Fiscal Multipliers in Small Open Economies With Heterogeneous Households

Jeppe Druedahl Søren Hove Ravn Laura Sunder–Plassmann
Jacob Sundram Nicolai Waldstrøm

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Introduction

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- What about small open economies?

- Potentially mitigating factors:
  - Real exchange rate appreciates $\Rightarrow$ Net exports fall
  - Consumer spending is in part on foreign goods

Related literature

- Massive older literature. Focus on wealth effects, response of monetary policy,
  - Closed economy: Barro '81, Aiyagari et al. '92, Baxter et al. '93, Woodford '11, Christiano et al. '11...
  - Open economy: Mundell '63, Fleming '62, Erceg et al. '12, Corsetti et al. '13, Nakamura et al. '14...
- Newer literature using TANK/HANK models starting with Galí et al. (2007)
  - Closed economy:
    - General: Guerrieri et al. '17, Kaplan et al. '18, Auclert et al. '20, Bayer, Born, et al. '23, Faccini et al. '24
    - Fiscal policy: Oh et al. '12, McKay et al. '16, Hagedorn et al. '19, Auclert, Rognlie, and Straub '24, Faccini et al. '24
  - Open economy:
    - General: De Ferra et al. '20, Bellifemine et al. '22, Hochmuth et al. '22, Guo et al. '23, Bayer, Kriwoluzky, et al. '23, Oskolkov '23, Auclert, Rognlie, Souchier, et al. '24, Druedahl et al. '24, Acharya et al. '25, Ferrante et al. '25

Model Framework

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- **Nominal rigidities**: Sticky wages generate a New Keynesian wage Phillips curve

Household problem

- Continuum of ex-ante identical households. Choose c_{it}, a_{it} to solve:

$$V_{i,t} = \max_{c_{it}, a_{it}} u(c_{it}) - \nu(L_t) + \mathbb{E}_t \beta V_{i,t+1}$$

$$\text{s.t.}$$

$$c_{it} + a_{it} = (1 + r_t) a_{it-1} + e_{it} \times Z_t$$

$$\ln e_{it} = \rho_e \ln e_{it-1} + \epsilon^e_{it}, \quad \epsilon^e_{it} \sim \mathcal{N}(0, \sigma^2_e),$$

$$a_{it} \geq 0$$

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- $\boldsymbol{Z_t} = (1 - \tau_t) \frac{W_t}{P_t} L_t$: Aggregate real labor income (post tax)

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- $\boldsymbol{r_t}$: Real return on assets

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- Aggregates:

$$C_t = \int c_{it}\,\mathrm{d}i, \qquad A_t = \int a_{it}\,\mathrm{d}i$$

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- Compare with representative agent framework where only permanent income matters:

$$u'\left(C_t\right) = \beta\left(1 + r_{t+1}\right) u'\left(C_{t+1}\right)$$

Sequence space representation

- Individual household demand $c_{i,t}$ depends on $c_{i,t} = f_i\left(\{Z_s, r_s\}_{s=0}^{\infty}\right)$

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$$d\boldsymbol{C} = \boldsymbol{M}\, d\boldsymbol{Z} + \boldsymbol{R}\, d\boldsymbol{r}$$

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- **Sequence space** representation. Convenient representation of complex dynamic system

MPC Matrix

- MPC matrix (Jacobian) **M** is central difference between RANK and HANK

$$\boldsymbol{M} = \begin{bmatrix} \frac{\partial C_0}{\partial Z_0} & \frac{\partial C_0}{\partial Z_1} & \frac{\partial C_0}{\partial Z_2} & \cdots \\ \frac{\partial C_1}{\partial Z_0} & \frac{\partial C_1}{\partial Z_1} & \frac{\partial C_1}{\partial Z_2} & \cdots \\ \frac{\partial C_2}{\partial Z_0} & \frac{\partial C_2}{\partial Z_1} & \frac{\partial C_2}{\partial Z_2} & \cdots \\ \frac{\partial C_3}{\partial Z_0} & \frac{\partial C_3}{\partial Z_1} & \frac{\partial C_3}{\partial Z_2} & \cdots \\ \frac{\partial C_4}{\partial Z_0} & \frac{\partial C_4}{\partial Z_1} & \frac{\partial C_4}{\partial Z_2} & \cdots \\ \vdots & \vdots & \vdots & \ddots \end{bmatrix}$$

