

Model Specifications with Various Levels of Data

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Why Model?

- Economic and social data -- raw material for reports and studies – in comprehensive databank used for analysis.
- Building models assists and test economists' understanding on how the economy works.
- Assist the economic forecasting *process*. Leverage the historic record to detect future trends. Provide a *comprehensive and consistent* framework to assess assumptions and structures of an economic forecast.
- Simulate “counterfactual” to produce alternative scenarios and/or to evaluate policy measures or exogenous economic shocks.

Economic Models: A Comparison

Macro models

- Time series data, econometrically estimated. Dynamic.
- No industry detail to assess relative impacts.

Static Input-Output (IO)

- IO allows for identification of industry demand and cost, the relative impacts on output and jobs.
- Static demand framework, no macro and supply constraints or dynamics. No relative price structure.

Computable General Equilibrium Models

- Include IO, industry detail (bottom up) and relative prices. Macro and supply constraints.
- Neoclassical optimizing behavior and associated assumptions (rational behavior, perfect knowledge, etc.)
- Parameters borrowed or calibrated, difficult to evaluate history or establish forecast baseline.

Interindustry Macroeconomic (IM) Models

Data Driven

A specific type of analysis with emphasis on time series economic data and structure.

Structural/Bottom-Up

Combine input-output structure with national accounts in dynamic framework. Aggregates are summations of detailed industry results. *Provides explicit linkage between micro/industry studies and macro economy (partial to general equilibrium).*

General Equilibrium (economy-wide)

Relative prices are integral and based on industry conditions such as costs and excess demand. Macro properties Keynesian in SR and neoclassical in the LR.

Interindustry Macroeconomic (IM) Models

Consistent

Growth and structure of real economy reconciled with nominal balances (savings-investment, government, foreign) to evaluate sustainability of growth.

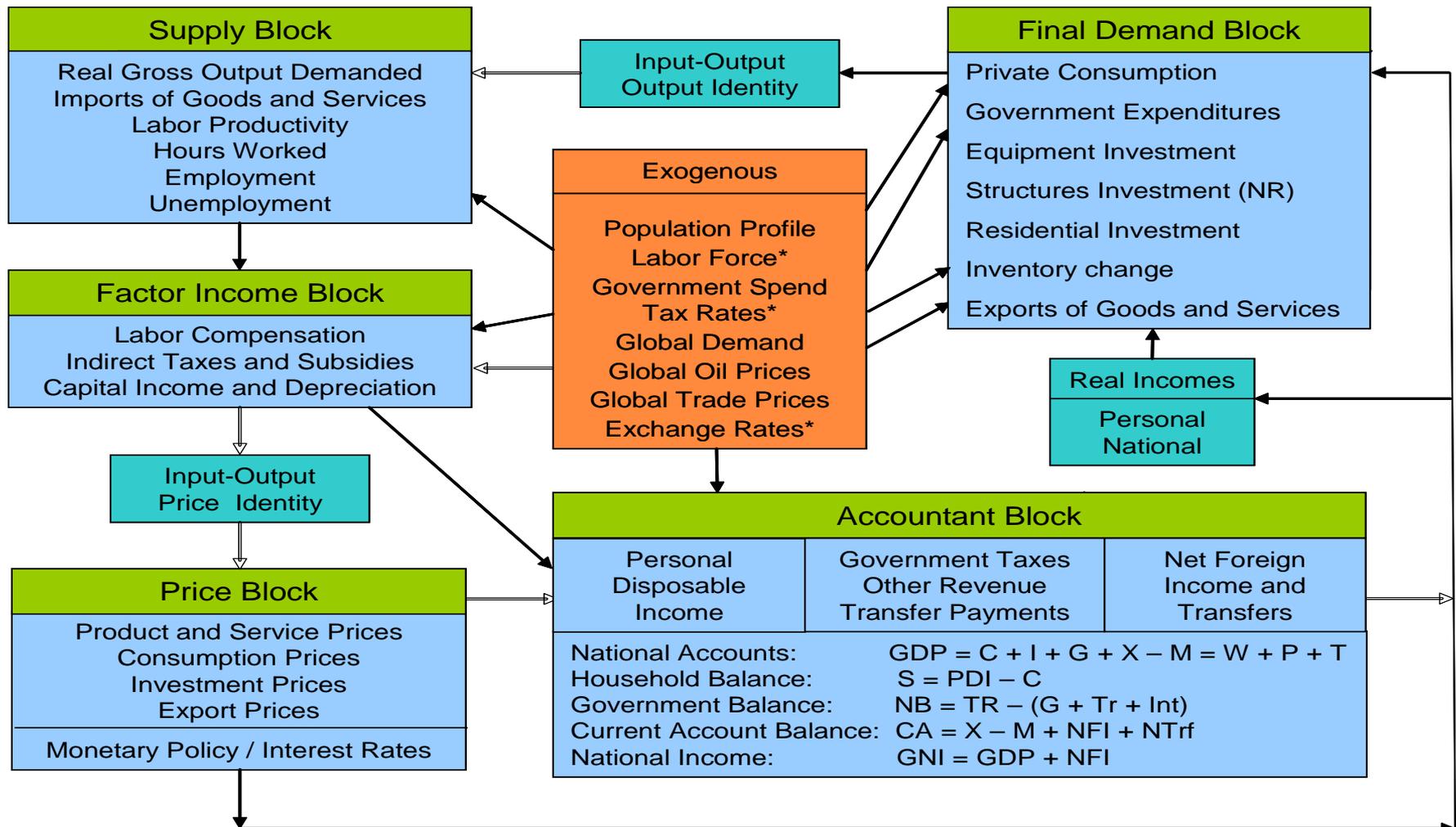
Econometric

Based on empirically estimated relationships, using detailed historical data. Simple and direct methodology. Flexible functional forms.

Dynamic

Models the economy year by year. Input-output coefficients change over time. The time path of response is important.

LIFT Interindustry Macro Model Schematic



Long-Term Economic Forecasting

- Policy makers need a structural accounting model to evaluate impact and sustainability of policies.
 - ILO – Employment projections by industry/occupation
 - Social Security and Medicare
 - Energy Technology and Climate Change
- Is “projection” a more benign word than “forecast”?
- Structural models provide context and consistency needed to organize assumptions about the future.
- For example, evaluate the consistency between assumptions of real economic growth and reasonable behavior of nominal values.

Data Considerations

- Modeling process requires a detailed and ongoing inventory and analysis of the available data.
- Data availability, consistency, and accuracy problems are the rule rather than the exception. Often necessary to work within given data to estimate and configure (torture) data, esp. at industry level.
- Most developing nations have, at least, national account data for expenditure (demand) and value added (supply) by 7-12 sectors, in nominal and real terms, across 20+ years. See UN national accounts.
- Availability of employment at a comparative sector detail a problem for many economies of Africa and Asia. See ILO data.
- Occupational data is also sparse for low income countries.
- International trade and physical production data for detailed products is generally available at some level for most countries.

