A TANK of Fiscal Policy Uncertainty

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Facts

- Houses and others iliquid assets accounts for the bulk of portfolio composition of the 1st quintile of wealth distribution (Kuhn and Ríos-Rull, 2016); Table Figures
- Employment recovery are slowed with self-insurance (Domeij and Flodén, 2006);
- Borrowing constraint individuals:
  - Little liquid asset;
  - Little liquid asset relative to historical earnings;
  - Little total wealth;
- Kaplan et al. (2014)

The Hand-to-Mouth Agent

- Households with little liquid wealth consume all of their disposable income every period (Hand-to-Mouth);
- HtM agents represent 20% of total US income;
- The fraction of HtM households remains fairly stable over time;
- The fraction varies from 25% to 50%, depending on the definition.

This Paper

- Two-Agent New Keynesian (TANK) general equilibrium model;
- We assume that a fraction of agents spend significant amounts of unexpected wealth when they arrive;
- We analyze the real effects of uncertainty shocks on a developed and developing country (US and Brazil);
- This framework generates larger indirect effects on aggregate consumption, which are absent on a RANK model.

Real effects of uncertainty

- An increase in uncertainty may depress investment and hires, expending a region of **inaction**;
- Bloom (2009) introduced uncertainty as a stochastic volatility process;
- Uncertainty about productivity can have large impacts on GDP and employment, but this is not a consensus on the empirical literature;

What is Fiscal Policy Uncertainty?

- An increase on the volatility of fiscal policy instruments;
- On the aftermath of 2008 financial crisis, fiscal policy uncertainty emerges on the US;
  - Discussions about its usage as stabilization instrument,
  - Cost of government rescuing banks,
  - How the recession would affect social transfers programs.
- The implication of taxation on consumption, saving and work effort is sensitive to the individuals' abilities to use **capital market to transfer income** across time;

Literature

General equilibrium quantitative macro models:

- With heterogeneous agents and incomplete markets (HANK): Kaplan et al. (2018);
- Two-Agent NK Models: Debortoli and Galí (2017);
- TANK with Fiscal Policy: Drautzburg and Uhlig (2015);
- RANK with Uncertainty: Born and Pfeifer (2014), Fernández-Villaverde et al. (2015) and Basu and Bundick (2017).

Model Outline

- Two-Agent Model;
- Sticky Prices and Wages;
- Epstein-Zin Preferences;
- Monopolistically competitive intermediate goods firms;
- A perfectly competitive labor packer aggregates the different types of labor;
- Firms cannot distinguish agents type;
- Fiscal shocks with stochastic volatility.

Environment

- A fraction μ is hand-to-mouth (HtM) and $(1-\mu)$ is non-hand-to-mouth (bondholders/savers);
- Both agents have preferences represented by an EZ aggregator between the period utility U_t and the continuation V_{t+1}:

$$V_t^{1-\psi} = (1-\beta)U_t(c_t, h_t)^{1-\psi} + \beta\mathbb{E}_t(V_{t+1}^{1-\gamma})^{\frac{1-\psi}{1-\gamma}}, \tag{1}$$

where $U_t = c_t^{\eta}(1-h_t)^{1-\eta}$.

Households

- The budget constraint for the HtM agent is:

$$c_t^h + \Omega_t^h = (1 - \tau_t^w) \int_0^1 w_{j,t} h_{j,t}^h dj - AC_{j,t}^w, \tag{2}$$

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- The Bondholder agent faces the following budget constraint:

$$\begin{aligned} c_t^b + x_t + b_t + \Omega_t^b =& (1 - \tau_t^w) \int_0^1 w_{j,t} h_{j,t}^b dj \\ & + (1 - \tau_t^k) r_t^k u_t k_{t-1} + \frac{R_{t-1} b_{t-1}}{\Pi_t} - AC_{j,t}^w + F_t, \end{aligned} \tag{3}$$

Wages Capital LOM

Agents Aggregation

Firms cannot distinguish the type of each agent on the labor market, thus,

$$h_t = \mu h_t^h + (1 - \mu) h_t^b.$$

Consumption and lump-sum taxes can also be represented as

$$\begin{aligned} c_t &= \mu c_t^h + (1 - \mu) c_t^b \\ \Omega_t &= \mu \Omega_t^h + (1 - \mu) \Omega_t^b. \end{aligned}$$

Firms

- There is a continuum of **monopolistically competitive intermediate goods firms**, which produce differentiate goods $y_{j,t}$;
- It rent labor $h_{i,t}$ from both agents and capital $k_{i,t-1}$ from the saver agent;
- Intermediate producers solve a two-stage problem.
- Cobb-Douglas with CRS;
- Prices subject to quadratic adjustment cost.

