When Beauty Meets Reality

Priceless Method, Worthless Results

Moderní nástroje pro finanční analýzu a modelování, Praha
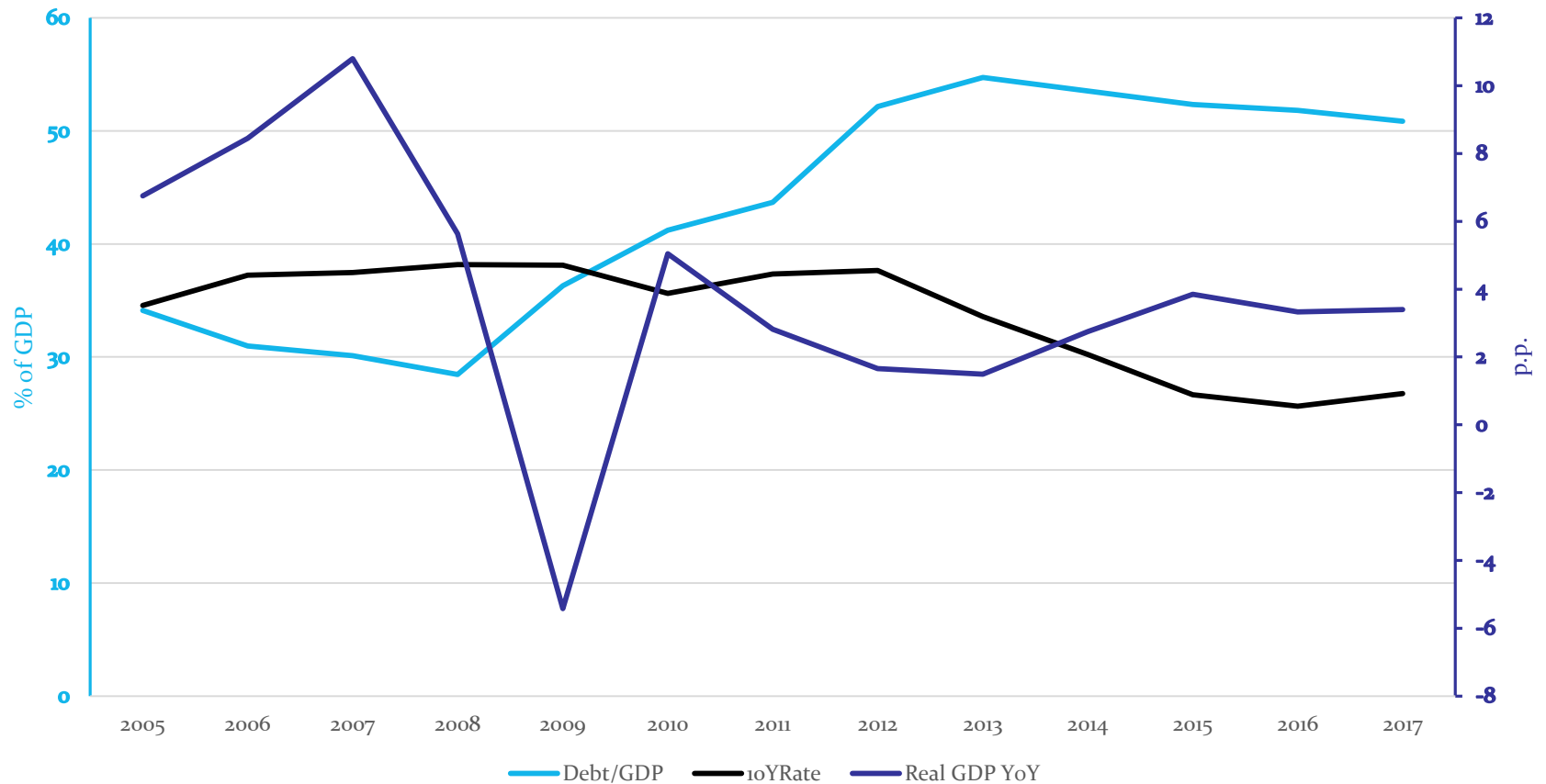
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Motivation

Q1: What is the optimal level of public debt?
Q2: How much to tax household income?

