Quantitative Aggregate Theory

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Prize Lecture

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Quantitative Aggregate Theory

- Model economies inhabited by people
- The quest for a framework for policy evaluation
- Lucas (1980), but easier said than done

- The computational experiment

  Definition

  Answer quantitative questions

  Evaluate government policy

- Models inhabited by millions of people

  Characterized by preferences over
  goods and leisure into the indefinite future

  Budget constraints

  Model economies are explicit about
  people's dynamic decision problems

- Models contain thousands of businesses

  Aggregate production function

  Technology for converting inputs of capital and labor into output of goods

  Technological change

- Calibration

  Model is a measuring device – needs to be calibrated

  Part of making the quantitative answer reliable

- A computational experiment yields:

  Time series of the aggregate decisions of the model economy's people

  Usually evaluated statistically…

  …and compared with analogous statistics from data for the nation(s) under study

- Walk through a simple model

  Contains household and business sectors

  No government or foreign sector

Stand-in household problem:

$$Max \quad E \sum_{t=0}^{\infty} \beta^{t} \frac{(C_t^{\alpha} L_t^{1-\alpha})^{1-\sigma} - 1}{1-\sigma}$$

subject to:

$$C_t + I_t = z_t K_t^{\theta} N_t^{1-\theta} = r_t K_t + w_t N_t$$

$$L_t + N_t = 1$$

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

$$Z_{t+1} = \rho Z_t + \varepsilon_t$$

ε's ~ Normal Probability Distribution

- Early research question:

  If technology shocks were the only source of impulse, what portion of business-cycle fluctuations would still remain?

- Does being different matter?

  It depends.

  For many business-cycle questions:
  NO

YES
in cases such as economic impact on savings and interest rates of:

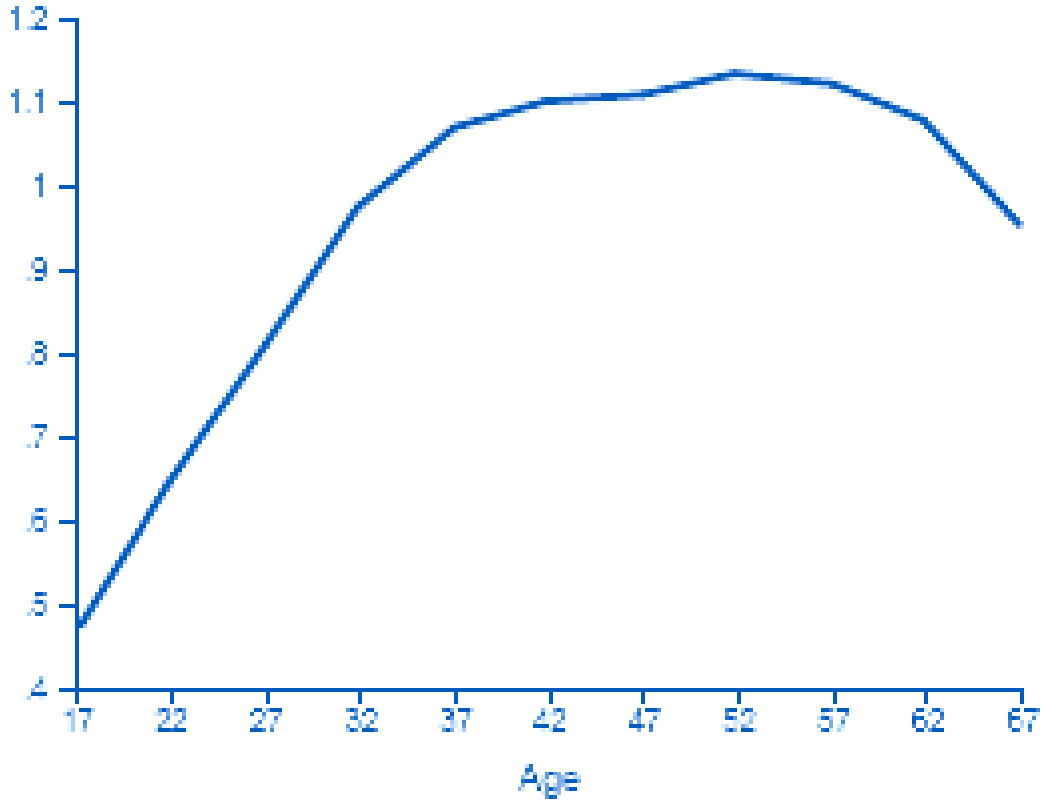
(i) Immigration

(ii) Social security reform

(iii) Baby boomers' retirement

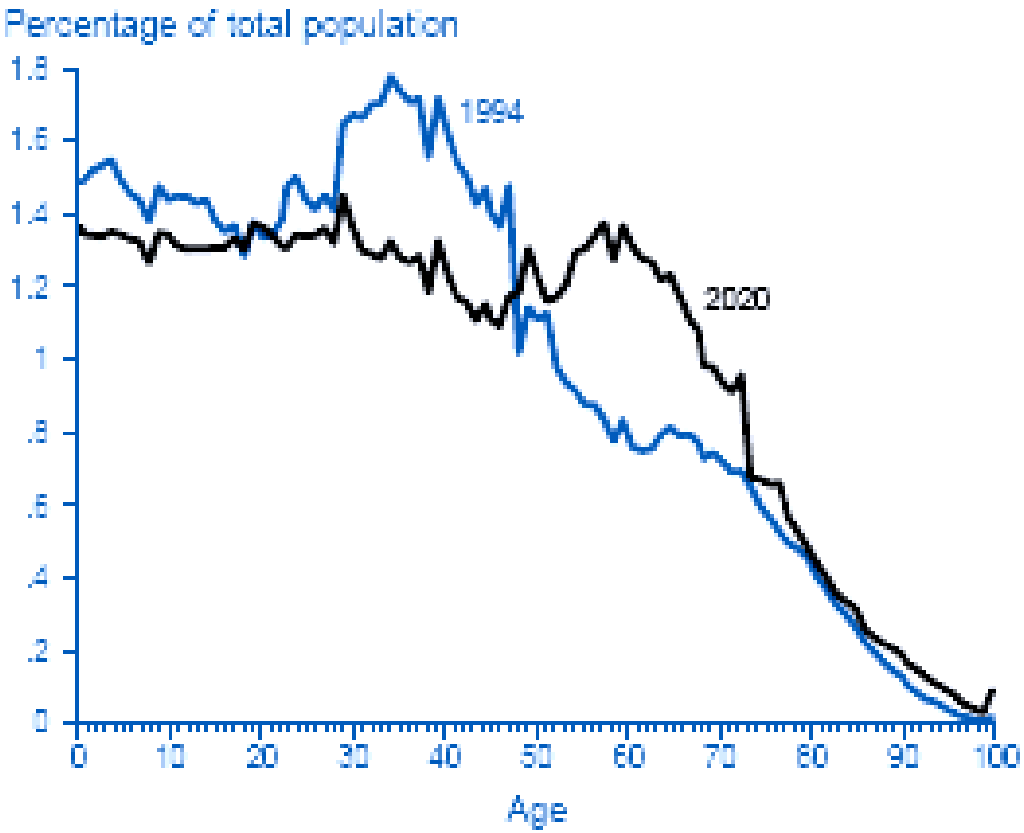
Life-Cycle Wage Profile

(Normalized to 1 on average)



SOURCE: Kjetil Storesletten, Institute for International Economic Studies, Stockholm University.

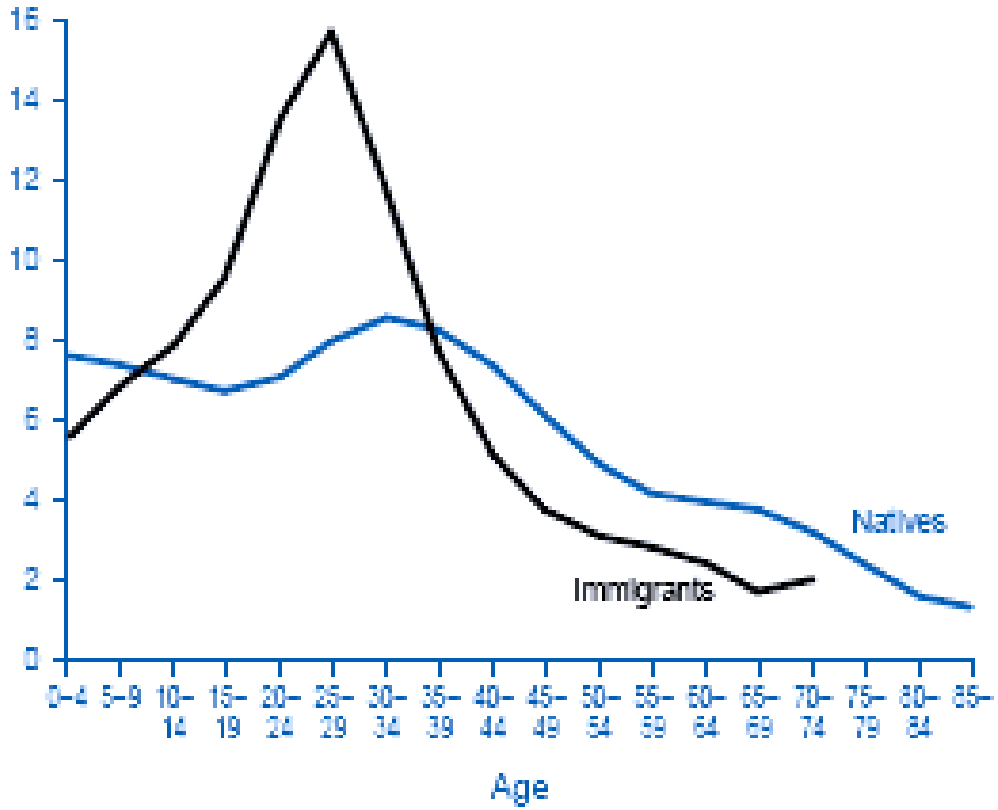
Age Distribution of the U.S. Population, 1994 and 2020



SOURCE: U.S. Census Bureau.

Figure 4

Age Distribution of U.S. Natives And New Immigrants



NOTE: The figure shows the age distribution of natives in 1991 and the average distribution of new immigrants over 1982–88.

SOURCE: Kjetil Storesletten, Institute for International Economic Studies, Stockholm University.

- What to add to such models?
- Hot topic: Account for the evolvement of income and wealth distributions

- Same framework is used to study monetary phenomena

Perennial question: Do monetary shocks cause business cycles?