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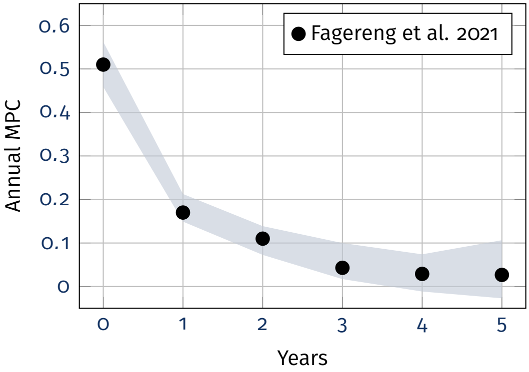
- Fagereng et al. (2021) identifies first elements of ***M***
  - Norwegian MPC estimates using lotteries for identification



First column of **M**: response $\frac{\partial C_s}{\partial Z_0}$ to a period-0 shock.

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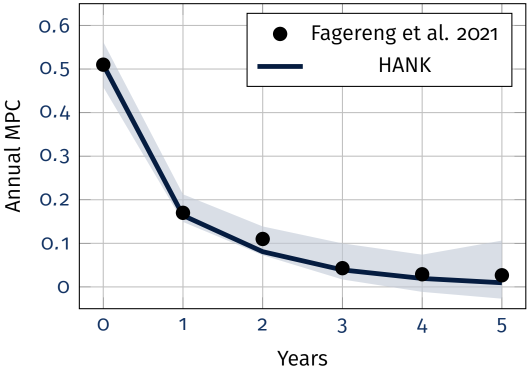
- **HANK** can match this through income risk, credit constraints and precautionary behaviour



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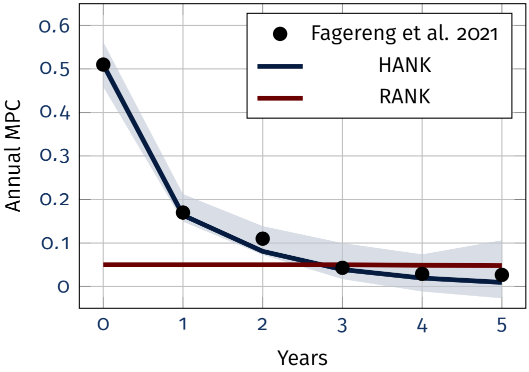
- **RANK**: Permanent income behaviour
  $\Rightarrow$ Low MPC ($\beta \approx [0.96, 0.99]$)



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  - Limited liquidity (Kaplan et al. '14, Kaplan et al. '18)
  - Precautionary savings behaviour (Zeldes '89, Deaton '89, Carroll et al. '01)
  - Subjective expectations, behavioural biases (Maxted et al. '24, Bellifemine et al. '24)
  - Ex-ante preference heterogeneity (Carroll et al. '17, Aguiar et al. '25)
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- But underlying theory of course affects extrapolation of rest of $\boldsymbol{M}$ and $\boldsymbol{R}$...

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- **Recap**: Fiscal policy in Closed economy with no systematic MP ($d\boldsymbol{r} = 0$)

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- **2. Taxes:** Higher taxes reduce $\boldsymbol{C}$ by $\boldsymbol{M}$, lowering output $\boldsymbol{Y}$

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- 2. Taxes: Higher taxes reduce $\boldsymbol{C}$ by $\boldsymbol{M}$, lowering output $\boldsymbol{Y}$
- **3. Multiplier:** $\uparrow d\boldsymbol{Y} \Rightarrow \uparrow d\boldsymbol{wL} \Rightarrow \uparrow d\boldsymbol{C} \Rightarrow \uparrow d\boldsymbol{Y} \ldots$