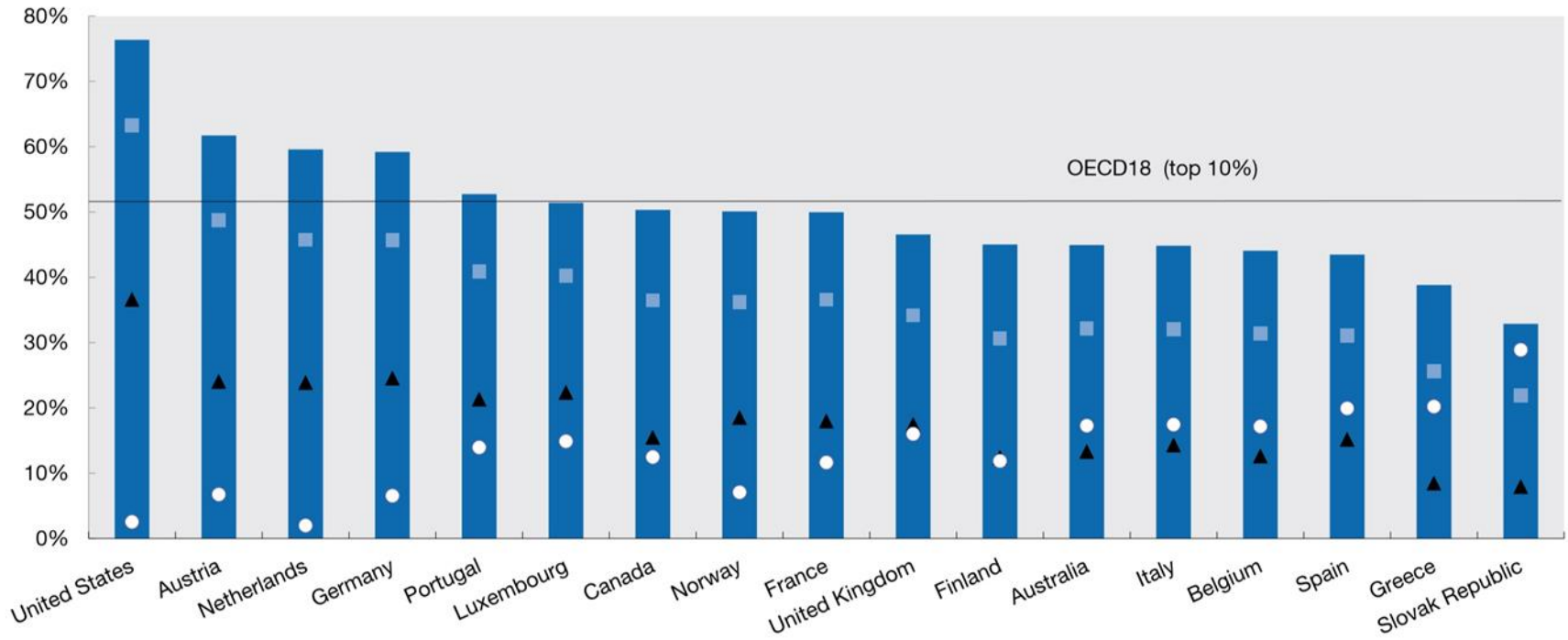# Intuition

Slovakia: Key indicators
(Source: Eurostat)

Intuition

Wealth shares of top percentiles of the net wealth distribution
(Source: OECD)

Motivation

Q1: What is the optimal level of public debt?