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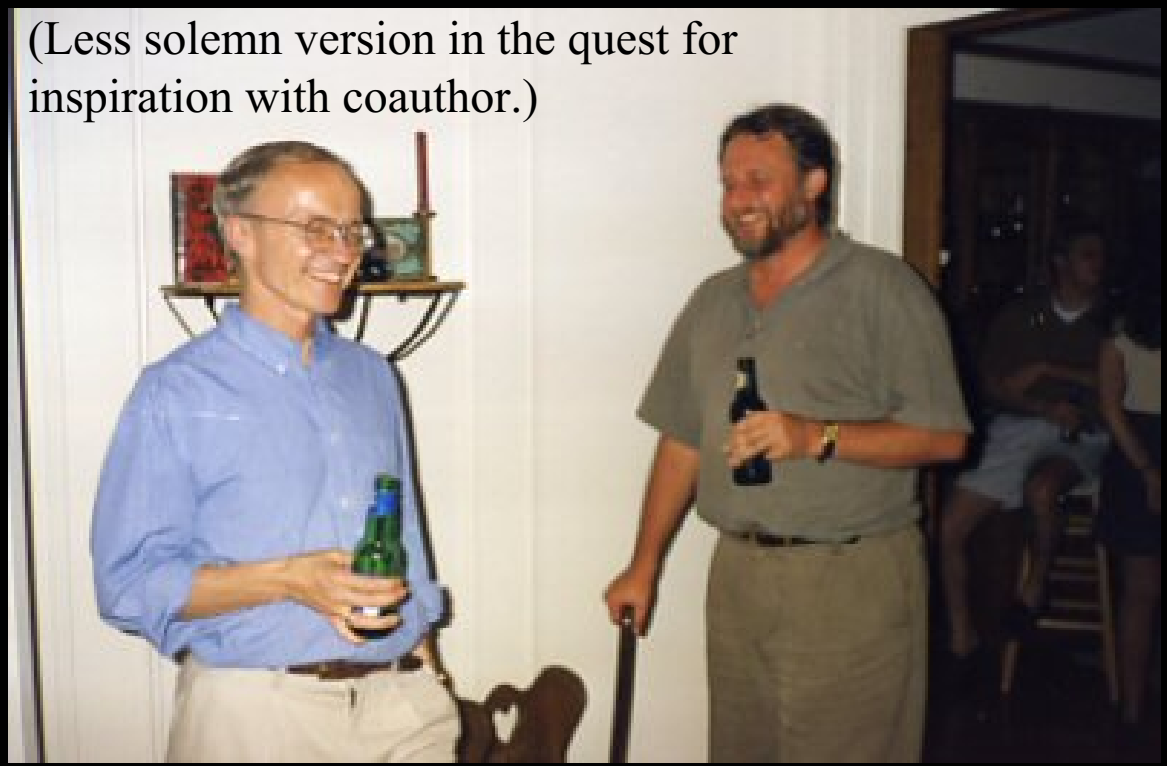


- Wild times in Santa Barbara

- One way to introduce money:

  People purchase a continuum of goods

  Small purchases (optimal to use currency) and large (optimal to use means of exchange backed by interest- earning assets)

  Finding : Money fluctuates procyclically even when the Central Bank does nothing

  Because model inhabited by people, we can evaluate welfare costs of inflation

- International business cycles

  Example: Is it an anomaly if the trade balance is the worst, cyclically when one's goods are cyclically the cheapest (as has been the case for major nations)?

  Answer: No.

- An application: How to think about Argentina in 1998.

  According to the Wall Street Journal, 4/2/98, the IMF dispatched representatives to Argentina, to convince the government to cool the economy. Reasons stated:

(i) High growth rates (6.5 to 7% annually) following upon strong growth which started in 1990, only interrupted briefly in 1995;
(ii) Export prices falling;
(iii) Trade deficit returning.

Sounds bad?

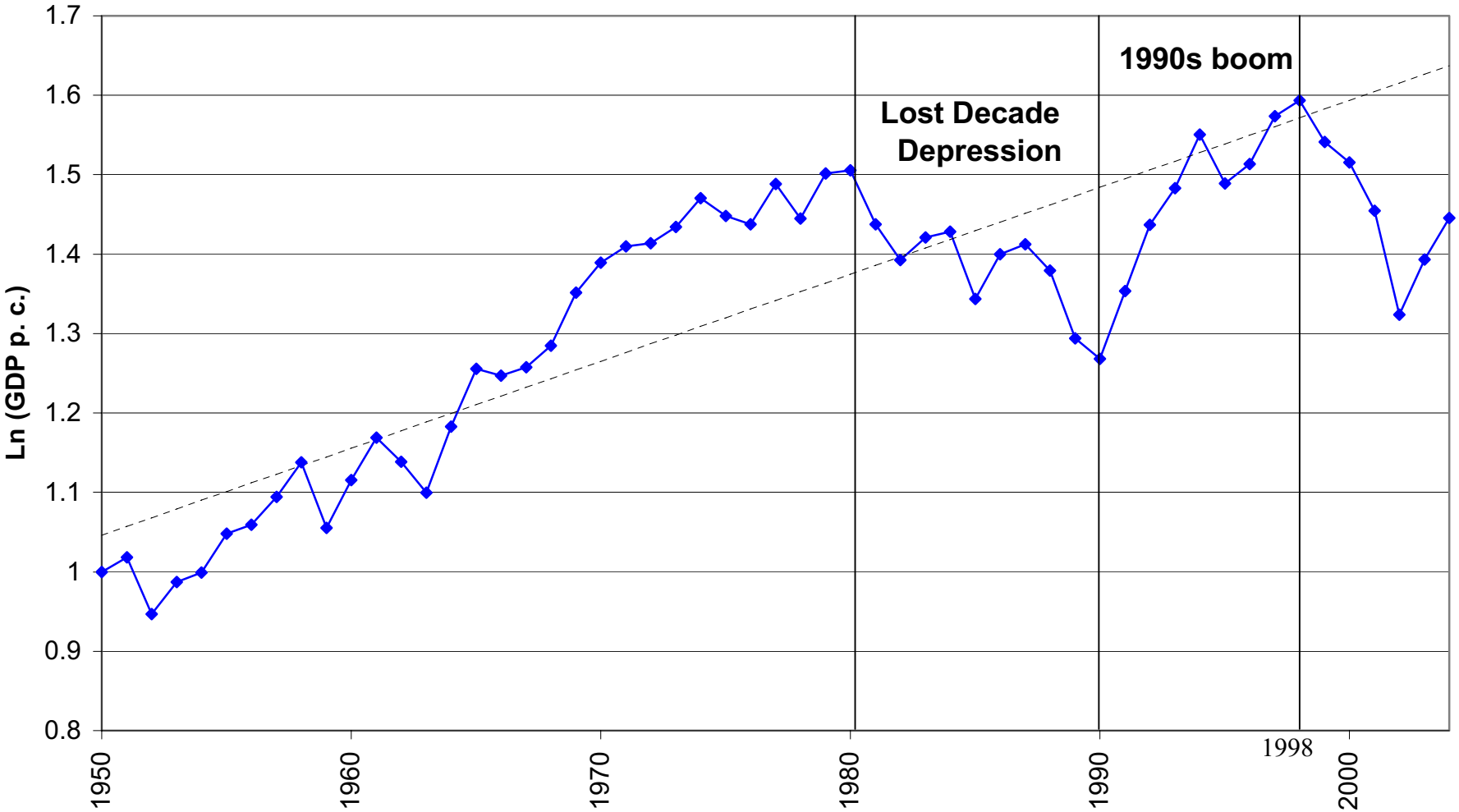
- Studies of Great Depressions

  Conference at Minneapolis Fed (volume edited by Tim Kehoe and Edward Prescott forthcoming)

