Fiscal Multipliers in Small Open Economies With Heterogeneous Households

Jeppe Druedahl [1,3] Søren Hove Ravn [1]
Laura Sunder-Plassmann [2] Jacob Marott Sundram [1] Nicolai Waldstrøm [1]

[1] University of Copenhagen

[2] University of Rostock

[3] CEBI

Joint ECB-IMF-IMFER conference, Frankfurt am Main, July 2024

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How effective is fiscal spending?

Closed economy theoretical literature:

- Fiscal multipliers are relatively large in HANK models because of strong income effects, compared to RANK settings

What about (small) open economies?

- Fiscal multipliers might be smaller in SOE-HANK than SOE-RANK
- Private spending is in part on foreign goods; real exchange rate appreciation lowers net exports

This paper

- Identify six channels that determine fiscal multipliers in a stylized SOE-HANK model

- Under some parameterizations, fiscal multiplier SOE-HANK *identical* to SOE-RANK
- Key factors shaping relative size: degree of openness/ trade elasticity and financing

- Quantitative model: Fiscal multiplier *similar* in open economies
- About 20 percent larger in SOE-HANK than SOE-RANK

- But the transmission is different
- Consumption boom and net export drop offset each other in SOE-HANK

Literature

- Large literature on fiscal multipliers surveyed by Ramey (2019)
- International HANK models: De Ferra et al. (2020), Auclert et al. (2021) Bellifemine et al. (2023), Guo et al. (2023), Oskolkov (2023, Bayer et al. (2024), Druedahl et al. (2022)
- Fiscal multipliers in closed economy HANK models: e.g. Gali et al. (2007), Hagedorn et al. (2019), Bilbiie (2020), Auclert et al. (2023)

Stylized model

Stylized model

- Incomplete-markets version of the canonical Gali and Monacelli (2005) SOE model; similar to Auclert et. al (2021)
- Households face idiosyncratic income shocks and borrowing constraints, consume CES bundle of foreign and domestic goods with trade elasticity η and openness parameter α
- Production of output Y is linear in labor
- Sticky wages imply a New Keynesian wage Phillips curve
- Exogenous government spending G is financed with debt B and taxes T
- Monetary policy has rule for real interest rate r, responds to output with parameter $\phi_Y > 0$
- Foreign economy demands domestic good according to CES demand function
- No arbitrage implies a UIP condition for the real exchange rate Q (from investments in domestic and foreign bonds)

- Representative-agent version: Standard Euler equation, no international risk sharing

Solution

- We restrict attention to small, perfect foresight fiscal policy shocks
- We consider the sequence space representation of the model
- In this framework, the key objects are the infinite-dimensional vectors of perturbations of variables from steady state, $d\boldsymbol{X} = (dX_0, dX_1, ...)\prime$, where $dX_t \approx X_t - X_{ss}$ is the deviation from steady state for any variable X

Output response to a fiscal policy shock

Proposition 1: An equilibrium following a fiscal policy shock satisfies

$$d\boldsymbol{Y} = \underbrace{d\boldsymbol{G}}_{\text{1. Gov consumption}} - \underbrace{(1-\alpha)\boldsymbol{M}d\boldsymbol{T}}_{\text{2. Taxes}} + \underbrace{(1-\alpha)\boldsymbol{R}d\boldsymbol{r}}_{\text{3. Interest rate}} + \underbrace{(1-\alpha)\boldsymbol{M}d\boldsymbol{Y}}_{\text{4. Multiplier}} + \underbrace{\frac{2-\alpha}{1-\alpha}\alpha\eta d\boldsymbol{Q}}_{\text{5. Exp. switching}} - \underbrace{\alpha\boldsymbol{M}d\boldsymbol{Q}}_{\text{6. Real income}}$$

$\boldsymbol{M}$: matrix of intertemporal MPCs; $\boldsymbol{R}$: intertemporal effects of real rate changes on consumption

1. Higher government consumption increases output directly via goods market equilibrium. This channel is independent of household behavior, and thus equivalent in the two models.

