Comparative Analysis of Fiscal Policies in an aging economy

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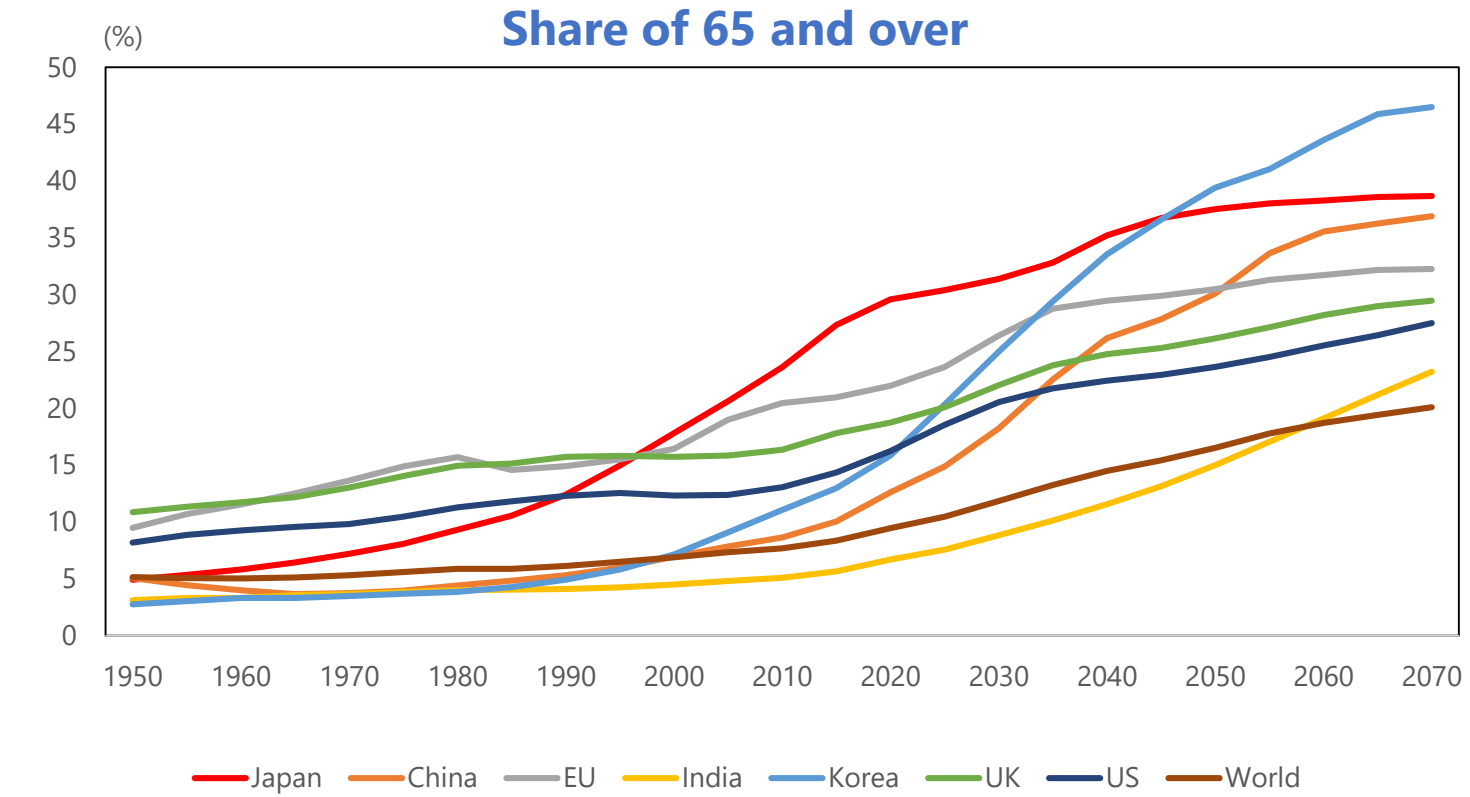
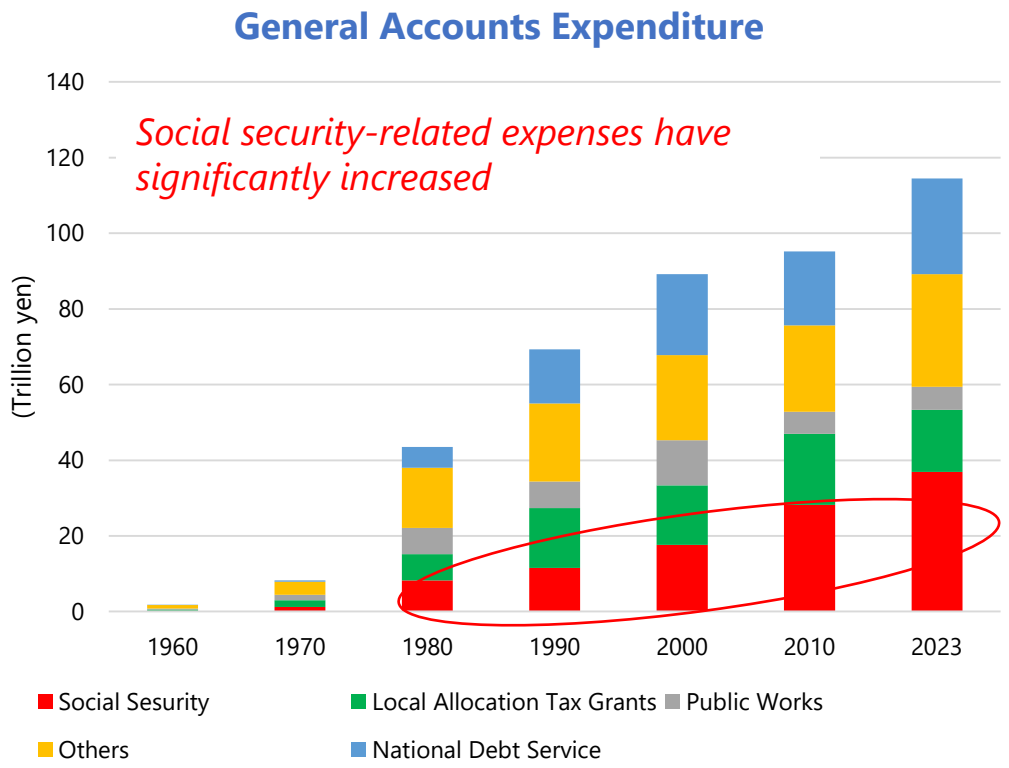
Aging populations challenge policymakers worldwide