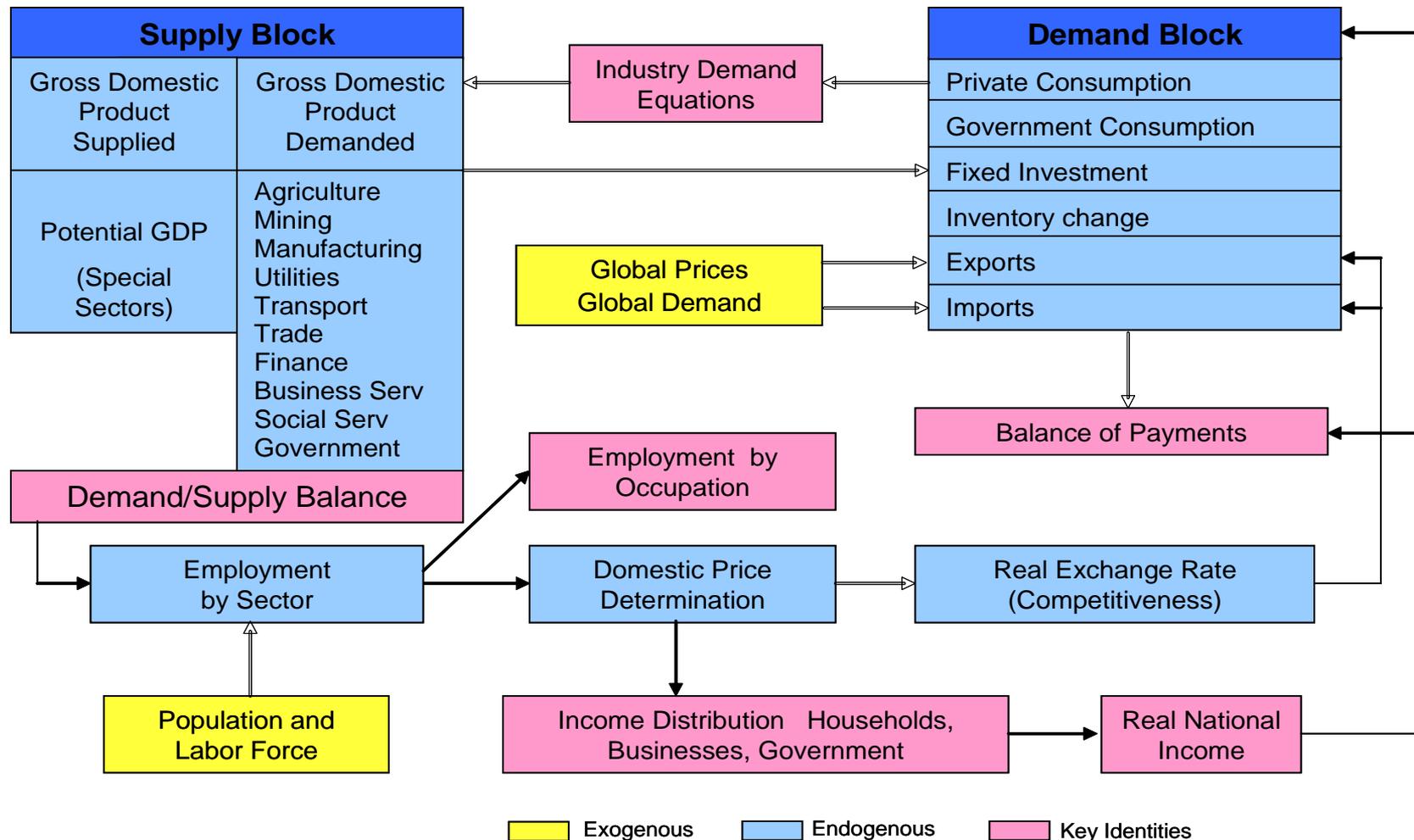
Data Considerations

- Notwithstanding typical data difficulties, it is rarely appropriate to say no useful model can be constructed for a given economy. Modeler must work with hand dealt and adapt to data conditions.
- However, also note that the “availability conditions” of the data is often an important bottleneck expanding the time frame for constructing a model.
 - electronically accessible vs. hard copy/pdf
 - changes to the base-year, the benchmark year, and/or conceptual definitions.
- In some modeling efforts data compilation & development can require 60-80 % of total effort.
- Appendix A offers list of data concepts to initiate inventory of country data to build a labor market model.

Model Structure with Basic (Rudimentary) Data Availability

1. Supply: GDP by sector in current and constant prices for 7-10 major sectors
2. Demand: GDP by expenditure in current and (maybe) constant prices
3. Employment by major sector
4. Total population and economically active population
5. Sectoral employment-occupation matrix for subject economy or borrowed