Details

Government

- Monetary authority sets interest rate R_t according to a Taylor rule, reacting to deviations of inflation, output and steady-state nominal interest rate; Taylor Rule Taylor Rule w/ Uncertainty
- The government budget constraint is

$$\begin{aligned} b_t =& \frac{R_{t-1} b_{t-1}}{\Pi_t} + g_t - \tau_t^w w_t h_t - \tau_t^k r_t^k k_{t-1} \\ & - z_t \left[\phi_{d,b} \left(\frac{b_{t-1}}{z_{t-1} y_s} - \frac{b_s}{y_s} \right) + \mu \Omega_t^h + (1-\mu) \Omega_t^b \right], \end{aligned} \tag{4}$$

- Spending g_t and taxes are set according to fiscal rules which incorporate stochastic volatility.

Fiscal Policy Rule

For $\mathsf{x} \in \{g, \tau^k, \tau^l\}$, the law of motion for each instrument is given by

$$\begin{aligned}\mathsf{x}_t - \mathsf{x} =& \rho_{\mathsf{x}}(\mathsf{x}_{t-1} - \mathsf{x}) + \rho_{\mathsf{x},y}\tilde{y}_{t-1} \\ &+ \rho_{\mathsf{x},b}\left(\frac{b_{t-1}}{y_{t-1}} - \frac{b_s}{y_s}\right) + \exp\{\sigma_{\mathsf{x},t}\}\varepsilon_{\mathsf{x},t}, \quad \varepsilon_{\mathsf{x},t} \sim \mathcal{N}(0,1),\end{aligned}$$

where the log standard deviation of each policy instrument ($\sigma_{e,t}$) has a time-varying stochastic volatility process,

$$\sigma_t = (1-\rho_\sigma)\sigma + \rho_\sigma\sigma_{t-1} + (1-\rho_\sigma^2)^{1/2}\eta_\sigma u_t, \quad u_t \sim \mathcal{N}(0,1).$$

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Fiscal Policy Instruments Parameters

	United States			Brazil		
	Labor	Capital	Government Spending	Labor	Capital	Government Spending
ρ_x	0.99	0.98	0.99	0.88	0.63	0.91
	[0.98, 0.99]	[0.92, 0.99]	[0.65, 0.97]	[0.80, 0.95]	[0.47, 0.77]	[0.87, 0.96]
$\rho_{x,y}$	0.040	**0.043**	-0.004	0.047	**0.11**	**0.021**
	[0.008, 0.045]	[0.003, 0.099]	[-0.018, 0.00]	[0.004, 0.159]	[0.02, 0.23]	[-0.025, 0.066]
$\rho_{x,b}$	0.003	0.003	-0.008	0.01	**-0.002**	-0.012
	[0.000, 0.008]	[0.003, 0.099]	[-0.018, 0.00]	[-0.01, 0.04]	[-0.03, 0.03]	[-0.021, -0.006]
σ_s	-6.01	-4.89	-6.20	-4.10	-4.56	-5.59
	[-6.20, -5.81]	[-7.35, -6.87]	[-6.53, -5.71]	[-4.74, -3.79]	[-5.15, -4.33]	[-5.99, -5.38]
ρ_σ	0.46	0.65	0.92	0.28	0.20	0.21
	[0.33, 0.58]	[0.39, 0.86]	[0.78, 0.99]	[0.03, 0.69]	[0.02, 0.69]	[0.02, 0.58]
η_σ	0.820	0.400	0.180	0.27	0.16	0.20
	[0.70, 0.97]	[0.22, 0.58]	[0.10, 0.29]	[0.02, 0.93]	[0.02, 0.88]	[0.02, 0.65]

Note: Parameters estimated following a Bayesian approach by combining the likelihood function with flat priors and sampling from the posterior with a Markov Chain Monte Carlo. For each parameter, we report the posterior mean and, in brackets, a 90 percent probability interval.

- Data: aggregate effective tax rates and total expenditure of the central government;

Solution and Calibration

- Third-order approximation with punning;
- Internally calibrated parameters: γ_h, γ_b, β, δ, δ_2, κ, Π_s, ϕ_R, ϕ_Π, ϕ_y and σ_m.
- SMM calibration matching 26 moments to calibrate 11 parameters:
  - The average of interest rates and inflation,
  - standard deviation, auto-correlation with one lag and correlation of all variables with output, and
  - the correlation between interest rates and inflation.

Data Desc.