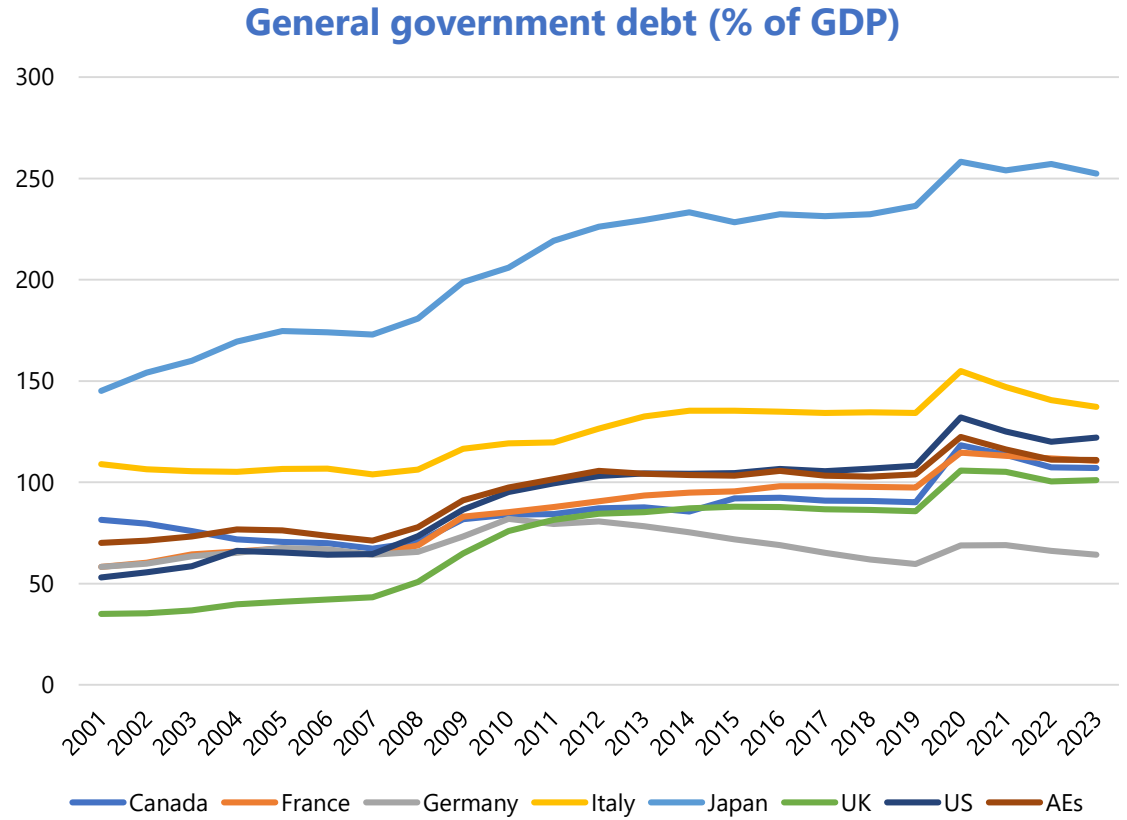
Source: UN

- Both advanced and emerging economies are experiencing aging.
- Japan is the most aged country globally.

Aging increases social security costs, straining public finances



Source: MoF



Source: IMF

- Ensuring fiscal sustainability is crucial.
- Examining fiscal policy effects is essential.

Motivation

- Recent studies analyze the impact of aging on fiscal policy effectiveness.
  - Honda and Miyamoto (2021), Basso and Rachedi (2021), Miyamoto and Yoshino (2022)

- These studies focus on government consumption but lack in-depth analysis of fiscal expenditure composition.

- They do not clarify the mechanisms through which aging affects fiscal policy.

Purpose

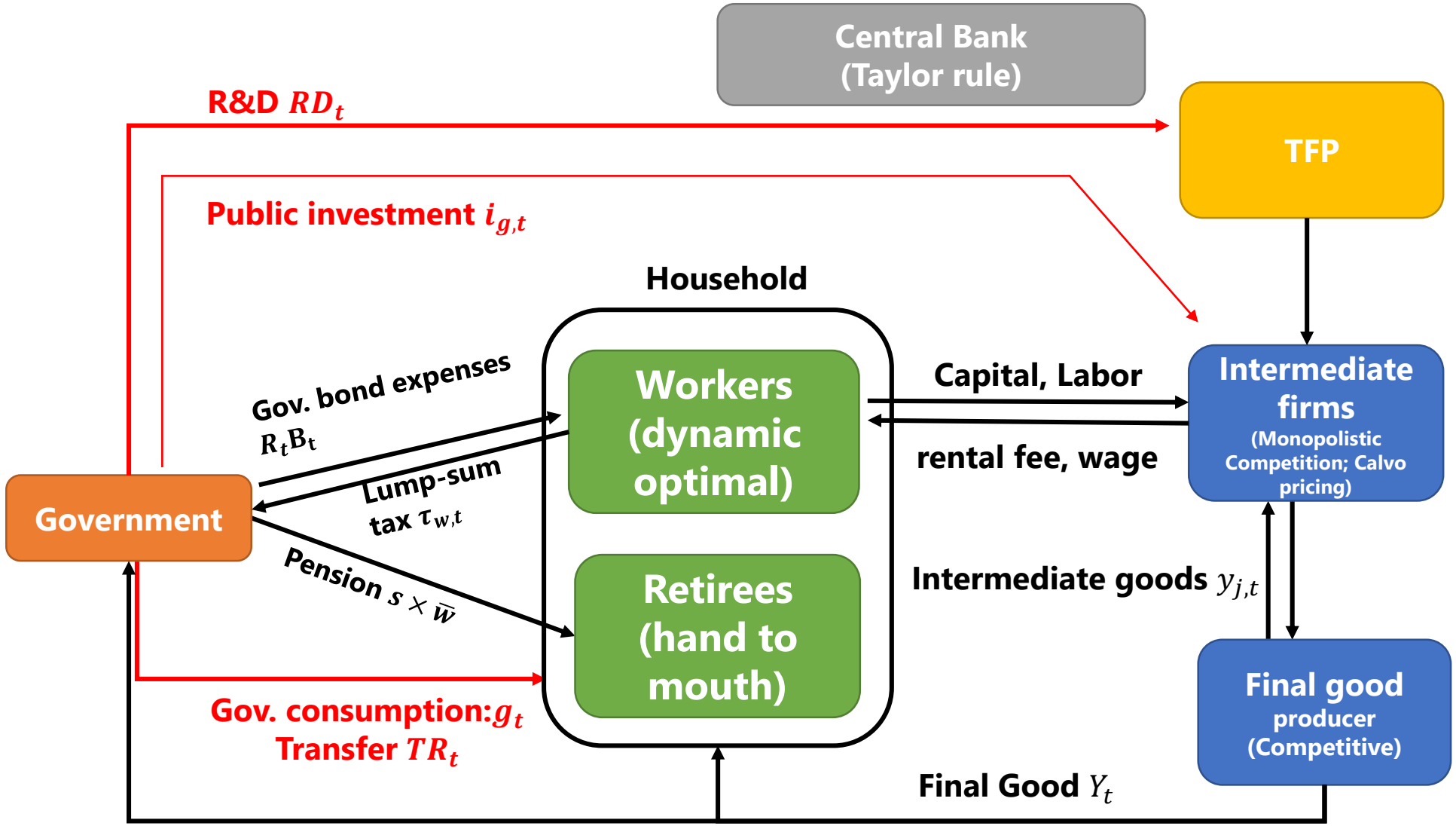
- Use a DSGE model to analyze the impact of aging on four types of fiscal policies:
  1. Government consumption to stimulate aggregate demand
  2. Universal transfer to all households
  3. Public investment in infrastructure
  4. R&D expenditure to foster technological progress