  Volume of *Review of Economic Dynamics*

  Argentina in the 1980s

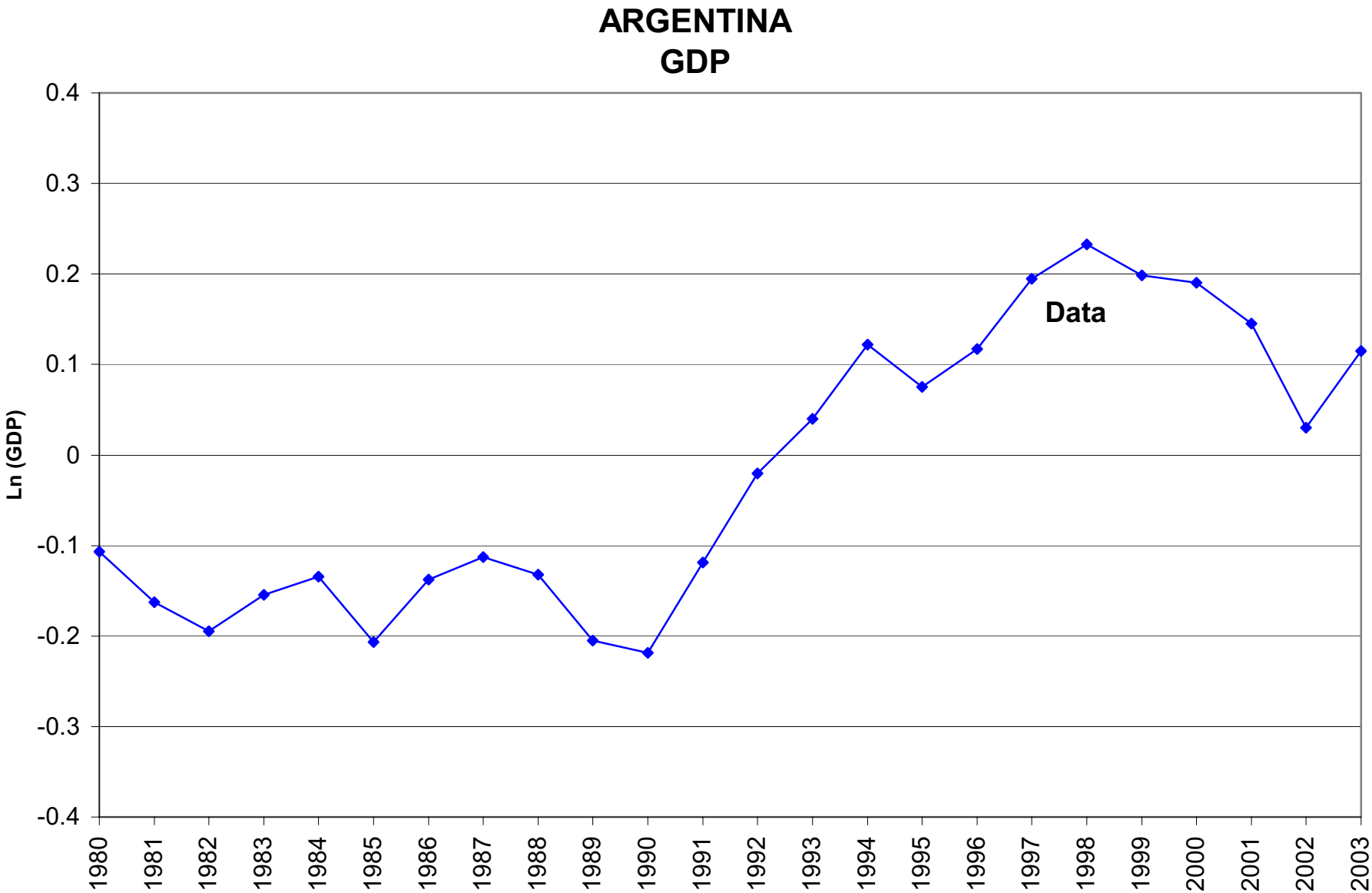
ARGENTINA
GDP per working age person (Index)



- Argentina even more interesting in 1990s boom

  Grew fast from 1990 to 1998

  Surprise: In light of high rate of productivity growth, standard model says investment should have been much larger in the 1990s, and capital stock therefore much larger by the end of the decade