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- **RANK**: $\boldsymbol{M}$ is such that $\boldsymbol{M}d\boldsymbol{T} = \boldsymbol{M}d\boldsymbol{Y}$ for all $d\boldsymbol{T}$ paths which satisfy IBC
  - IBC: $\sum_t (1+r)^{-t} dG_t = \sum_t (1+r)^{-t} dT_t$
  - Ricardian equivalence ⇒ Multiplier = 1

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- **RANK**: M is such that $MdT = MdY$ for all dT paths which satisfy IBC
  - IBC: $\sum_t (1+r)^{-t} dG_t = \sum_t (1+r)^{-t} dT_t$
  - Ricardian equivalence $\Rightarrow$ Multiplier = 1
- **HANK**: Ricardian equivalence fails (property of M)
  - Tax financed (dG=dT) $\Rightarrow$ Multiplier = 1
  - Deficit financed fiscal policy can give multipliers above 1

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- **RANK**: Multiplier now below 1
- **HANK**: Multiplier can be above or below 1

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- **Open economy:** An equilibrium following a fiscal policy shock $d\boldsymbol{G}$ satisfies

$$d\boldsymbol{Y} = d\boldsymbol{G} - (1-\alpha)\boldsymbol{M}\,d\boldsymbol{T} + (1-\alpha)\boldsymbol{M}\,d\boldsymbol{Y} + (1-\alpha)\boldsymbol{R}\,d\boldsymbol{r} + \frac{2-\alpha}{1-\alpha}\alpha\eta\,d\boldsymbol{Q} - \alpha\boldsymbol{M}\,d\boldsymbol{Q}$$

Notation.

- α is trade openness (import/export share)
- η is the trade elasticity
- $\boldsymbol{Q}$ is the real exchange rate (increase $d\boldsymbol{Q} > 0$ = depreciation)

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- Closed economy terms get scaled down by $1-\alpha$

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- **5. Expenditure switching:** Higher r appreciates the real exchange rate ($dQ < 0$) $\Rightarrow$ Home goods become relatively more expensive $\Rightarrow$ NX fall

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$$
\begin{aligned}
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\end{aligned}
$$

- **6. Real income:** Real exchange rate appreciation strengthen households' purchasing power $\Rightarrow$ Real income increases $\Rightarrow$ Affects C by M

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- **Bottom line**: Open economy dimension governed by two parameters α, η
  - Openness α matters for all channels
  - Trade elasticity η matters for expenditure switching channel

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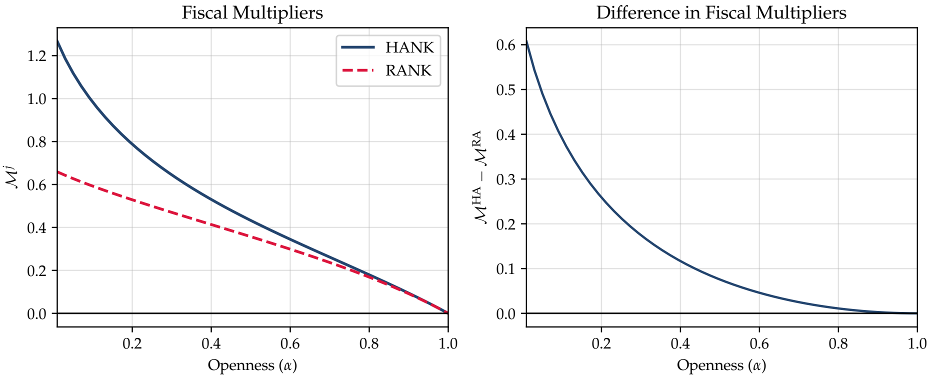
- Keynesian multiplier is shut down when consumption spending is on foreign goods only
- Full crowding out via net exports if real rates rise (active monetary policy)

Openness and fiscal multipliers

- Multiplier $\frac{dY}{dG}$ as function of α (deficit financed shock)
  - $\alpha = 0$: HANK produces larger multiplier (Auclert, Rognlie, and Straub 2024) when deficit financed
  - $\alpha \to 1$: No Keynesian multiplier, same fiscal multipliers