- DSGE model with heterogenous agents
  - Young (workers) and old (retirees)

Main Results

- Output effects of government consumption, investment, and R&D expenditure shocks decrease with aging.
- R&D expenditure shock is the most effective regardless of aging.
- Public investment shock ranks second in the long run; government consumption shock is second in the short run.

Model Overview



Model

- Two agents: workers (ϕ) who maximize utility, and retirees (1-ϕ) who consume hand-to-mouth.

- Worker's problem: optimize consumption and labor supply

$$\underset{c_{w,t},k_{w,t},h_{w,t},b_{w,t}}{Max} \; \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{1}{1-\sigma} \left[\left\{ \omega c_{w,t}^{\frac{\zeta-1}{\zeta}} + (1-\omega) g_t^{\frac{\zeta-1}{\zeta}} \right\}^{\frac{\zeta}{\zeta-1}} \right]^{1-\sigma} - \frac{h_{w,t}^{1+\mu}}{1+\mu} \right\}$$

$$s.t. \; c_{w,t} + k_{w,t} + b_{w,t} = w_t h_{w,t} + r_{k,t} k_{w,t-1} + (1-\delta) k_{w,t-1} + R_{t-1} \frac{b_{w,t-1}}{\pi_t} - \tau_{w,t} + TR_{w,t}$$

- Retiree's problem: consume given income

$$c_{r,t} = s * \bar{w} + TR_{r,t}$$

Model

- Intermediate firms produce goods

$$y_{j,t} = A_t (k_{j,t-1})^{\alpha} (h_{j,t})^{1-\alpha} k_{g,t}^{\alpha_g} \ , 0 < \alpha < 1, \ \ 0 < \alpha_g < 1$$

- R&D expenditure affects TFP

$$log(A_t) = \rho_a log(A_{t-1}) + \rho_{ag} \left(\frac{RD_t}{Y_t} - \frac{\overline{RD}}{\bar{Y}} \right) + \epsilon_a$$

  - A_t:TFP, RD_t:R&D expenditures, Y_t:GDP

Fiscal Authorities

- The accumulation of public capital

$$k_{g,t} = i_{g,t} + (1-\delta)k_{g,t-1}$$

- Public investment $i_{g,t}$ follows

$$\log(i_{g,t}) = (1-\rho_{ig})\log\left(\overline{i_g}\right) + \rho_{ig}\log(i_{g,t-1}) + \epsilon_{ig,t},\ \epsilon_{ig,t} \sim N(0,\sigma_{ig}^2).$$

- Government consumption g_t follows

$$\log(g_t) = (1-\rho_g)\log\left(\overline{g}\right) + \rho_g\log(g_{t-1}) + \epsilon_{g,t},\ \epsilon_{g,t} \sim N(0,\sigma_g^2).$$

- The one-time transfer follows

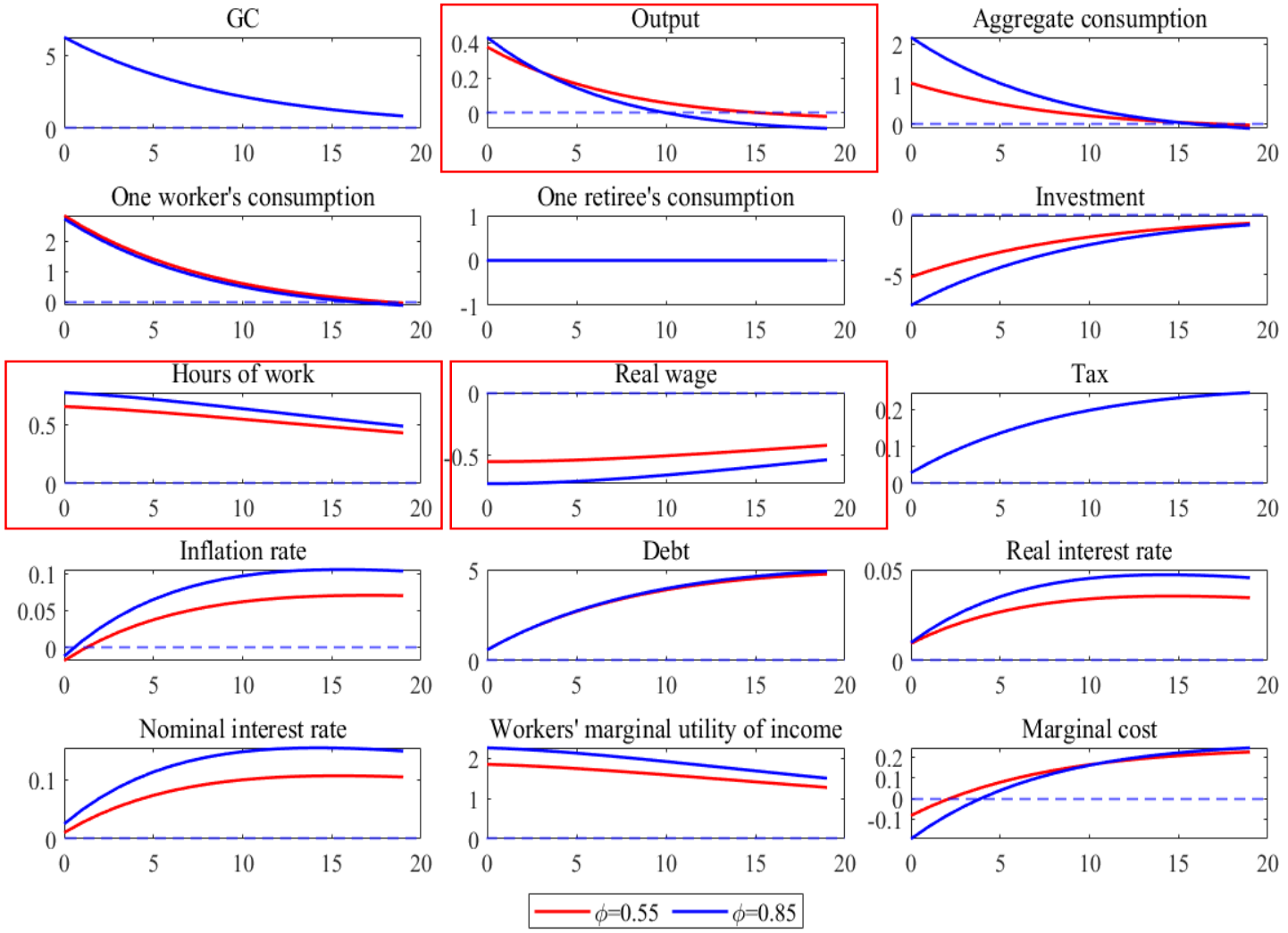
$$\log(TR_t) = (1-\rho_{tr})\log\left(\overline{TR}\right) + \rho_{tr}\log(TR_{t-1}) + \epsilon_{tr,t},\ \epsilon_{tr,t} \sim N(0,\sigma_{tr}^2).$$