Calibration

	Description	Brazil	United States	Source
Preferences				
β	Time-discount factor	0.9785	0.9959	Calibration
γ_h	HtM Risk Aversion	1329.10	370.34	Calibration
γ_b	Bondholder Risk Aversion	373.46	661.83	Calibration
Technology				
δ	Steady state depreciation	0.0442	0.0451	Calibration
δ_2	Rate of capital depreciation	0.003	0.0139	Calibration
κ	Investment cost	0.9458	0.758	Calibration
Taylor Rule				
ϕ_R	Smoothing of past interest rate	0.7611	0.7584	Calibration
ϕ_Π	Response to inflation deviations	1.5701	1.6966	Calibration
ϕ_y	Response to output gap deviations	0.0097	0.0863	Calibration
Π_s	Steady state inflation	1.0124	1.0090	Calibration
σ_m	Standard dev. of the monetary shock	0.0034	2.0e-4	Calibration
ϕ_σ	Response to capital tax volatility	0.005	0.005	FGKR

More Parameters Model Fit

Preliminary Results - United States

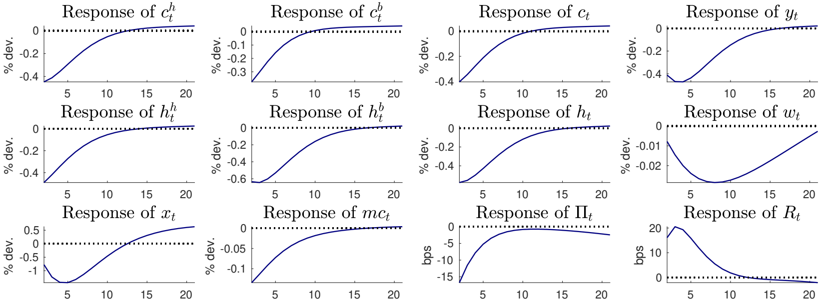


Figure 1: IRF to a Fiscal Policy Uncertainty Shock

Note: GIRFs to a positive two-standard-deviations innovation to a fiscal volatility shock to the capital income tax. Interest rate and inflation are in annualized basis points. In the first line the plots presents the reaction of consumption of HtM agent (c_t^h), bondholder (c_t^b), aggregate consumption and product (c_t and y_t). Second line, HtM, Saver and aggregate hours worked (h_t^h, h_t^b and h_t) and wages (w_t). Finally, investments (x_t), marginal cost (mc_t), inflation (Π_t) and interest rates (R_t).

Preliminary Results - Brazil

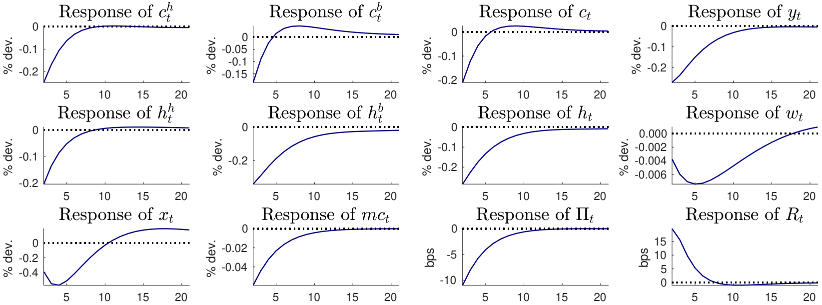


Figure 2: IRF to a Fiscal Policy Uncertainty Shock

Note: GIRFs to a positive two-standard-deviations innovation to a fiscal volatility shock to the capital income tax. Interest rate and inflation are in annualized basis points. In the first line the plots presents the reaction of consumption of HtM agent (c_t^h), bondholder (c_t^b), aggregate consumption and product (c_t and y_t). Second line, HtM, Saver and aggregate hours worked (h_t^h, h_t^b and h_t) and wages (w_t). Finally, investments (x_t), marginal cost (mc_t), inflation (Π_t) and interest rates (R_t).

Summary Results

- Saver household invest less because of the increased probability of a high tax rate on capital income;
- Lower marginal cost (higher markups) imply that firms will produce less output and require less capital;
- HtM household would have to decrease consumption drastically if she reduce labor supply as much as for Savers. When wages fall more drastically, they have to increase labor supply.

