Fiscal Multipliers and Liquidity Constraints: a HANK approach

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Agenda

1. Introduction
2. Literature Review
3. Model
4. Calibration
5. Results
6. Conclusion

Research Question

Research Question

How does the share of Hand-to-Mouth agents influence the size of fiscal multipliers?

How do we answer to that question?

- Using a **structural model** instead of an empirical approach.
- Comparing two model specifications - **1-asset and 2-asset** - to distinguish the role of different Hand-to-Mouth agents.
- Calibrating **five** different Euro Area economies, including **Portugal**.

Motivation

Why fiscal multipliers?

- Fiscal stimuli in the aftermath of COVID-19 were similar in size.
- But generated **different economic responses** across countries.

Why heterogeneity?

- The shares of HtM agents are very different across countries.
- W-HtM are sometimes **9 times higher** than P-HtM.

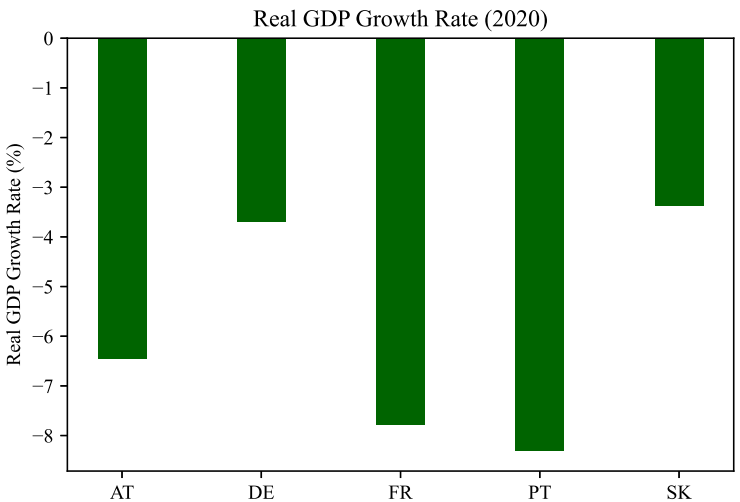

Figure: Real GDP growth rates in 2020 across the several countries analyzed.

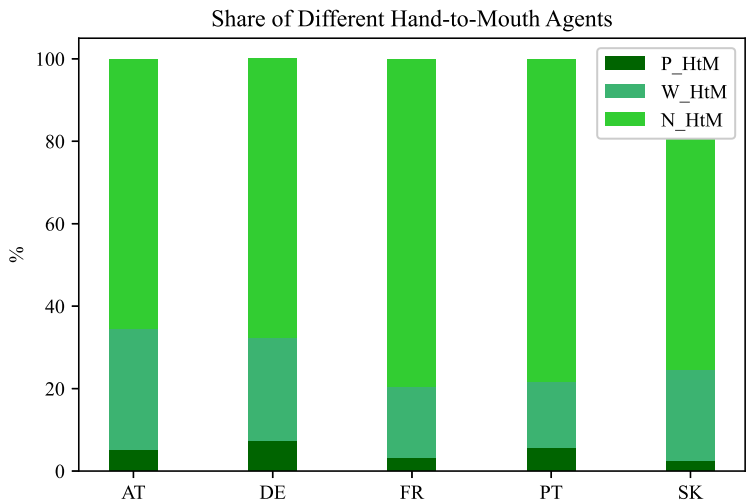

Figure: Share of Different HtM Agents across the several countries analyzed.

Extensive literature on fiscal multipliers

What can influence multipliers?

Paper	Factors that influence fiscal multipliers
Barrell et al. (2013)	Country size, openness to trade, elasticity of consumption
Ilzetzki et al. (2013)	Degree of development, exchange rate regime, gov. debt
Brinca et al. (2016)	**Wealth inequality**
Hagedorn et al. (2019)	**Market incompleteness, monetary policy role**
Bernardino (2020)	Fiscal consolidations and expansions behave differently
Brinca et al. (2020)	Labour share
Santos (2020)	Tax progressivity
Rodrigues (2020)	Frisch elasticity
Broer et al. (2021)	**Distribution of factor incomes, source of nominal rigidities**

- Discussion was intensified after the **2008's crisis**.
- Some hints on the literature for the role of **liquidity constraints**.