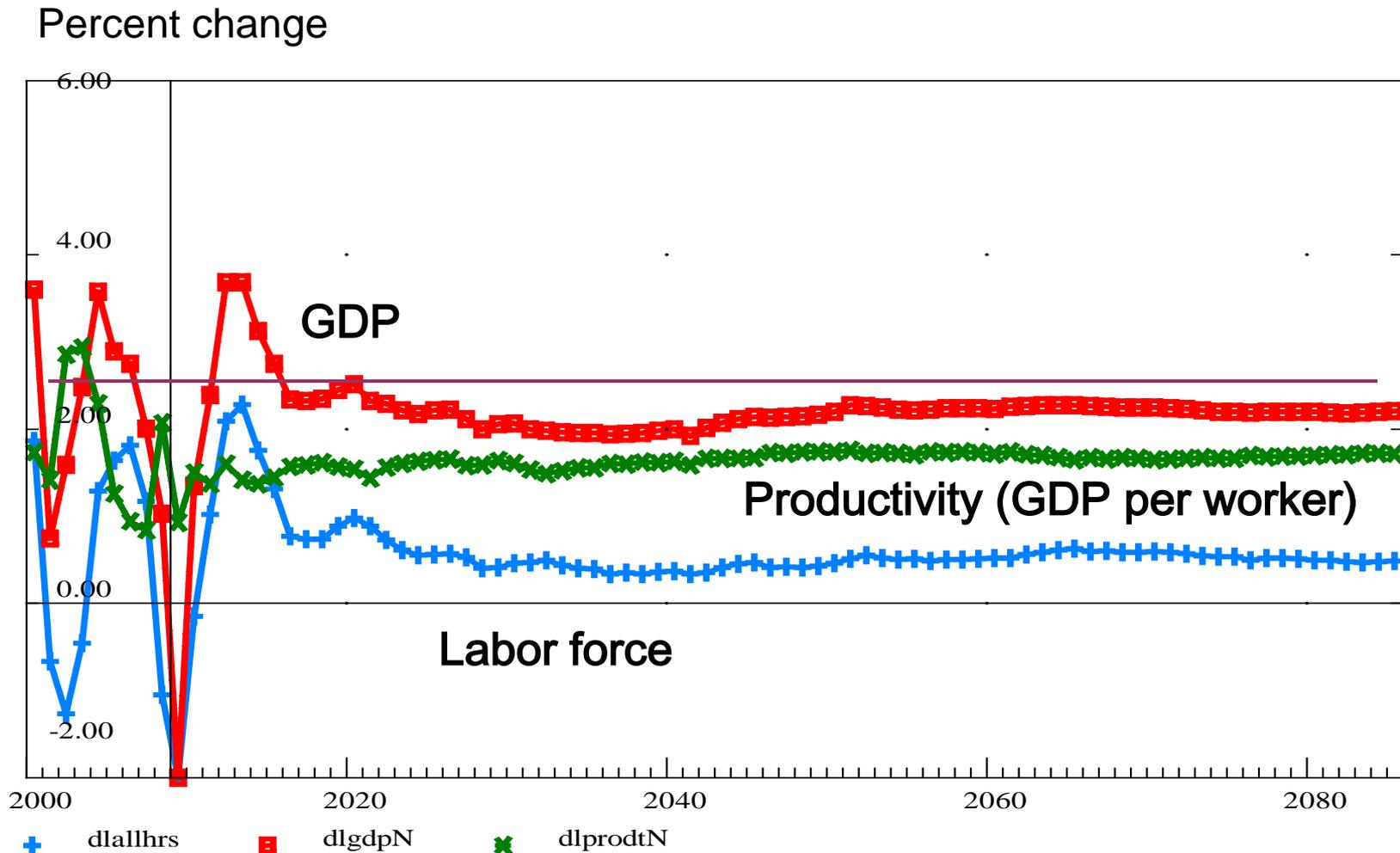
“Basic” Data Model



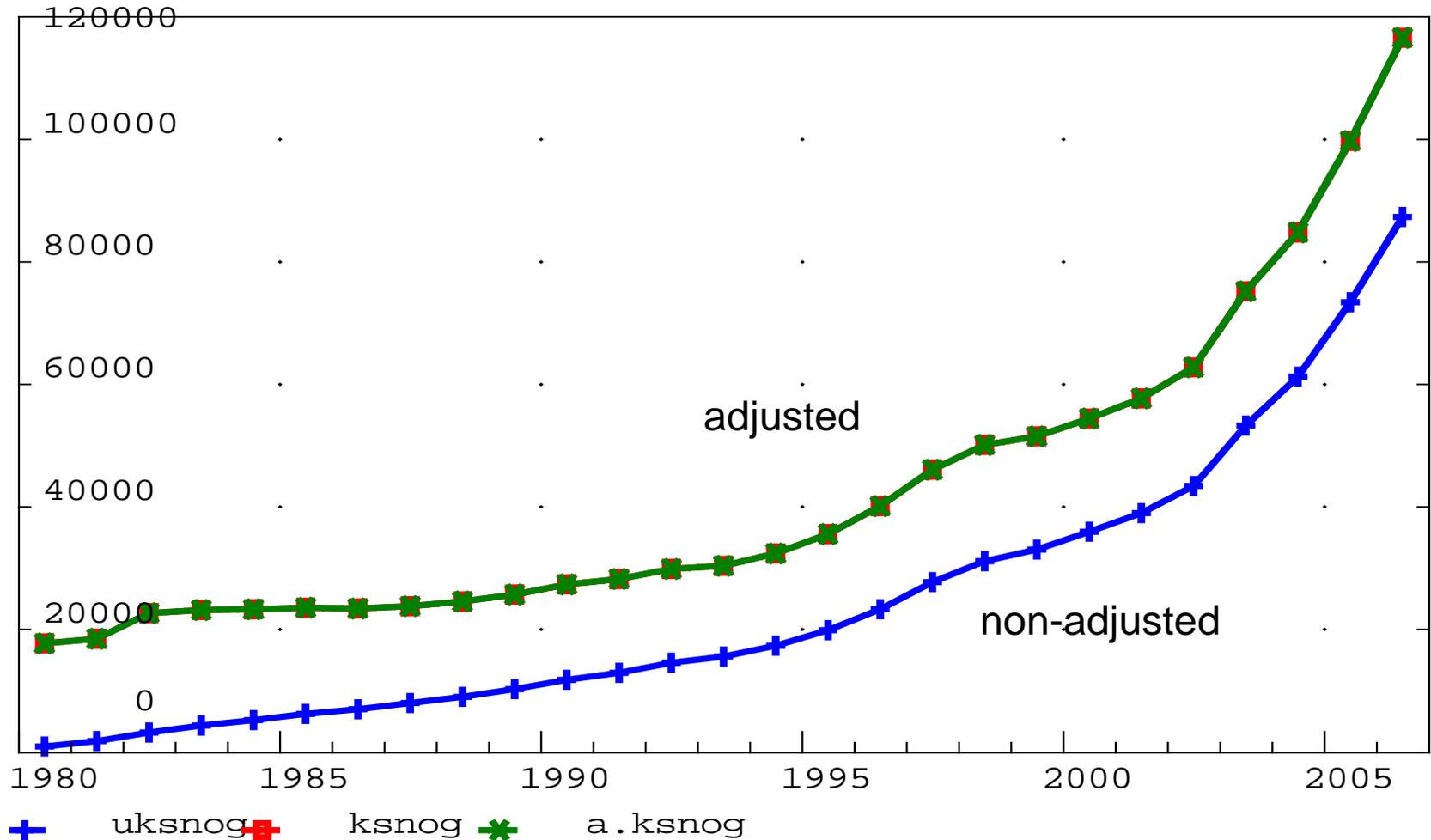
Potential Growth (Supply)

1. Exogenous time trend:
 $\text{gdpS} = f(\text{time})$
2. Labor constrained (developed):
 $\text{gdpS} = f(\text{lor, labor force})$
3. Harrod-Domar growth model (developing):
 $\text{gdpS} = f(\text{kor, kstock})$
4. Solow Growth Model (Cobb Douglas):
 $\text{gdpS} = f(a, b \cdot \text{kstock}, c \cdot \text{labforce})$

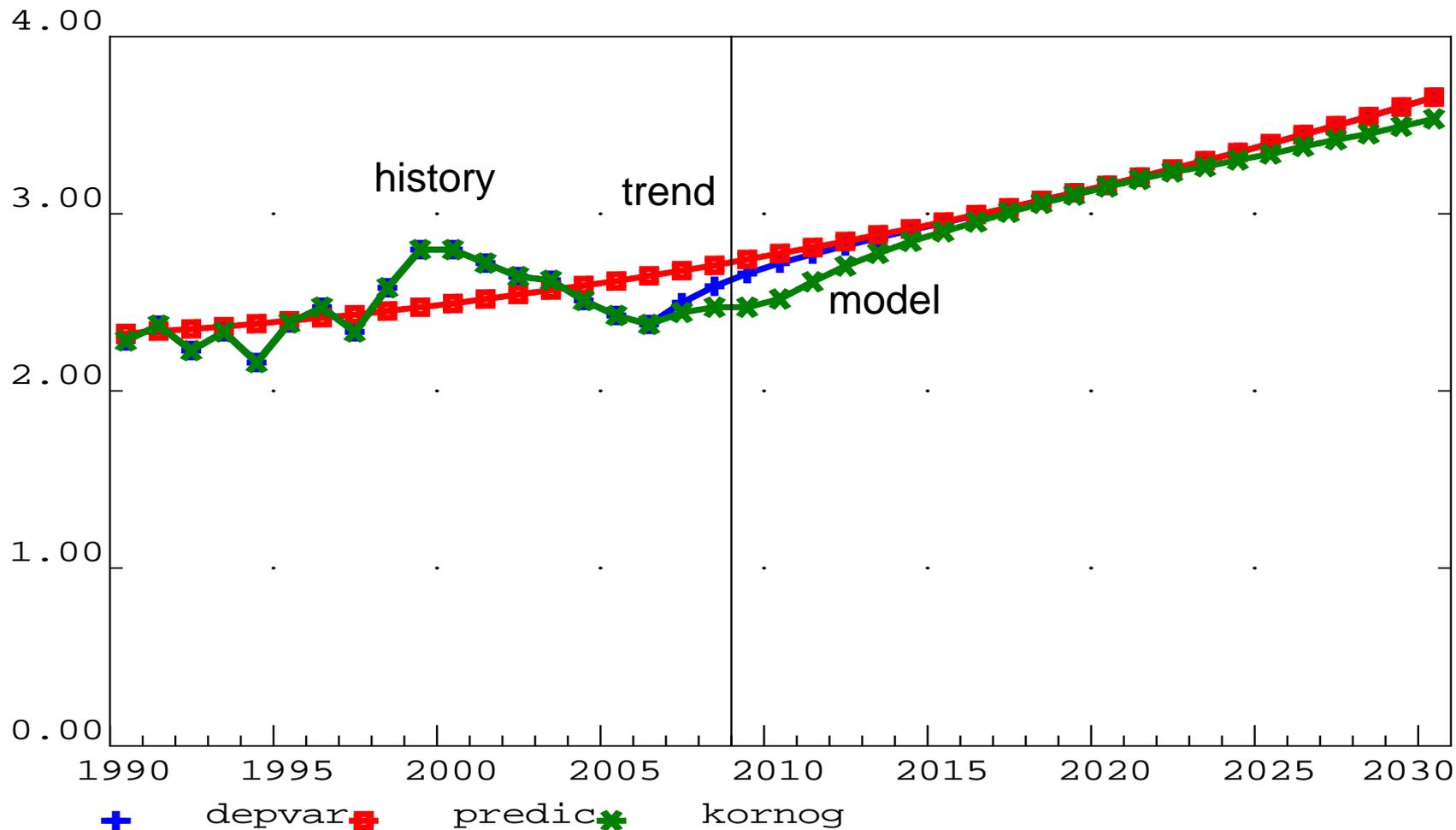
U.S. long term potential growth: strong productivity growth, low labor force growth