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2. Higher taxes reduce spending, and more so in HANK with high MPCs
   In an open economy, this and the next two channels are scaled by the factor $1-\alpha$, the fraction of income spent on domestic goods

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3. If the real interest rate increases—which will typically be the case given the interest rate rule we have assumed—households increase savings and reduce current consumption (intertemporal substitution)

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4. Higher output means more labor income, which in turn implies higher consumption, and thus higher output

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$\boldsymbol{M}$: matrix of intertemporal MPCs; $\boldsymbol{R}$: intertemporal effects of real rate changes on consumption

5. If the real interest rate increases, the real exchange rate appreciates through UIP (i.e., $d\boldsymbol{Q}_t < 0$). This makes domestic goods more expensive

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6. Real exchange rate appreciation stimulates purchasing power of domestic households, who then consume more, boosting output

Equivalence and openness

Proposition 2: Consider a government spending shock. The entire path of output and therefore the fiscal multiplier is identical in HANK and RANK when

$$\alpha \to 1$$

In particular,

$$d\boldsymbol{Y}^{RA} = d\boldsymbol{Y}^{HA} = \begin{cases} 0 & \text{if monetary policy is active} \\ d\boldsymbol{G} & \text{if monetary policy is passive} \end{cases}$$

- 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)

Equivalence and the trade elasticity

Proposition 3: Consider a government spending shock and assume active monetary policy ($\phi_Y > 0$). The entire path of output and therefore the fiscal multiplier is identical in HANK and RANK when

$$\eta \to \infty$$

In particular,

$$d\boldsymbol{Y}^{RA} = d\boldsymbol{Y}^{HA} = 0$$

- Full crowding out via net exports (with a small drag from taxes in HANK)

Equivalence and the trade elasticity

Proposition 4: Consider a government spending shock that is financed period-by-period, i.e. $d\boldsymbol{G} = d\boldsymbol{T}, \forall t$. The entire path of output and therefore the fiscal multiplier is identical in HANK and RANK when

$$\eta = 1$$

In particular,

$$d\boldsymbol{Y}^{RA} = d\boldsymbol{Y}^{HA} = d\boldsymbol{G} - \frac{1}{1-\alpha}\boldsymbol{U}d\boldsymbol{r}$$

where $\boldsymbol{U}$ is an upper triangular matrix of ones

- Net exports constant, expenditure switching identical across models (log utility)
- Consumption change also identical (intertemporal substitution channel in RANK, plus income channel in HANK)

Equivalence and the trade elasticity: Partial financing

With partial financing, $dT_t = \phi_G dG_t$, for every value $\phi_G \in [0, 1]$, there is a value of the trade elasticity η such that the present-value fiscal multiplier $\mathcal{M}(\phi_G, \eta)$ is identical across models

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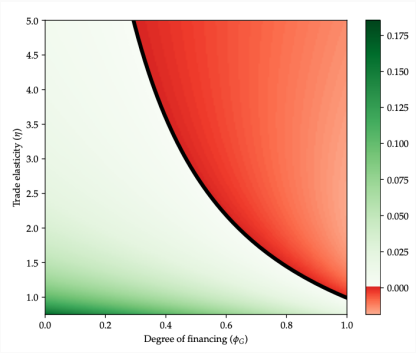
Difference in PV fiscal multipliers:

$$\mathcal{M}^{HA}(\phi_G, \eta) - \mathcal{M}^{RA}(\phi_G, \eta)$$



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- $\uparrow \phi_G$: more of a drag from taxes in HANK. $\mathcal{M}^{HA} - \mathcal{M}^{RA}$ falls

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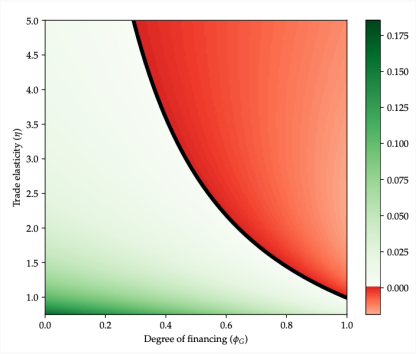

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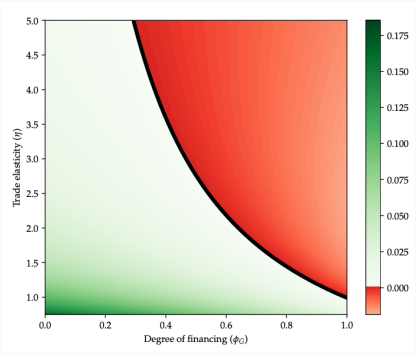
- $\uparrow \phi_G$: more of a drag from taxes in HANK. $\mathcal{M}^{HA} - \mathcal{M}^{RA}$ falls
- $\uparrow \eta$: more of a drag from expenditure switching in HANK. $\mathcal{M}^{HA} - \mathcal{M}^{RA}$ falls