Different Hand-to-Mouth Agents

We have some important definitions from **Kaplan et al. (2014)**:

Poor Hand-to-Mouth

The **P-HtM** are households who hold **no liquid nor illiquid** wealth.

Wealthy Hand-to-Mouth

The **W-HtM** hold few or **no liquid** assets, but have **positive** net holdings of **illiquid** assets.

Non-Hand-to-Mouth

The **N-HtM** are the ones who hold **positive** amounts of both **liquid and illiquid** wealth.

Close to this work

Sá (2022):

- **Overlapping generations model** with **heterogeneous agents** calibrated to match estimations of the **shares of HtM** to study how it shapes fiscal multipliers.
- Acknowledges the importance of considering a model with **liquid and illiquid assets** to properly represent the W-HtM.

Guo et al. (2023):

- **Local projections method** and find that a higher share of **HtM households enhances fiscal multipliers**.
- Find that spending multipliers are **more amplified by P-HtM** households.

We employ **structural models** to study the same issues, being one of few studies which **compare a one-asset with a two-asset model**.

Key Ingredients

Heterogeneous Agents New Keynesian Model

- **HANK model** as in Auclert et al. (2018).
- Households choose in each period how much to **consume** and **save**, deriving utility from consumption and disutility from working.
- **Sticky** prices and wages and hours worked determined by **unions**.
- In equilibrium, markets **clear** and agents **optimize** their decisions.

Two Assets and Uncertainty

- Agents are **infinitely lived**, facing an **uninsurable idiosyncratic income risk**, for which they can save using two types of assets – a **liquid** and an **illiquid** one – with different levels of **return**.
- In the presence of an income shock, if a given household is in shortage of liquid wealth, it may retrieve funds from its illiquid wealth, but incurring in a **portfolio adjustment cost**.

Households (1/2)

Portfolio Adjustment Cost

$$\Phi_t\left(a_{it}, a_{it-1}\right) = \frac{\chi_1}{\chi_2}\left|\frac{a_{it} - \left(1 + r_t^a\right) a_{it-1}}{\left(1 + r_t^a\right) a_{it-1} + \chi_0}\right|^{\chi_2}\left[\left(1 + r_t^a\right) a_{it-1} + \chi_0\right]$$

Utility Function

$$U(c, N) = \frac{c_{it}^{1-\sigma}}{1-\sigma} - \varphi\frac{N_t^{1+\eta}}{1+\eta}$$

Households (2/2)

Bellman Equation (2-asset model)

$$V_t\left(e_{it}, b_{it-1}, a_{it-1}\right) = \max_{c_{it}, b\prime_{it}, a\prime_{it}} \left\{U(c, N) + \beta \mathbb{E}_t V_{t+1}\left(e_{it+1}, b_{it}, a_{it}\right)\right\}$$

s.t.

$$c_{it} + a_{it} + b_{it} = \left(1 - \tau_t\right) w_t N_t e_{it} + \left(1 + r_t^a\right) a_{it-1} + \left(1 + r_t^b\right) b_{it-1} - \Phi_t\left(a_{it} a_{it-1}\right)$$

$$a_{it} \geq 0, \quad b_{it} \geq \underline{b}$$

Bellman Equation (1-asset model)

$$V_t\left(e_{it}, h_{it-1}\right) = \max_{c_{it}, h\prime_{it}} \left\{U(c, N) + \beta \mathbb{E}_t V_{t+1}\left(e_{it+1}, h_{it}\right)\right\}$$

s.t.

$$c_{it} + h_{it} = \left(1 - \tau_t\right) w_t N_t e_{it} + \left(1 + r_t\right) h_{it-1}$$

$$h_{it} \geq 0$$

Other agents

Financial Intermediary

A financial intermediary **issues the assets**. It collects liquid short-term deposits and invests them in government debt, B_t, and illiquid wealth to invest into government bonds, B_t^g, and firm equity, p_t.

Firms

A **competitive final goods** firm and **monopolistically competitive firms** that produce a continuum of **intermediate** goods, j, compose this economy. Intermediate goods firms have a standard **Cobb-Douglas** production function

Labour Unions

As is standard to New Keynesian modelling with sticky wages, households' working hours, n_{it}, are determined by the **union labour demand**.