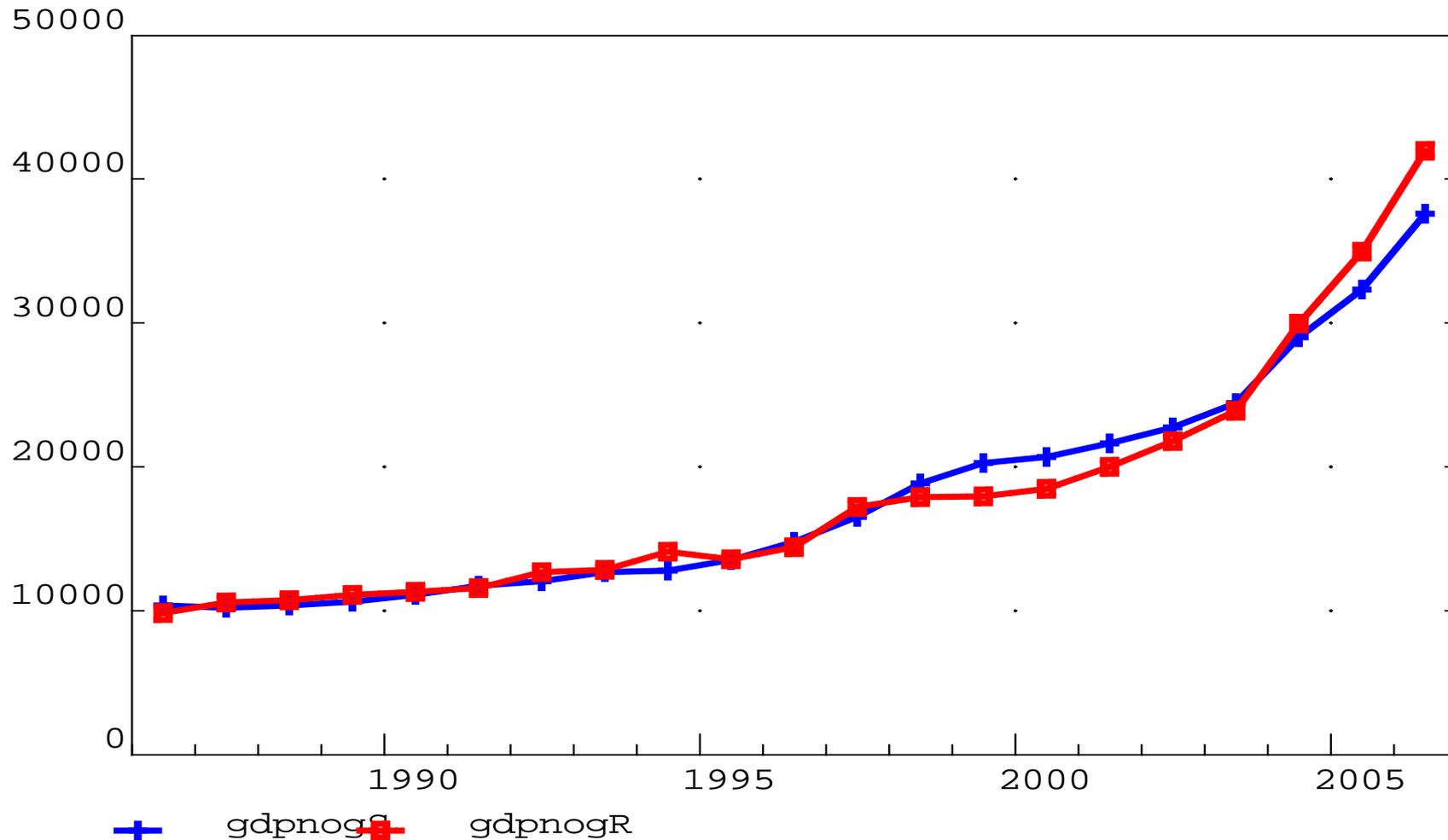
Qatar non-oil non-govt GDP: Capital stock with unit bucket adjustment



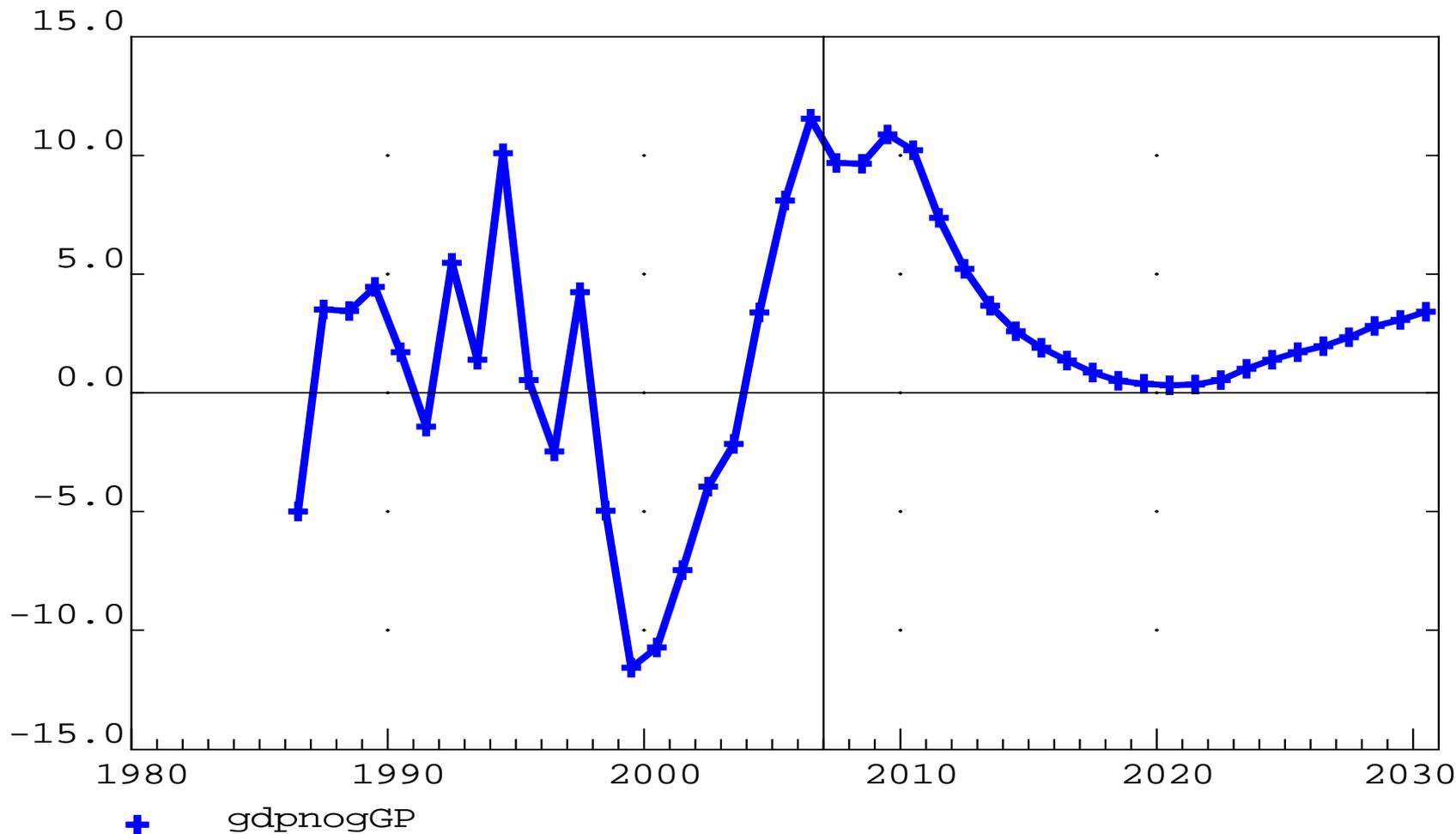
Qatar non-oil non-govt GDP: Actual Output vs. Optimal (history)



Qatar non-oil non-govt GDP: Actual Output vs. Optimal (history)



Qatar non-oil non-govt GDP gap as percentage of output



Final Demand functions (examples)

- $pceR / pop = a + b * (dpi / pceD) / pop$ (4)

- $gceR = a + b * (taxrate * dpi / gceD) + c * (ogi / gceD)$ (5)

- $invR = a + b * (dgdpr[t]) + c * (dr * kstock[1])$ (6)

- $expR = a + b * (gdpG) + c * (expD / (impD) * exind)$ (7)

- $impR = a + b * (pceR + gceR + invR) + c * (gdpG) + d * (impD / gdpD)$ (8)

- $venR = a + b * gdpR$

Supply side functions (examples)

- $vamfgR = a + b * pceR + c * invR + d * (expR - impR)$ (9)

- $vasrvR = a + b * pceR + c * gceR$ (10)

Can $gdpRv$ be scaled to $gdpR$?