Calibration

- Parameters calibrated to the Japanese economy.
- Model period: one quarter.
- Fiscal policy shock: 0.01% of GDP.

Impact of Gov. Consumption Shock

- Future tax burden for workers:
  - Negative wealth effect
  - LS ↑, Output ↑, Real wages ↓
- GC complements PC:
  - Worker consumption ↑
- Retiree consumption unchanged:
  - $c=\phi c_w\uparrow+(1-\phi)c_r$
- Total demand > Total supply:
  - Inflation ↑
- Taylor rule: interest rate ↑
- Market clearing condition:
  - $i=Y-c\uparrow-g\uparrow-RD$
  - Investment ↓



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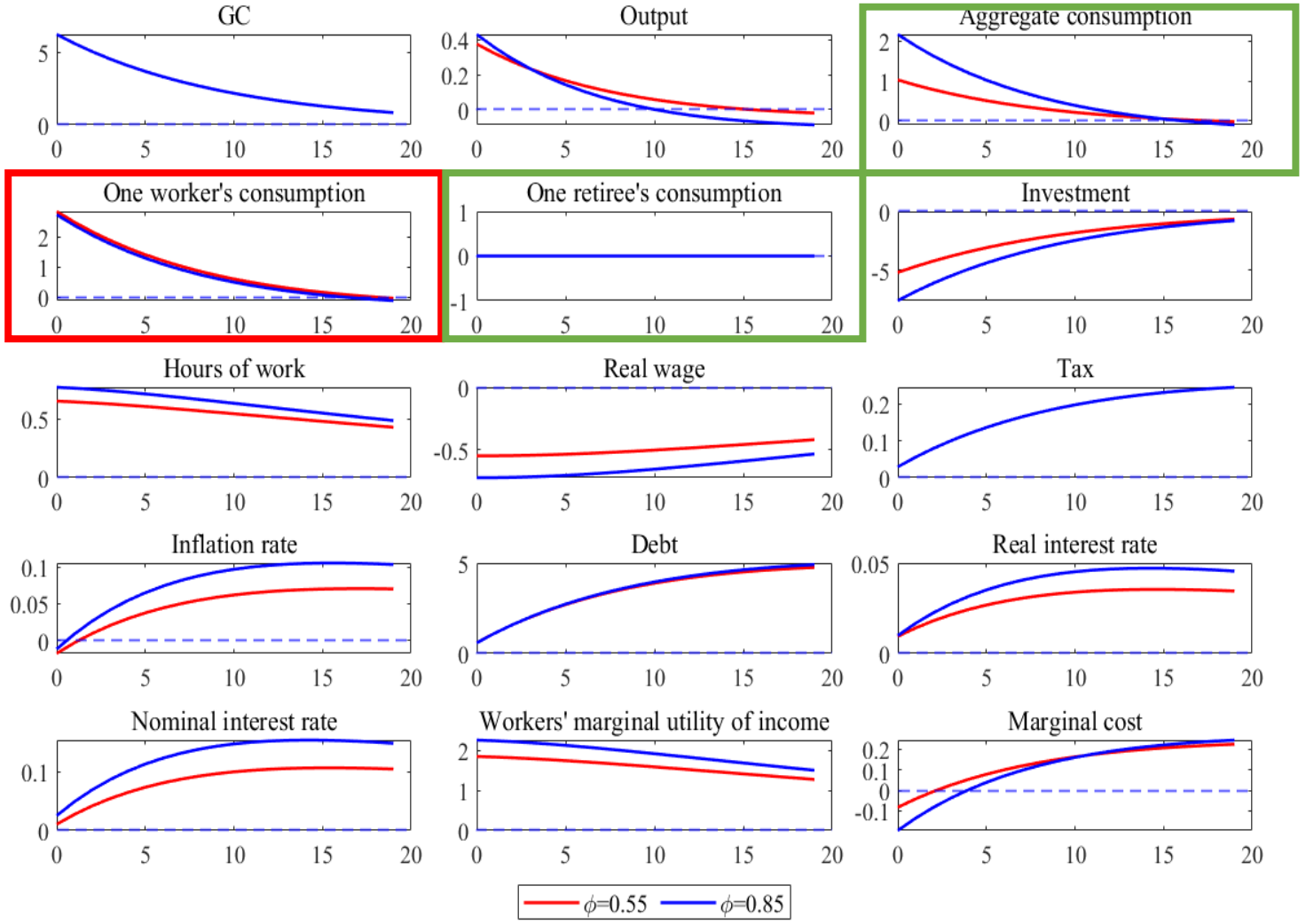