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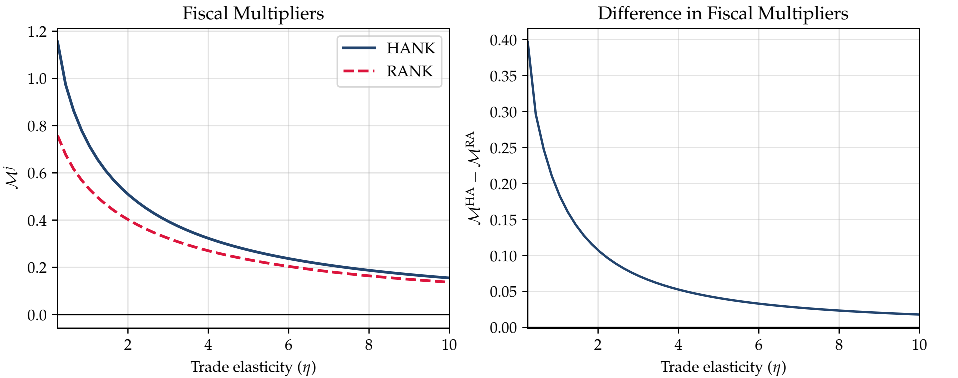
- **Bonus info**: They also coincide when $\eta = 1$ (Cole-Obstfeld) if shock is tax financed ($d\boldsymbol{G} = d\boldsymbol{T}$)

The trade elasticity and fiscal multipliers

- Multiplier $\frac{dY}{dG}$ as function of η
  - Low trade elasticity: Less crowding out, large difference in multipliers
  - High trade elasticity ($\eta \to \infty$): Strong crowding out, same fiscal multipliers



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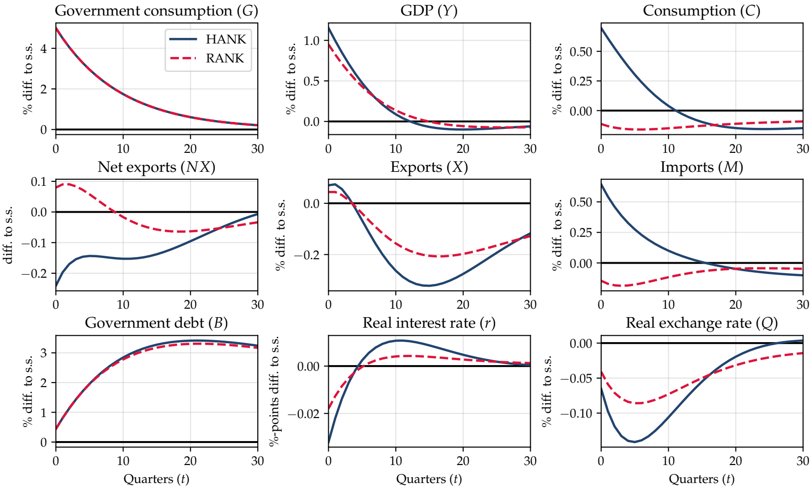
- **Next**: Quantitative model
  - Quantitative Taylor rule + Phillips curve
  - Dynamic Trade Elasticities (Boehm et al. 2023)
- **Calibration**: Target average small open economy in OECD
  - Openness (exports/imports to GDP, α): 42%
  - $G/Y = 20\%$, $B/Y = 232\%$ (quarterly)
  - Annual MPC = 0.51 (Fagereng et al. 2021)

Impulse responses

- IRFs to deficit financed G shock:



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- **Answer**: When fiscal shock produces large *income* redistribution

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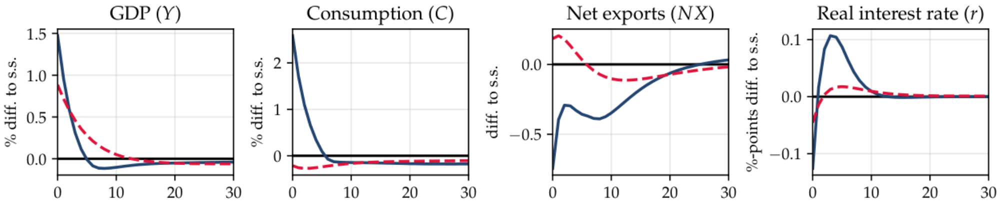