Monetary Policy - follows a standard Taylor Rule

$$i_t = r_t^* + \phi_\pi \pi_t + \phi_y (Y_t - Y_{ss})$$

Fiscal Policy

Government - balances its budget every period

$$\tau_t w_t N_t = r_t B^g + G_t$$

Fiscal Multipliers

$$Impact = \frac{\Delta Y_0}{\Delta G_0} \qquad Cumulative = \frac{\sum_{t=0}^{t=T}(\prod_{s=0}^{s=T} \frac{1}{1+r_s})\Delta Y_t}{\sum_{t=0}^{t=T}(\prod_{s=0}^{s=T} \frac{1}{1+r_s})\Delta G_t}$$

Fiscal Experiment

- With the economy initially at its steady-state equilibrium, the government, without any announcement, **increases spending**, G, with a degree of persistency of $\rho_G = 0.7$, as in Auclert et al. (2018).
- This fiscal expansion can either be financed by **raising the proportional tax on labour income** such that the deficit of the government remains at zero, or it can be financed by **increasing the deficit** (with a shock to government bonds with persistency $\rho_B = 0.7$).

Equilibrium

1. Taking factor prices and initial conditions as given, **households** solve the maximization problem, using the value function $V_t(e_{it}, b_{it-1}, a_{it-1})$ and the respective policy functions, $c(e_{it}, b_{it-1}, a_{it-1})$, $b\prime(e_{it}, b_{it-1}, a_{it-1})$ and $a\prime(e_{it}, b_{it-1}, a_{it-1})$.
2. The **financial intermediary, firms and labor unions** optimize their decisions.
3. **Fiscal and monetary** authorities follow their rules.
4. **Asset market** clears, meaning total savings by households equal the value of firm equity and government bonds:

$$p_t + B^g = \int a_{it}\, di + \int b_{it}\, di$$

5. **Goods market** clears when the final good is used for private and public consumption, investment, price adjustment costs, liquidity transformation costs and portfolio adjustment costs:

$$Y_t = \int c_{it}\, di + G_t + I_t + \psi_t + \omega \int b_{it}\, di + \int \Phi_t \left(a_{it}, a_{it-1}\right) di$$

Calibration Targets - 1-asset model

- **No distinction** of liquid/illiquid wealth.
- Therefore, we **do not capture** the W-HtM in the one-asset. They are (wrongly) considered N-HtM.

Table: **Calibration targets** in the one-asset model specification

Country	Total Wealth	K/Y	% of HtM
AT	6.116	3.359	0.052
DE	5.169	3.013	0.074
FR	6.549	3.392	0.032
PT	7.774	3.229	0.055
SK	5.484	3.799	0.025

Calibration targets - 2-asset model

- Now we can **distinguish different types of wealth** - liquid or illiquid.
- Hence, the different HtM behaviours are captured.

Table: **Calibration targets** in the two-asset model specification

Country	Illiquid W.	Liquid W.	K/Y	% of P-HtM	% of W-HtM
AT	5.113	1.003	3.359	0.052	0.294
DE	4.008	1.160	3.013	0.074	0.248
FR	5.318	1.231	3.392	0.032	0.173
PT	6.765	1.009	3.229	0.055	0.162
SK	5.050	0.433	3.799	0.025	0.220

Data source

Household Consumption and Finance Survey

- The data used comes from the **first wave of the HCFS**.
- Joint project of the Euro Area central banks and national statistical agencies, providing consolidated information on **household balance sheets** and related economic and demographic variables.
- Sample includes more than **62,000 households** and its first wave was carried out between late 2008 and mid-2011, although most countries collected **data in 2010**.
- Estimates for **hand-to-mouth agents** are taken from Sá (2022), which are obtained by replicating the methodology of Kaplan et al. (2014).
- The **liquid and illiquid assets** in each country are estimated based on Sierminska and Medgyesi (2013).

Penn World Table 8.0

Used to compute the capital-to-output ratios in each country.

Parameters constant across countries

- Some parameters are **held constant** across countries, based on Auclert et al. (2018) and Auclert et al. (2021): σ, η, χ_2, $\underline{b}$, ρ_z, Θ_p, δ, κ_p, κ_w, μ_w, G, ϕ_π, and ϕ_y.

