital stocks:

$$K_{j,t+1} = (1-\delta) K_{jt} + I_{j,t}$$

Model: equilibrium 1

- Individuals in each country choose consumption to maximize utility
- One consequence is the second-order difference equation

$$a_{i+1,t+1} = a_{i,t}R_t + \epsilon_i w_t + h_t - \left(\frac{1}{\beta s_{i-1,t-1} R_t}\right)^{-\frac{1}{\sigma}} \left(a_{i-1,t-1}R_{t-1} + \epsilon_{i-1} w_{t-1} + h_{t-1} - a_{i,t}\right).$$

  Combined with initial and terminal conditions, this uniquely defines the life-cycle saving and consumption sequence for given prices.

- Firms choose labor and capital to maximize profits:

$$K^d_{j,t} = \left(\frac{r_{j,t}}{\alpha\theta_{j,t}}\right)^{\frac{1}{\alpha-1}} N_{j,t}.$$

Model: equilibrium 2

- Goods market clears

$$C_{jt} \equiv \sum_i c_{ijt}$$

$$\sum_j Y_{jt} = \sum_j (C_{jt} + I_{jt})$$

- Asset/capital market clears

$$A_{jt} \equiv \sum_i a_{ijt}$$

$$\sum_j A_{jt} = \sum_j K_{jt}$$

Model: capital flows implied by demography

[Coming soon!!]

Model

1. Individuals at all ages in all countries optimize – and supply capital (savings) – given prices

$$\mathrm{E}_{t+I_0}\left\{\sum_{i=I_0+1}^{I}\beta^i s^i u_i\left(c_{i,t}\right)\right\},$$

subject to constraints

$$c_{i,t}+a_{t+1,i+1}=a_{i,t}\left(1+r_t\right)+\epsilon_i w_t+h_{i,t}, \quad \text{and} \quad a_{1,t}=a_{I+1,t}=0.$$

2. Firms in all countries demand capital and labor given prices (rental and wage rates)

3. Prices are set such that global capital demand equals global capital supply.

Calibration

Conditional survival propabilities	Data
Cohort sizes	Data
Capital's share of output (α)	$1/3$
Risk aversion / intertemp. subst. (σ)	4
Time-preference parameter (β)	Net annual risk-free rate of return of 2.5%.
Depreciation rate (δ)	2.5% annually.