➢ representative agent macro model: quantity of public debt is irrelevant for private decision making

➢ heterogeneous agents face idiosyncratic shocks: public debt can have important consequences for agents' decisions

➢**Q2: How much to tax household income?**

➢ trade-off between insurance and efficiency

Model framework à la Bewley-Huggett-Aiyagari embedded by
➢ Government's provision of **productive public goods & infrastructure**
➢ **Transitional dynamics** of the economy
⟹ crucial implications on the characterization of the optimal public debt

Analytical Framework

Households:

➢ Incomplete insurance markets, non-trivial borrowing constraint

➢ Partial insurance against idiosyncratic labour income shock: accumulation of assets (capital + gov.bonds)

➢ Nonseparable utility augmented by the supply public goods

Firms

➢ Homogeneous output produced using neoclassical technology

➢ Presence of public infrastructure (productivity spillovers)

Government

➢ Tax levied on labour & capital income

➢ Transfers, productive and nonproductive spending

➢ Bonds issuance & purchase

Solution
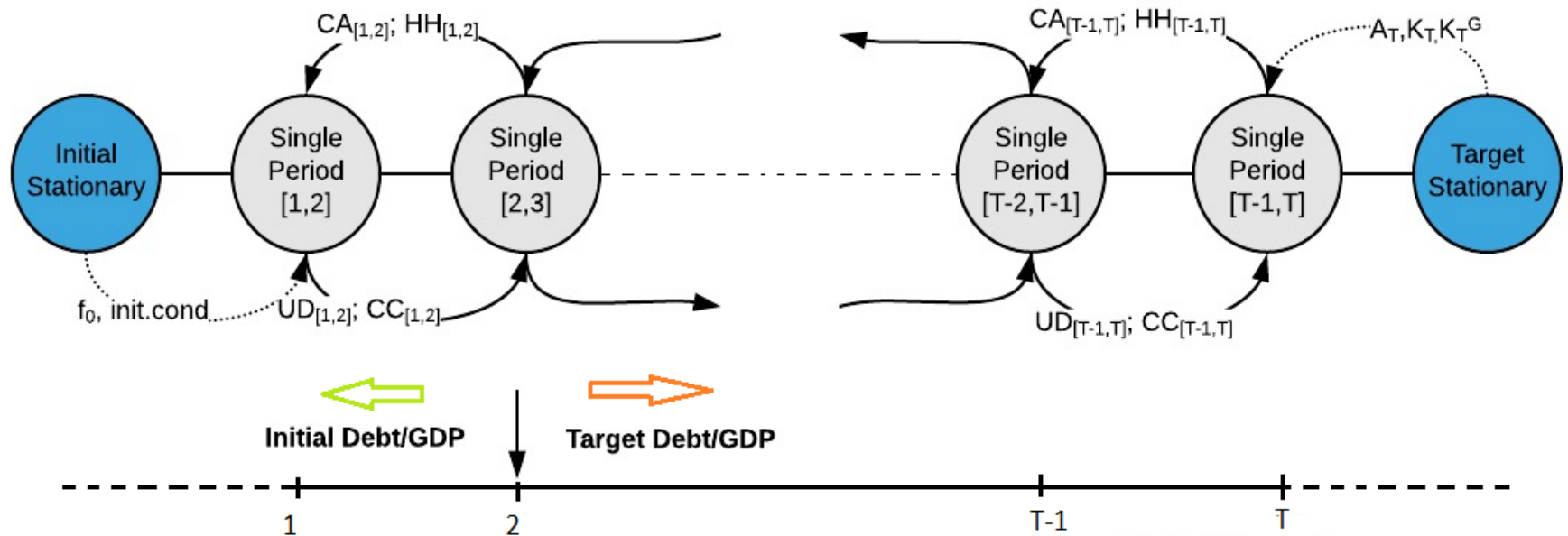
Stationary model: solution determination scheme
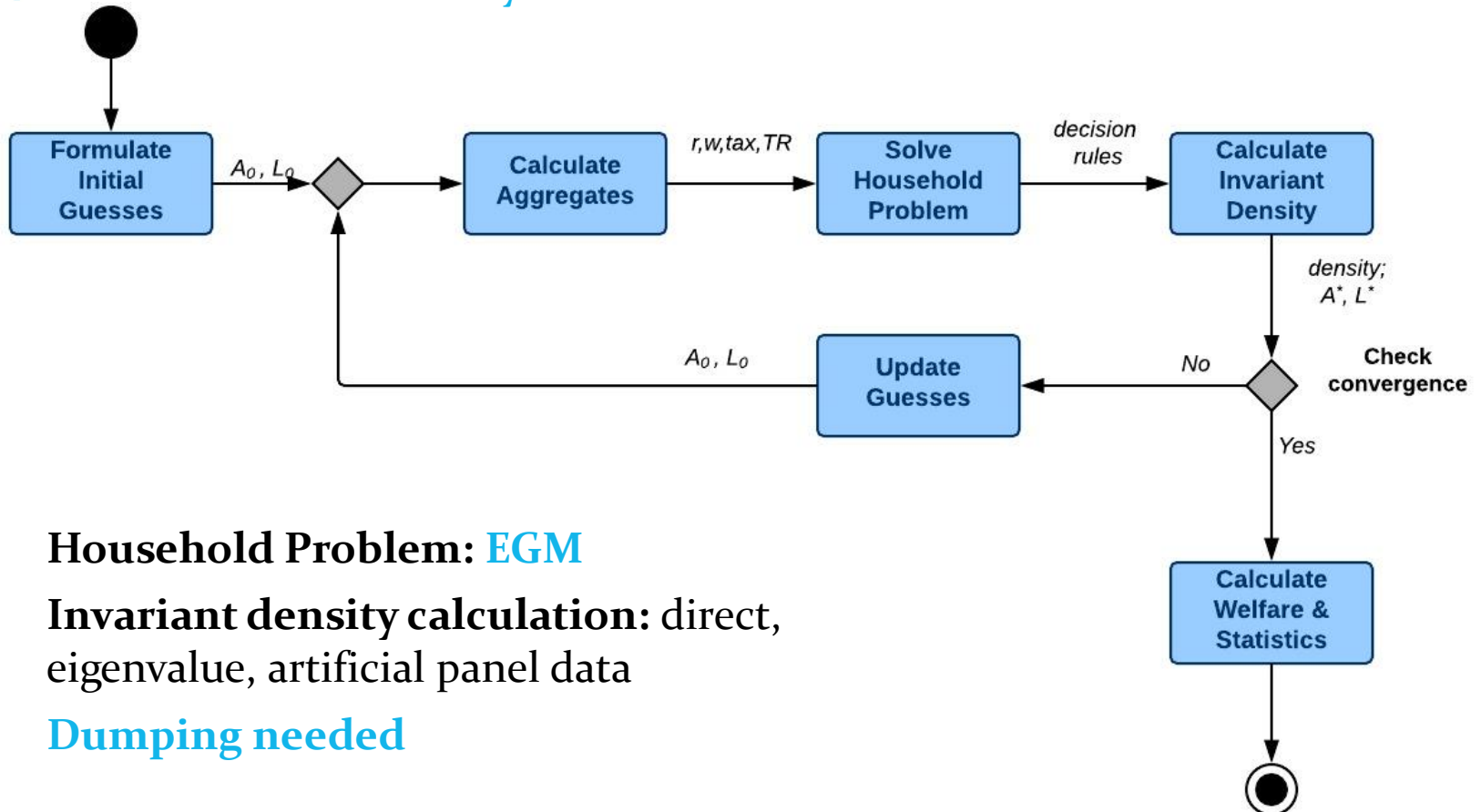
Household Problem: EGM

Invariant density calculation: direct, eigenvalue, artificial panel data

Dumping needed

Solution

Transition paths: solution determination scheme

Transition paths between 2 equilibria: e.g. fiscal (tax) reform introduced in period 2 leads to change in debt/GDP ratio