Parameter	2-asset	1-asset
Households		
σ	2	2
η	1	1
χ_2	2	nd.
$\underline{b}$	0	0
ρ_z	0.91-0.95	0.95
Financial Intermediary		
Θ_p	0.85	0.85
Firms		
δ	0.06	0.06
κ_p	0.1	0.1

Parameter	2-asset	1-asset
Labor Unions		
κ_w	0.1	0.1
μ_w	1.1	1.1
Policy		
G	0.2	0.2
ϕ_π	1.5	1.5
ϕ_y	0 or 0.5	0 or 0.5

Figure: Parameters held constant across countries.

Endogenously calibrated parameters

- A set of parameters which do not have any empirical counterpart are **endogenously calibrated** for each country:
  - In the one-asset model, these parameters are β and σ_z.
  - In the two-asset model, besides β and σ_z, they are χ_0, χ_1 and ω, as well as ρ_z, within a small range, when strictly required.

- The **calibration** is done by **updating the guesses of the unknowns** until the calibration targets are achieved, as in Auclert et al. (2021).

Understanding the mechanisms

1. **Start with the fiscal policy shock of the government:**
   1. $\uparrow G \longrightarrow \uparrow Y$ - aggregate demand is directly boosted
   2. $\uparrow G \longrightarrow \uparrow \tau$ - but taxes on labour income must be raised
2. **The increase in taxes makes households poorer:**
   1. $\uparrow \tau \longrightarrow \downarrow N$ - Substitution Effect
   2. $\uparrow \tau \longrightarrow \uparrow N$ - Income Effect (**dominates**)
3. **The role of Hand-to-Mouth agents:**
   1. Higher % of HtM $\longrightarrow$ stronger income effect $\longrightarrow$ greater $\uparrow N$
   2. Greater $\uparrow N \longrightarrow$ weaker crowding-out effect $\downarrow C$
4. **Conclusion: Higher % of HtM $\longrightarrow$ greater $\uparrow Y$**

Accounting for the W-HtM increases fiscal multipliers

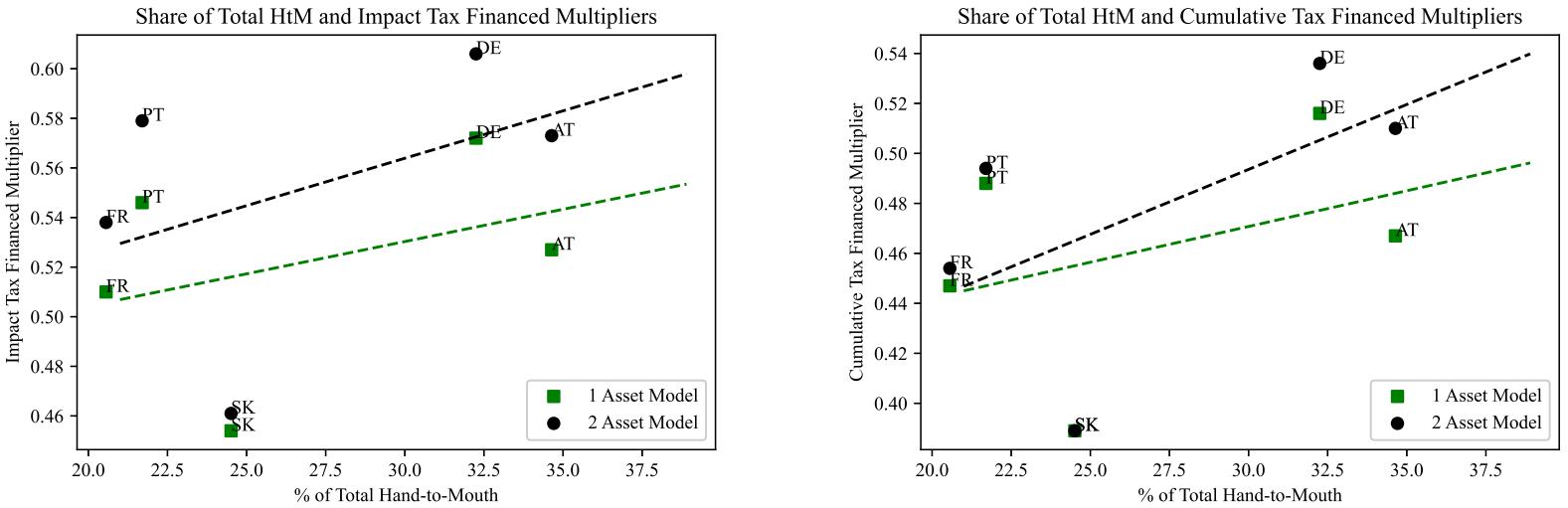

Figure: Fiscal multipliers (tax-financed) computed in the two model specifications for economies calibrated.

