

Great Depressions of the Twentieth Century

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Great Depressions of the Twentieth Century Project

Use growth accounting and applied dynamic equilibrium models to reexamine great depression episodes:

United Kingdom (1920s and 1930s) — Cole and Ohanian

Canada (1930s) — Amaral and MacGee

France (1930s) — Beaudry and Portier

Germany (1930s) — Fisher and Hornstein

Italy (1930s) — Perri and Quadrini

Argentina (1970s and 1980s) — Kydland and Zarazaga

Chile and Mexico (1980s) — Bergoeing, Kehoe, Kehoe, and Soto

Japan (1990s) — Hayashi and Prescott

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Great Depressions Methodology

Cole and Ohanian (1999), Kehoe and Prescott (2002)

Aggregate production function:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha}.$$

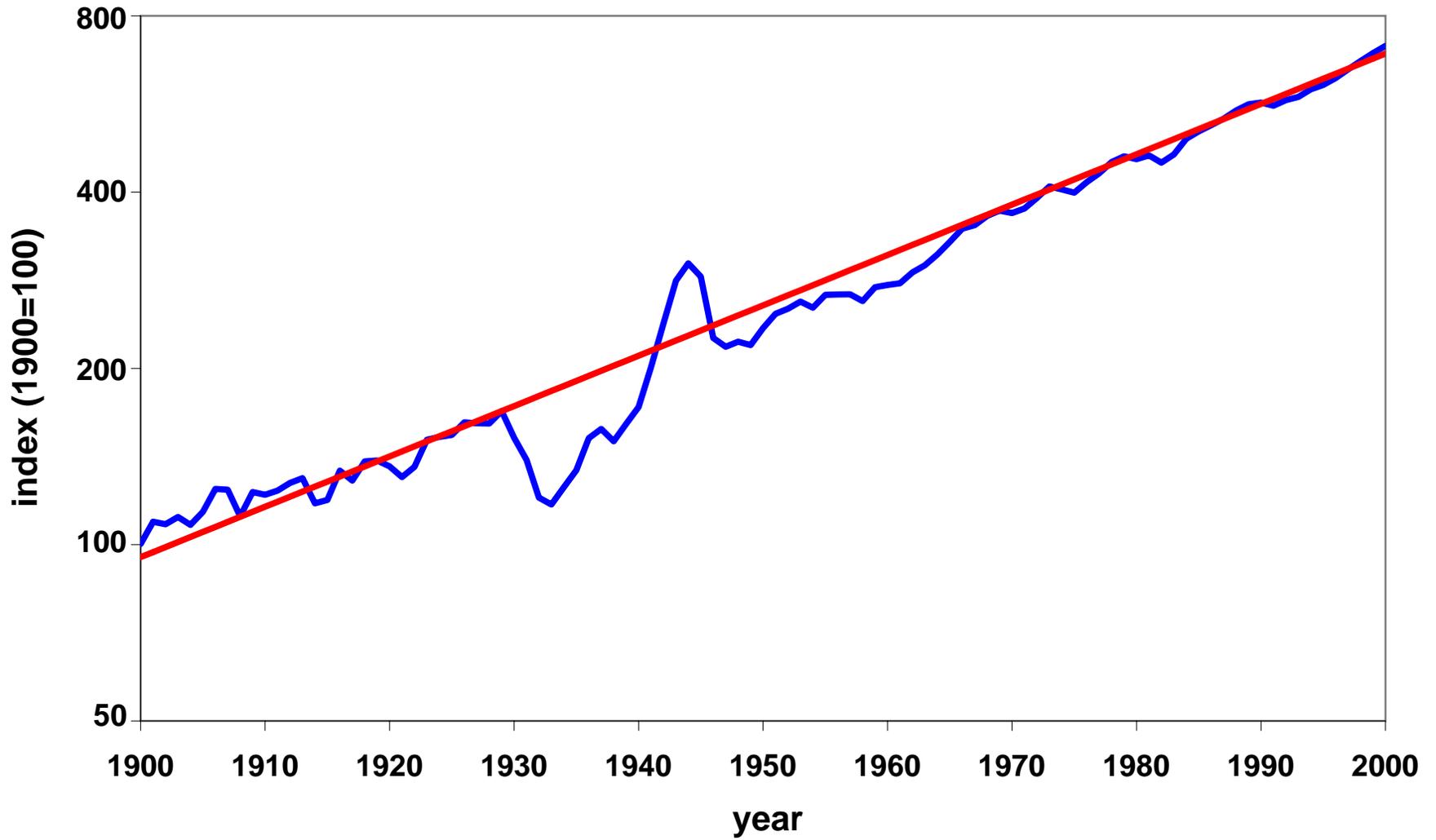
When $A_t = A_0 g^{(1-\alpha)t}$, output per capita grows at constant rate $g - 1$.

Measure output growth with respect to this trend.

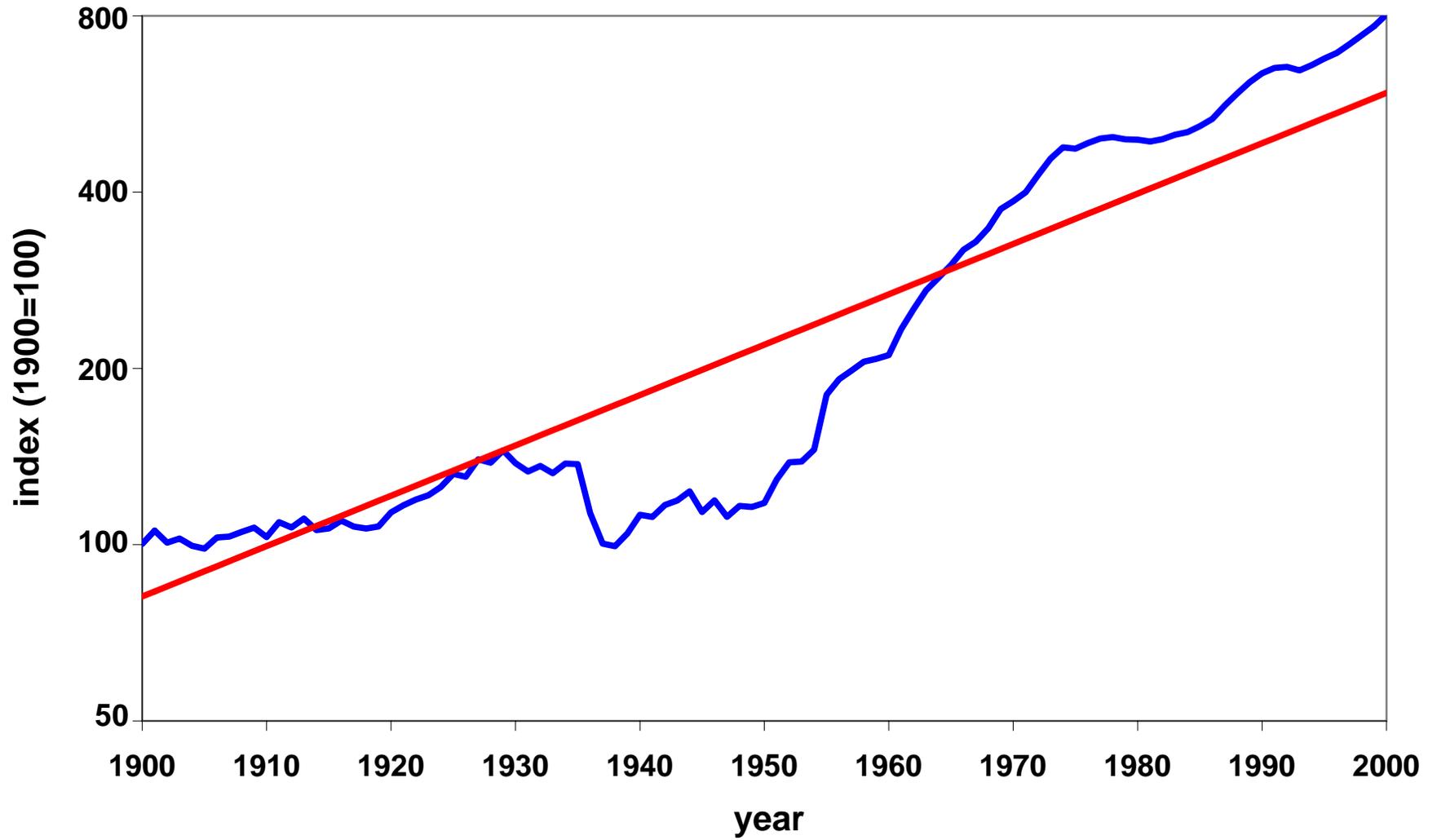
- Trend growth represents the stock of useable production knowledge growing smoothly over time.
- This knowledge is not country specific.
- Countries grow at the same rate, $g - 1$, on different balanced growth paths.
- Levels differ across countries because institutions are different.
- Changing institutions moves the country to a different balanced growth path.
- Take $g - 1$ to be growth rate of the industrial leader – United States.

$$g = 1.02$$

Real GDP per Capita in the United States



Real GDP per Capita in Spain



Growth Accounting

Y_t : real GDP (national income accounts)

X_t : real investment (national income accounts)

L_t : hours worked (labor surveys)

Construct Capital Stocks:

$$K_{t+1} = (1 - \delta) K_t + X_t$$

Total factor productivity is the residual:

$$A_t = Y_t / K_t^\alpha L_t^{1-\alpha}$$

$$\delta = 0.05$$

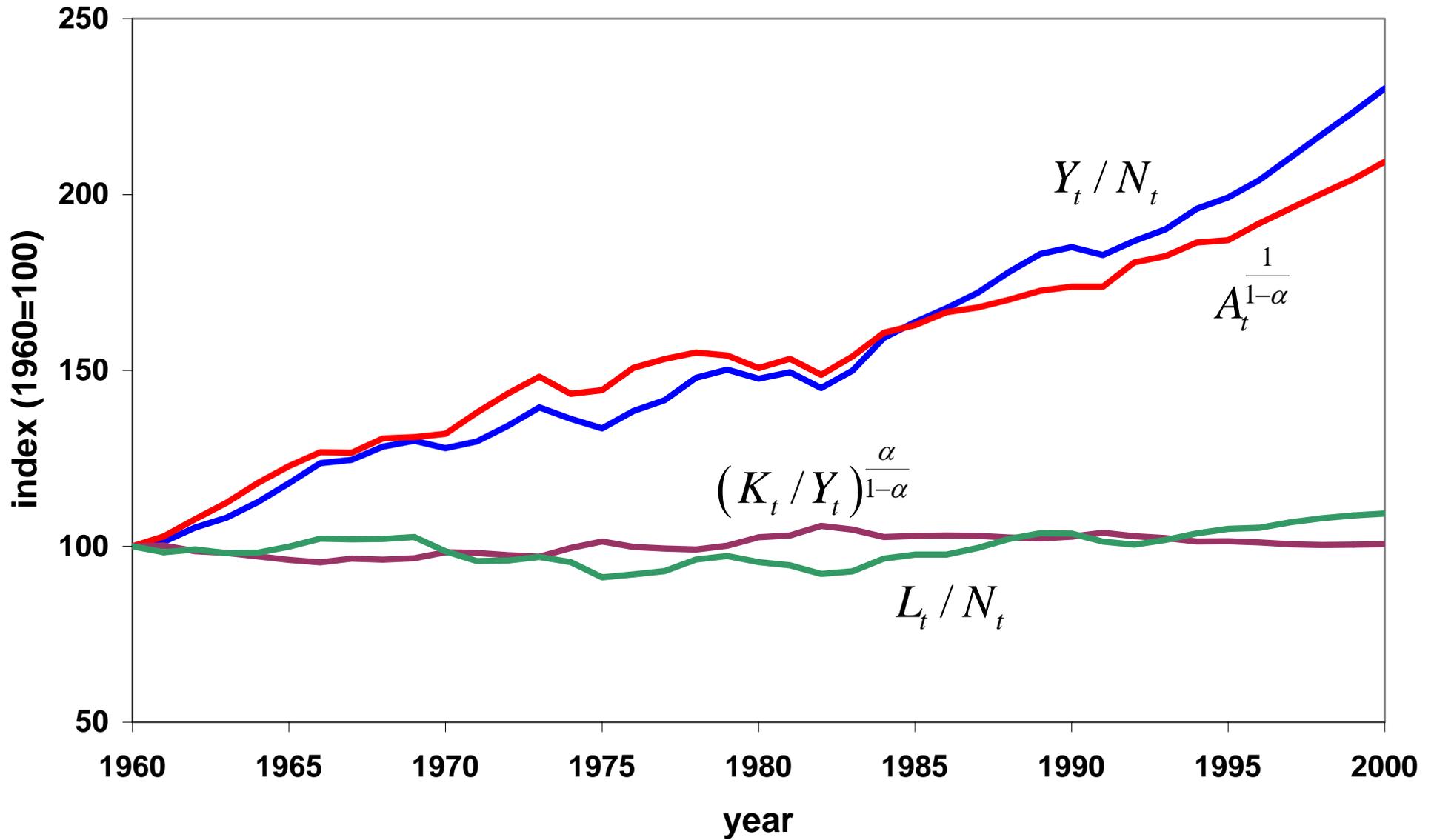
$$\alpha = 0.30$$

Decomposing Changes in GDP per Working-Age Person

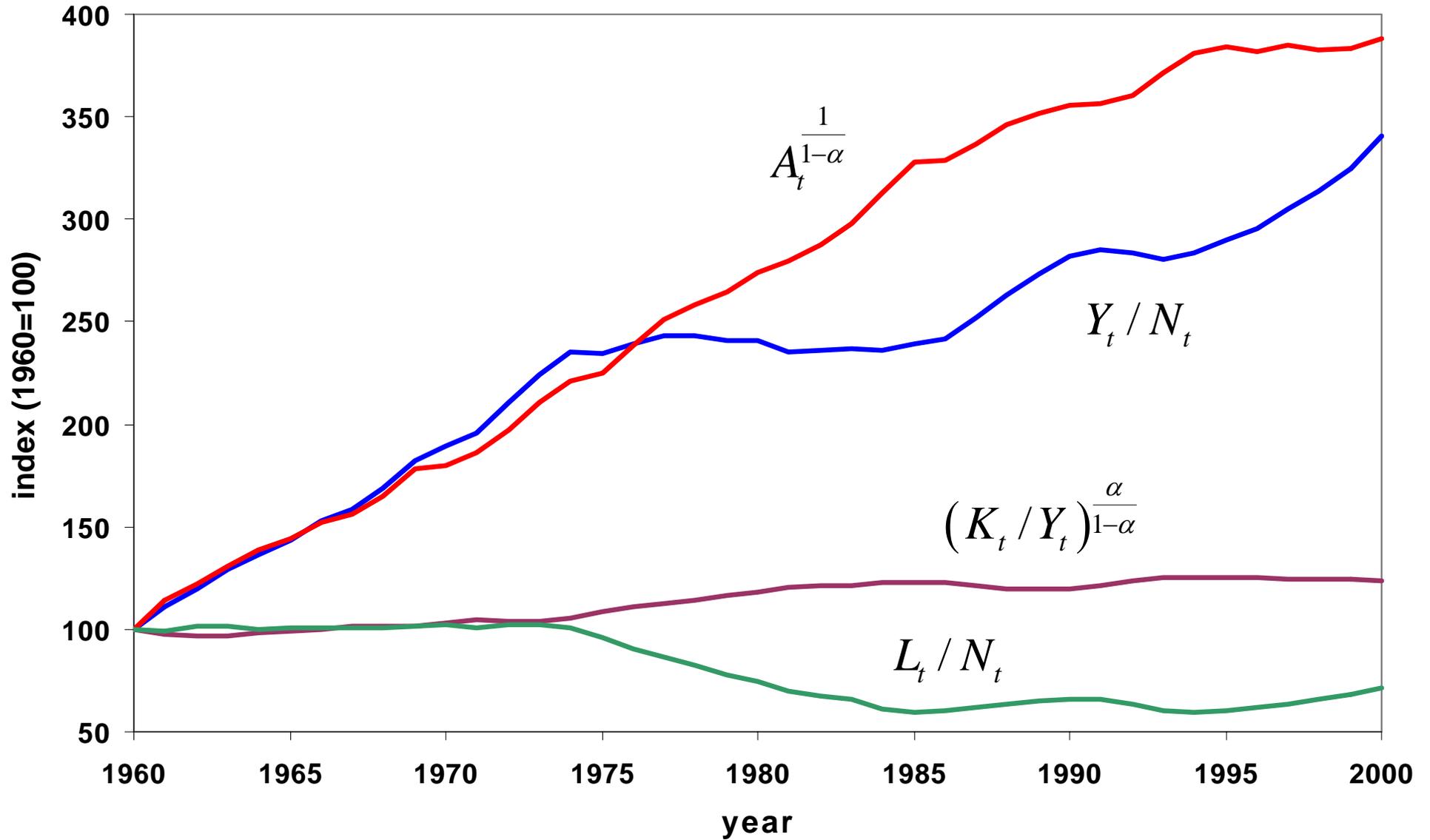
$$\log\left(\frac{Y_t}{N_t}\right) = \frac{1}{1-\alpha}\log(A_t) + \frac{\alpha}{1-\alpha}\log\left(\frac{K_t}{Y_t}\right) + \log\left(\frac{L_t}{N_t}\right)$$

Traditional theories of depressions stress declines in the capital stock or in hours worked as the most important factors in accounting for depressions.

Growth Accounting for the United States 1960-2000



Growth Accounting for Spain 1960-2000



Lessons from Great Depressions Project

- The main determinants of depressions are not drops in the inputs of capital and labor — stressed in traditional theories of depressions — but rather drops in the efficiency with which these inputs are used, measured as total factor productivity (TFP).
- Exogenous shocks like the deteriorations in the terms of trade and the increases in foreign interest rates that buffeted Chile and Mexico in the early 1980s can cause a decline in economic activity of the usual business cycle magnitude.
- Misguided government policy can turn such a decline into a severe and prolonged drop in economic activity below trend — a great depression.

**Decades Lost and Found:
Mexico and Chile Since 1980**

Raphael Bergoeing
Patrick J. Kehoe
Timothy J. Kehoe
Raimundo Soto

Mexico and Chile in the 1980s

Similar crises in 1981-1983

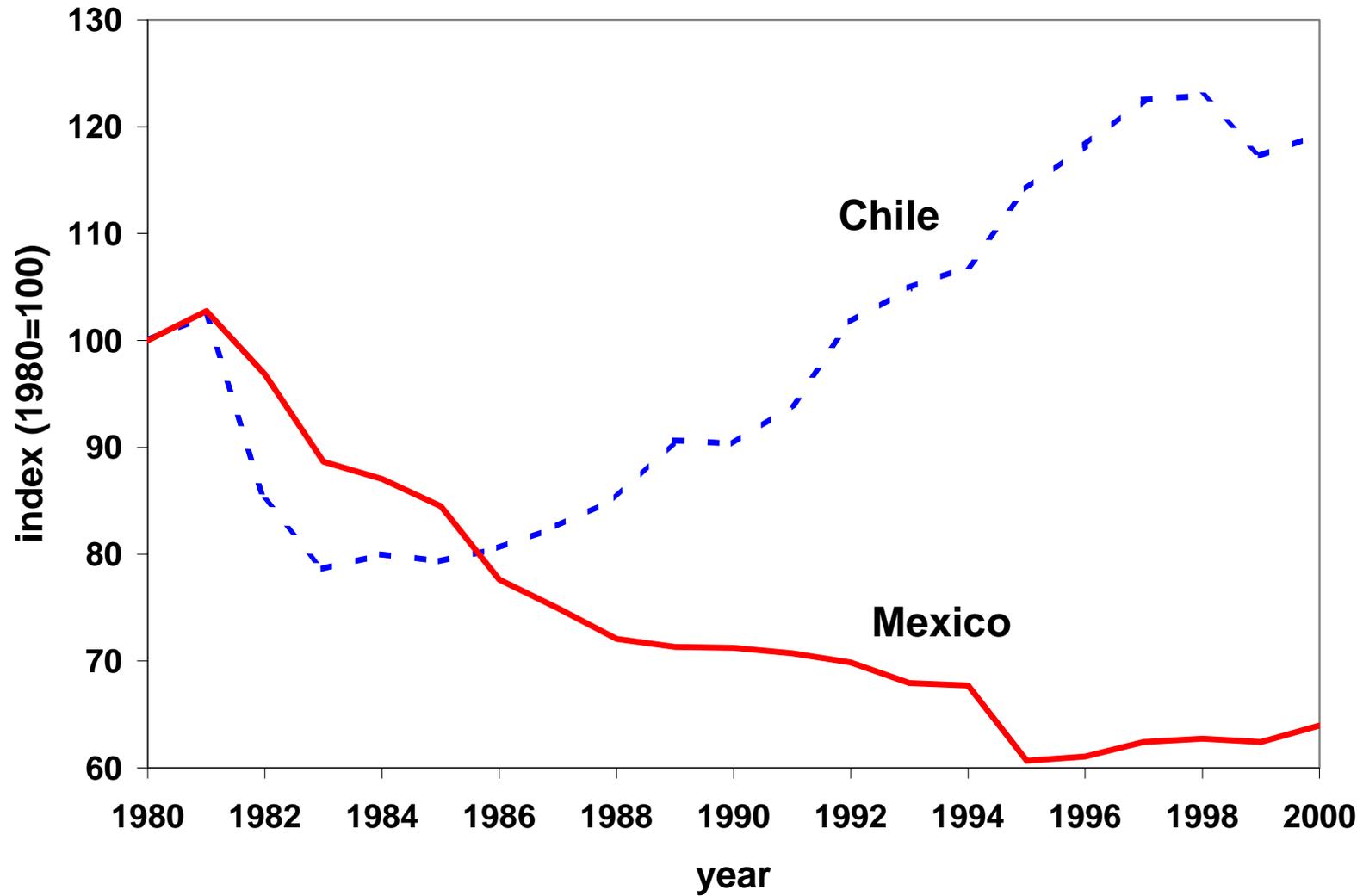
- more severe in Chile than in Mexico

Different recoveries

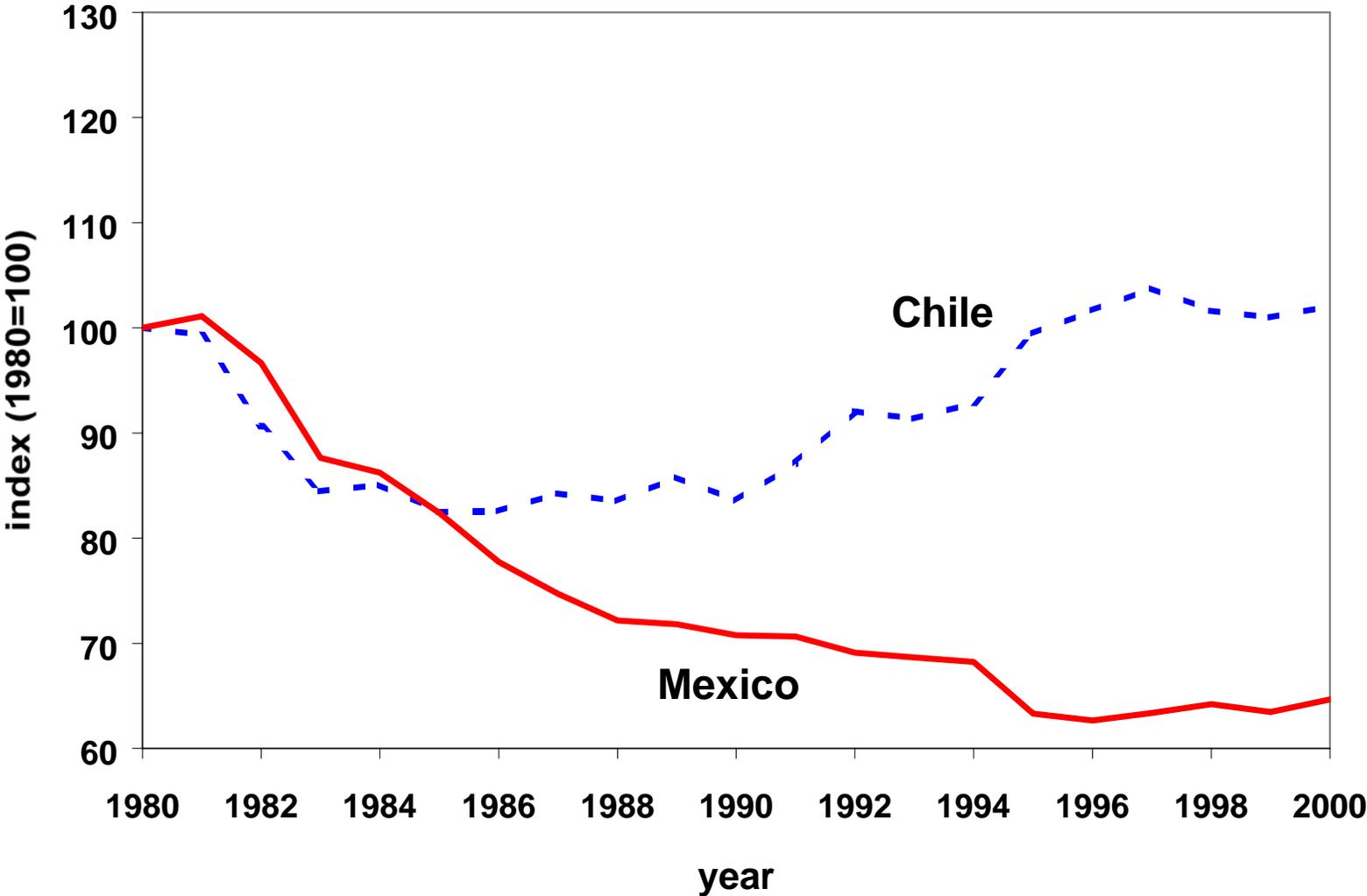
- much faster in Chile than in Mexico

Why different pattern?