- $gdpRv = \sum_{iii} vaiiiiR$

- $gdpR = pceR + gceR + invR + venR + expR - impR$

GDP “gap” computation:

- $gdpG = (gdpR - gdpS) / gdpR$ (11)

Employment and Prices

- $emp = gdpR / prdv$ (12)

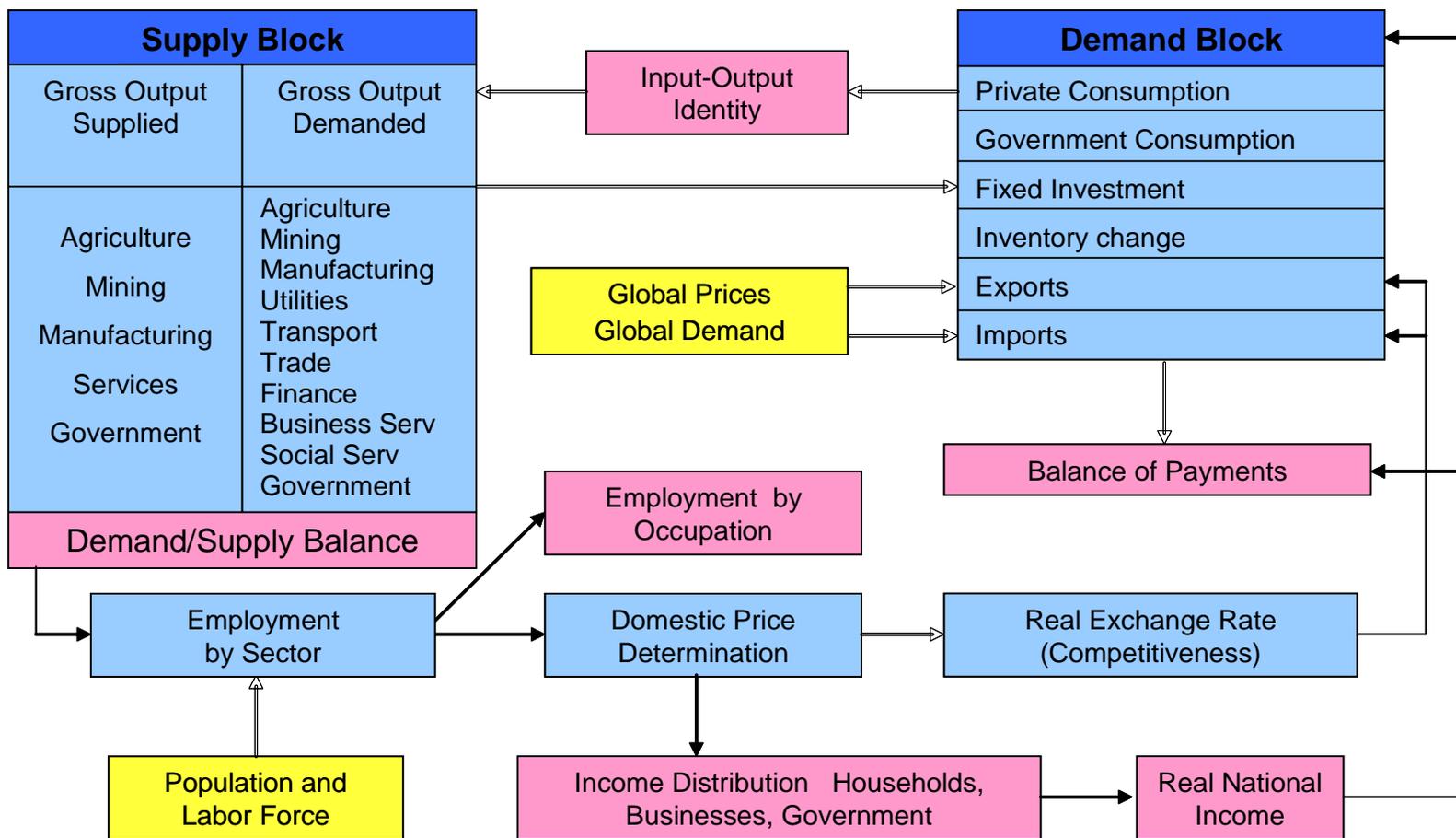
- $gdpD = a + b * gdpGP + c * unemp$
 $+ gdpD[1]$ (13)

- $impD = a + b * (pworldD * rex)$ (14)

Medium data level adds:

- Gross output and corresponding employment by sector across time.
- Production prices per sector or product across time.
- An input-output table for one or more years.
- A sectoral employment-occupational matrix specific for the subject economy for at least one recent year.

Medium Data Availability: Gross output, IO Table, more income data



Exogenous
 Endogenous
 Key Identities

Supply side based on gross output

- $qmfgS = kstmfg[1] / kormfg \quad (15)$

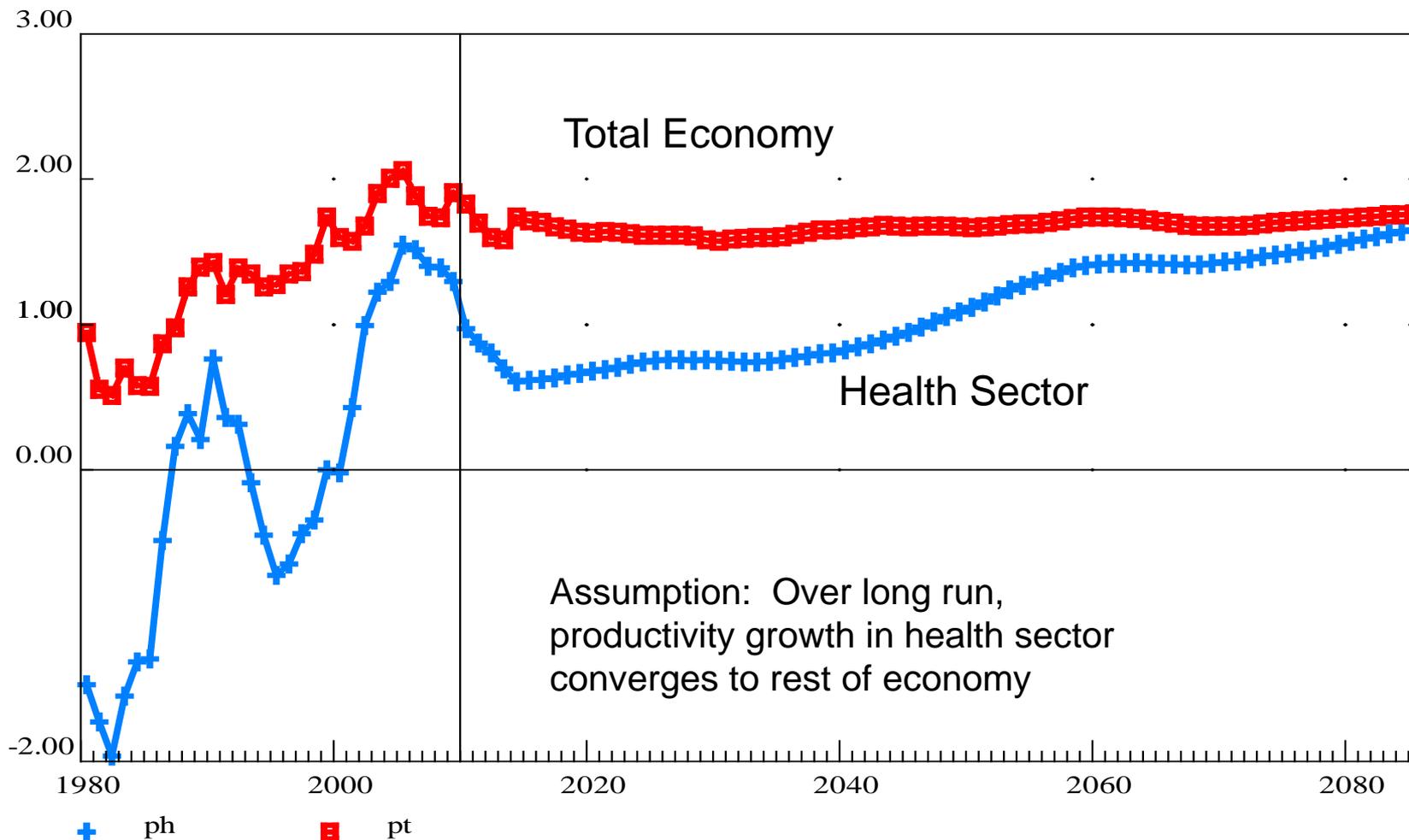
- $q = (I - A)^{-1}f, \quad f = Bfd \quad (16)$