**Convergence & stability issues** : role of initial judgements

Calibration

parameters	value
labour share	0.5
depreciation rate	0.1
public goods elasticity	2
public goods weight	0
infrastructure elasticity	0.065
debt/GDP	50%
unprod.consumtion/GDP	14.30%
public investment/GDP	3.60%
transfers/GDP	14.10%
public goods/GDP	5%
time discount rate	0.9075
private consumption elasticity	2.25
labour supply elasticity	0.5771
borrowing constraint	-0.01
income shocks	0.105,0.295,0.965,1.290,2.815
transition matrix	5D

| key indicators	target	model
interest rate	17.17%	17.18%
tax rate	50.55%	50.55%
private capital/gdp	184.00%	167.00%
total investment/gdp	22.00%	22.00%
labour	29.00%	29.06%
gini wealth	0.49	0.5025
gini income	0.59	0.5945
pct wealth	1.3; 8.1; 13.4; 19.1; 58.2	1.7,8.5,14.0,20.2,55.6
pct income	0,0.59,15.03,30.62,53.76	0, 0.5,15.1,28.8,54.7
indebted households	6%	5.86%

Calibration: Painful & time-consuming process ⟹ Smart approach is inevitable
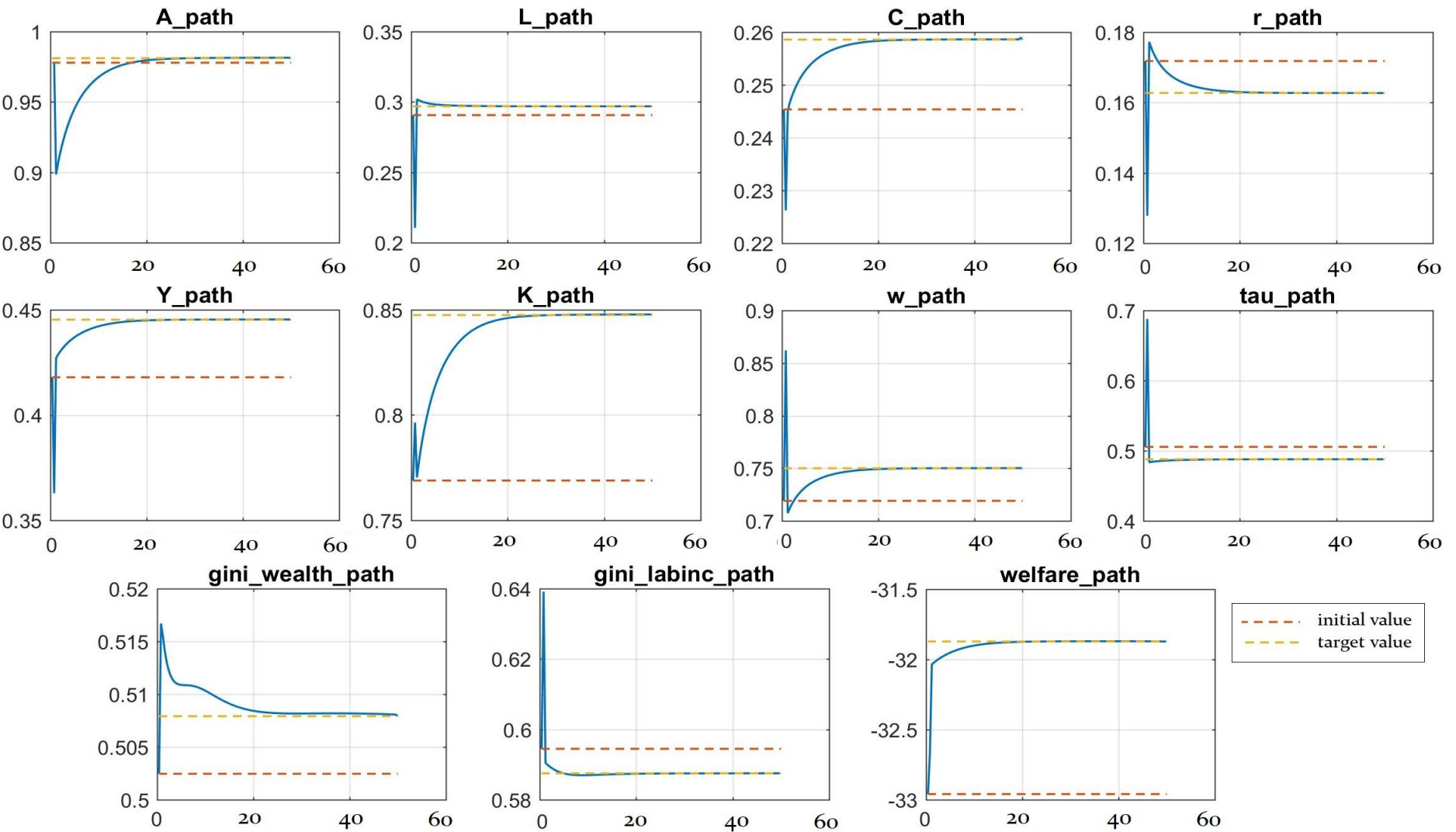
Results
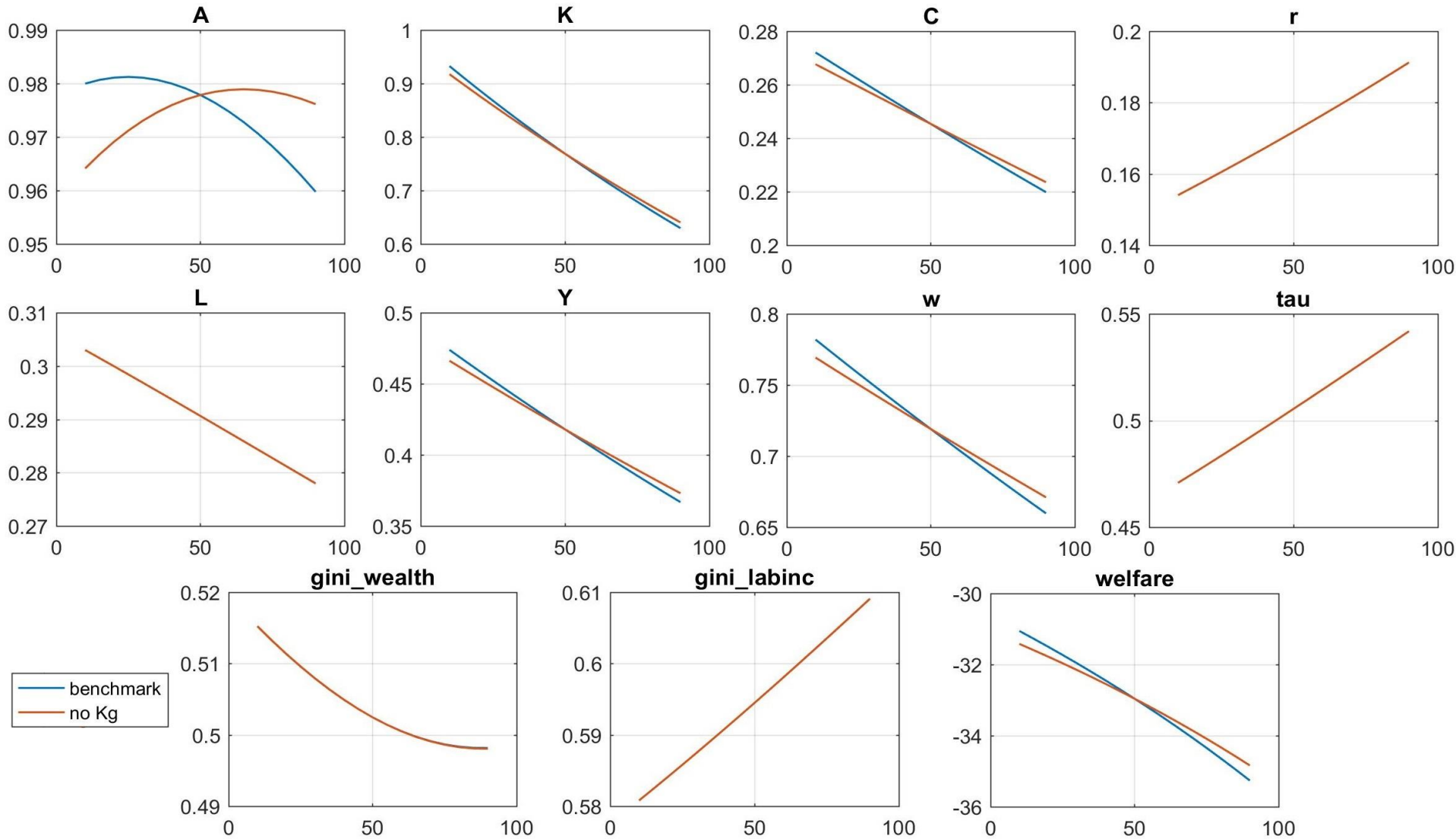
Adjustment in aggregate variables in stationary models (x-axis = debt/GDP)