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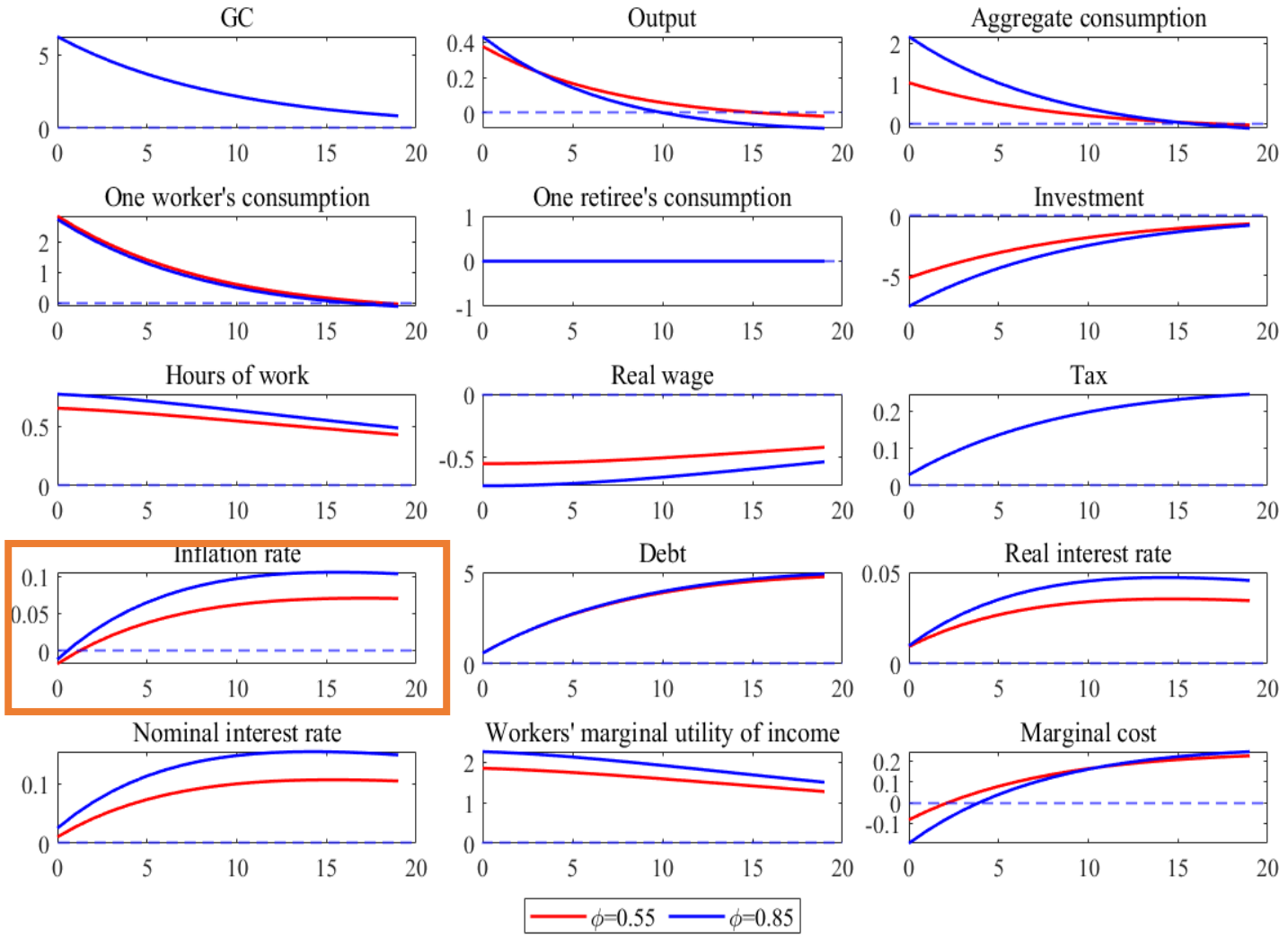