- $\ln(q_i R) = a + b * \ln(q_i) \quad (17)$

Labor Productivity, Hours Worked and Employment

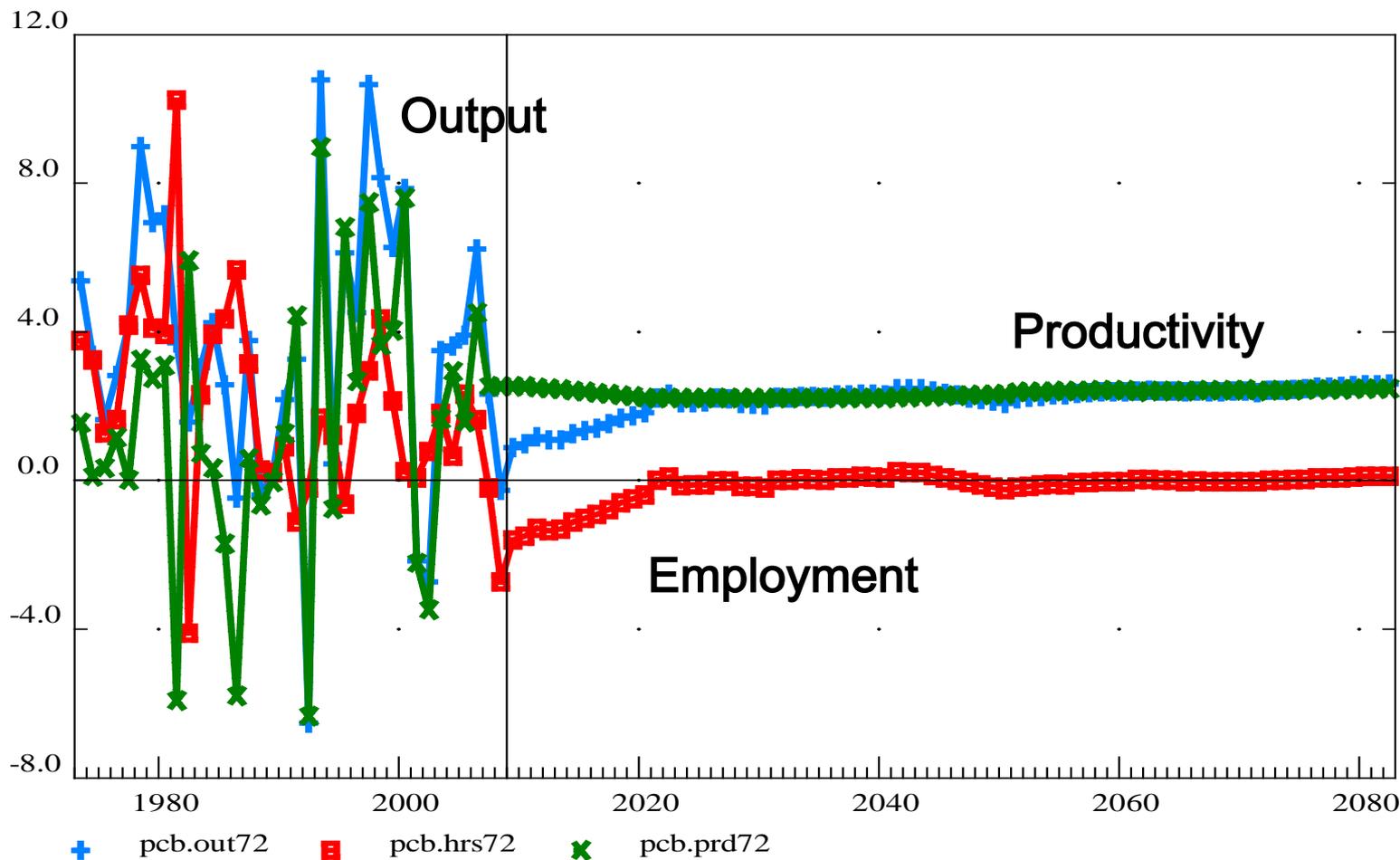
- The labor productivity equation is based on logarithmic industry-specific time trends and, maybe, a specification for output that allows for pro-cyclical labor productivity.
- Forecasts of productivity are tempered by judgment -- especially in hard to measure service industries.
- Hours worked by industry, when available, are obtained by dividing output by productivity.
- Equations for the length of the work year are used to convert hours worked to employment by industry.
- Aggregate employment is the sum of private industry and government employment.

Differential productivity growth is key to economic structure

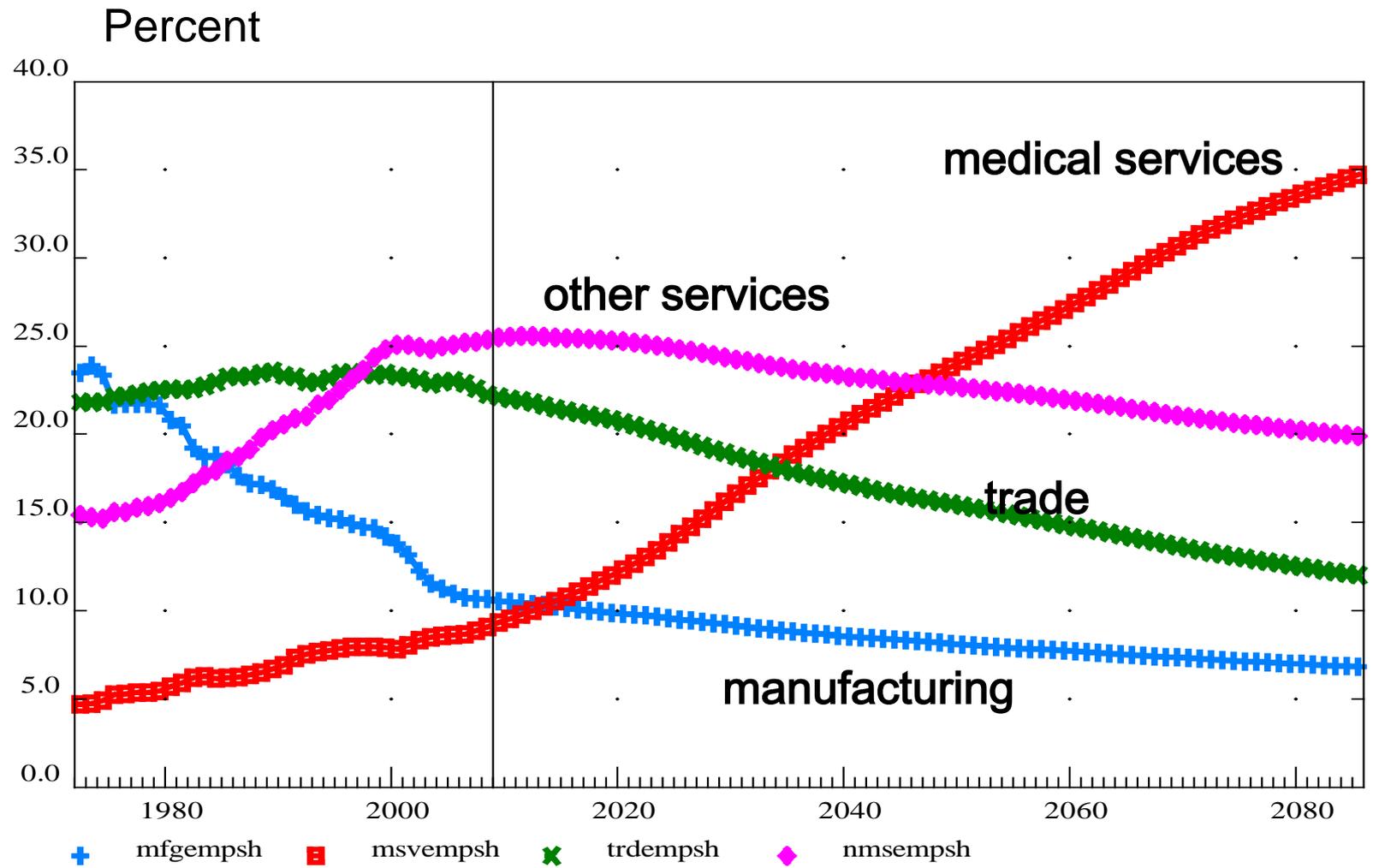


Financial Services: Slow output growth, rapid productivity growth means that employment stagnates.