ARGENTINA
GDP
Ln (GDP)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
Data
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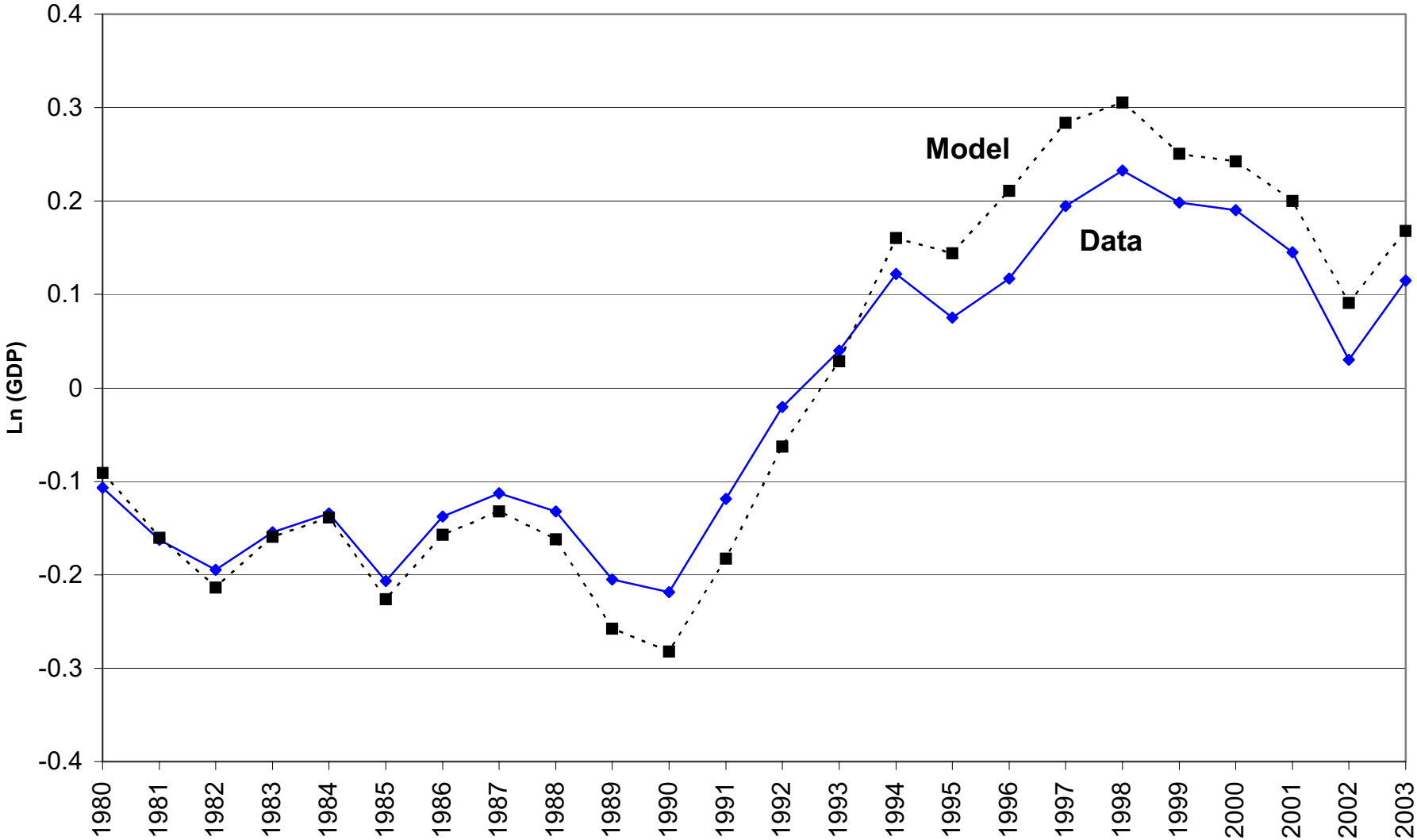
ARGENTINA
GDP
Model
Data
Ln (GDP)
0.4