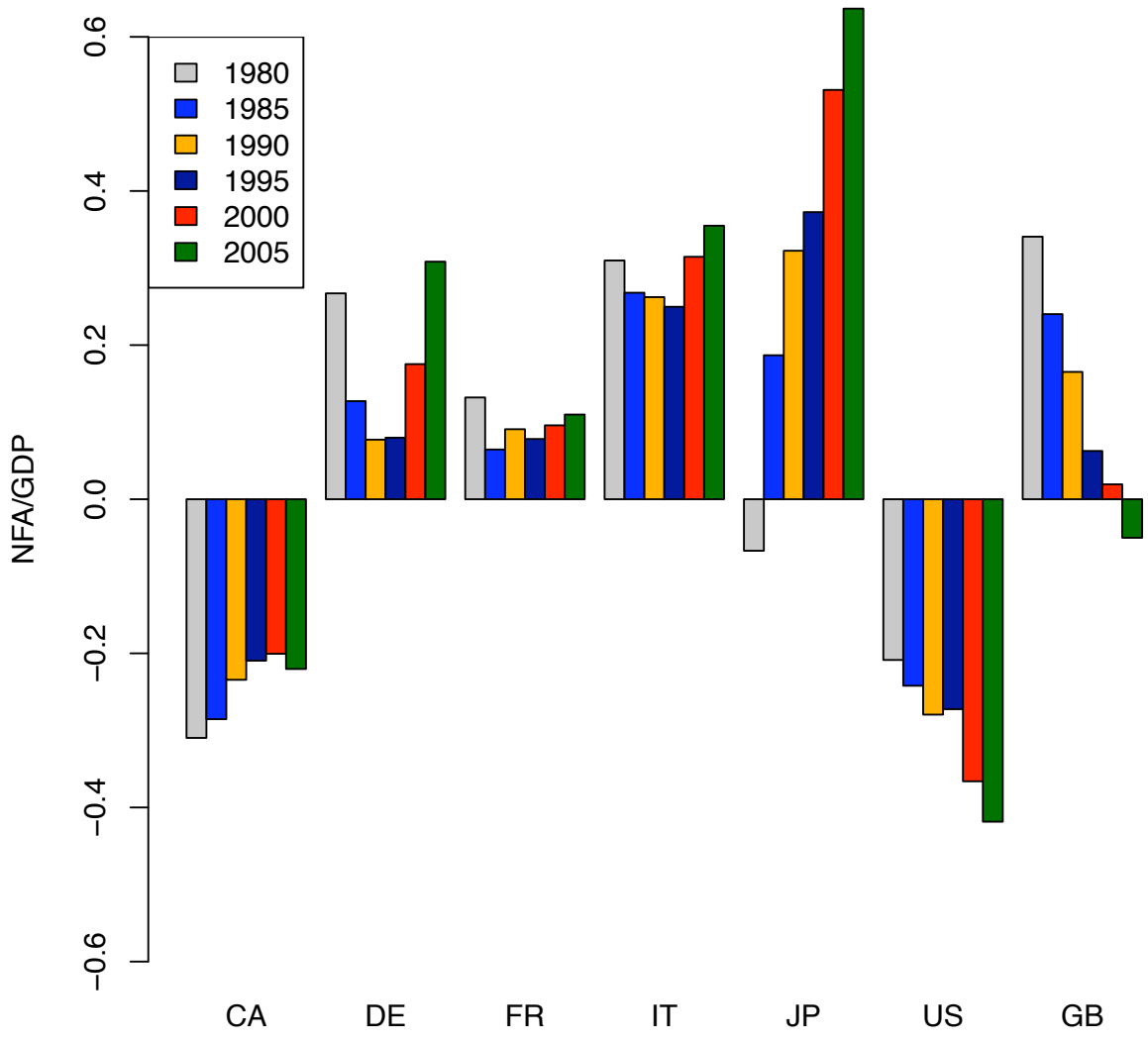
Numerical experiments

1. Benchmark model – countries only differ in terms of demographics