Percent change

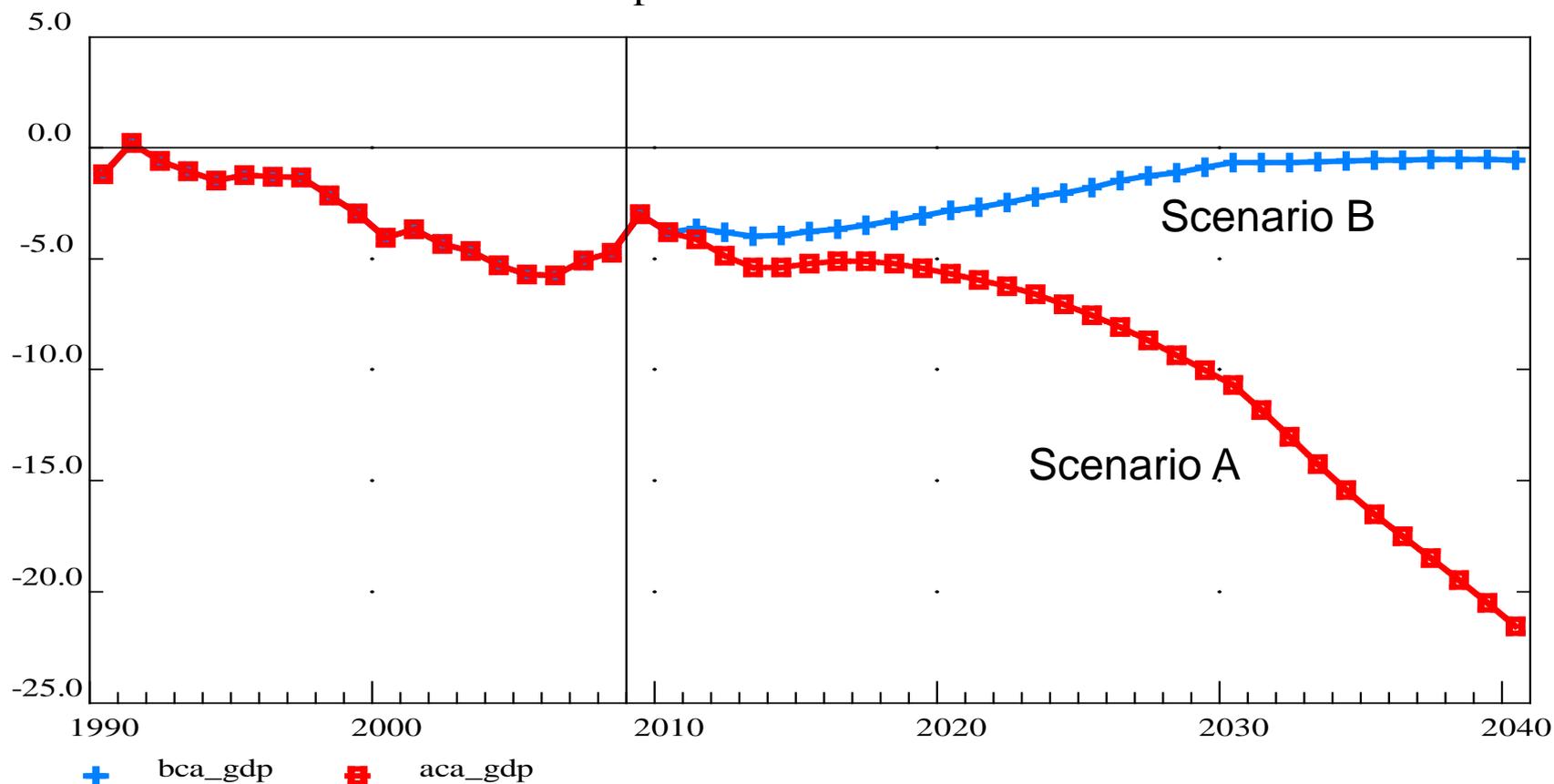


Industry employment shares: Productivity growth must come from all sectors

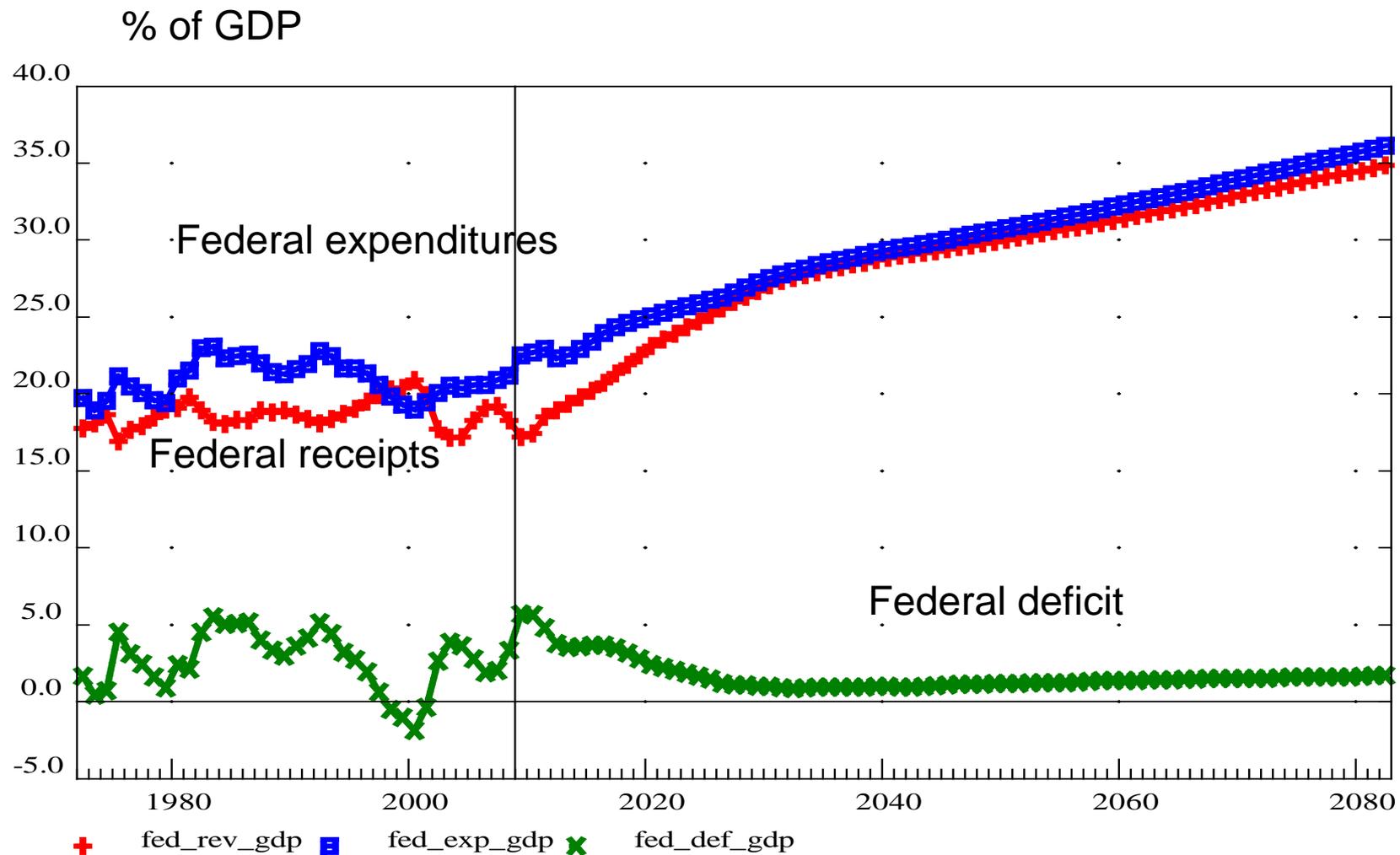


Is this scenario sustainable?