Real GDP per working-age (15-64) person detrended by 2 percent per year



Total factor productivity detrended by 1.4 percent per year



Similar crises

Initial conditions:

- large foreign debt
- appreciating real exchange rate
- large trade deficit
- banking problems.

Shocks:

- jump in world interest rate
- plummet in copper and oil prices
- cutoff in foreign lending.

Stories for different recoveries

Standard monetarist story

- Different money growth rates induced different real responses.

Corbo-Fischer's story for Chile's fast recovery

- Sharp depreciation of real exchange rate and decline in real wages generated export-led growth.

Sachs's story for Mexico's slow recovery

- Debt overhang deterred investment.

Structural reforms story

- Structural reforms that took place in Chile in the 1970s took place in Mexico in the 1980s or 1990s.

Monetarist story

expansionary monetary policy

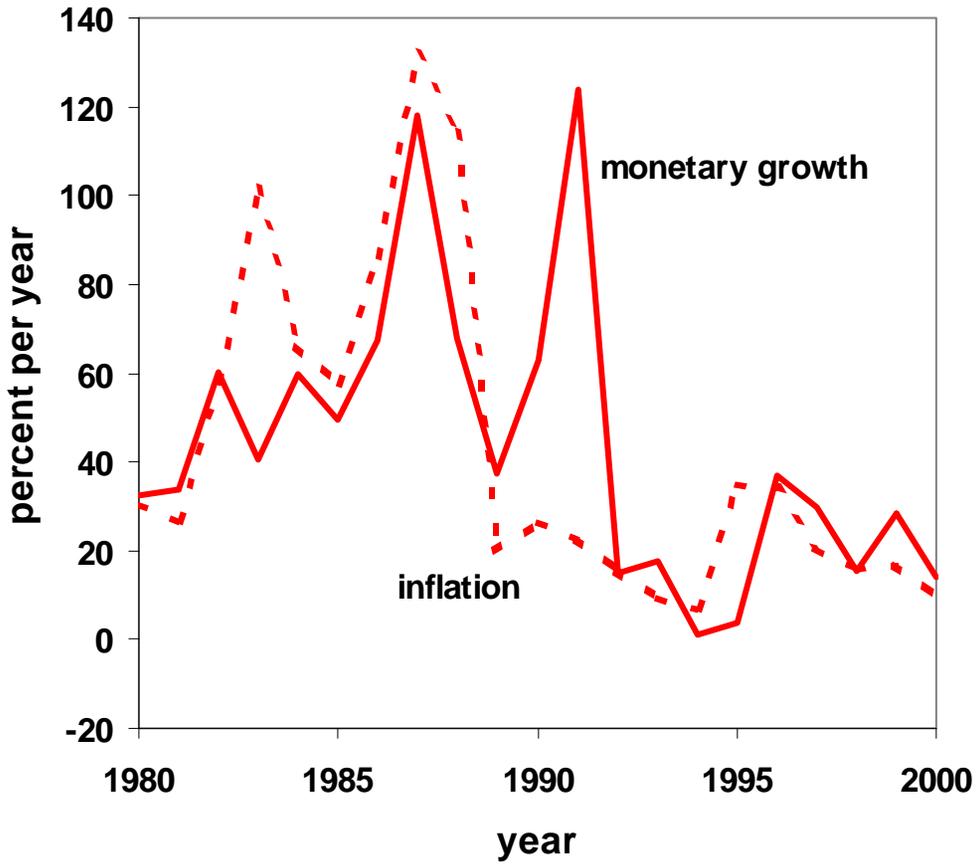
⇒ rapid growth

Short of inducing hyperinflation, the more rapidly a country in a depression reflate, the better.

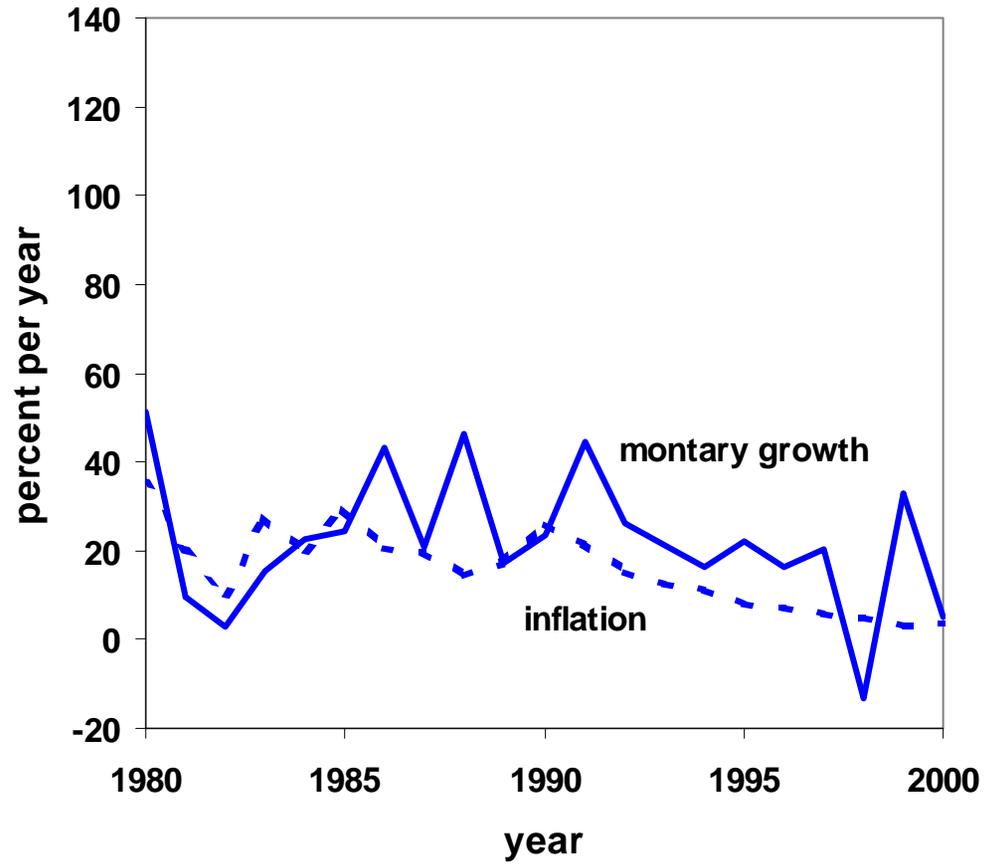
What happened in Mexico and Chile?