Difference in PV fiscal multipliers:

$\mathcal{M}^{HA}(\phi_G, \eta) - \mathcal{M}^{RA}(\phi_G, \eta)$



Quantitative model

Quantitative model

New elements

- Permanent discount factor heterogeneity
- Time-varying trade elasticities
- Taylor rule with interest rate smoothing and inflation response
- Fixed cost in production

Calibration

- We target the average small open OECD economy
- Build on the calibration in Druedahl et al. (2022)

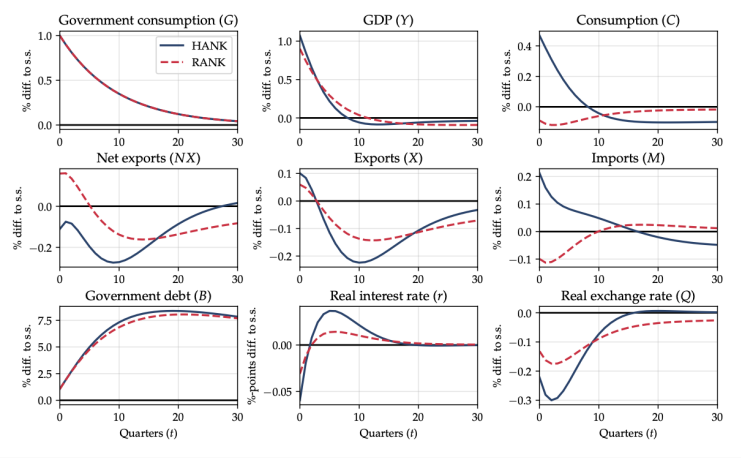
Calibration

	Description	Value	Target (Source)
	Households		
β^{RA}	RANK discount factor	0.995	Interest rate
β^{high}	High discount factor	0.991	Interest rate
β^{low}	Low discount factor	0.878	MPC $= 0.51$ (F21)
ρ_e	Persistence of idiosyncratic income	0.966	(D22, FL01)
σ_e	Std. of idiosyncratic income	0.13	(D22, FL01)
$1/\varphi$	Frisch elasticity	0.5	(D22, C11)
	Firms and Philips-curve		
μ	Markup	1.2	(D22)
κ	Slope of Philips-curve	0.05	(D22)
F	Fixed cost	0.116	$A/Y = 10$ (D22, OECD)
	Government and monetary policy		
G_{ss}	Public consumption to GDP	0.20	$G/Y = 20\%$ (D22, OECD)
B_{ss}	Government debt to GDP	2.32	$B/Y = 232\%$ (D22, OECD)
ϕ_π	Taylor rule coefficient on π	1.5	(D22)
ϕ_Y	Taylor rule coefficient on Y	0	(D22)
ρ_i	Interest rate smoothing	0.9	(D22)
ϕ_B	Debt financing	0.02	(G20)
ρ_G	Gov. cons. AR(1) coefficient	0.9	(HMM19)
	Trade		
i^*	Foreign interest rate (annual)	2%	(D22)
α	C_F share	0.614	$M/Y = 42\%$ (D22, OECD)
η	Trade elasticity	2	(D22, B23)
ρ_η	Trade rigidity	0.9	(D22, B23)

Table 2: Calibration

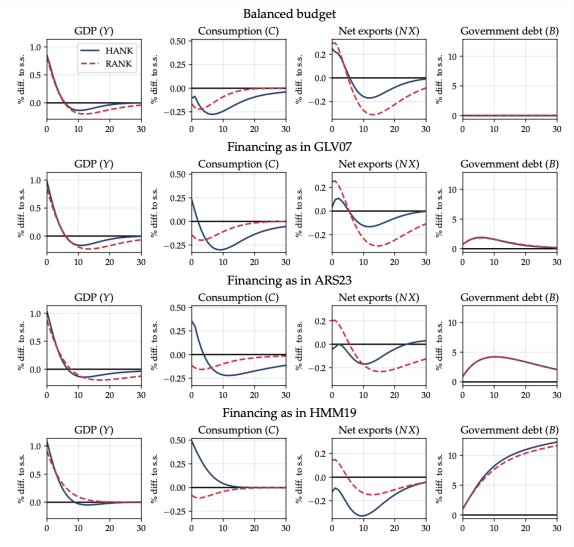
Note: The table summarizes the baseline parameter values. B23 is Boehm et al. (2023). C11 is Chetty et al. (2011). D22 is Druedahl et al. (2022). F21 is Fagereng et al. (2021). FL01 is Floden and Lindé (2001). G20 is Galí (2020). HMM19 is Hagedorn et al. (2019). OECD refers to data from the OECD for the sample in Druedahl et al. (2022).

