Monetary-Fiscal Interactions and Household Heterogeneity: an Analytical Characterization

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Introduction

What I do?

- I develop an analytical formula for the government spending multiplier in economy populated with heterogeneous agents
- In my analysis I use the Bewley-Huggett-Aiyagari model extended to capture product market frictions
- The derived formula clearly shows the character of monetary-fiscal interactions when households are heterogeneous
- Calibrated model is used to estimate the multiplier and its components under 3 monetary-fiscal scenarios:
  - tax-financed stimulus
  - debt-financed stimulus
  - liquidity trap

Frictional product market:

- A decentralized, search-and-matching product market is crucial for solving the model with paper and pencil
- Non-Walrasian market for goods in the literature: Diamond (1982), Michaillat and Saez (2015), Kaplan and Menzio (2016), Bai, Rios-Rull and Storesletten (2018)

Technical contribution:

I relax 3 restrictive assumptions made in the literature to derive closed-form expressions in heterogeneous agent models:

1. **Extreme illiquidity:** used by Werning (2015), Ravn and Sterk (2016), McKay and Reis (2016)
2. **Constant real interest rates:** used by Auclert, Rognlie and Straub (2018), Patterson (2018)
3. **Partial equilibrium:** used by Auclert (2018)

Theoretical analysis: Bewley-Huggett-Aiyagari model with frictional product market

Self-employed households:

$$V(z,b) = \max_{c,v,b'} \left\{ \tilde{u}(c,v) + \beta \mathbb{E}_{z'|z} V(z',b') \right\}$$

subject to:

$$c + \tau(z) \cdot \Theta + \frac{b'}{1+i} = \frac{b}{\Pi} + z \cdot f$$

$$c = q \cdot v$$

$$b' \geq -\xi$$

Fiscal and monetary policy:

$$\Theta + \frac{\bar{B}'}{1+i} = \frac{\bar{B}}{\Pi} + G$$

$$G = q \cdot v_G$$

$$i = \max\left\{ \bar{i} + \phi_Y \cdot \left(\frac{Y - \bar{Y}}{\bar{Y}} \right) + \phi_\Pi \cdot (\Pi - \bar{\Pi}), 0 \right\}$$

Matching process and price-setting:

$$x \equiv \frac{\int_{B\times Z} v(b,z)\, d\mu(b,z) + v_G}{\int_{B\times Z} z\, d\mu(b,z)}$$

$$f(x) = M(x,1), \quad q(x) = M\left(1, \frac{1}{x}\right)$$

$$\Pi = \Pi(x), \; \Pi'(x) > 0$$

Resource constraint:

$$\int_{B\times Z} c(b,z)\, d\mu(b,z) + G = \underbrace{f(x) \cdot \int_{B\times Z} z\, d\mu(b,z)}_{\equiv Y(x)}$$

Additional notation:

$\lambda \equiv \frac{d\bar{B}_{t+1}}{dG_t}$ - proportion of dG_t financed with public debt

$\alpha \equiv \frac{d\Pi/dx}{dY/dx}$ - a demand-driven comovement between prices and output

$\Omega \equiv \phi_\Pi \cdot \alpha + \phi_Y$ - strength of the monetary policy reaction

Λ - fiscal rule that determines the way in which stimulus is financed

Multiplier:

An unexpected rise in fiscal purchases arrives in period t and is followed by a perfect-foresight transition path. The multiplier's formula is:

$$\frac{dY_t}{dG_t} = \frac{1 + \frac{\partial C_t}{\partial G_t}}{1 - \frac{\partial C_t}{\partial x_t} \cdot \frac{1}{f'(x_t)}}$$

where:

$$\frac{\partial C_t}{\partial G_t} \equiv -\underbrace{\left(1 - \frac{\lambda}{1+i}\right) \cdot \mathbb{E}_\mu(MPC \cdot \tau)}_{\textit{Taxation channel } (-)} + \underbrace{\beta \cdot (1+i) \cdot \mathbb{E}_\mu\left(MPS \cdot \frac{1}{u_{cc}(c)} \cdot \mathbb{V}^{\Lambda}_{bG}\right)}_{\textit{Precautionary motives channel } (-/+)}$$

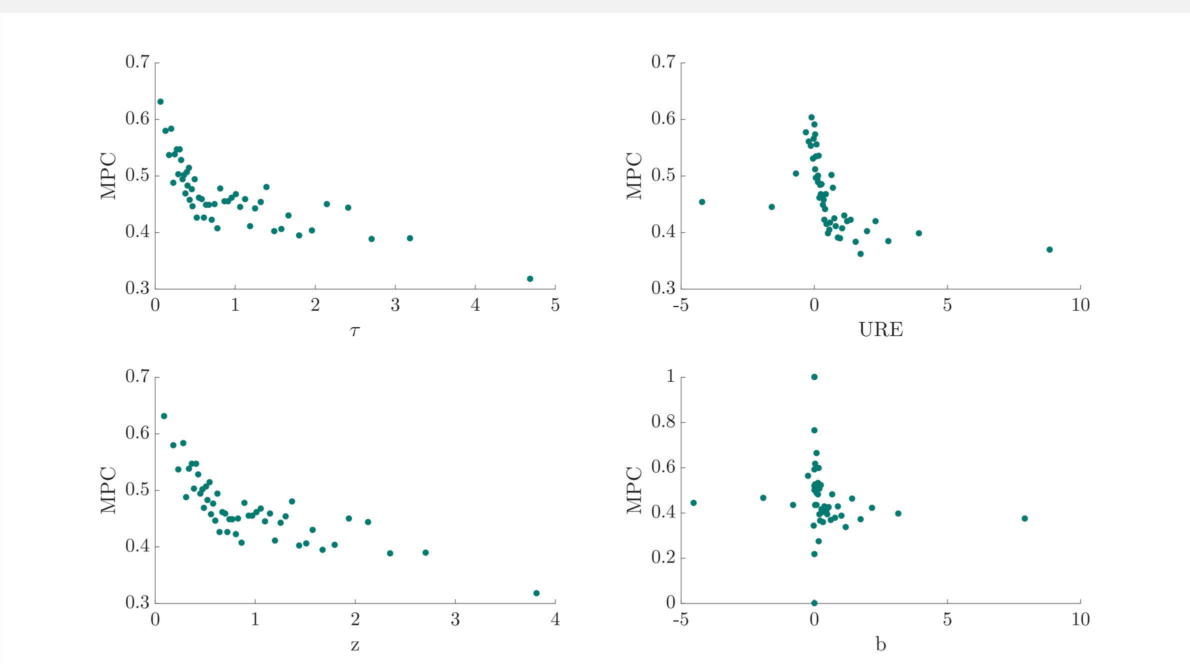
and:

$$\frac{\partial C_t}{\partial x_t} \cdot \frac{1}{f'(x_t)} \equiv -\underbrace{\frac{\Omega}{1+i} \cdot \mathbb{E}_\mu(MPS \cdot c)}_{\textit{Intertemporal substitution channel } (-)} + \underbrace{\frac{\Omega}{1+i} \cdot \mathbb{E}_\mu(MPC \cdot URE)}_{\textit{Unhedged interest exposure channel } (-/+)}$$

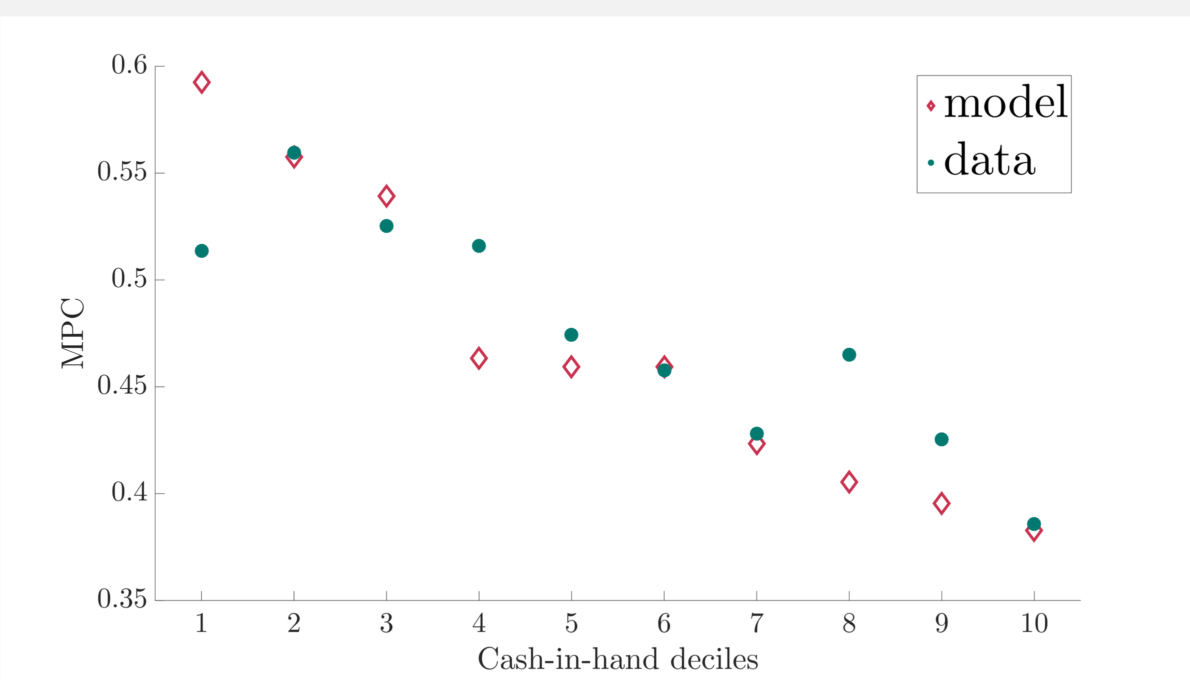
$$+ \underbrace{\mathbb{E}_\mu(MPC \cdot z)}_{\textit{Income channel } (+)} - \underbrace{\left(\frac{\Omega}{(1+i)^2} - \alpha\right) \cdot \bar{B} \cdot \mathbb{E}_\mu(MPC \cdot \tau)}_{\textit{Debt service cost channel } (-/+)} - \underbrace{\alpha \cdot \mathbb{E}_\mu(MPC \cdot b)}_{\textit{Fisher channel } (-/+)}$$

Empirical analysis: a calibrated model is used to decompose the multiplier under 3 alternative scenarios

Empirical counterparts of model's cross-product terms (SHIW survey, Italy):



Key calibration target - MPC over cash-in-hand deciles:



Three scenarios:

1. **Benchmark:** unconstrained monetary policy and tax-financed stimulus
2. **Liquidity trap:** monetary policy constrained by the ZLB and tax-financed stimulus
3. **Debt-financed stimulus:** accompanied by unconstrained monetary policy

Simulation results:

Channel\Scenario	Benchmark	Liquidity trap	Debt-financed
Taxation	−0.57	−0.57	0
Precautionary motives	−0.02	−0.02	−0.28
Intertemporal substitution	−0.05	0	−0.05
Interest rate exposure	0.16	0	0.16
Income	0.58	0.58	0.58
Debt service costs	−0.10	0.06	−0.10
Fisher	−0.06	−0.06	−0.06
MUTLIPLIER	0.88	0.97	1.55