Fiscal Shock KMV results

Preliminary Results - United States

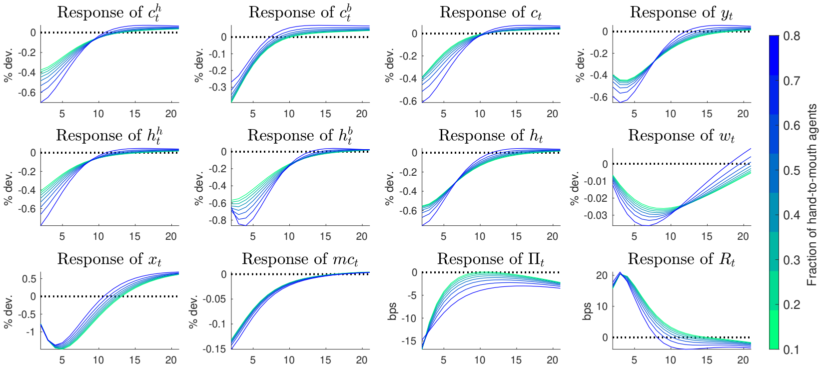
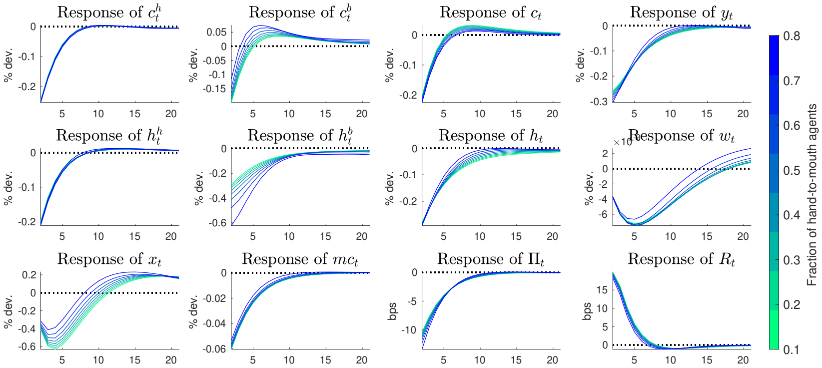


Figure 3: Sensitivity to the fraction of HtM agents

Note: Sensitivity test to the fraction of HtM agents on the economy μ given a positive two-standard-deviations innovation to a fiscal volatility shock to the capital income tax. Interest rate and inflation are in annualized basis points. In the first line the plots presents the reaction of consumption of HtM agent (c_t^h), bondholder (c_t^b), aggregate consumption and product (c_t and y_t). Second line, HtM, Saver and aggregate hours worked (h_t^h, h_t^b and h_t) and wages (w_t). Finally, investments (x_t), marginal cost (mc_t), inflation (Π_t) and interest rates (R_t).

Preliminary Results - Brazil



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Final Remarks

- The fraction of HtM agents has stronger effect on aggregate variables for the US;
- A greater fraction of HtM agents in Brazil affects mainly bondholders and the investment levels;
- We still need further analysis to understand the channels that lead to these differences (fiscal policy rule, risk aversion or Taylor rule parameters...);
- Results of fiscal policy volatility shock are similar to those presented by Bayer et al. (2019) as income risk on a fully heterogeneous model with incomplete markets;
- We are able recognize some country specific reactions to uncertainty shocks.

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- Wages are subject to a quadratic adjustment cost

$$AC^{w}_{j,t} = \frac{\phi_w}{2}\left(\frac{w_{j,t}}{w_{j,t-1}} - z_s\right)^2 y_t,$$

where z_s is the steady-state of the productivity shock z_t.

- A perfect competitive labor packer aggregate the different types of labor $h_{j,t}$ into homogeneous labor, so $h_{j,t} = h^d_t \int_0^1 \left(\frac{w_{j,t}}{w_t}\right)^{-\varepsilon_w} dj$.

The law of motion of capital is:

$$k_t = (1 - \delta(u_t))k_{t-1} + \left(1 - \mathcal{S}\left[\frac{x_t}{x_{t-1}}\right]\right) x_t, \tag{5}$$

where the adjustment cost of investments assumes a quadratic form $\mathcal{S}\left[\frac{x_t}{x_{t-1}}\right] = \frac{\kappa}{2}\left(\frac{x_t}{x_{t-1}} - z_s\right)^2$, and $\delta(u_t) = \delta + \delta_1(u_t - 1) + \frac{1}{2}\delta_2(u_t - 1)^2$ is the depreciation rate that depends on the capacity utilization rate.