Results
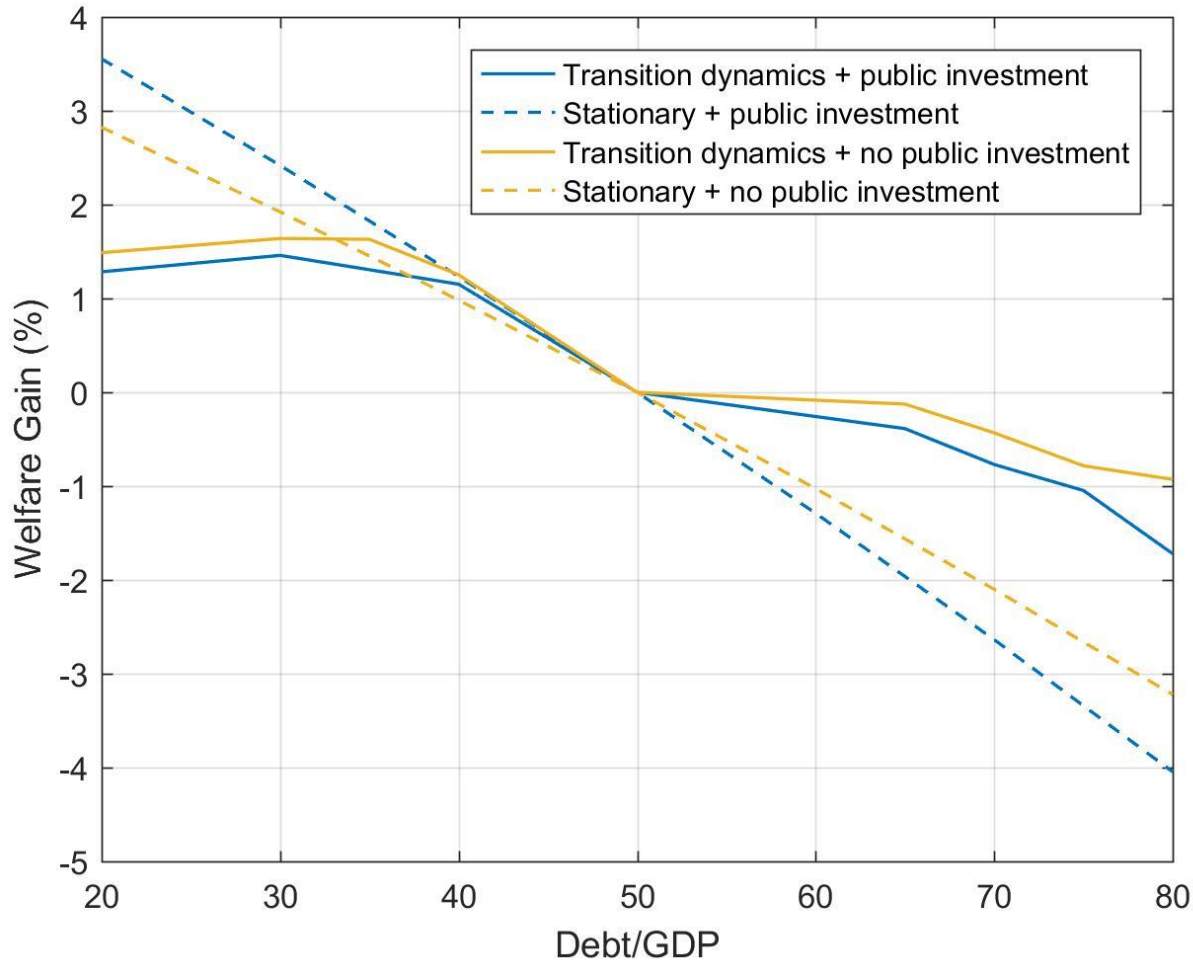
Consumption (welfare) gain including/ignoring transition dynamics