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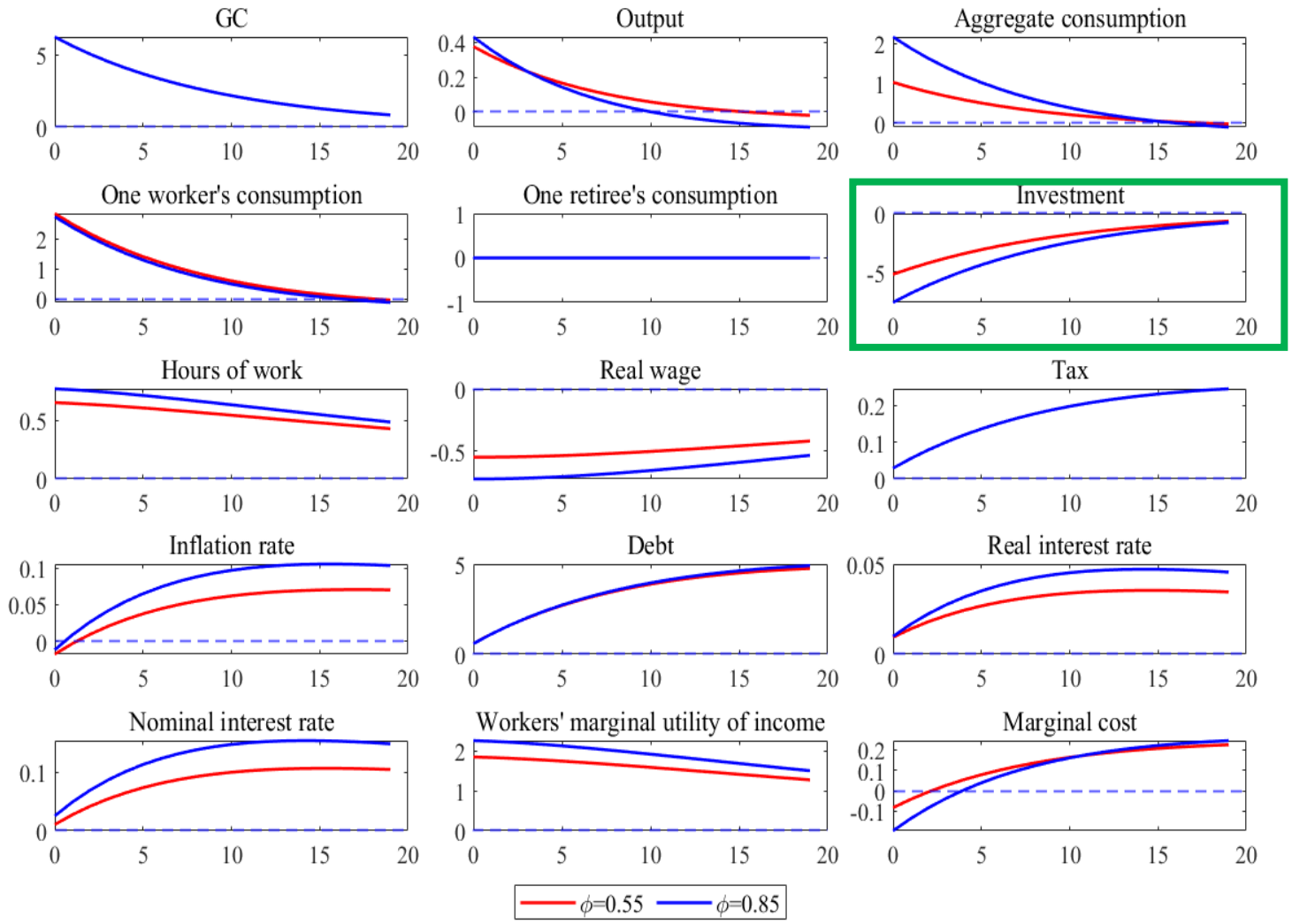
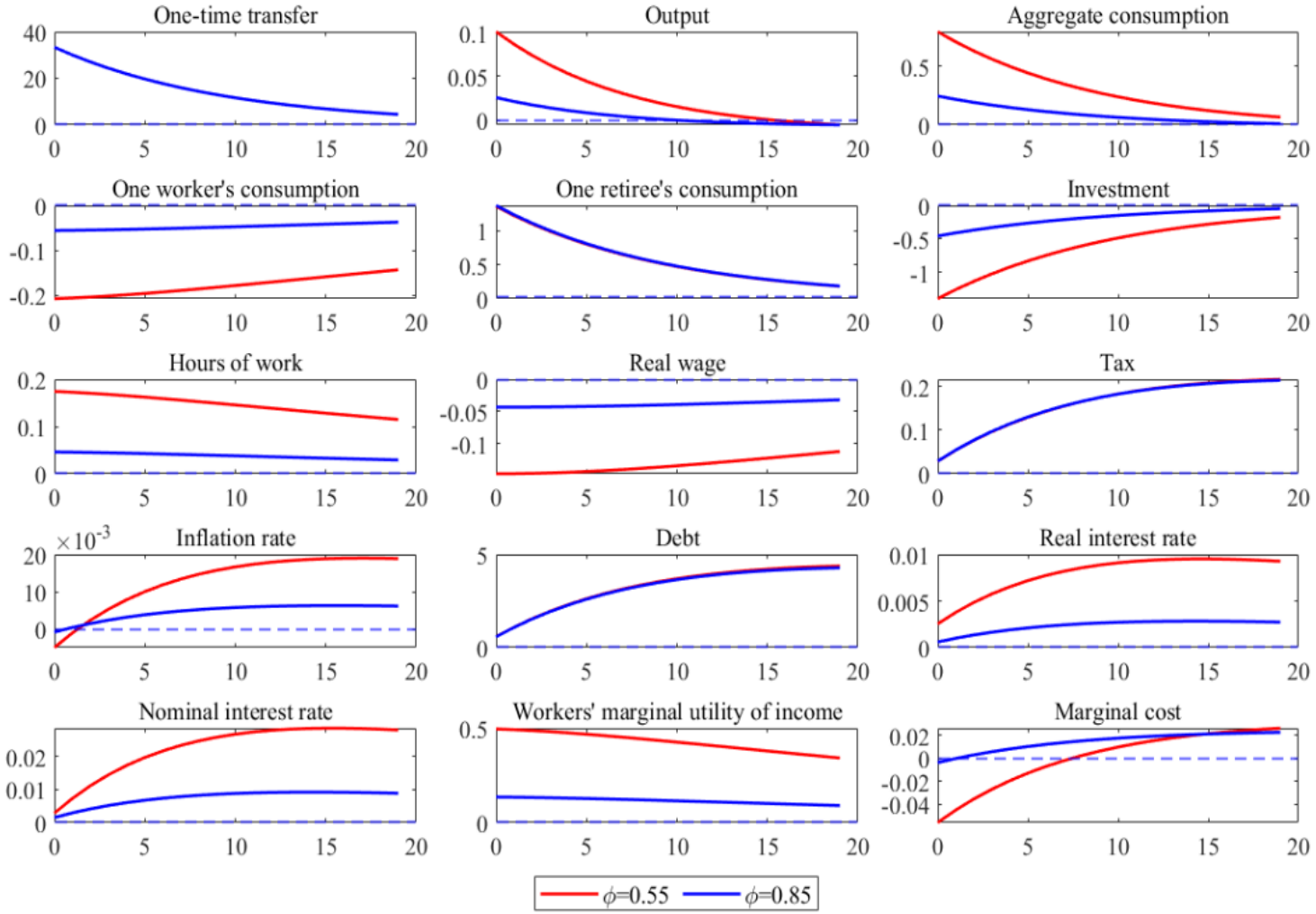