The 2-asset model specification generates **higher fiscal multipliers** because we can account for the **W-HtM**, which are also somewhat liquidity constrained.

The P-HtM contribute to explain cross-country differences

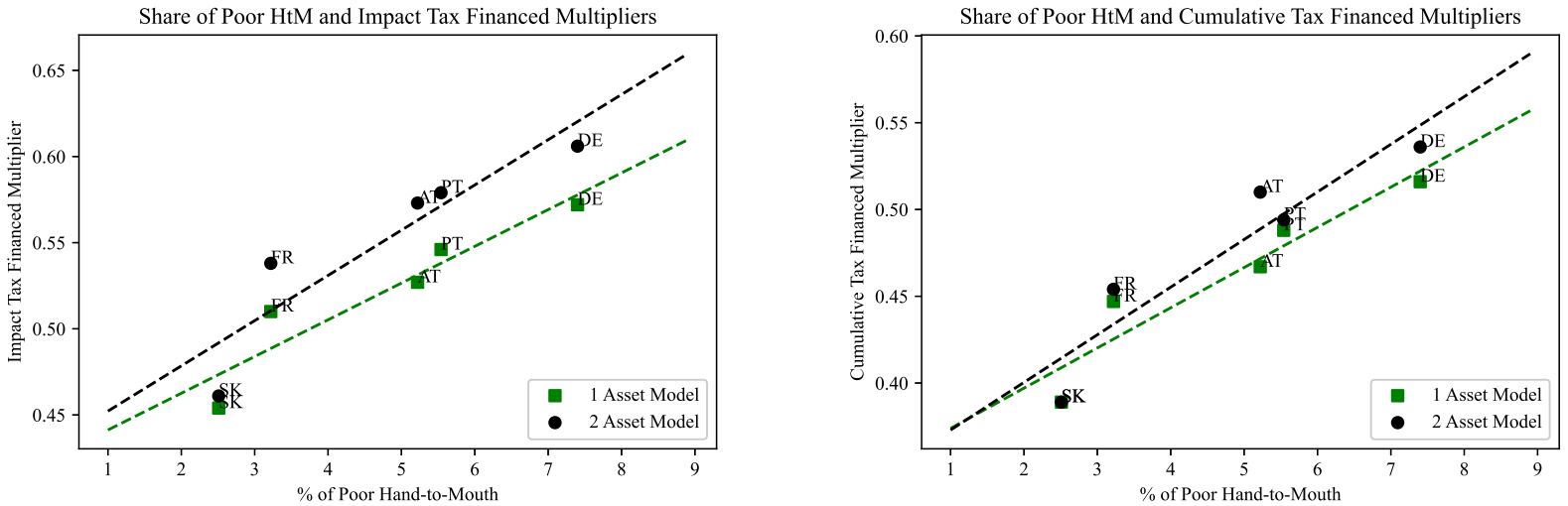

Figure: Fiscal multipliers plotted against the share of P-HtM. The correlation coefficients are 0.938 (left plot, 1-asset) and 0.914 (left plot, 2-asset), and 0.944 (right plot, 1-asset) and 0.934 (right plot, 2-asset).

The **P-HtM** are **significant** to explain **cross-country differences** in spending multipliers, which is line with the findings from Guo et al. (2023).

These results are robust to...

1. Whether we look at **impact or cumulative** multipliers.

2. The **choice of the financing** of the government spending shock, i.e., either financed by raising the proportional tax on labour income or by issuing debt.

3. The **Taylor Rule** employed by the Central Bank, which only responds to inflation in the baseline case (EA economies) and to inflation and output (US-style) in the extension.

Further interesting findings

1. **Cumulative** multipliers are **lower** than **impact** multipliers.
   - In line with the findings of Auclert et al. (2018).
   - Agents are having stronger responses in the first period, anticipating the persistence of the government spending shock.

2. **Deficit-financed impact** multipliers are **higher** than **tax-financed impact** multipliers.
   - Drop in private consumption is lower when taxes are not immediately raised - Ricardian Equivalence does not hold.
   - If we consider cumulative multipliers, it is no longer the case.