Results

Transition paths: moving to the optimal debt level

Conclusions

Transition dynamics included/excluded:

➢ No dynamics: accumulate assets

➢ With dynamics: 30-35% Debt/GDP is optimal

   ➢ Considerably smaller welfare effects when dynamics is included

   ➢ Relatively flat welfare profile

➢ Lower level of taxation is optimal

Presence of public infrastructure

➢ Amplification effect

➢ Reduces households precautionary saving motives

Appendix

Households:

$$U(c, h; PG) = \theta \frac{(c^\eta (1-h)^{1-\eta})^{1-\sigma}}{1-\sigma} + (1-\theta) \frac{PG^{1-\zeta}}{1-\zeta}$$

$$c + a' \leq (1 + (1-\tau)r)a + (1-\tau)weh + TR; a' \geq \bar{a}; e \sim \pi$$

$$V(a, e; PG) = \max_{c,h,a'} \{ U(c, h; PG) + \beta \sum_{e'} \pi(e'|e) V(a', e') \}$$

Firms:

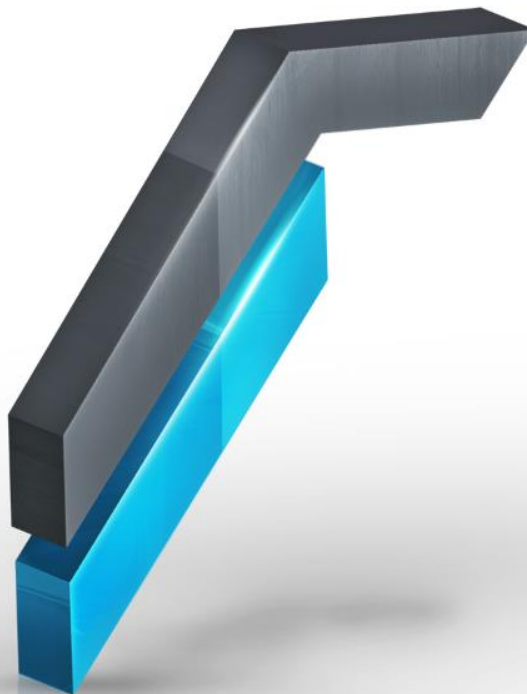$$\max_{K,L} (Y(K, L) - wL - (r + \delta)K)$$

$$Y = K_G^\phi K^\alpha L^{1-\alpha}$$

Government:

$$B' \leq (1 + r)B + G_i + G_c + TR + PG - \tau(wL + rA)$$

$$K_g' = G_i + (1-\delta)K_g$$

$$A = K + B; C + \delta K + G_i + G_c + PG = Y$$

**Thank you for your
attention**