Inflation and Monetary Growth

Mexico



Chile

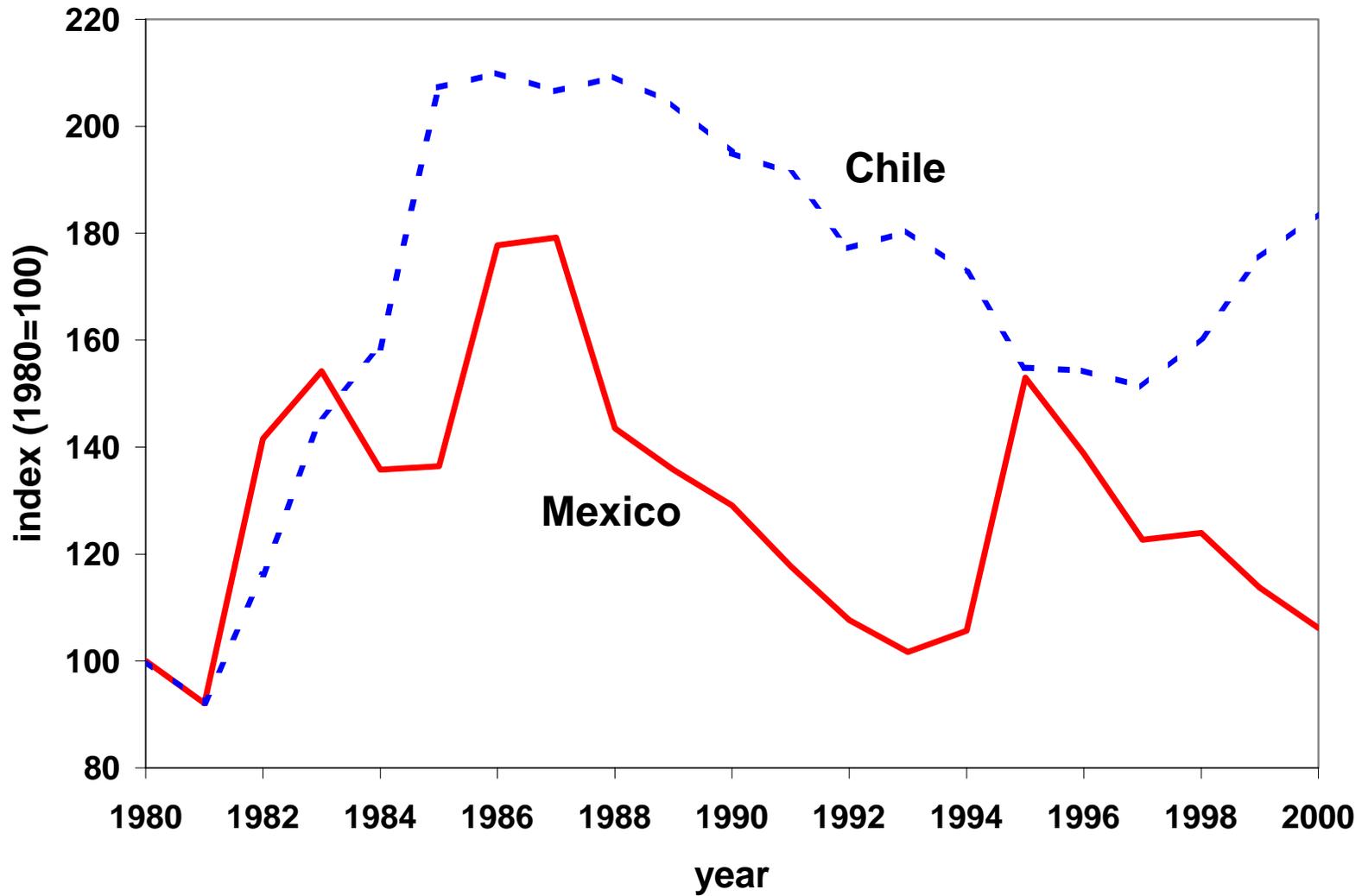


Corbo-Fischer's story for Chile

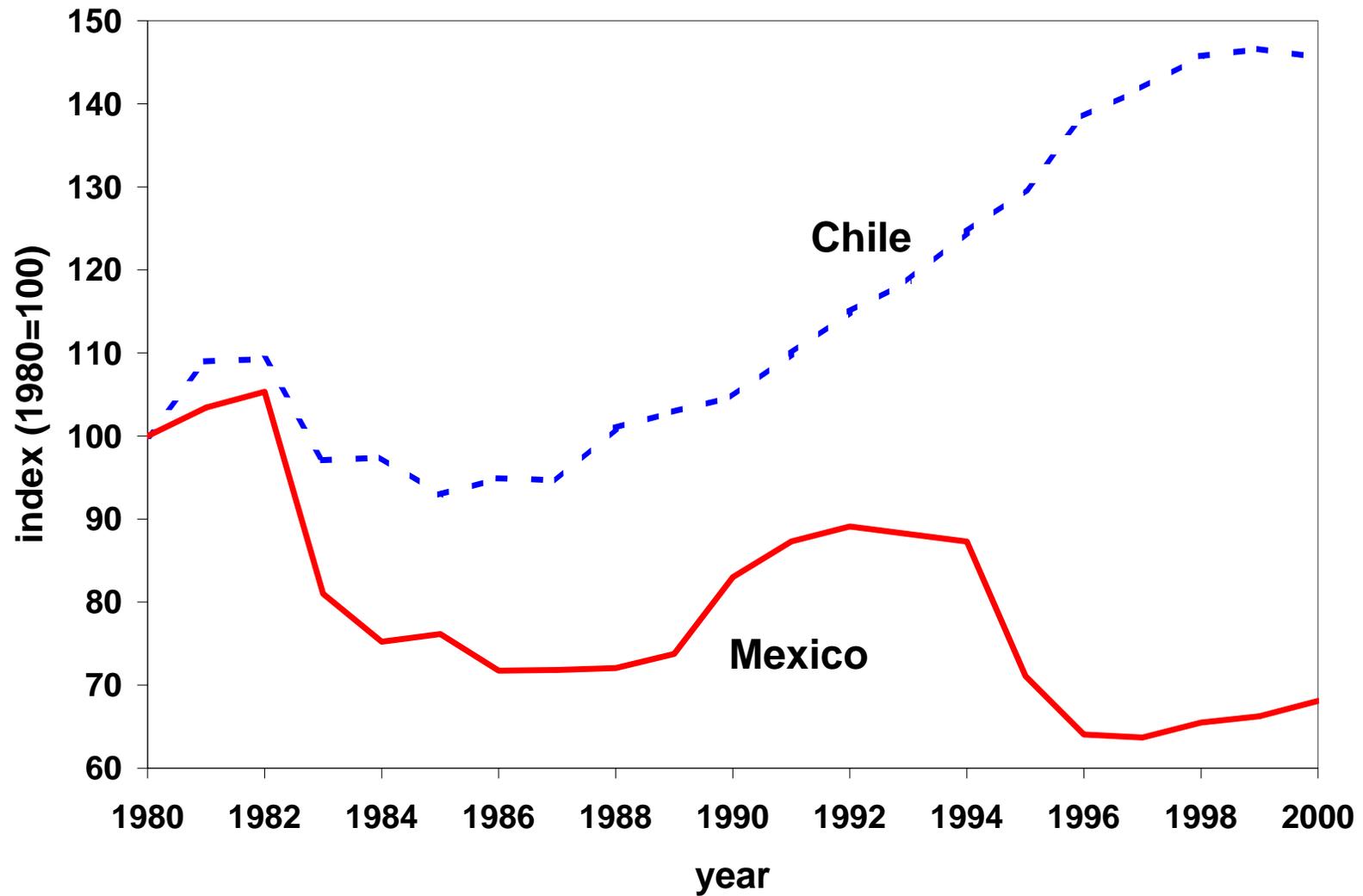
Sustained real depreciation of the real exchange rate and decline in real wages generated export-led growth in Chile.

What about Mexico?