3. A **Taylor Rule** that **only** responds to **inflation** generates **higher** multipliers.
   - The monetary authority responds more aggressively with a higher interest rate in the case where it cares both about output and inflation.

A closer look to Portugal

- Even though this study is not directly focused on Portuguese multipliers, we can take a closer look to those results.
- The computed multipliers range from **0.37 to 0.64**.
- However, an **empirical approach is likely more suitable** for more accurate estimations.

	Taylor Rule - Inflation Only				Taylor Rule - Inf. and Output			
	1 Asset		2 Asset		1 Asset		2 Asset	
Multiplier	**Tax**	**Deficit**	**Tax**	**Deficit**	**Tax**	**Deficit**	**Tax**	**Deficit**
Impact	0.546	0.585	0.579	0.641	0.383	0.406	0.434	0.474
Cumulative	0.488	0.498	0.494	0.509	0.370	0.373	0.421	0.426

Figure: Fiscal multipliers in Portugal.

Limitations and future work

There are some limitations in this study:

- A HANK Model with two assets lacks some other important features to assess fiscal policy: **fiscal transfers**, **social security**, or **different types of taxes**.
- Calibration could include more **country-specific parameters**.
- **Taylor Rule** neglects **common monetary policy** in the EA.

Future research should focus on:

- How do these results depend on the **economic cycle**?
- Do other **country-specific parameters** change the conclusions?
- Extend the analysis to **more economies** for robustness.

Conclusions and policy implications

The key conclusions of this study are that:

- Accounting for the **W-HtM** is **significant** because these agents are also liquidity constrained, generating **higher multipliers**.
- The share of **P-HtM** significantly **amplifies multipliers** and is **significant** in explaining **cross-country differences**.
- These results are **robust** to the **specification of the multiplier**, the **financing** of the shock and the **Taylor Rule** choice.

Policy implications:

- Attention should be drawn to **households' wealth distribution** when governments want to boost output, to calibrate the shock.
- But simply increasing government spending is **not the best way to increase growth** when output is already at its potential level (**multipliers lower than unity**).

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Fiscal Multipliers

	Taylor Rule - Inflation Only				Taylor Rule - Inf. and Output			
	1 Asset		2 Asset		1 Asset		2 Asset	
Country	Tax	Deficit	Tax	Deficit	Tax	Deficit	Tax	Deficit
AT	0.527	0.576	0.573	0.584	0.321	0.350	0.468	0.476
DE	0.572	0.631	0.606	0.632	0.377	0.414	0.496	0.516
FR	0.510	0.534	0.538	0.598	0.293	0.311	0.343	0.379
PT	0.546	0.585	0.579	0.641	0.383	0.406	0.434	0.474
SK	0.454	0.476	0.461	0.512	0.247	0.266	0.270	0.298

Figure: Impact Multipliers.

	Taylor Rule - Inflation Only				Taylor Rule - Inf. and Output			
	1 Asset		2 Asset		1 Asset		2 Asset	
Country	Tax	Deficit	Tax	Deficit	Tax	Deficit	Tax	Deficit
AT	0.467	0.466	0.510	0.498	0.295	0.294	0.472	0.461
DE	0.516	0.532	0.536	0.531	0.359	0.368	0.499	0.494
FR	0.447	0.416	0.454	0.471	0.261	0.247	0.306	0.312
PT	0.488	0.498	0.494	0.509	0.370	0.373	0.421	0.426
SK	0.389	0.343	0.389	0.382	0.212	0.193	0.234	0.228

Figure: Cumulative Multipliers.

Parameters

Parameter	2-asset	1-asset
Households		
σ	2	2
η	1	1
χ_2	2	nd.
$\underline{b}$	0	0
ρ_z	0.91-0.95	0.95
Financial Intermediary		
Θ_p	0.85	0.85
Firms		
δ	0.06	0.06
κ_p	0.1	0.1
Labor Unions		
κ_w	0.1	0.1
μ_w	1.1	1.1
Policy		
G	0.2	0.2
ϕ_π	1.5	1.5
ϕ_y	0 or 0.5	0 or 0.5

Figure: Parameters held constant across countries.

Country	β	σ_z
AT	0.98572	0.15897
DE	0.98413	0.19194
FR	0.98676	0.11758
PT	0.98218	0.29466
SK	0.98749	0.04328

Figure: Endogenously calibrated parameters (1-asset model).