Household

- Since the firms do not hire labor services provided by the labor packer and there is no distinguish between labor supplied by saver or buyers, the intermediate firms problem will be standard;
- Cobb-Douglas RCE production function $y_{i,t} = k_{i,t-1}^{\alpha}[z_t h_{i,t}^d]^{1-\alpha}$, where z_t is the labor-augmenting productivity that follows an AR(1) process.
- Cost minimization implies marginal cost $mc_t = \left(\frac{1}{1-\alpha}\right)^{1-\alpha} \left(\frac{1}{\alpha}\right) \frac{w_t^{1-\alpha} r_t^{\alpha}}{A_t^{1-\alpha}}$.
- Prices are subject to quadratic adjustment costs,

$$AC_{i,t}^p = \frac{\phi_p}{2} \left(\frac{p_{i,t}}{p_{i,t-1}} - \Pi_s \right)^2 y_{i,t},$$

where Π_s is the steady state level of inflation.

Back

- Firms solve:

$$\max_{p_{i,t+s}} \quad \mathbb{E}_t \sum_{s=0}^{\infty} \left[\frac{\partial V_t / \partial c^2_{t+s}}{\partial V_t / \partial c^2_t} \right] \left[\frac{p_{i,t+s}}{p_{t+s}} y_{i,t+s} - mc_{i,t+s} y_{i,t+s} - AC^p_{i,t+s} \right] \tag{6}$$

subject to $y_{i,t} = \left(\frac{p_{i,t}}{p_t}\right)^{-\varepsilon_p} y^d_t$ and $AC^p_{i,t}$.

Back

- Monetary authority sets the nominal interest rate according to the following Taylor rule:

$$R_t = R_s \left(\frac{R_{t-1}}{R_s}\right)^{\phi_R} \left[\left(\frac{\Pi_t}{\Pi_s}\right)^{\phi_\Pi} \left(\frac{y_t}{y_s}\right)^{\phi_y}\right]^{1-\phi_R} \exp\{\sigma_m \Phi_t\}, \quad (7)$$

  where the monetary policy shock Φ_t follows a $\mathcal{N}(0,1)$ process.

- The parameter ϕ_R generates interest-rate smoothing;
- ϕ_Π and ϕ_y control the responses to deviations of inflation from target inflation and output.

Fernández-Villaverde et al. (2015) highlight that this Taylor Rule does not generates the same effects from empirical estimations for the **inflation** and **interest rates**, so they propose the following alternative:

$$R_t = R_s \left(\frac{R_{t-1}}{R_s}\right)^{\phi_R} \left[\left(\frac{\Pi_t}{\Pi_s}\right)^{\phi_\Pi} \left(\frac{y_t}{y_s}\right)^{\phi_y} \left(\frac{e^{\sigma_{e,t}}}{e^{\sigma_{e,s}}}\right)^{\phi_\sigma}\right]^{1-\phi_R} \exp\{\sigma_m \Phi_t\},$$

where the monetary authority also reacts to fiscal volatility shocks.

Government

Fiscal Policy in Developing Countries

- Developing countries does not have the same fiscal policy reaction of advanced countries:
  - Gavin and Perotti (1997) for Latin America;
  - Alesina et al. (2008) and Vegh and Vuletin (2015) show that countercyclical reaction of the government spending to the output does not hold for many developing countries;
  - Campos and Cysne (2019) evidences for Brazil.
- We also relaxed the the procyclicality assumption on the reaction of labor and capital tax to lagged debt, since direction for this relation are absent on the literature of developing countries.

Back: fiscal policy rules

Baker et al. (2016) developed an index of economic policy uncertainty (EPU) based on newspaper coverage frequency.