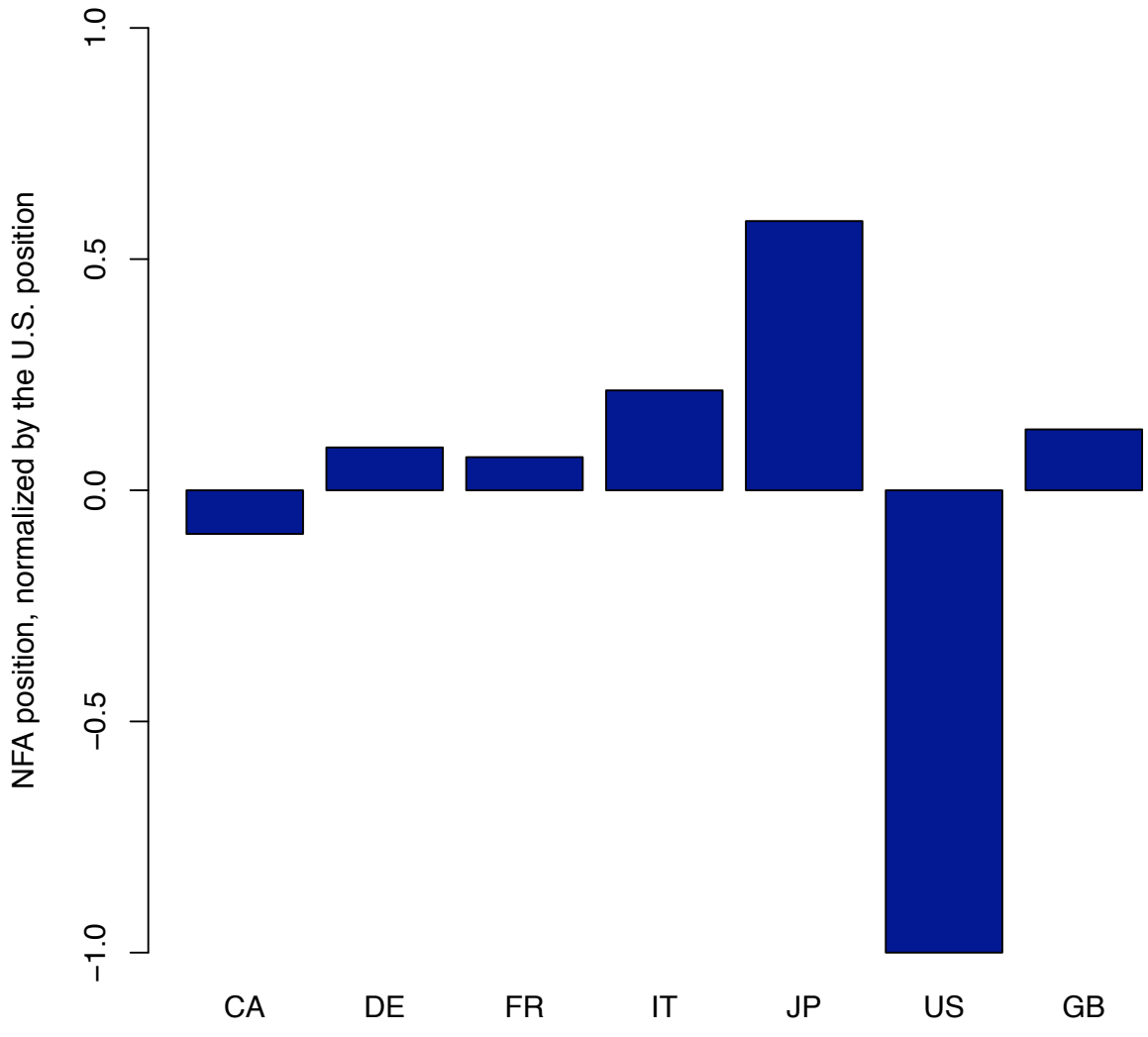
2. TFP differences – match relative aggregate GDP across countries