Impulse responses to a positive government spending shock



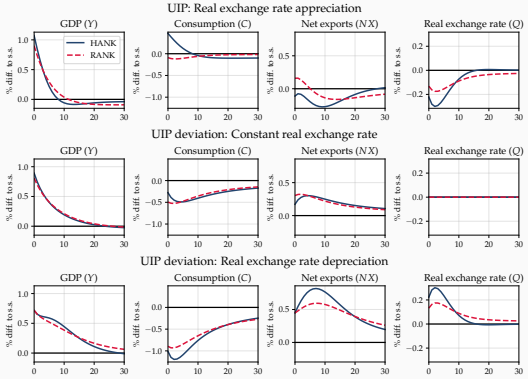
- Fiscal multiplier: Impact HANK 1.10, RANK 0.91. PV HANK 0.36, RANK 0.39

Alternative financing assumptions



- Fiscal multipliers broadly unchanged across specifications
- C and NX response in HANK offset each other

UIP shocks and the real exchange rate



- Real exchange rate appreciation or depreciation following a fiscal expansion?
- We add a UIP shock to investigate effects of different RER responses
- Result: Fiscal expansion with RER depreciation generates C drop and NX boost in HANK, leaving overall multiplier broadly unchanged

Conclusion

Conclusion

- Fiscal multipliers in HANK and RANK small open economies are identical under some conditions in a stylized model
- In a quantitative setting, multipliers tend to be similar and slightly above 1 on impact
- Tax financing and openness reduce multipliers in HANK relative to RANK
- The transmission is different. HANK predicts a consumption and import boom

Appendix

Present value cumulative multiplier

- The present-value cumulative fiscal multiplier is up to some horizon T is defined as

$$\mathcal{M} \equiv \frac{\sum_{t=0}^{T} \frac{dY_t^j}{(1+r)^t}}{\sum_{t=0}^{T} \frac{dG_t}{(1+r)^t}}$$

Stylized model

Households

- Heterogeneous households solve

$$
\begin{aligned}
V_t(a_{t-1}, e_t) &= \max_{c_t, a_t} \log c_t + \beta \mathbb{E}_t[V_{t+1}(a_t, e_{t+1})] \\
c_t + a_t &= (1 + r_t^a) a_{t-1} + Z_t e_t \\
a_t &\geq 0 \\
\ln e_t &= \rho_e \ln e_{t-1} + \epsilon_t^e, \epsilon_t^e \sim \mathcal{N}(0, \sigma_e^2)
\end{aligned}
$$

- Assets a_{t-1}, earnings e_t, consumption c_t
- r_t^a real asset returns, $Z_t = (1 - \tau) w_t N_t$ real labor income

- Representative household model: Standard problem with optimality condition, no international risk sharing

$$
\frac{1}{C_t} = \beta (1 + r_{t+1}^a) \frac{1}{C_{t+1}}
$$

Assets

- Domestic government bonds, foreign bonds, domestic equity
- No arbitrage:

$$1 + r_t = (1 + r^*)\frac{Q_{t+1}}{Q_t} = \frac{D_{t+1} + p^D_{t+1}}{p^D_t}$$

- $Q_t = E_t P^*/P_t$ real exchange rate
- D_t real after tax dividends
- $r_t = \mathbb{E}_t[r^a_{t+1}]$ and $r^a_t = r_{t-1}, t = 1, 2, ...$

Consumption goods

- Households split total consumption C_t between home $C_{H,t}$ and foreign goods $C_{F,t}$:

$$C_{H,t} = (1-\alpha)\left(\frac{P_{H,t}}{P_t}\right)^{-\eta} C_t$$

$$C_{F,t} = \alpha\left(\frac{P_{F,t}}{P_t}\right)^{-\eta} C_t$$

- Home bias $1-\alpha \in (0,1)$
- Elasticity of substitution between home and foreign goods η
- Consumer price index

$$P_t = \left[(1-\alpha)P_{H,t}^{1-\eta} + \alpha P_{F,t}^{1-\eta}\right]^{\frac{1}{1-\eta}}$$