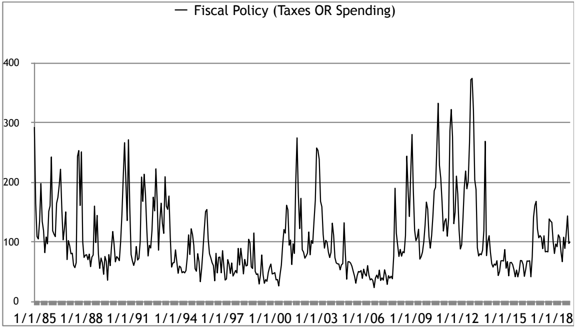


Figure 5: Categorical EPU - Fiscal Policy and Government spending

Back: Fiscal Policy Uncertainty

	0–1	1–5	5–10	1st	2nd	3th	4th	5th	90–95	95–99	99–100	All
Liquid assets	2.8	4.8	22.9	8.1	17.0	10.2	7.4	5.9	6.5	7.0	4.6	6.4
CDs	0.0	0.6	1.7	0.5	0.6	1.0	1.6	0.9	1.5	0.7	0.5	0.9
Mutual funds	0.0	0.4	1.1	0.3	0.4	0.8	1.6	7.9	5.2	7.6	10.5	7.0
Stocks	0.0	0.9	2.0	0.7	1.5	1.1	1.9	8.2	5.6	9.4	9.7	7.4
Bonds	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.8	0.5	2.0	2.5	1.5
Saving bonds	0.0	0.1	0.6	0.2	0.3	0.4	0.2	0.1	0.2	0.1	0.0	0.1
Other managed assets	0.0	0.0	2.1	0.3	0.3	0.7	1.9	3.9	2.9	3.3	5.1	3.6
Cash value life insurance	0.1	1.3	2.2	1.1	4.9	1.9	1.7	1.2	1.4	1.0	1.1	1.3
Other financial assets	0.1	0.3	1.2	0.6	2.1	0.8	0.8	0.8	0.9	0.9	0.7	0.8
Retirement accounts	5.2	9.0	31.8	12.0	21.5	19.6	24.3	17.8	29.0	19.6	9.4	18.7
Houses	48.8	122.9	308.7	140.3	207.1	120.5	74.8	21.7	33.8	21.5	9.0	32.4
Vehicles	7.7	29.1	102.8	40.3	73.1	20.3	8.7	1.7	2.5	1.4	0.6	3.7
Other residential RE	1.4	11.8	33.0	10.0	5.5	6.7	6.8	8.0	9.0	8.6	7.3	7.9
Nonresidential RE	0.0	0.1	0.6	0.3	1.3	1.7	2.0	3.9	4.0	4.3	3.7	3.6
Business	5.2	2.3	3.9	4.3	2.2	2.6	4.0	23.3	9.0	19.5	36.9	20.8
Other nonfinancial assets	0.4	0.4	2.1	0.7	1.5	1.1	0.7	0.9	0.9	0.6	1.2	0.9
Mortgages + HELOCs	−66.5	−145.9	−333.1	−161.1	−178.4	−71.4	−30.7	−6.0	−10.0	−5.6	−1.5	−12.7
Residential debt	−0.4	−13.9	−36.0	−10.7	−3.6	−3.9	−2.4	−1.3	−1.9	−1.4	−0.8	−1.6
Other lines of credit	0.0	−0.4	−5.2	−0.8	−1.1	−0.2	−0.1	−0.1	0.0	−0.1	−0.2	−0.1
Credit cards	−7.4	−7.9	−32.8	−13.0	−9.3	−2.4	−1.1	−0.1	−0.2	0.0	0.0	−0.4
Installment loans	−97.3	−108.4	−204.4	−129.7	−45.7	−10.9	−3.9	−0.4	−0.6	−0.2	−0.1	−2.3
Other debt	−0.2	−7.5	−5.1	−4.4	−1.3	−0.6	−0.2	−0.1	−0.1	−0.1	−0.1	−0.2

Figure 6: Portfolio Composition of the wealth partition, 2013

Source: Kuhn and Ríos-Rull (2016)

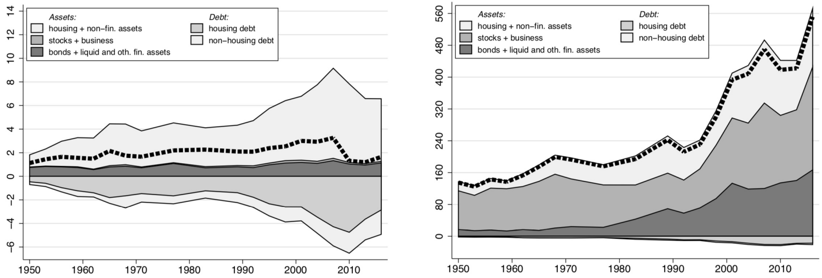
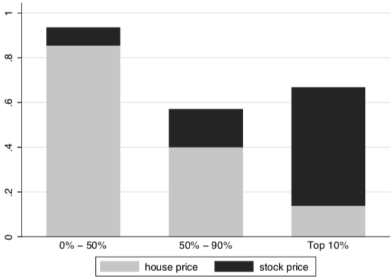


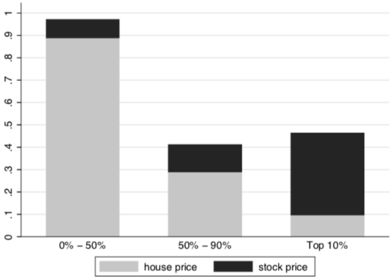
Figure 7: Household Portfolio for <50% and top 10% wealth groups

Source: Kuhn et al. (2017)

Facts



(a) Wealth growth from asset prices



(b) Share in total wealth growth

Figure 8: Wealth growth from asset prices, 1971 - 2007

Source: Kuhn et al. (2017)