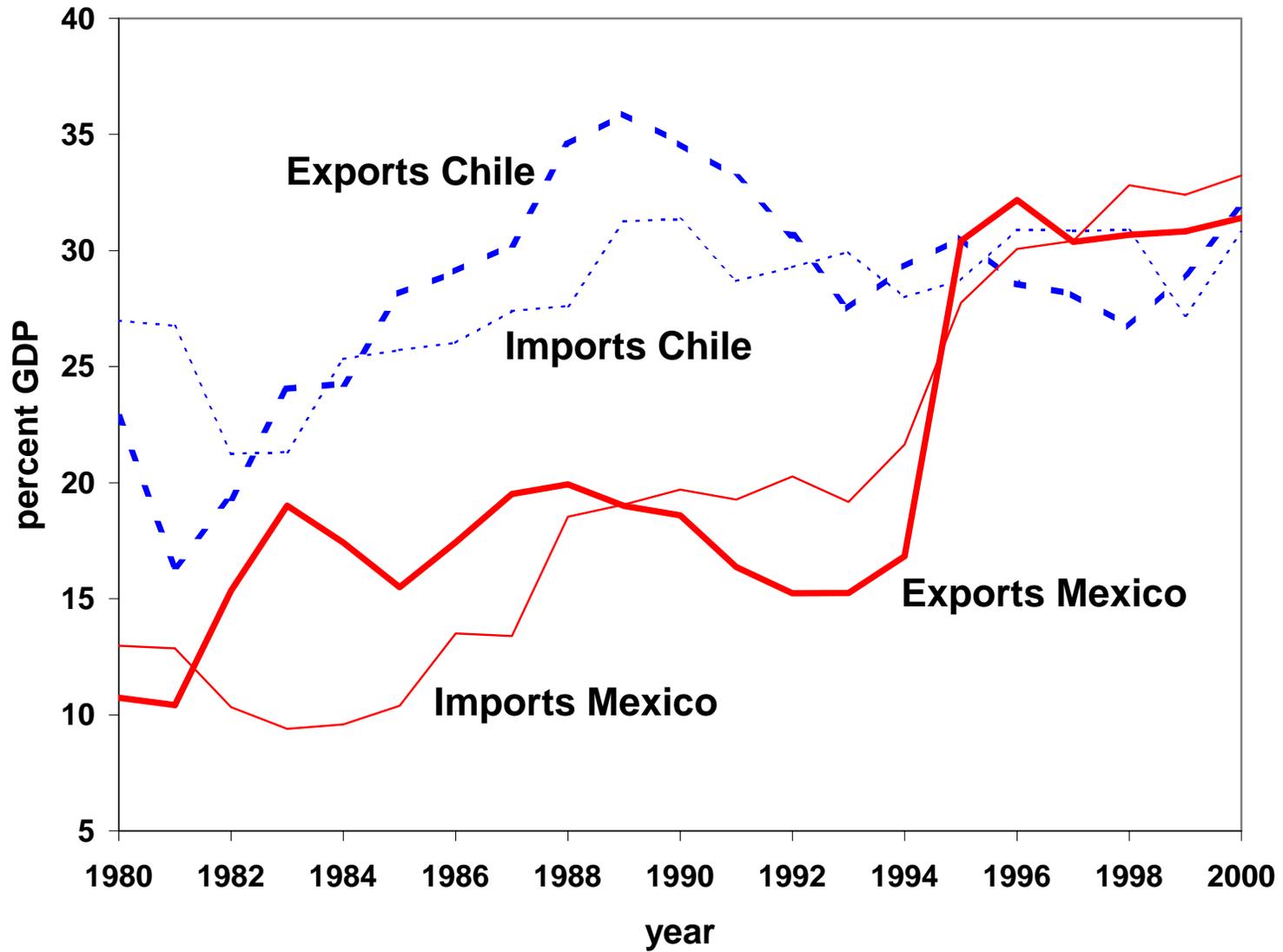
Real exchange rate against U.S. dollar



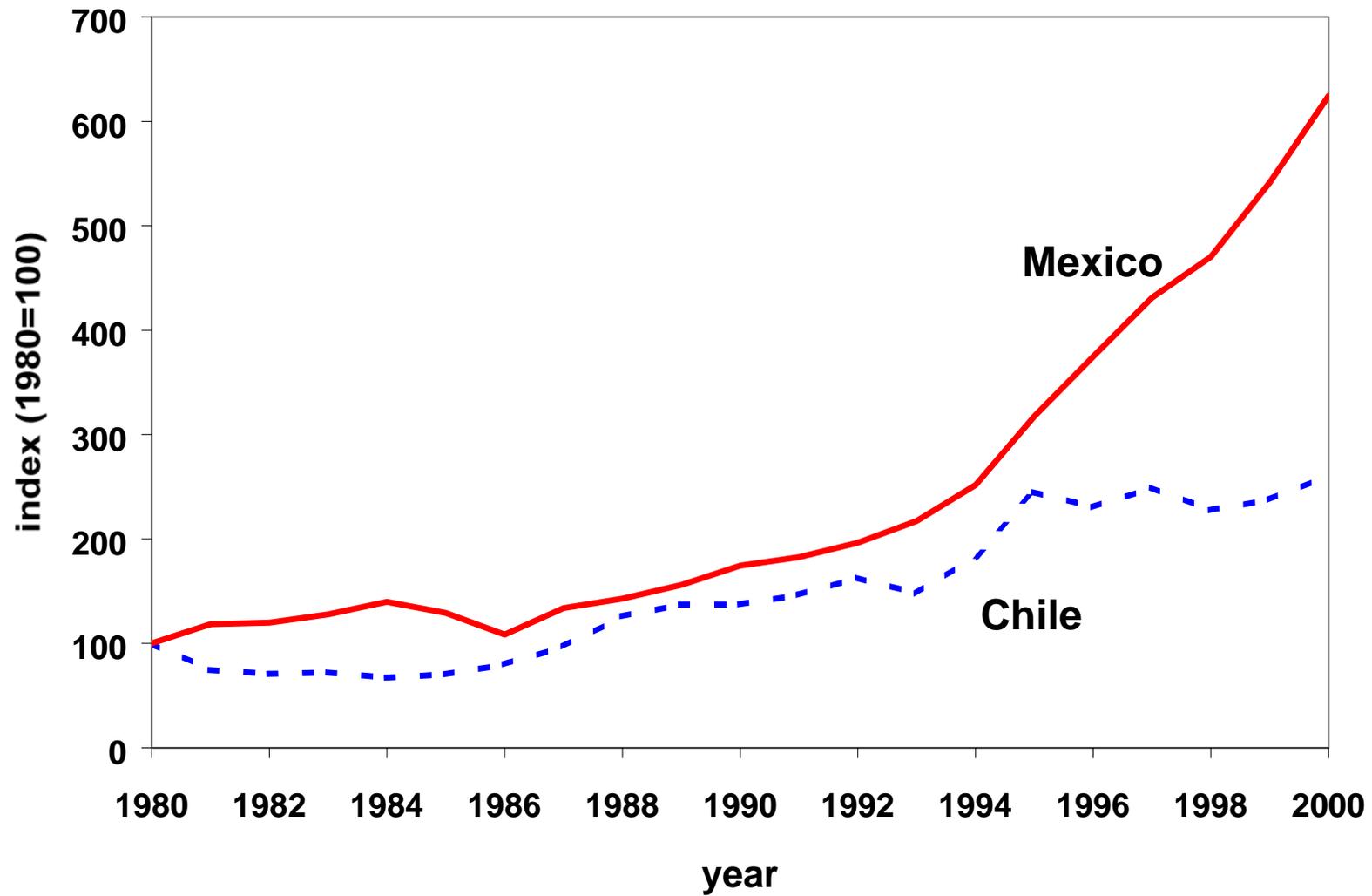
Index of real wages in manufacturing



International trade as a percent of GDP



Export value in U.S. dollars deflated by U.S. PPI



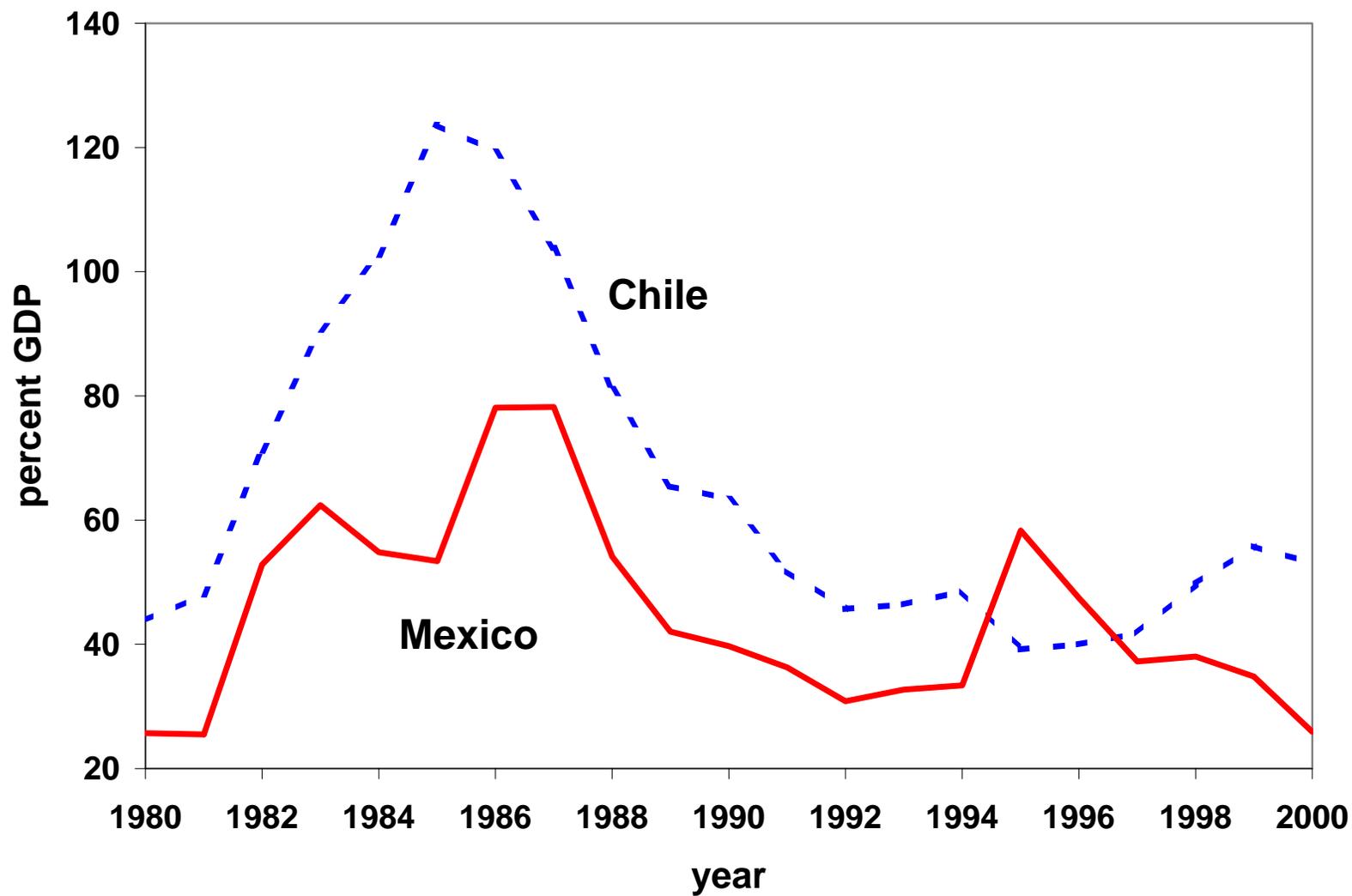
Sachs's story for Mexico

Large debt overhang in Mexico:

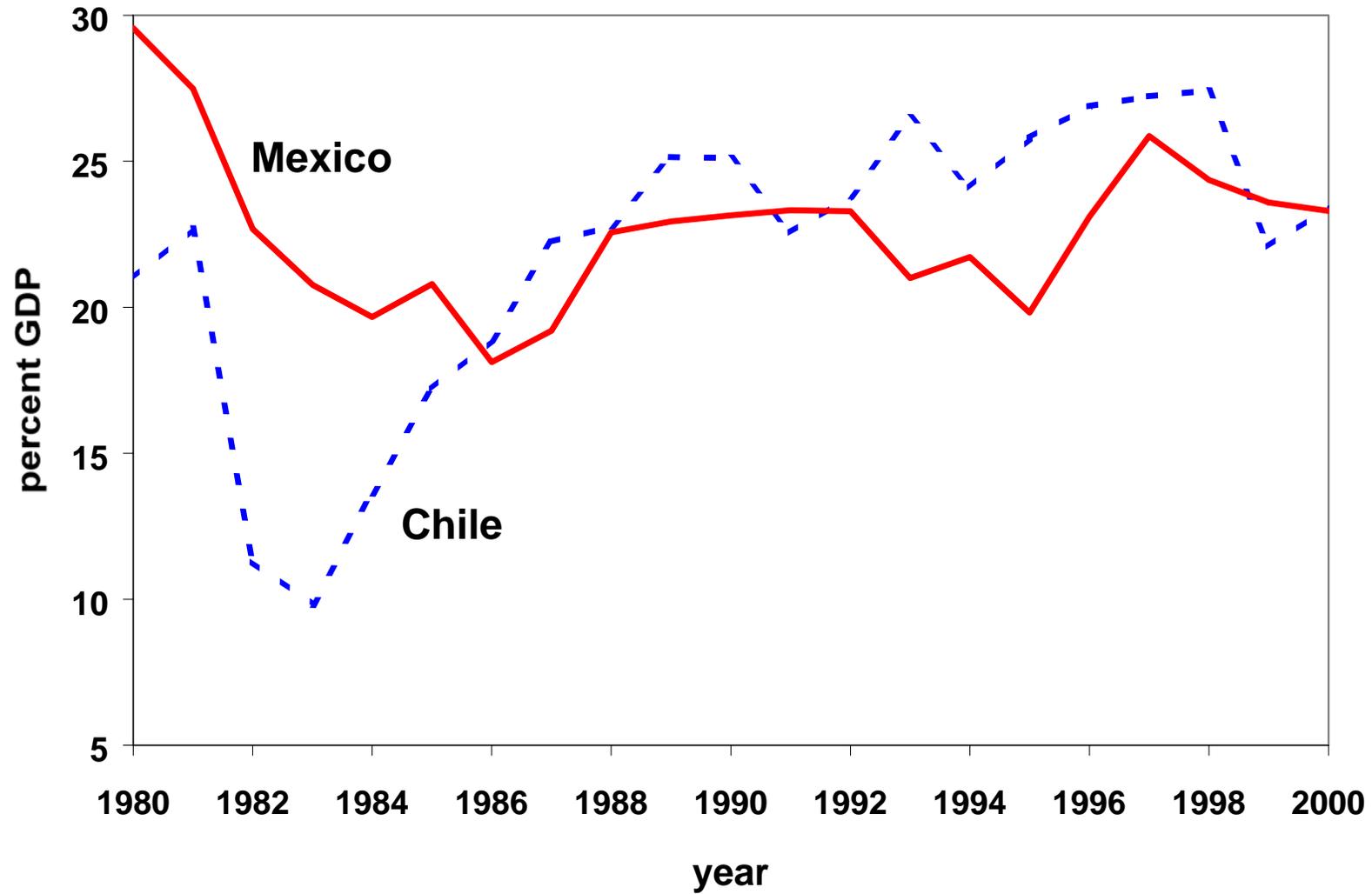
- Most of new loans needed to repay old loans.
- Socially profitable investments not undertaken.

What about Chile?

Total external debt as a percent of GDP



Investment as a percent of GDP



Structural reforms story

By 1979 Chile had privatized and reformed its tax system, its banking system, its bankruptcy laws, and its trade policies.

Mexico waited until later.

Different recoveries:

- Chile reaping benefits of reforms.
- Mexico paying costs for distortions.

How can we determine which reforms were crucial?

- Did reforms affect factor inputs or productivity?
- What was timing of reforms?

Applied dynamic general equilibrium model

The representative consumer maximizes

$$\sum_{t=1980}^{\infty} \beta^t \left[\gamma \log C_t + (1-\gamma) \log(\bar{h}N_t - L_t) \right]$$

subject to

$$C_t + K_{t+1} - K_t = w_t L_t + (1 - \tau_t)(r_t - \delta)K_t + T_t$$

where $T_t = \tau_t (r_t - \delta)K_t$ is a lump-sum transfer.

Feasibility:

$$C_t + K_{t+1} - (1 - \delta)K_t = A_t K_t^\alpha L_t^{1-\alpha}.$$

Calibration

First order conditions:

$$\frac{1}{C_{t-1}} = \frac{\beta}{C_t} \left[1 + (1 - \tau_t)(r_t - \delta) \right]$$

$$\frac{1 - \gamma}{\bar{h}N_t - L_t} = \frac{\gamma w_t}{C_t}.$$

Look at 1960-1980 data

$$\beta = 0.98, \quad \tau = 1 - \frac{C_t - \beta C_{t-1}}{(r_t - \delta)C_{t-1}} \Rightarrow \tau = 0.45 \text{ in Mexico, } \tau = 0.56 \text{ in Chile;}$$

$$\gamma = \frac{C_t}{C_t + w_t(\bar{h}N_t - L_t)} \Rightarrow \gamma = 0.30 \text{ in Mexico, } \gamma = 0.28 \text{ in Chile .}$$

Numerical experiments

Base case:

$\tau_t = 0.45$ in Mexico, $\tau_t = 0.56$ in Chile, 1980-2000.

Tax reform:

$\tau_t = 0.45$ in Mexico, $\tau_t = 0.56$ in Chile, 1980-1988;

$\tau_t = 0.12$ in Mexico, $\tau_t = 0.12$ in Chile, 1988-2000.

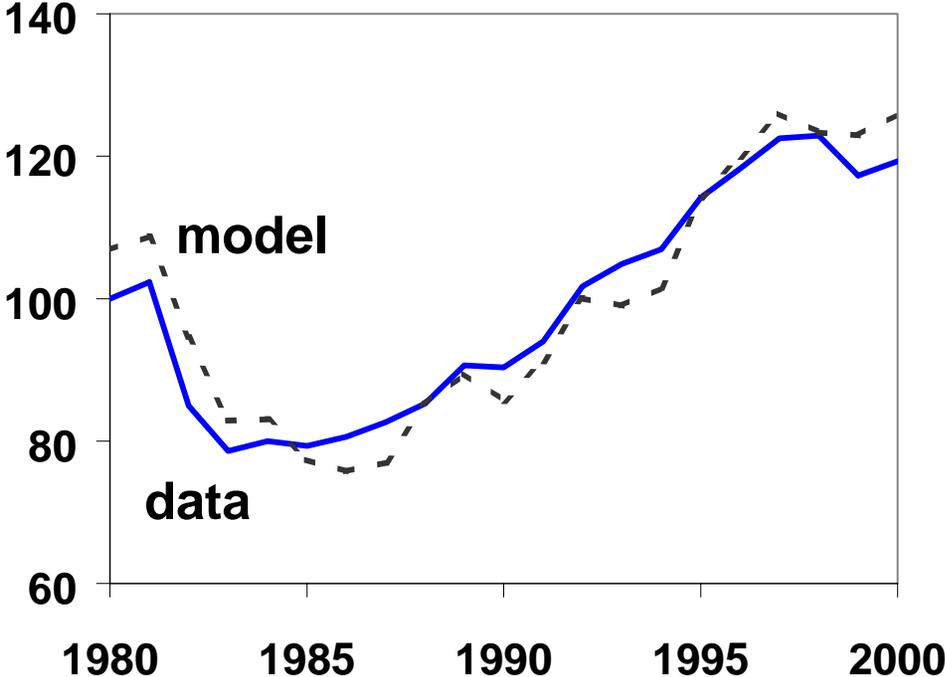
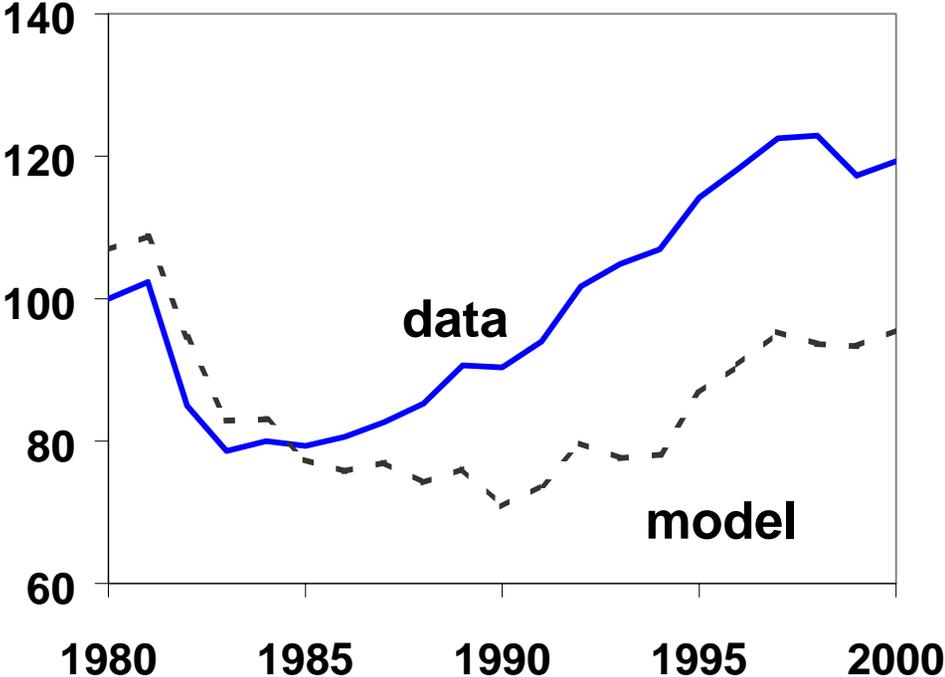
Numerical experiments for Chile: GDP per working-age person