Firms

- Production is linear in labor $Y_t = N_t$
- Price of home goods in domestic currency is a markup over the nominal wage $P_{H,t} = \mu W_t$
- Sticky wages imply a standard New Keynesian wage Phillips curve

$$\pi_{W,t} = \kappa \left(\frac{\psi N_t^{\varphi} C_t}{(1-\tau_t) w_t / \mu} - 1 \right) + \beta \pi_{W,t+1}$$

$\pi_{W,t} = W_t / W_{t-1}$ nominal wage growth

Government

- Government spending is financed with debt and taxes

$$B_t = (1 + r_{t-1})B_{t-1} + \frac{P_{H,t}}{P_t} G_t - T_t$$

- Tax rate adjusts to ensure that tax receipts satisfy

$$T_t - T_{ss} = \phi_G (G_t - G_{ss})$$

- Monetary policy follows a real interest rate rule

$$r_t = r_{ss} + \phi_Y \left(\frac{Y_t}{Y_{ss}} - 1 \right), \phi_Y \geq 0$$

- No inflation response for analytical simplicity (no trade-off under govt. spending shocks)

Foreign economy and market clearing

- Consumption of domestically produced goods by foreign consumers is given by

$$C^*_{H,t} = \alpha(P^*_{H,t})^{-\eta} C^*_{ss}$$

- Goods market clearing

$$Y_t = C_{H,t} + C^*_{H,t} + G_t$$

Equilibrium

- Definition (Equilibrium): Given sequences for G_t and T_t, an initial household distribution over assets and earnings $\mathcal{D}_0(a, e)$, and an initial portfolio allocation between foreign and domestic assets, a competitive equilibrium in the domestic economy is
  - a path of household policies $\{c_t(a_{t-1}, e_t), a_t(a_{t-1}, e_t)\}$,
  - distributions $\mathcal{D}_t(a, e)$,
  - prices $\{E_t, Q_t, P_t, P_{H,t}, P_{F,t}, W_t, p_t^D, r_t, r_t^a\}$ and
  - quantities $\{C_t, C_{H,t}, C_{F,t}, Y_t, N_t, D_t, \tau_t, B_t\}$

  such that all households and firms optimize, monetary and fiscal policy follow their rules, and the goods market clears

Quantitative model

Quantitative model: Details

- Permanent discount factor heterogeneity: Half the households are impatient, $\beta^{low} < \beta^{high}$ to match MPC (as in stylized model) plus realistic level of government debt
- Time varying trade elasticity: Low in the short run

$$C_{F,t} = \alpha(\hat{p}_t)^{-\eta} C_t, \hat{p}_t = (\hat{p}_{t-1})^{\rho_n} \left(\frac{P_{F,t}}{P_t}\right)^{1-\rho_n}$$

$$C^*_{H,t} = \alpha^*(\hat{p}^*_t)^{-\eta} C^*_t, \hat{p}^*_t = (\hat{p}^*_{t-1})^{\rho_n} \left(\frac{P^*_{H,t}}{P_t}\right)^{1-\rho_n}$$

where $\rho_\eta \in [0, 1)$ captures the speed of adjustment in the elasticity over time

Quantitative model: Details

- Monetary policy reaction function with inflation response and interest rate smoothing

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\left(i_{ss} + \phi_\pi \pi_t + \phi_Y \left[\frac{Y_t}{Y_{ss}} - 1\right]\right)$$

- Tax rule that ensures that government debt returns to its original steady state

$$T_t = T_{ss} + \phi_B * B_{t-1} - B_{ss}$$

- Fixed cost in production to match realistic markup and aggregate wealth/GDP ratio. Profits:

$$D_t = (1-\tau_t)\frac{P_{H,t}Y_t - W_t N_t}{P_t} - F$$

Goods market clearing:

$$Y_t = C_{H,t} + C^*_{H,t} + G_t + \frac{P_t}{P_{H,t}} F$$

Impact multipliers in alternative model specifications

Impact multipliers in alternative model specifications

Model specification	HANK	RANK
Baseline	1.07	0.90
with capital	0.86	0.77
Fixed exchange rate	1.12	0.95
Aggressive monetary policy	0.95	0.75
Passive monetary policy	1.19	1.00
High trade elasticity	1.03	0.89
Constant trade elasticity	0.66	0.66
Sticky prices	1.37	0.87
Sticky prices and wages	1.13	0.93