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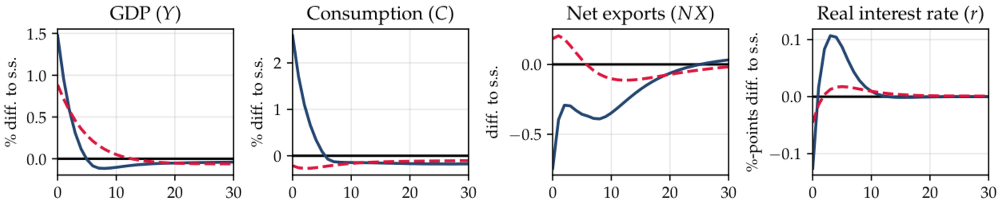

- Large multiplier difference (impact): 0.59
- ... but not consistent with observed rigidity of prices vs. wages and cyclicality of profits

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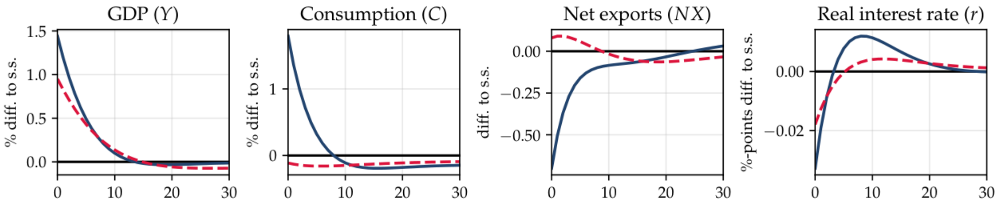

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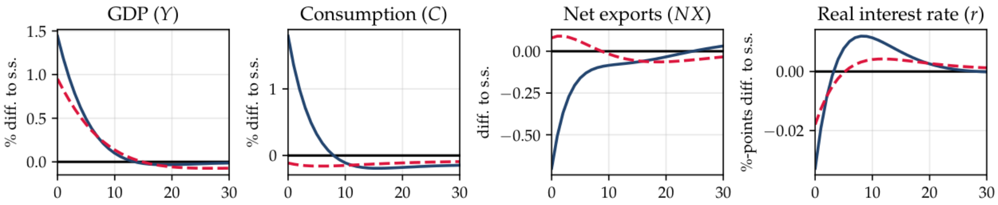

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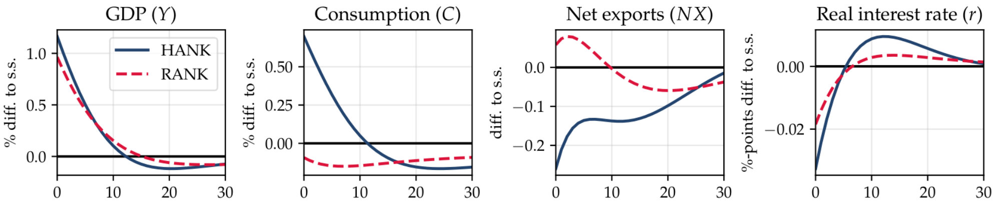

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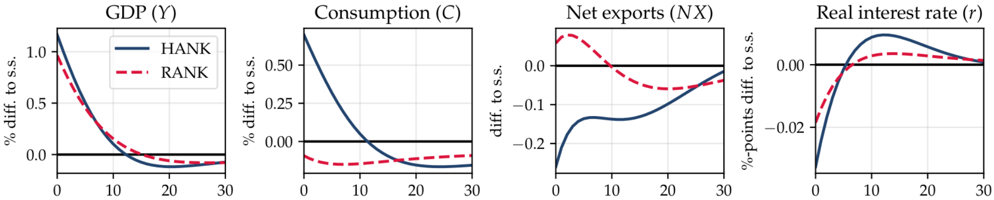

- Multipliers are slightly larger compared to **float**
- ..but difference between **HANK** and **RANK** still small

Conclusion

- Analysis of fiscal multipliers in a **Small open economy** with **heterogeneous agents**
- For relatively open economies the Keynesian multiplier weakens
  - $\Rightarrow$ Overall fiscal multiplier close to NK benchmark
- Cyclical inequality/redistribution can alter this result