Base Case

Tax Reform

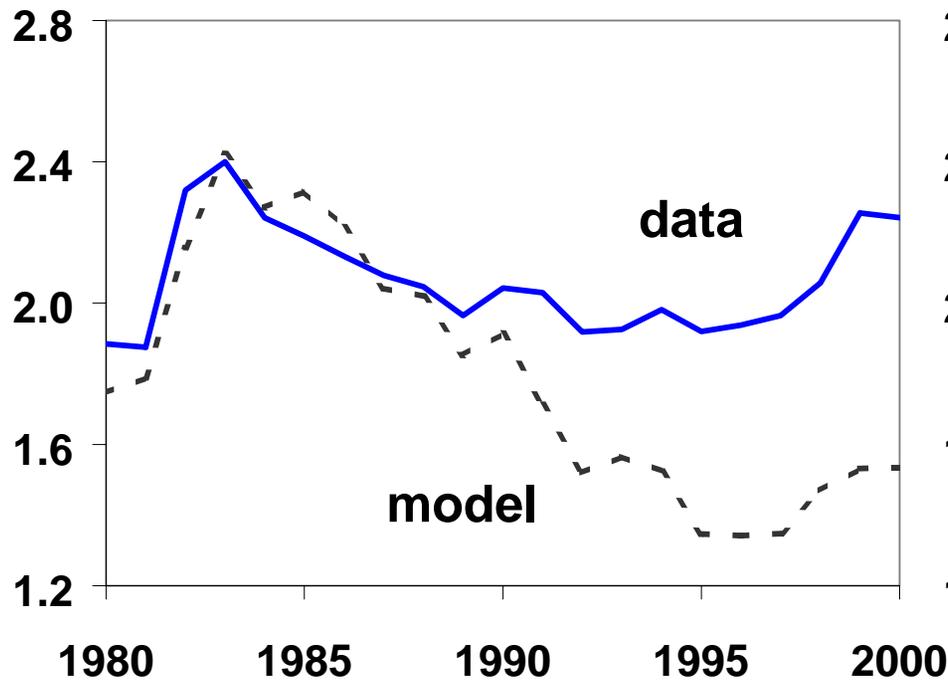
Y/N (detrended)

Y/N (detrended)