Country	χ_0	χ_1	β	σ_z	ω	ρ_z
AT	0.14500	5.27220	0.97987	0.29787	0.003	0.95
DE	0.11732	3.16578	0.97888	0.29151	0.002	0.95
FR	0.51287	12.28398	0.98508	0.15932	0.001	0.94
PT	0.80000	29.85067	0.98328	0.16903	0.003	0.93
SK	3.00000	9.16413	0.98646	0.11292	0.001	0.91

Figure: Endogenously calibrated parameters (2-asset model).

Impulse Response Functions - One-Asset

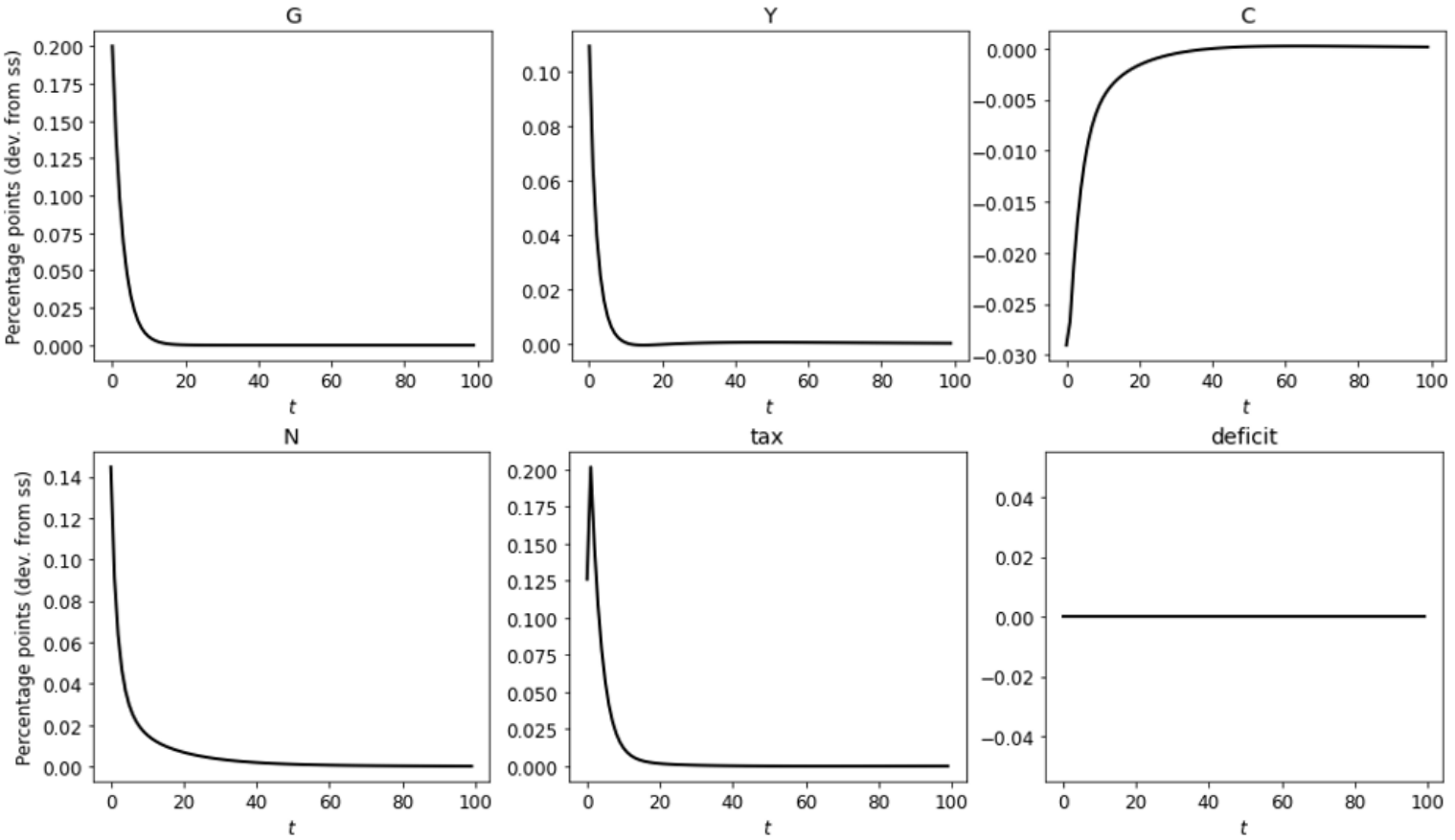

Figure: IRFs of Portugal in the one-asset model, tax-financed, baseline Taylor Rule.