3. Differences in capital wedges – match K/Y-ratios

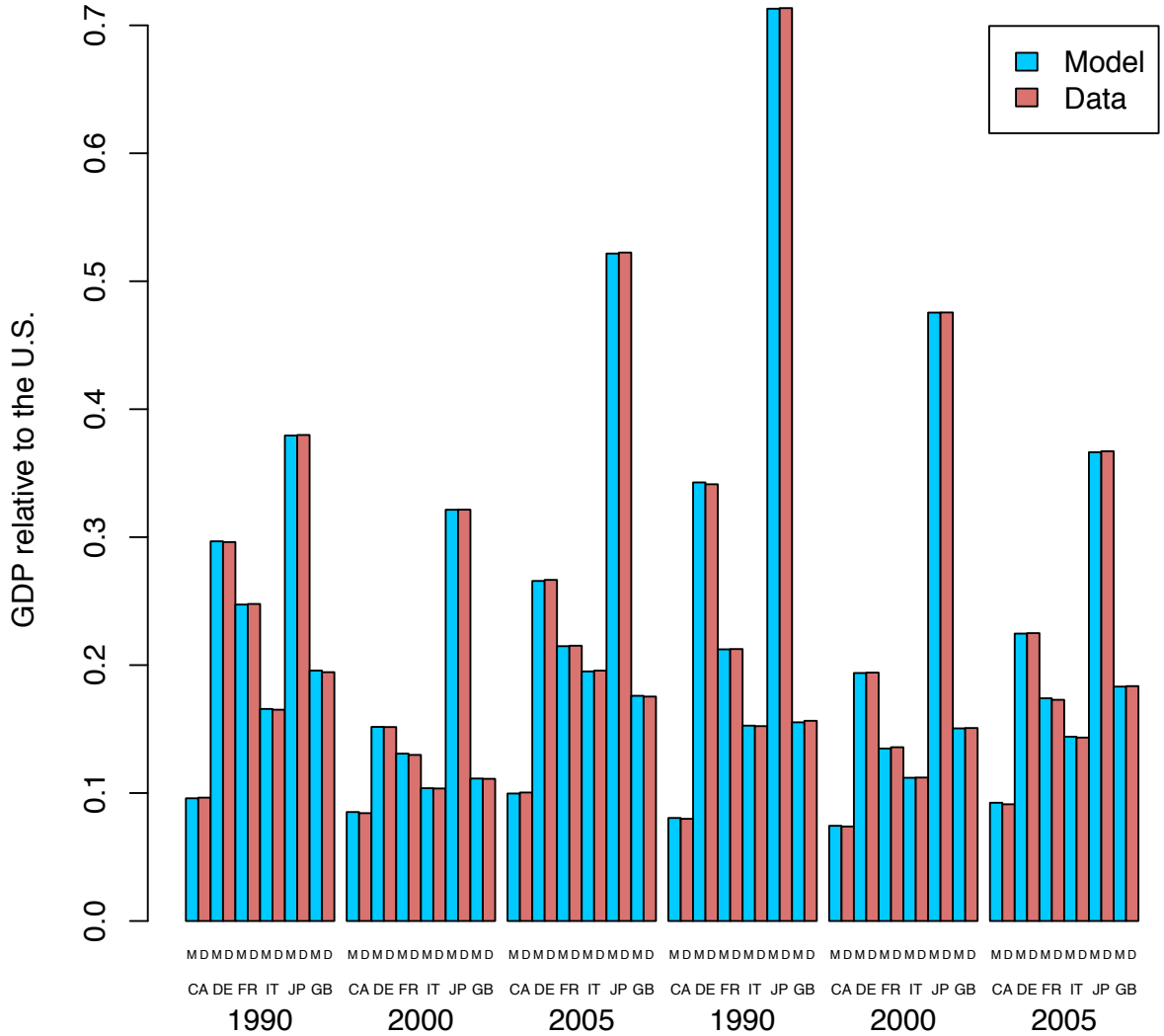
NFA/GDP positions, benchmark model



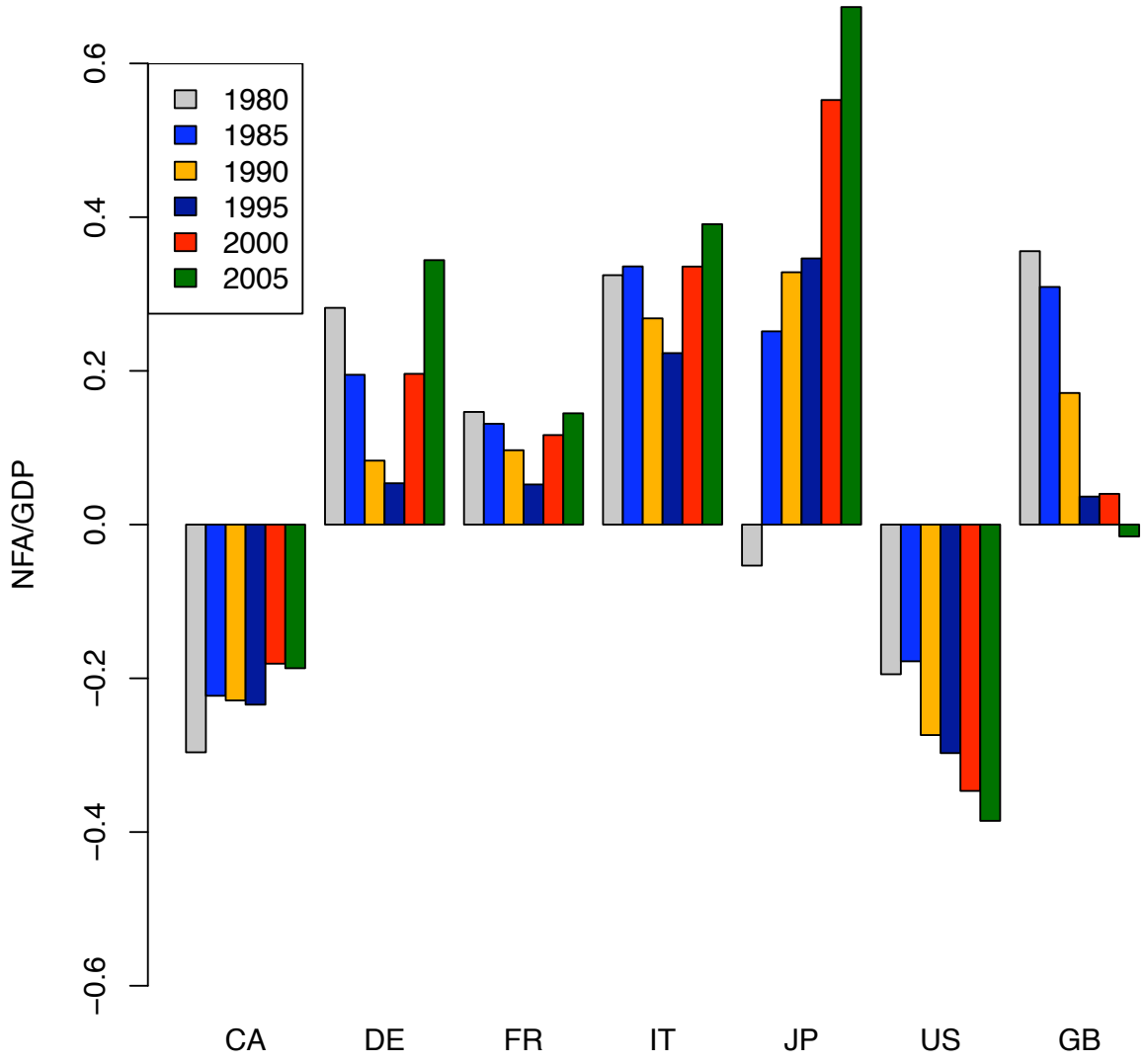
Relative size of NFA positions, benchmark model