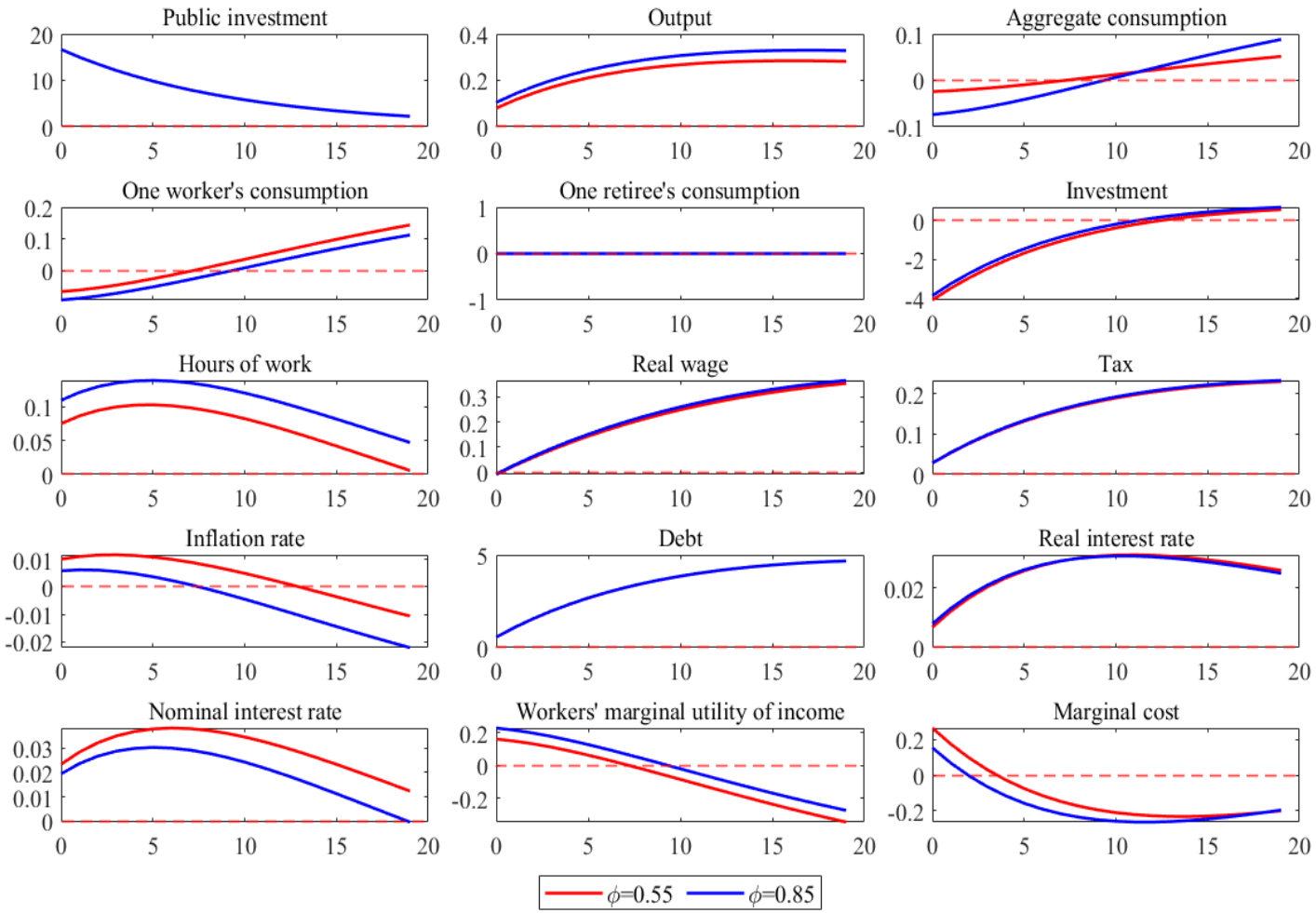
Effects of Universal Transfer Increase

- Retirees consume all subsidies:
  - Retiree consumption ↑↑
- Worker tax burden increases:
  - Negative wealth effect
  - Worker consumption ↓, Labor supply ↑, Output ↑
  - $c=\phi c_w\downarrow+(1-\phi)c_r\uparrow\uparrow$
  - Total consumption ↑
- Total demand > Total supply:
  - Inflation ↑
- CB Taylor rule:
  - Nominal & Real interest rate ↑
- Market clearing condition:
  - Investment ↓