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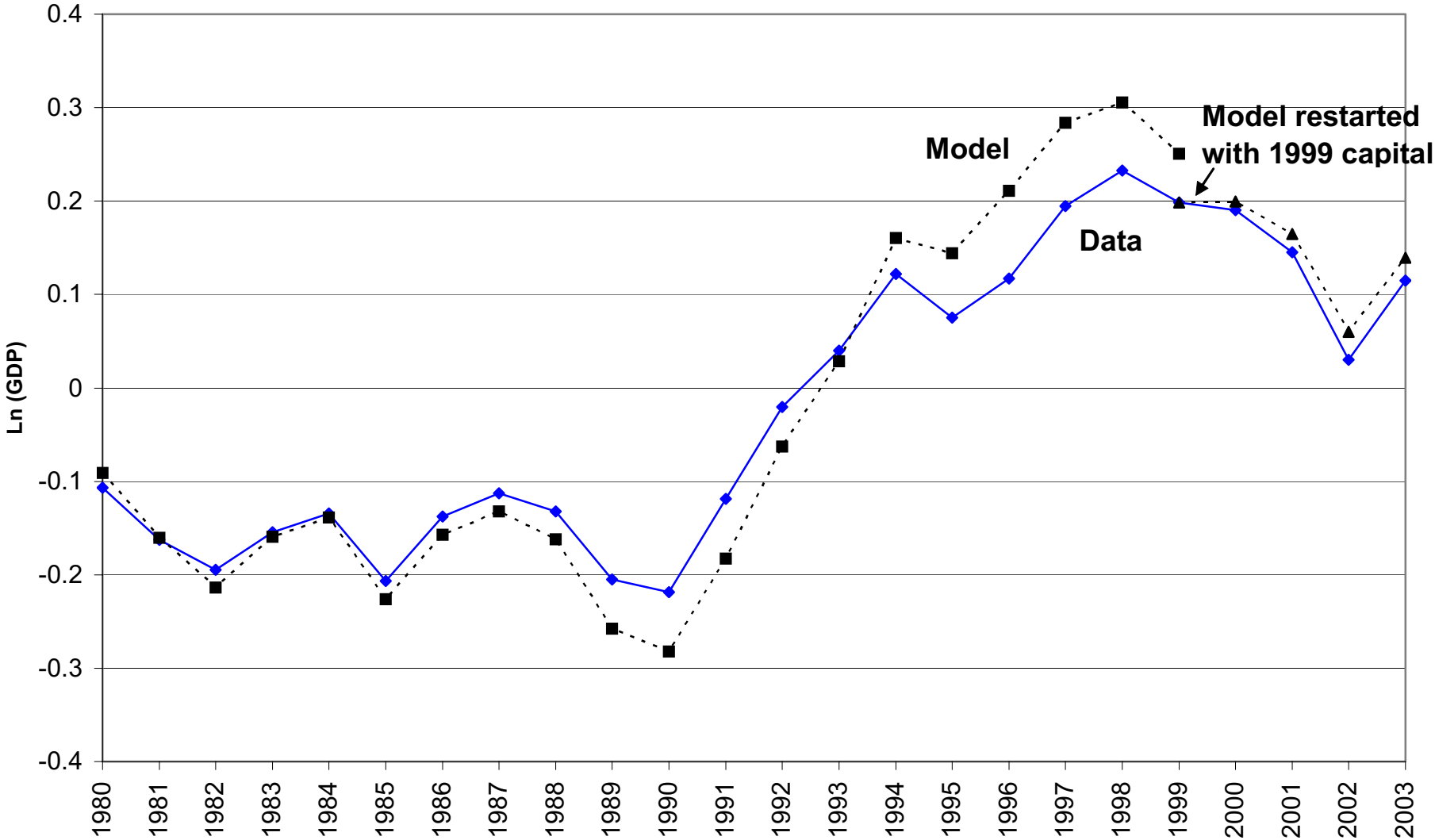
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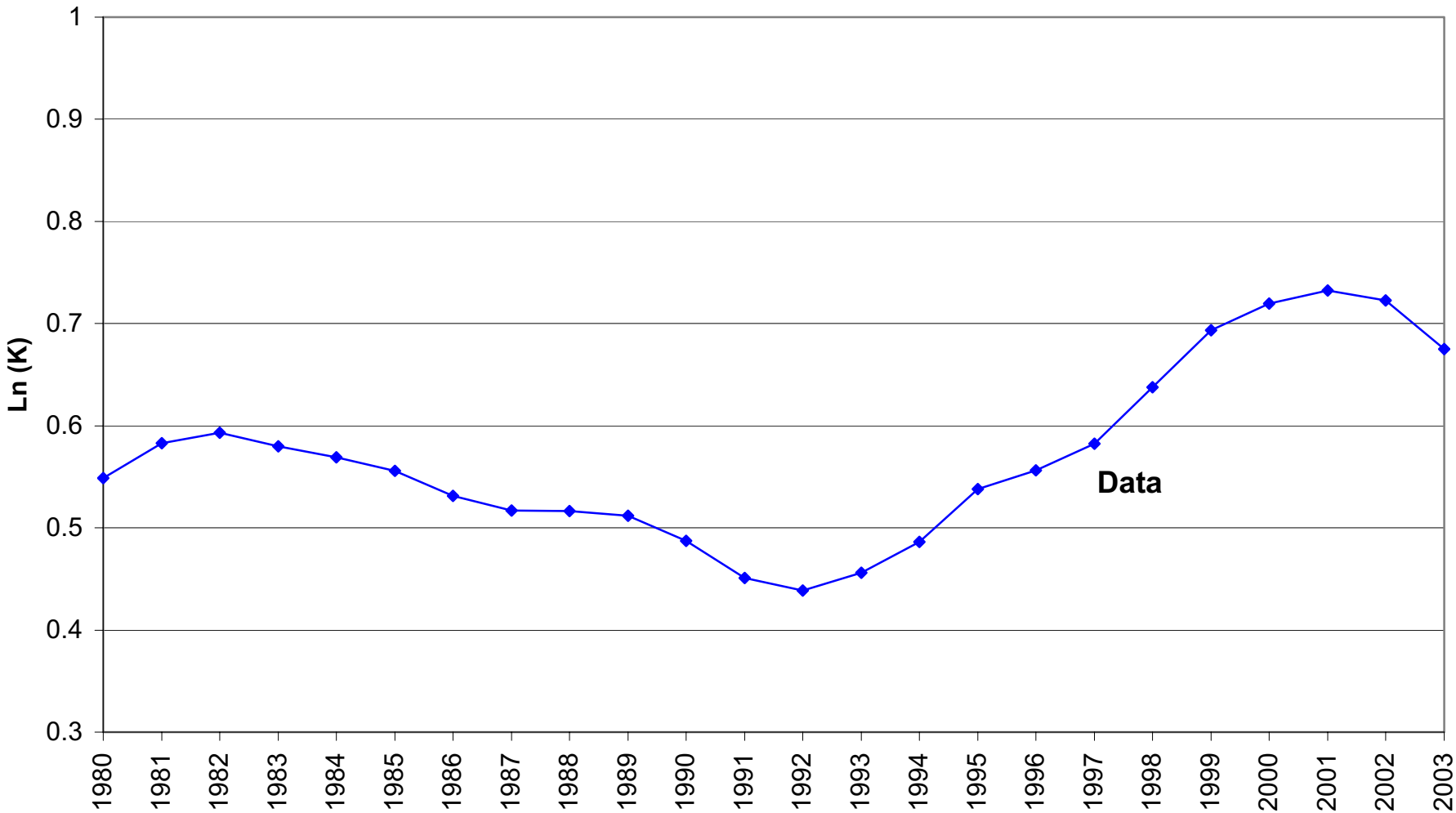
Model
Model restarted
with 1999 capital
Data