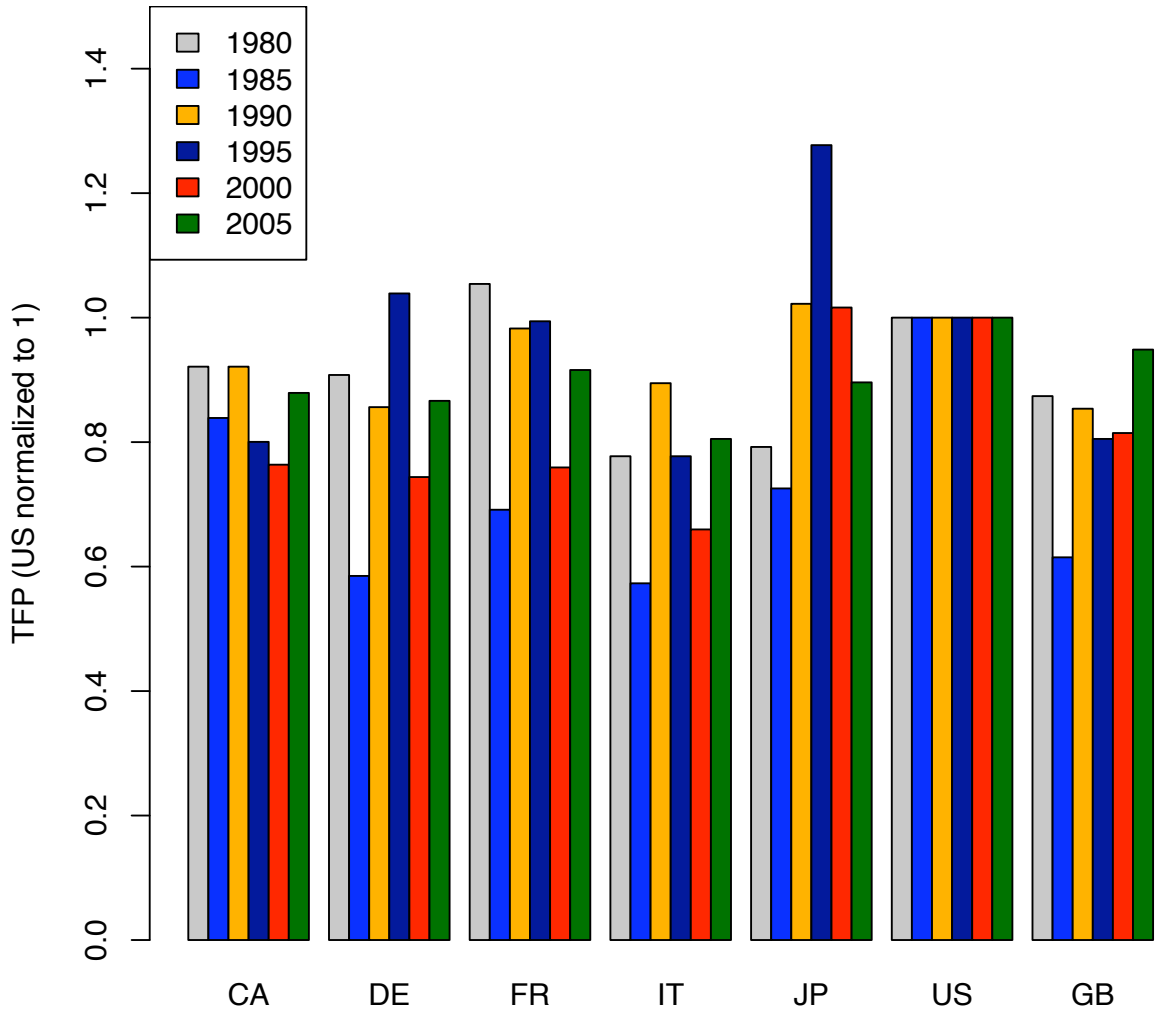
Implied GDP levels relative to the U.S., benchmark model



NFA/GDP positions, TFP set to match relative GDP levels



Implied relative TFP levels, TFP set to match relative GDP levels



International capital flows revisited

- An "imbalance" to be managed or a fact of life to be explained?
- Persistence is a clue to their origin
- Demographics both persistent and different across countries
- A role in international capital movements?

US household net worth