Facts

Preliminary Results

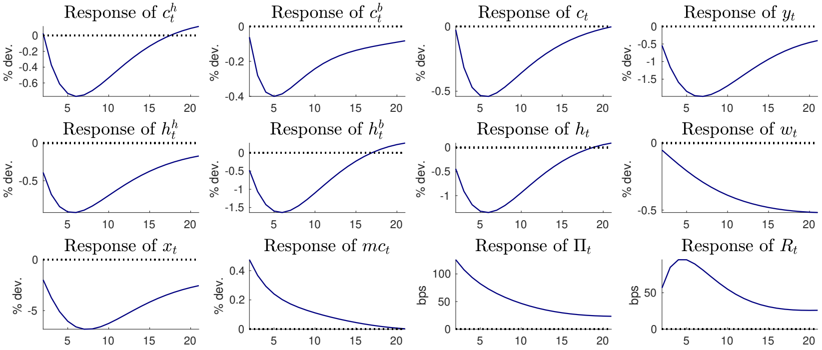


Figure 9: IRF to a Fiscal Policy Shock to Capital Income Tax

Note: GIRFs to a positive two-standard-deviations innovation to a fiscal shock to the capital income tax. Interest rate and inflation are in annualized basis points. In the first line the plots presents the reaction of consumption of HtM agent (c_t^h), bondholder (c_t^b), aggregate consumption and product (c_t and y_t). Second line, HtM, Saver and aggregate hours worked (h_t^h, h_t^b and h_t) and wages (w_t). Finally, investments (x_t), marginal cost (mc_t), inflation (Π_t) and interest rates (R_t).

Preliminary Results

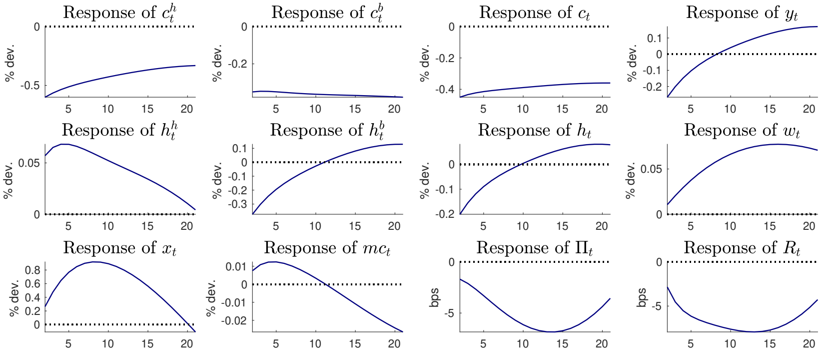


Figure 10: IRF to a Fiscal Policy Shock to Labor Income Tax

Note: GIRFs to a positive two-standard-deviations innovation to a fiscal shock to the labor income tax. Interest rate and inflation are in annualized basis points. In the first line the plots presents the reaction of consumption of HtM agent (c_t^h), bondholder (c_t^b), aggregate consumption and product (c_t and y_t). Second line, HtM, Saver and aggregate hours worked (h_t^h, h_t^b and h_t) and wages (w_t). Finally, investments (x_t), marginal cost (mc_t), inflation (Π_t) and interest rates (R_t).

Preliminary Results

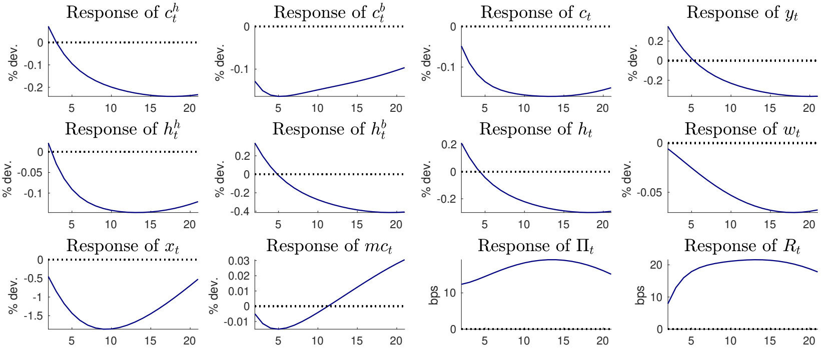


Figure 11: IRF to a Fiscal Policy Shock to Government Spending

Note: GIRFs to a positive two-standard-deviations innovation to a fiscal shock to the government spending.. Interest rate and inflation are in annualized basis points. In the first line the plots presents the reaction of consumption of HtM agent (c_t^h), bondholder (c_t^b), aggregate consumption and product (c_t and y_t). Second line, HtM, Saver and aggregate hours worked (h_t^h, h_t^b and h_t) and wages (w_t). Finally, investments (x_t), marginal cost (mc_t), inflation (Π_t) and interest rates (R_t).