U.S. Current Account Balance percent of GDP

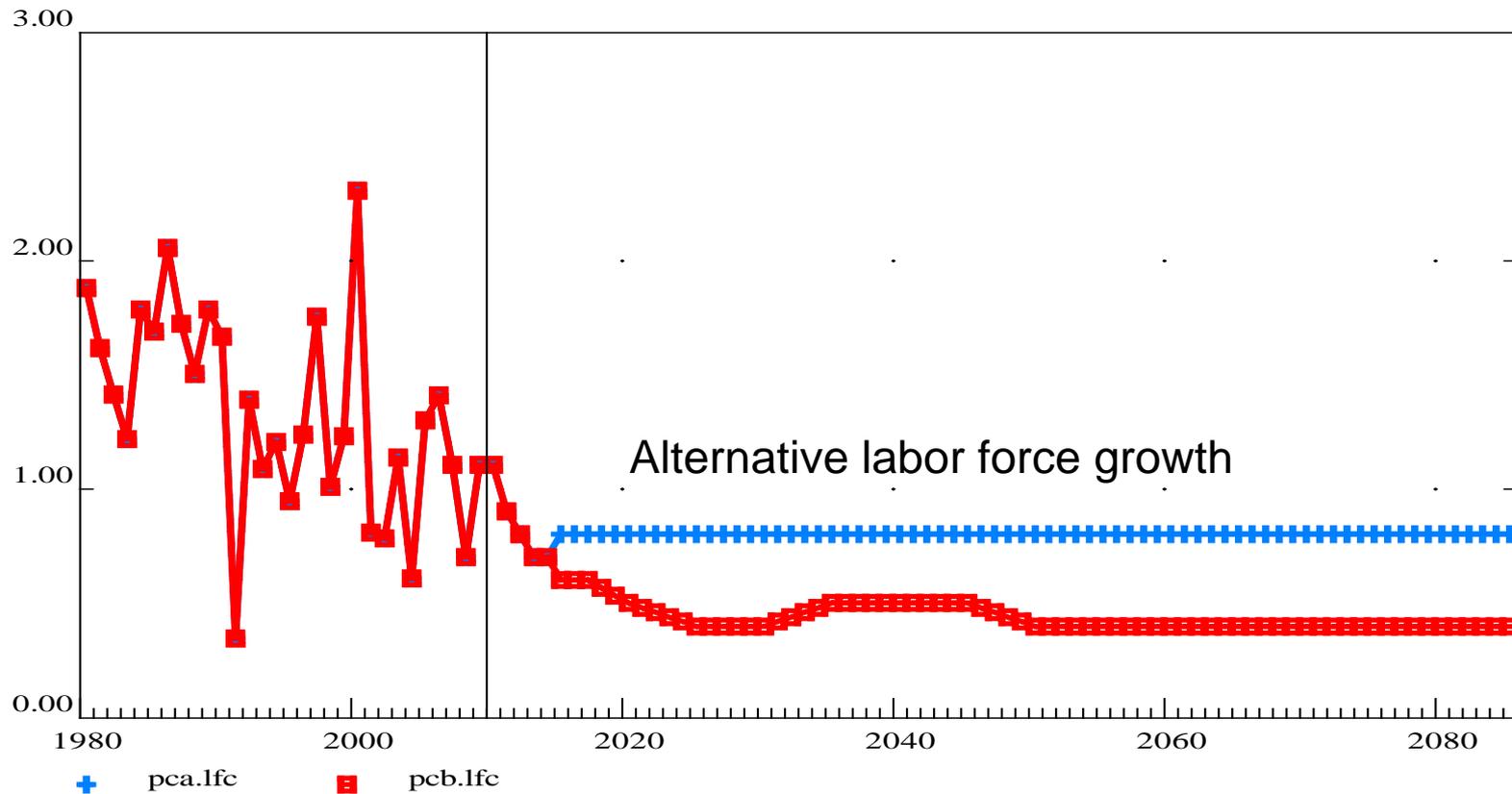


Federal balance: sustainability requires much larger tax rates.

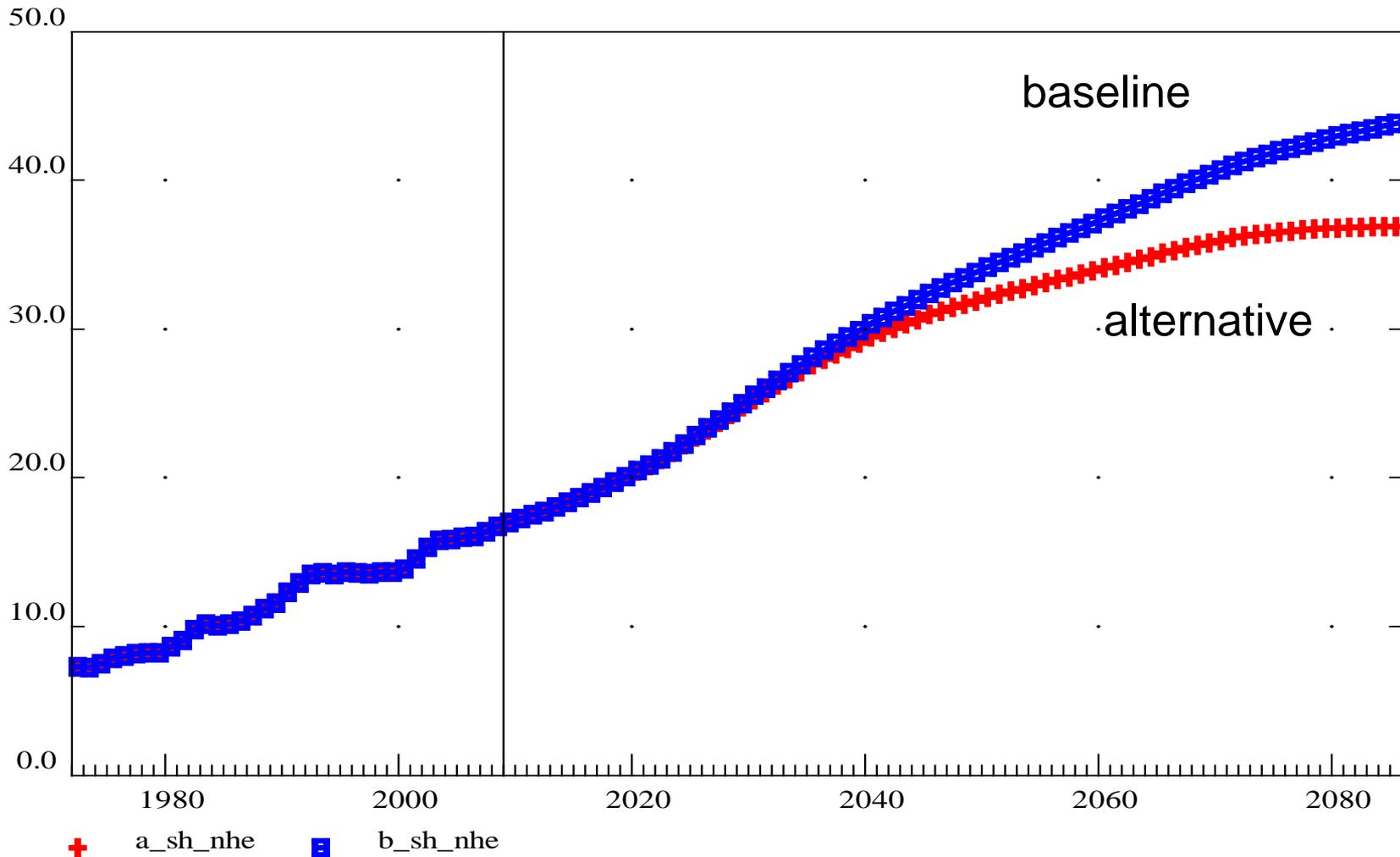


How sensitive is baseline scenario to labor force growth?

Percent change



NHE as percent of GDP is lower ...



...so tax burden is lower.