ARGENTINA
Capital Input
Ln (K)
1
0.9
0.8
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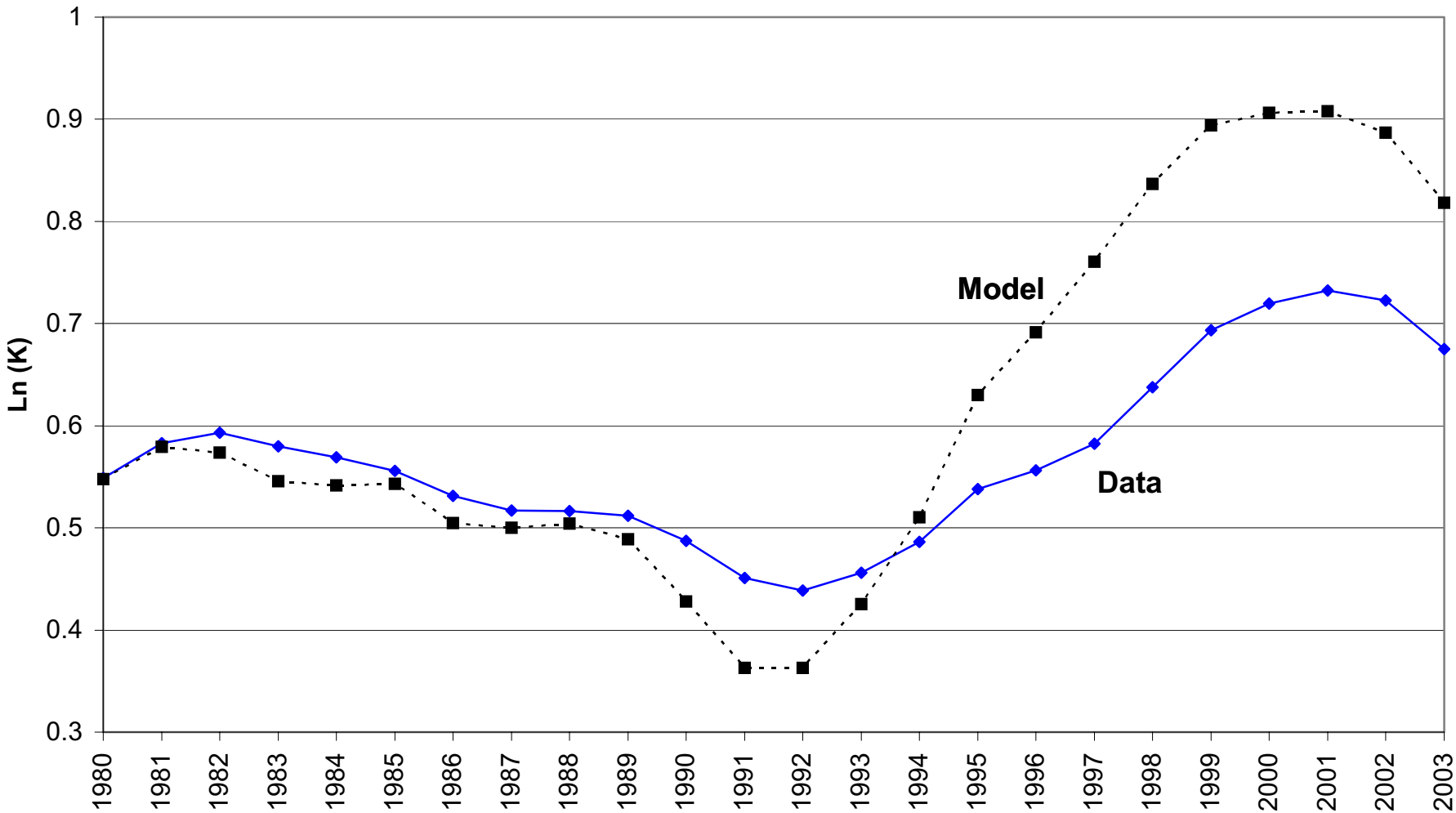
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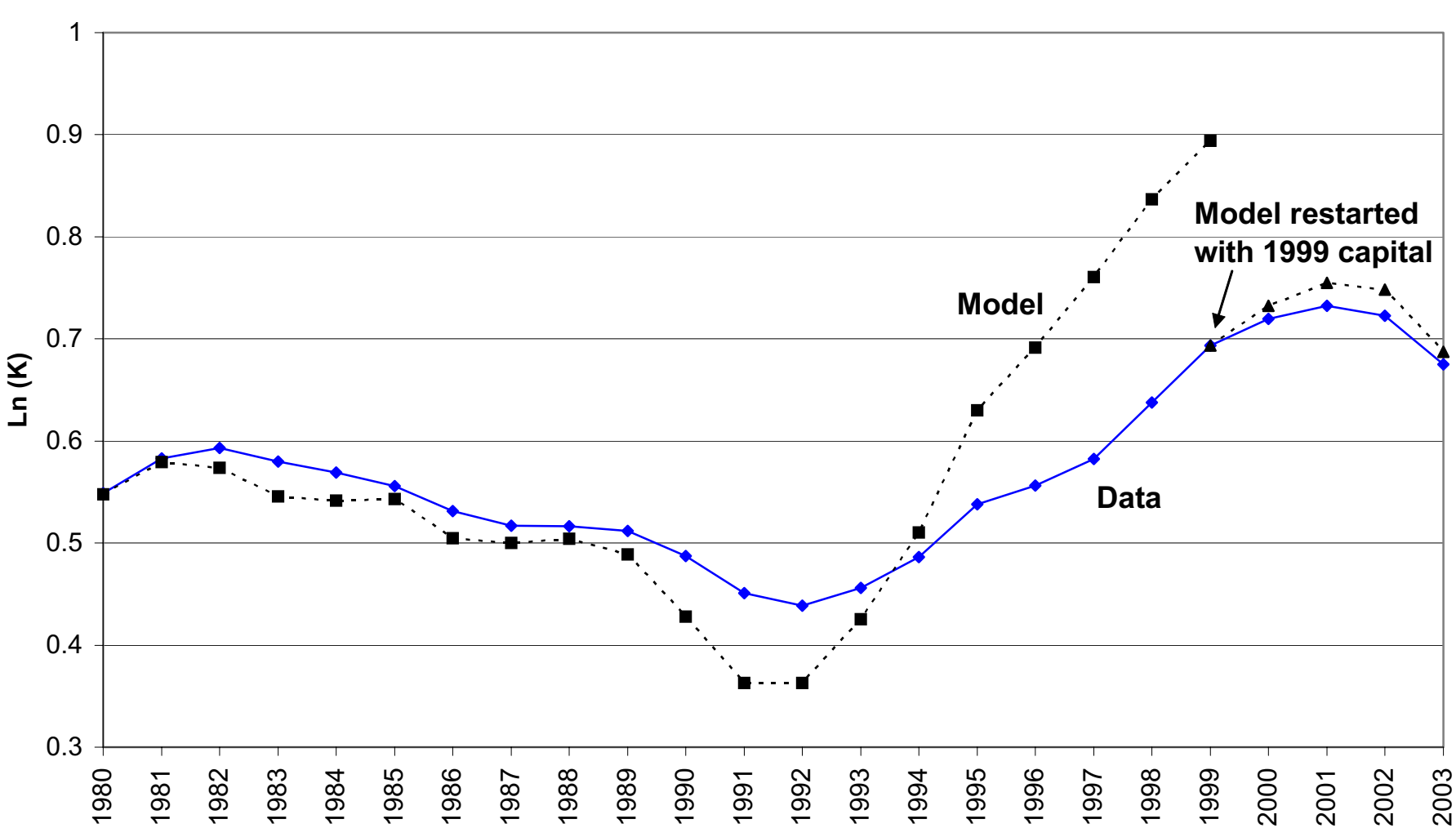
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Model restarted
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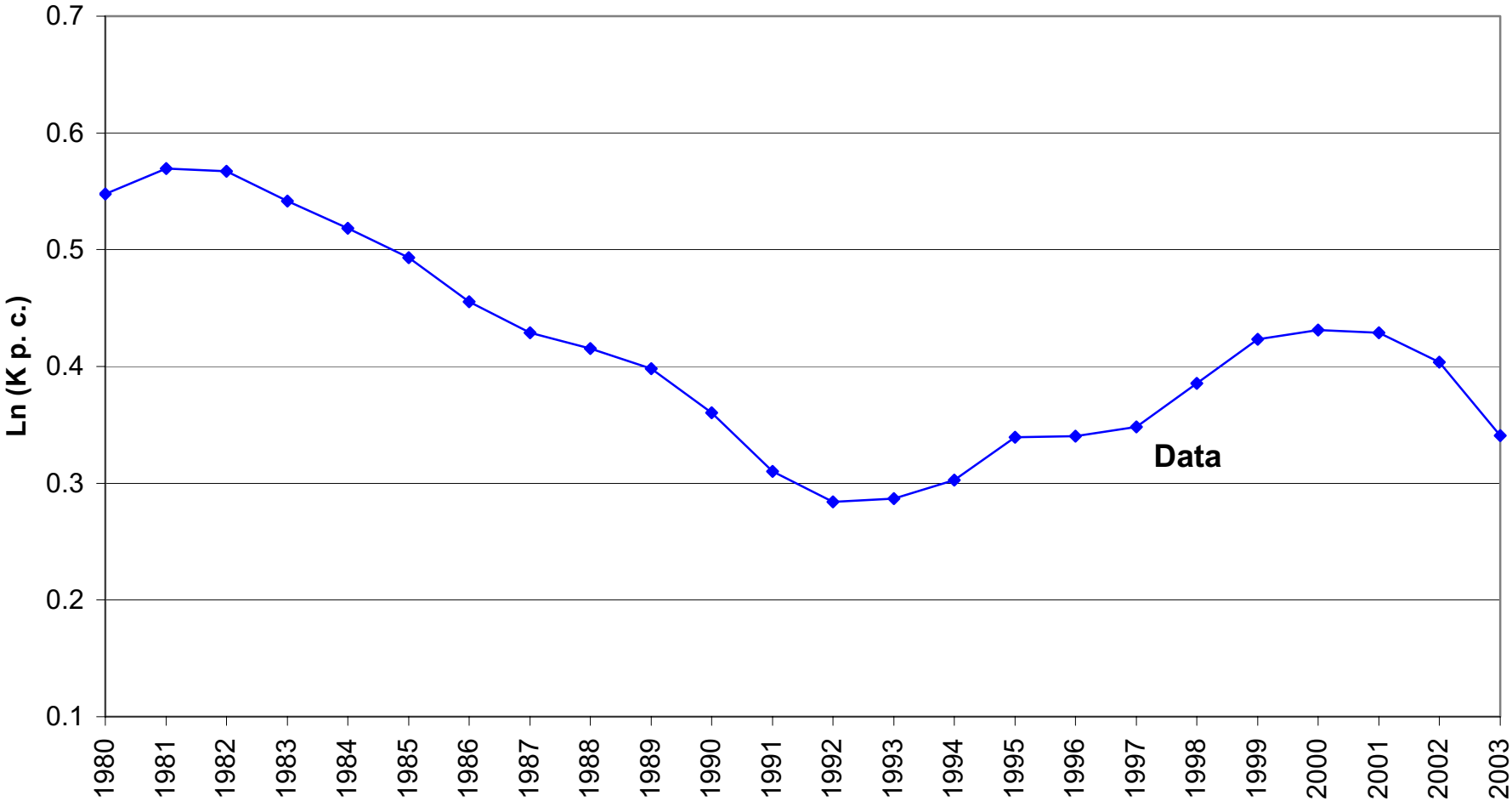
ARGENTINA

Capital input per working age person

LOWER CAPITAL: LOWER REAL WAGES, WORSE DISTRIBUTION OF INCOME



- Possible explanations:

  Measurement problems?

  Unlikely, Anchorena (2004) gets similar results with alternative way of constructing capital-stock series.

  Time-inconsistency “disease” due to past hyperinflations, devaluations, deposit freezes and defaults on government obligations:
  Lack of credibility among investors

- Argentina's recent recovery

  Will "capital gap" be closed? If not, poor will continue to be poor for a long time

  How to restore confidence?

  No easy answer

  Need policy geared for the long run

- Concluding remarks

Dynamic macro difficult for beginners to learn

Not easy to do dynamics on paper

Gap between research and textbooks

Possible remedy: teaching aided by computers (e.g., computational experiments, including plots of impulse responses)