Impulse Response Functions - Two-Asset

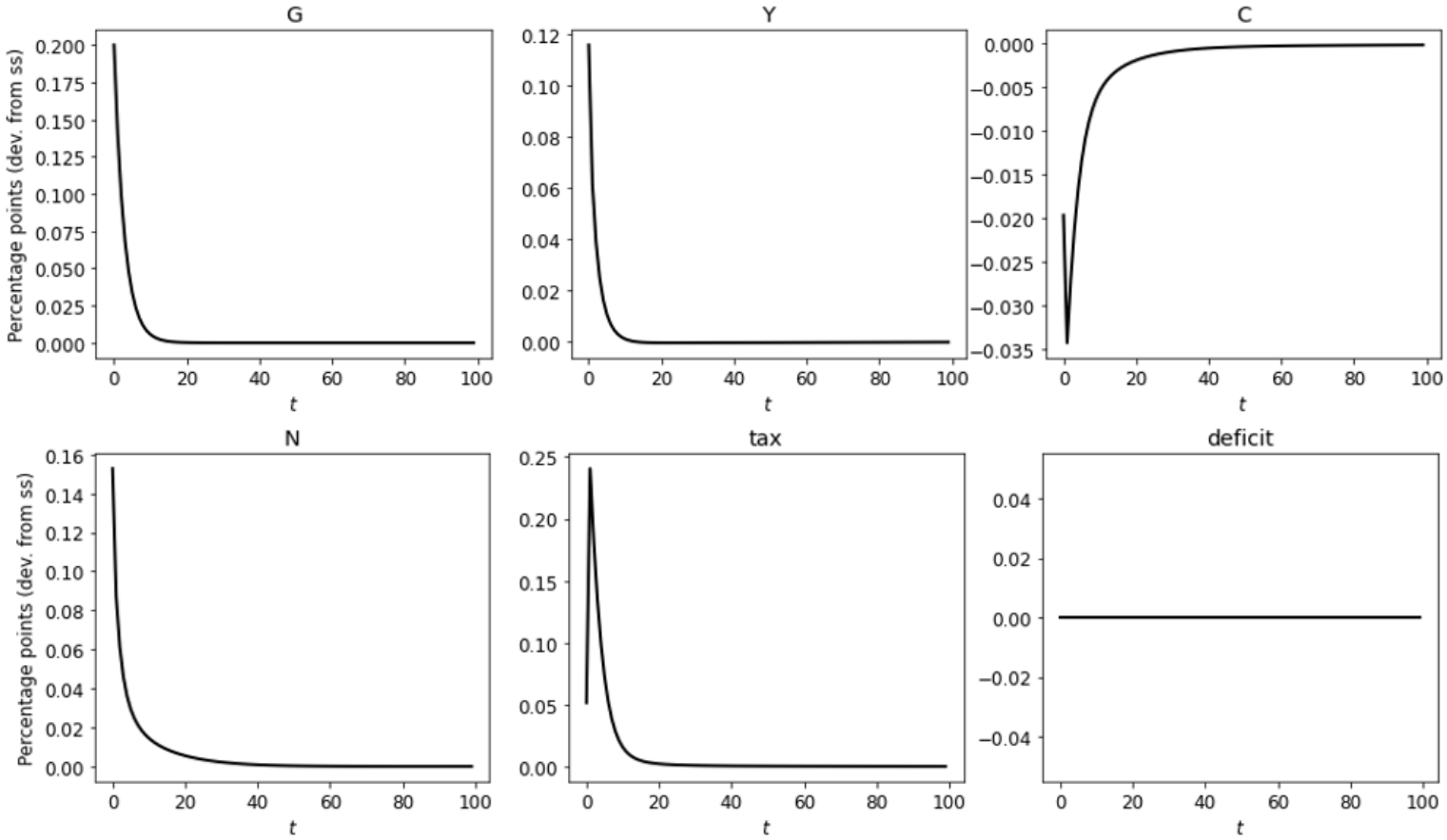

Figure: IRFs of Portugal in the two-asset model, tax-financed, baseline Taylor Rule.