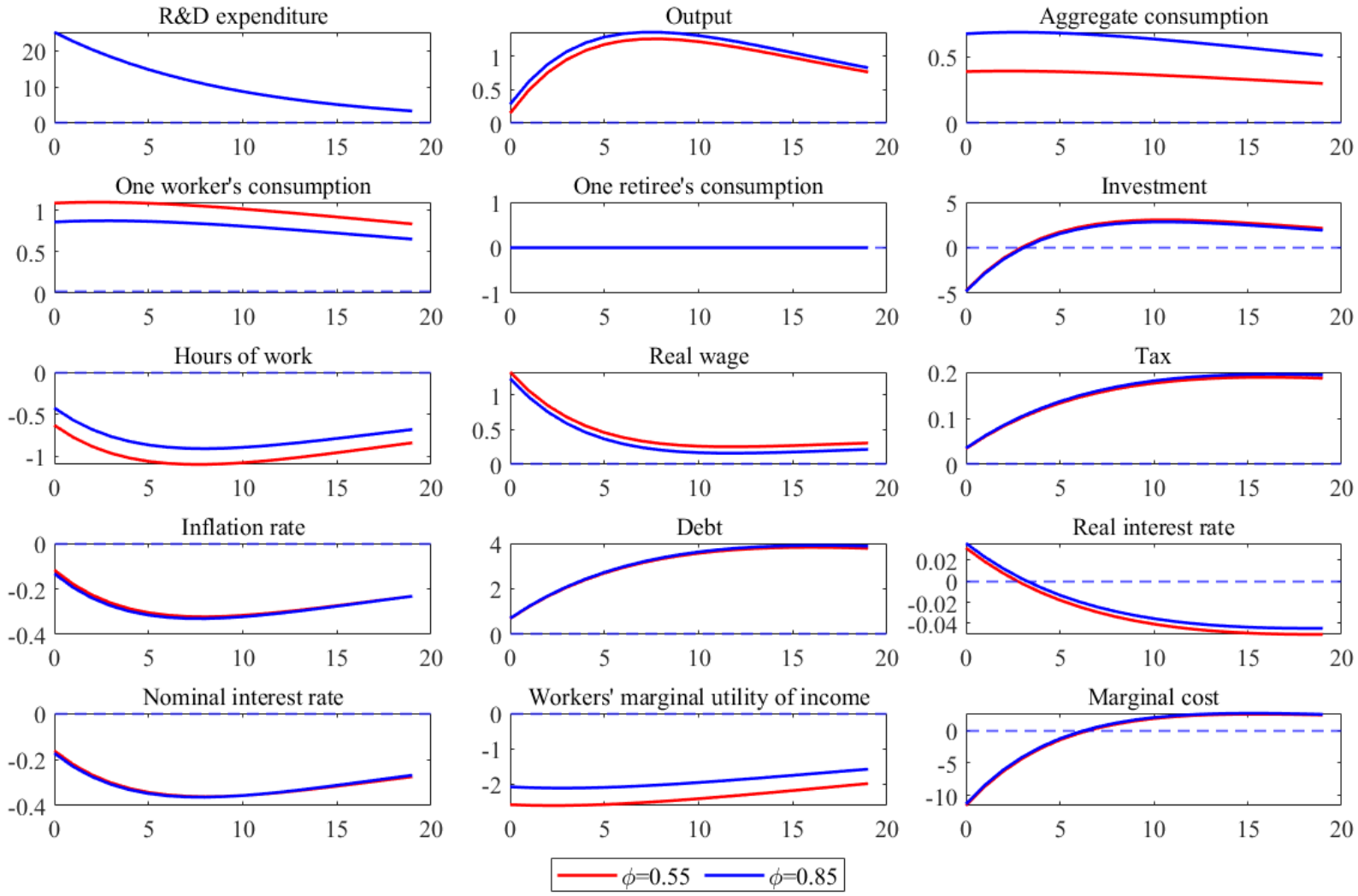
Effect of Public Investment Shock

- Public capital accumulation:
  - Output ↑, LP ↑, Wages ↑
- SR: Negative wealth effect:
- LR: Positive wealth effect
  - Labor supply ↑ ⇒ ↓
  - Worker consumption ↓ ⇒ ↑
- Retiree consumption unchanged:
  - Total consumption ↓ ⇒ ↑
- SR: Demand > Supply:
- LR: Demand < Supply
  - Inflation ↑ ⇒ ↓



Effects of R&D Expenditure Shock

- Significant TFP increase:
  - Output ↑, Productivity ↑, Wages ↑
- Positive wealth effect:
  - Labor supply ↓
  - Worker consumption ↑
- Retiree consumption unchanged:
  - Total consumption ↑
- Supply > Demand:
  - Inflation ↓



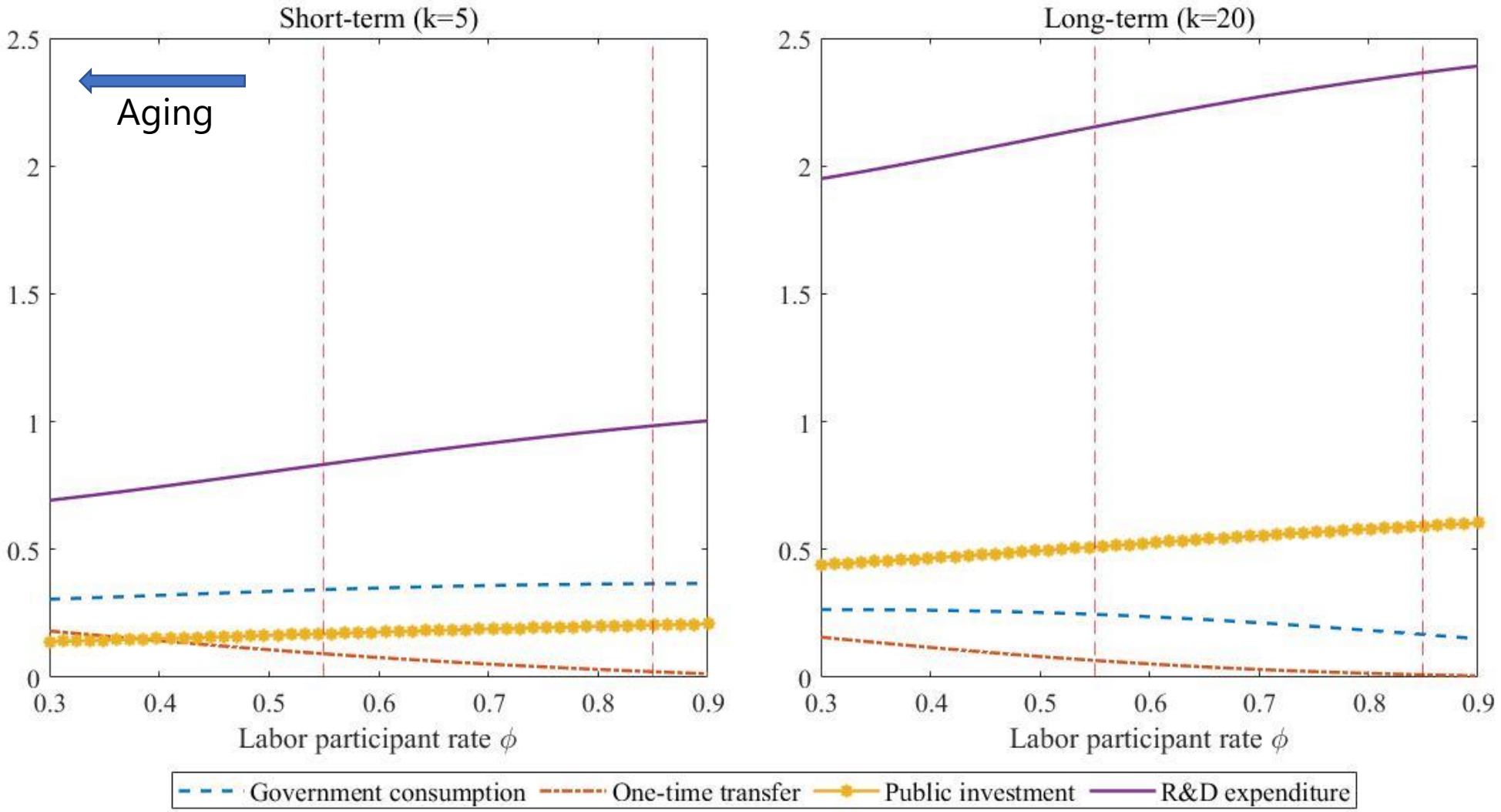
Fiscal Multiplier

- Following Mountford and Uhlig (2009), compute the present value output multiplier.

$$PV(Y_k|_\phi) = \frac{E_0 \Sigma_{j=0}^{k} \beta^j \Delta Y_j|_\phi}{E_0 \Sigma_{j=0}^{k} \beta^j \Delta G_j|_\phi} \quad , \; k \in \{5, 20\}$$

  - $\Delta X_j \mid_\phi$：Deviation of X from its steady state value with respect to ϕ

Comparison of Fiscal Multipliers



Conclusion

- Short-term demand-stimulating measures (government consumption and universal transfers) boost GDP. Supply-side policies (R&D expenditure and public investment) support medium- to long-term growth.

- Aging reduces fiscal policy effectiveness due to:
  - Lower labor supply
  - Reduced consumption stimulus

- Structural reforms, especially labor market reforms, are needed to enhance fiscal policy effectiveness in an aging economy.

- Secure sufficiently large fiscal room during normal times, to prepare effective fiscal stimulus, without creating concerns for fiscal sustainability.