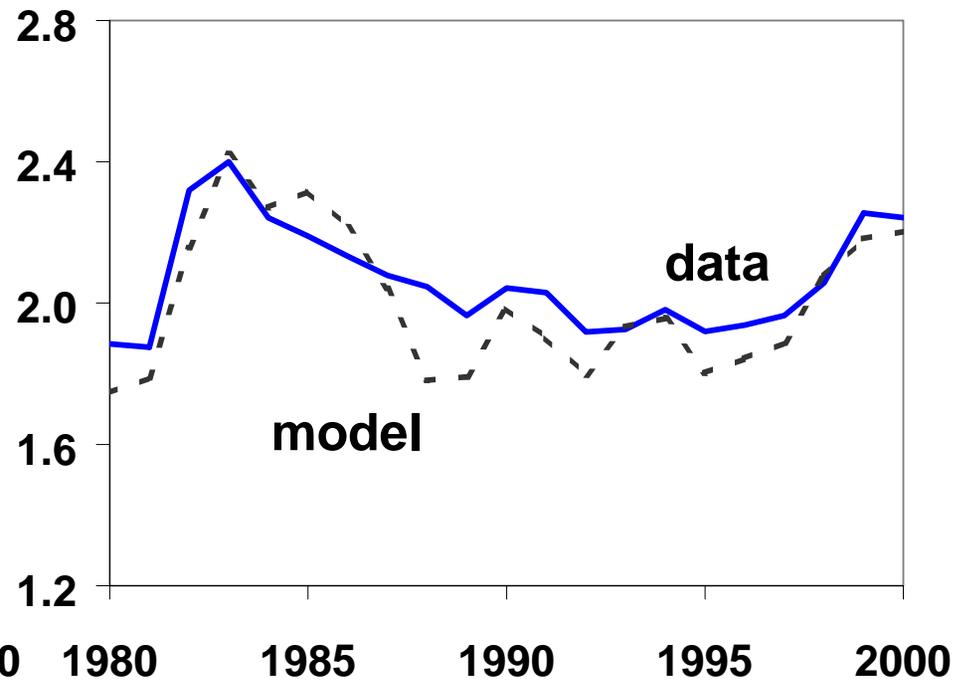
Base Case

K/Y



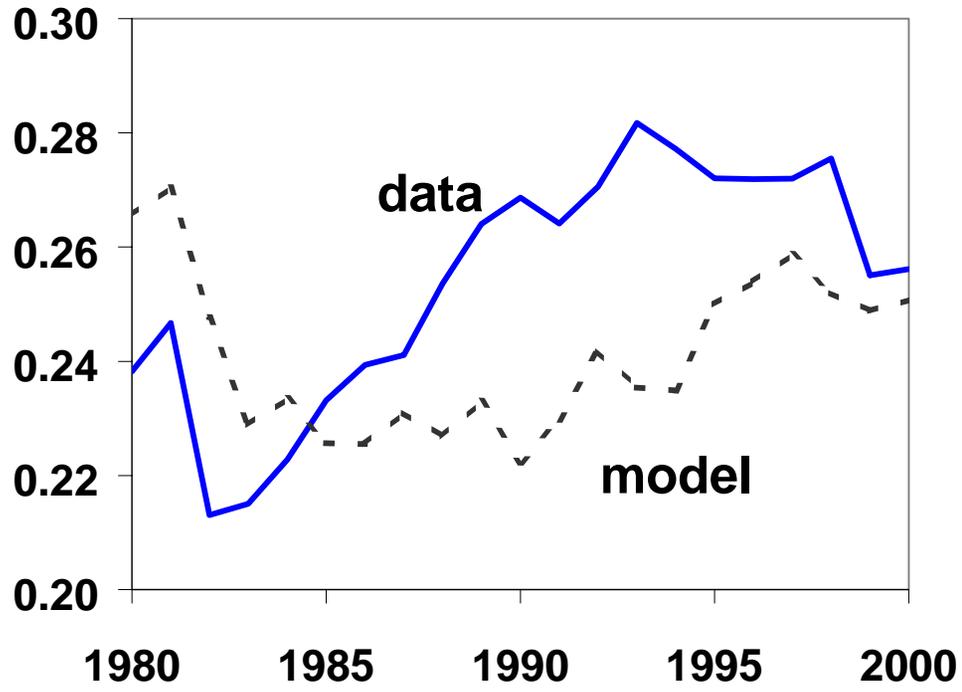
Tax Reform

K/Y



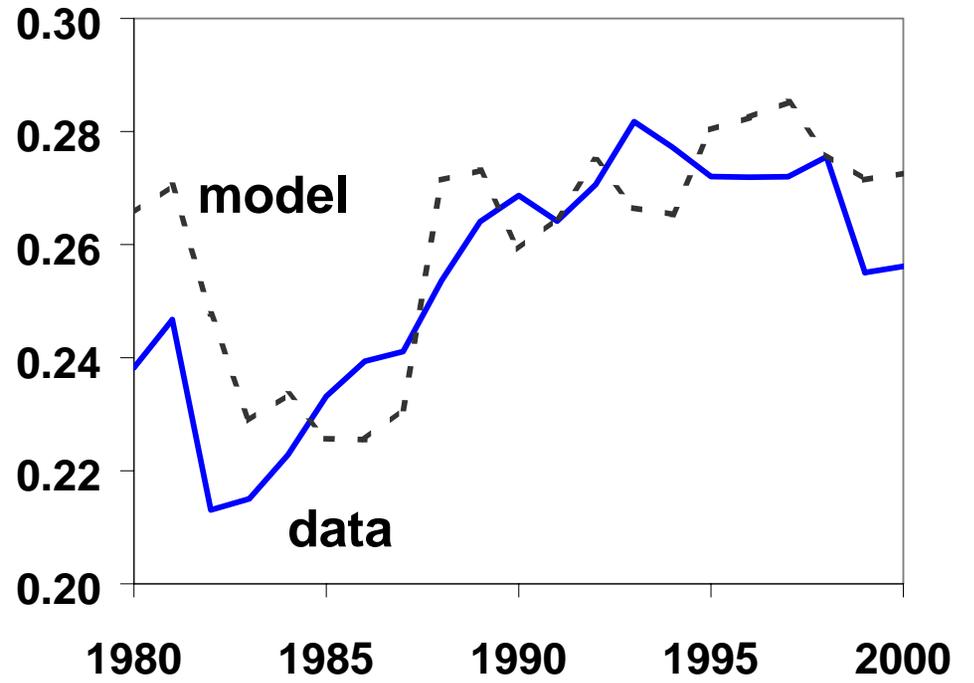
Base Case

L/N



Tax Reform

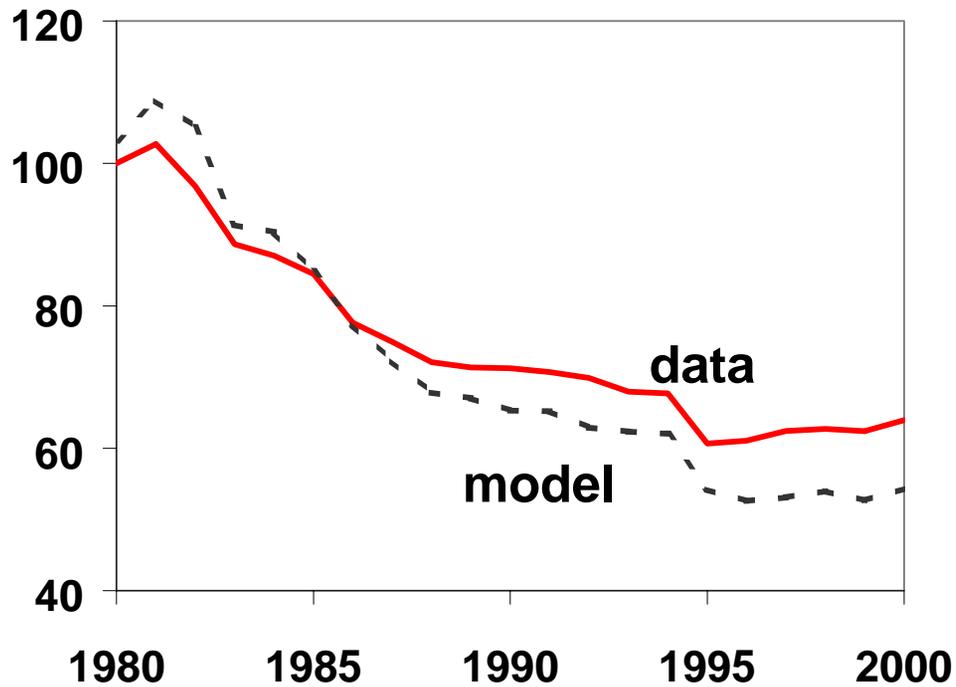
L/N



Numerical experiments for Mexico: GDP per working-age person

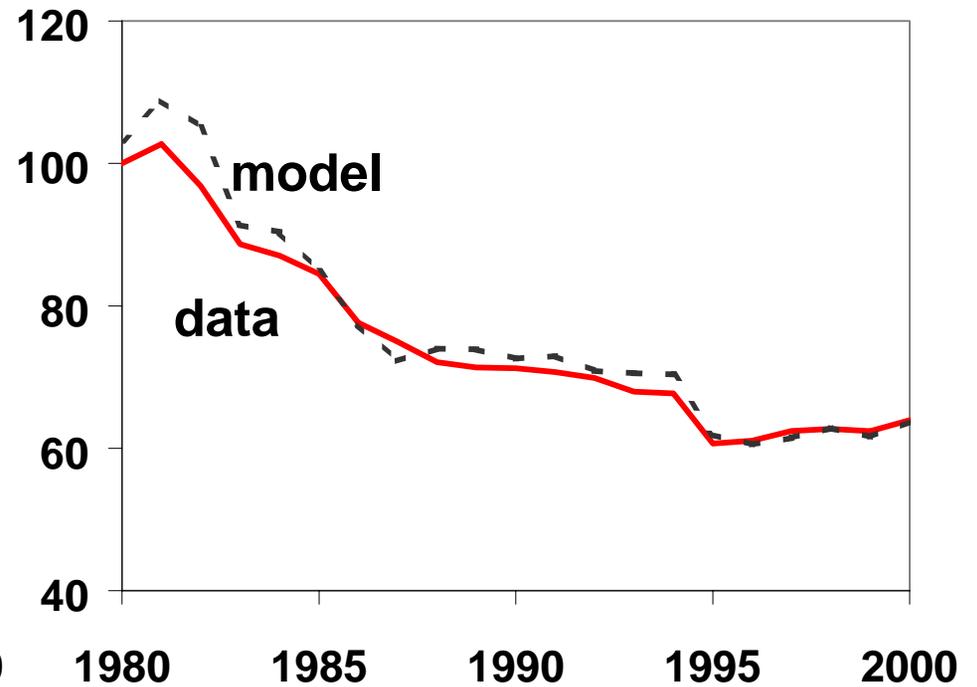
Base Case

Y/N (detrended)



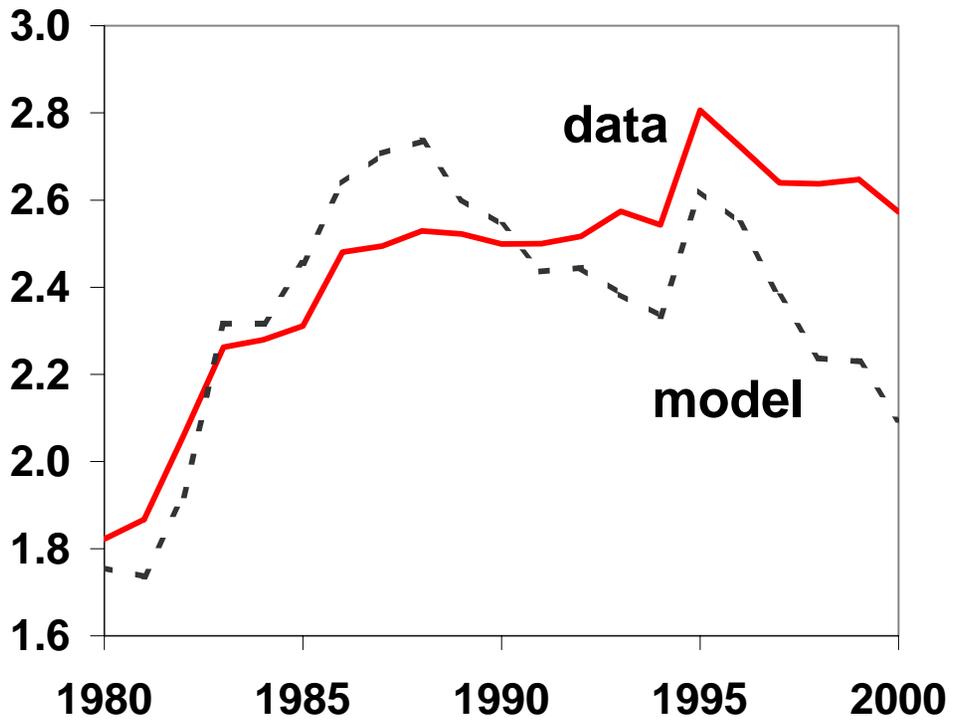
Tax Reform

Y/N (detrended)



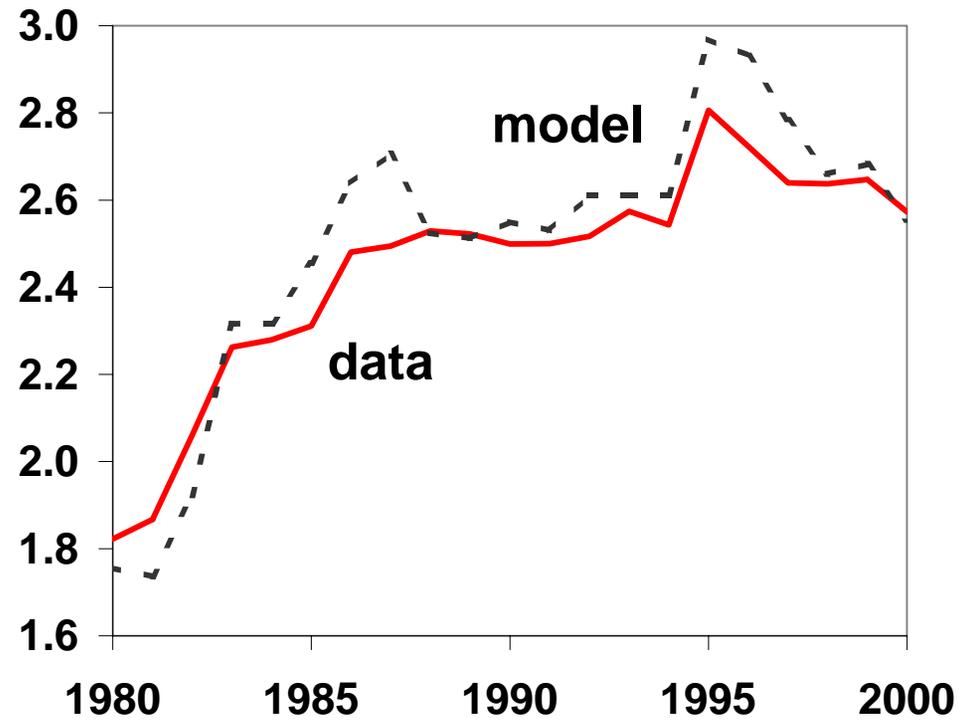
Base Case

K/Y



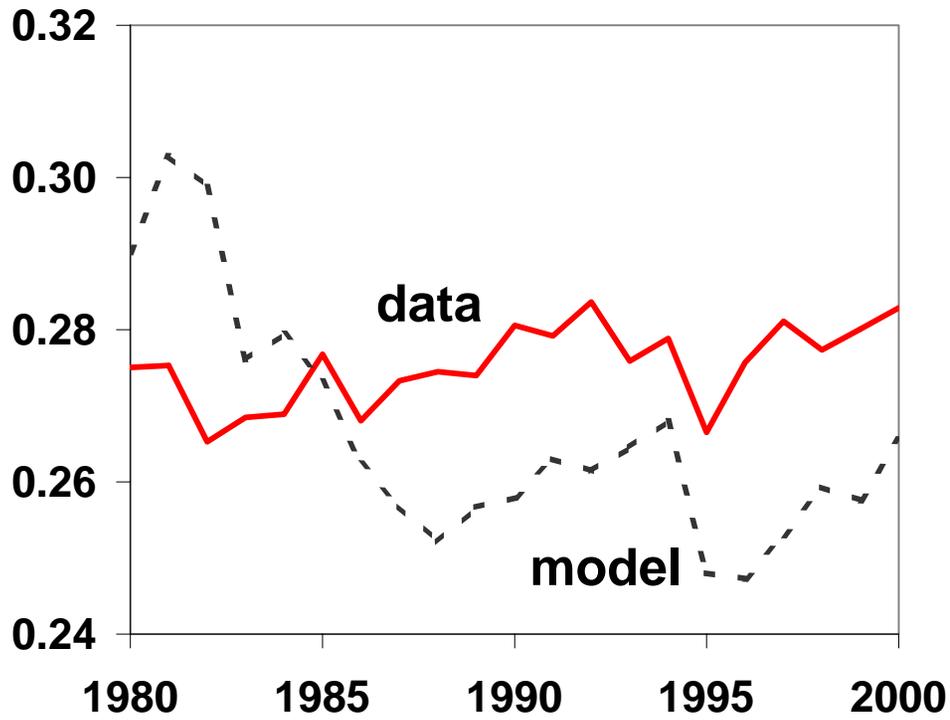
Tax Reform

K/Y



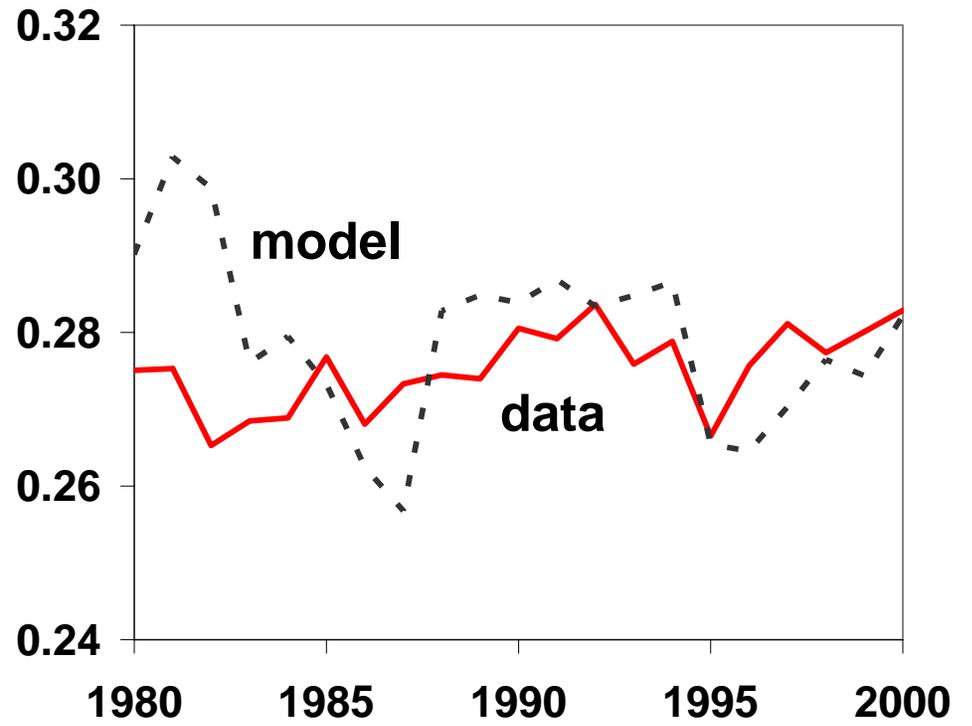
Base Case

L/N



Tax Reform

L/N



What do we learn from growth accounting and numerical experiments?

Nearly all of the differences in the recoveries in Mexico and Chile result from different paths of productivity.

Tax reforms are important in explaining some features of the recoveries, just not the differences.

Implications for studying structural reforms story:

- Only reforms that are promising as explanations are those that show up primarily as differences in productivity, not those that show up as differences in factor inputs.
- Timing of reforms is crucial if they are to drive the differences in economic performance.

Fiscal reforms

Chile:

- tax reforms 1975, 1984
- social security reform 1980
- fiscal surpluses

Mexico:

- tax reforms 1980, 1985, 1987, 1989
- fiscal deficits

Important, but not for explaining the differences!

Trade reforms

Chile: by 1979

- all quantitative restrictions eliminated
- uniform tariff of 10 percent
- tariff hikes during crisis — tariff back below 10 percent in 1991

Mexico: in 1985

- 100 percent of domestic production protected by import licenses
- nontariff barriers and dual exchange rates

Massive trade reforms in Mexico 1987-1994, culminating in NAFTA

Timing seems wrong!

Privatization

Chile

- major privatizations 1974-1979

Mexico

- major nationalization 1982
 - expropriated banks' holdings of private companies
 - government controlled 60-80 percent of GDP
- major privatizations after 1989

Timing seems wrong?

Banking

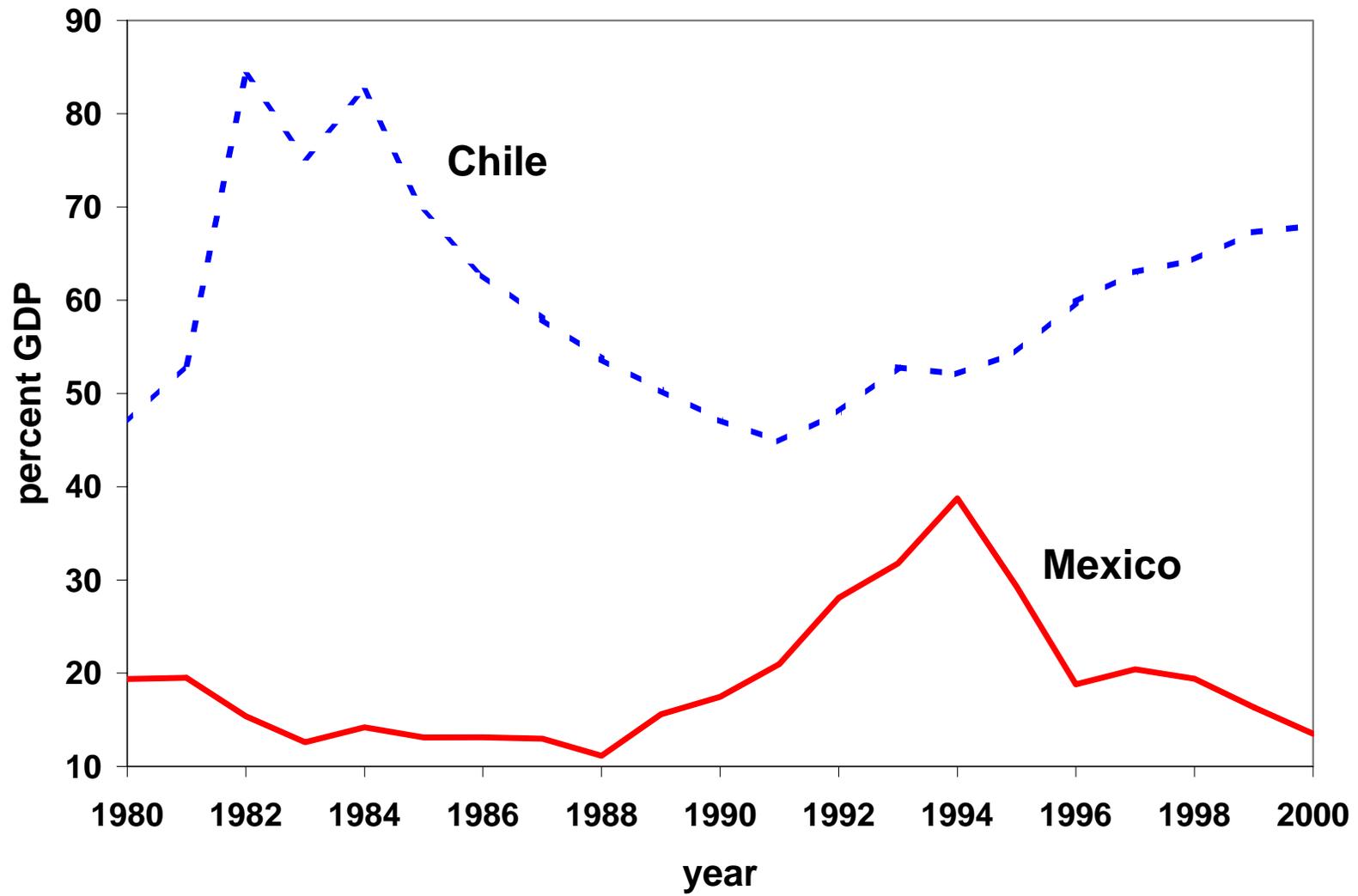
Chile: 1982 and after

- took over failed banks
- market-determined interest rates
- lowered reserve requirements.

Mexico: 1982 and after

- nationalized all banks
- government set low deposit rates
- 75 percent of loans either to government or directed by government.

Private credit as a percent of GDP



Banking in Chile

- hasty liberalization in 1975
 - poorly supervised *financieras*
 - explosion of *grupos*
 - bailouts – Banco Osorno in 1975 and CRAV grupo in 1978.
- better after crisis
 - takeover of distressed banks
 - debt restructuring
 - preferential exchange rate to repay dollar loans
 - recapitalization of banks
 - reprivatization of banks by 1985
 - tighter regulation and supervision.

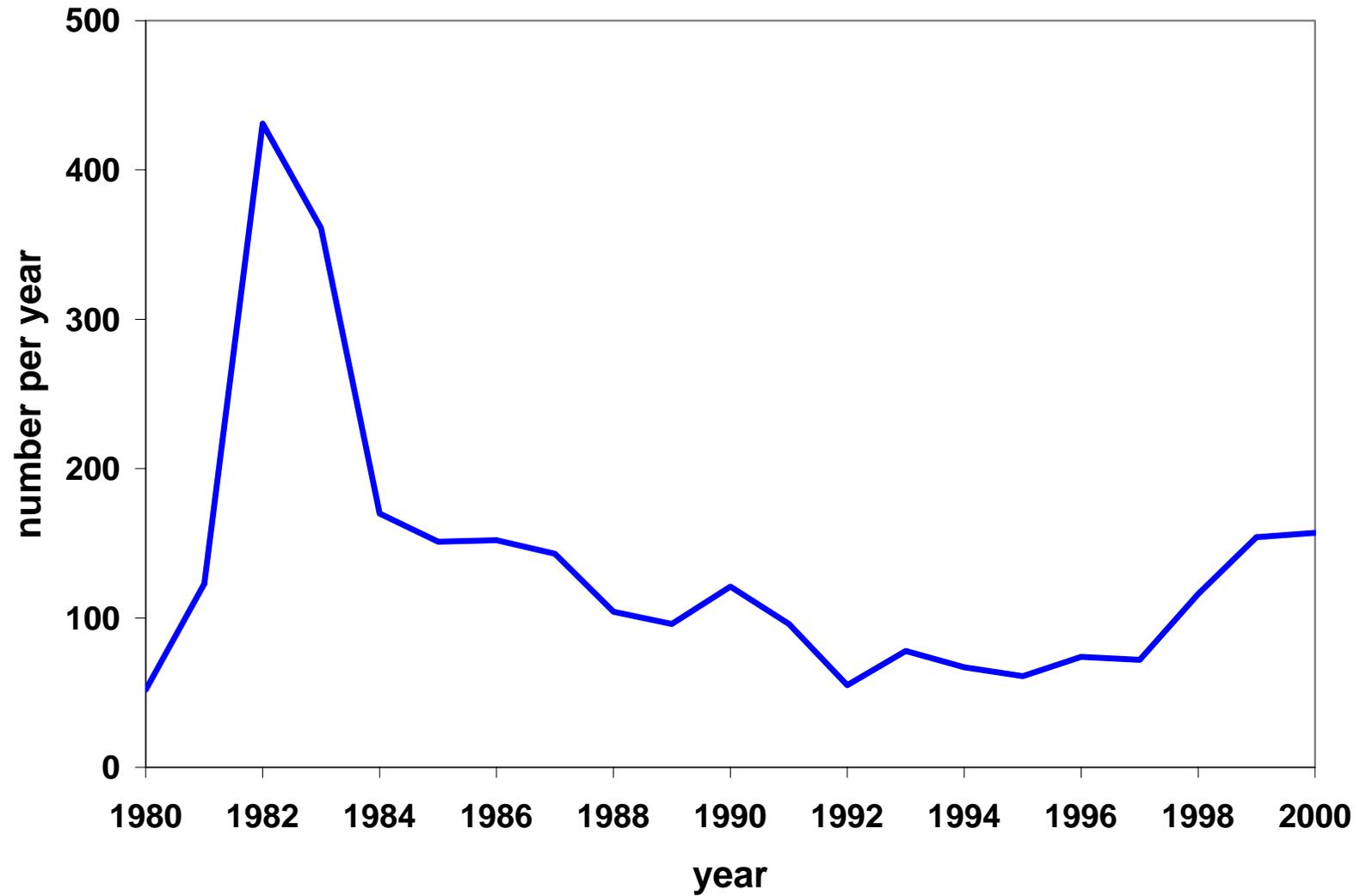
(These reforms were costly ~ 35 percent of one year's GDP.)

Bankruptcy laws

Chile had reformed the administration of its bankruptcy procedures in 1978. In 1982 it reformed its bankruptcy laws to look much like those in the United States.

Mexico reformed its bankruptcy procedures in a similar way only in 2000.

Business bankruptcies in Chile



How reforms can increase productivity

Suppose that $Y_i = A_i K_i^\alpha$, $i = 1, 2$. Sector 1 receives a subsidy of τ_1 on the interest rate that it pays on loans, and sector 2 pays a tax τ_2 :

$$\frac{\alpha A_1 K_1^{\alpha-1}}{(1 - \tau_1)} = \frac{\alpha A_2 K_2^{\alpha-1}}{(1 + \tau_2)} = r.$$

This leads to a misallocation of capital:

$$\frac{K_1}{K_2} = \left(\frac{A_1}{A_2} \right)^{\frac{1}{1-\alpha}} \left(\frac{1 + \tau_2}{1 - \tau_1} \right)^{\frac{1}{1-\alpha}}.$$

If these distortions decrease the incentives to make loans, then they can also lead to a lower level of overall capital and have an additional negative effect on output.

Models with dynamic inefficiencies

Atkeson and Kehoe (1995) and Chu (2001) — models with entry and exit of firms.

Each firm (plant) has its own level of productivity A and is operated by a manager.

$$y = A^{1-\nu} (k^\alpha l^{1-\alpha})^\nu.$$

A manager who decides to operate a plant chooses capital k and labor l to maximize static returns

$$d_t(A) = \max_{k,l} A^{1-\nu} (k^\alpha l^{1-\alpha})^\nu - r_t k - w_t l - w_t^m.$$

Let the solutions be $k_t(A)$ and $l_t(A)$.

For a given distribution $\lambda_t(A)$ of productivities across plants, aggregate output is $Y_t = \bar{A}_t^{1-\nu} K_t^\alpha L_t^{1-\alpha}$ where

$$\bar{A}_t = \int_A A \lambda_t(dA), \quad K_t = \int_A k_t(A) \lambda_t(dA), \quad L_t = \int_A l_t(A) \lambda_t(dA)$$

Over time, the productivity of each plant evolves stochastically:
 $A' = A\varepsilon$ where ε is drawn from $\pi(\varepsilon)$.

Decision for the manager of whether or not to operate a plant is dynamic and is described by the Bellman equation

$$V_t(A) = \max[0, V_t^o(A)] \quad \text{where} \quad V_t^o(A) = d_t(A) + \frac{1}{1+R_t} \int_{\varepsilon} V_{t+1}(A\varepsilon) \pi(d\varepsilon).$$

The outcome of all the managerial decisions to operate or not is a new distribution $\lambda_{t+1}(A)$ over productivities in period $t + 1$.

Imagine that banking system provides subsidized loans to some firms and not to others and that bankruptcy procedures make it difficult for firms to exit and/or subsidize inefficient firms.

How would the removal of distortions in the banking system and bankruptcy procedures affect the path of productivity over time?

Some effects would be immediate. Upon removal, some previously favored firms that would have continued will fail, and some unfavored firms that would have failed will continue.

The more subtle, and potentially more important, effects take more time to show up in aggregates. The removal of distortions would encourage new firms to enter. Such new firms would have the newest technologies, but would build up their organization-specific productivity only slowly over time. (Generalization of model with age-specific $\pi(\varepsilon)$.)

Bottom line

Different recoveries due to

- Chile reaping benefits of reforms
- Mexico paying costs for distortions

Not due to

- money
- real exchange rates
- debt overhang

Reforms in banking and bankruptcy procedures more important than those in fiscal policy, in trade policy, and (probably) in privatization for explaining different recoveries.