- According do Kaplan et al. (2018), a negative monetary shock will be transfer to consumption through four channels:
  - Direct effect (+): lower R_t, intertemporal substitution and income effect;
  - Indirect effect(−): Portfolio reallocation due to $R_t - r_t^k$;
  - Indirect effect (+): Labor demand channel $\uparrow w_t$;
  - Indirect effect (+): fiscal adjustment, an increase on transfers[1] in response to decrease in interest payments on b_t.

Results

[1] Our counterpart is government spending g_t

Data for the period 1970:I–2014:II (jun) are taken from St. Louis Fed's FRED database.

1. GDPC1 : Real Gross Domestic Product, Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate
2. GPDIC1 : Real Gross Private Domestic Investment, Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate
3. PCECC96 : Real Personal Consumption Expenditures, Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate
4. FEDFUNDS: Effective Federal Funds Rate, Percent, Not Seasonally Adjusted (Monthly)
5. GDPDEF : Gross Domestic Product: Implicit Price Deflator, Index 2012=100, Seasonally Adjusted
6. HCOMPBS : Business Sector: Compensation Per Hour, Index 2012=100, Seasonally Adjusted
7. HOABS : Business Sector: Hours of All Persons, Index 2012=100, Seasonally Adjusted
8. TCU : Capacity Utilization: Total Industry, Percent of Capacity, Seasonally Adjusted (Monthly)

Solution & Calibration

Data for the period 1999:I–2014:II (jun) for Brazil.

1. Real Gross Domestic Product (GDPC1),
2. Real Gross Private Domestic Investment (GPDIC1),
3. Real Personal Consumption Expenditures (PCECC96), chained indexes (Source: System of Quarterly National Accounts, IBGE),
4. Effective SELIC Rate (FEDFUNDS), Percent, Not Seasonally Adjusted (Source: BCB-SGS id code 4390),
5. Broad Consumer Price Index, IPCA, (GDPDEF), Index 1993 = 100, (Source: (IBGE/SNIPC, IPEADATA id code 36482),
6. Average nominal salary in industry in the State of São Paulo (HCOMPBS), Index 2006 = 100, (Source: *Federação e Centro das Indústrias do Estado de São Paulo, Levantamento de Conjuntura*, Fiesp, IPEADATA id code 33689),
7. Industry: Hours of All Persons (HOABS)m Index 2006 = 100, Seasonally Adjusted, (Source: *Confederação Nacional da Indústria*, IPEADATA id code 33209),
8. Capacity Utilization: Total Industry (TCU), Percent of Capacity, Seasonally Adjusted Monthly, (Source: *Confederação Nacional da Indústria*, IPEADATA id code 33211).

Solution & Calibration

	Description	Value	Source
Preferences			
β	Time-discount factor	0.9959	Calibration
γ_h	HtM Risk Aversion	370.34	Calibration
γ_b	Bondholder Risk Aversion	661.83	Calibration
ψ_h	HtM Inverse IES	0.40	Vissing-Jørgensen (2002)
ψ_b	Bondholder Inverse IES	1.25	Vissing-Jørgensen (2002)
μ	Fraction of HtM agents	0.40	Kaplan et al. (2014)
η	Consumption preferences	0.4034	Endogenous
Ω^h	HtM lump-sum tax steady state	-0.2263	Endogenous
Ω^b	Lump-sum tax steady state	0.3019	Endogenous
Technology			
α	Capital Share	0.36	FGKR
ε_p	Demand elasticity goods	21.0	FGKR
ε_w	Demand elasticity labor	21.0	FGKR
δ	Steady state depreciation	0.0451	Calibration
δ_1	Rate of capital depreciation	0.01	**?**
δ_2	Rate of capital depreciation	0.0139	Calibration
κ	Investment cost	0.9419	Calibration
Taylor Rule			
ϕ_R	Smoothing of past interest rate	0.7584	Calibration
ϕ_Π	Response to inflation deviations	1.6966	Calibration
ϕ_y	Response to output gap deviations	0.0863	Calibration
ϕ_σ	Response to capital tax volatility	0.005	FGKR
Π_s	Steady state inflation	1.0090	Calibration
σ_m	Standard dev. of the monetary shock	2.0e-4	Calibration

Note: parameters fixed prior to the estimation are referred with their corresponding source. Parameters estimated with SMM procedure are tagged with "Calibration". The consumption preference parameter η is tagged with "Endogenous" because we normalize the steady state of hours worked to 1/3 using η. We also set Ω^h and Ω^b endogenously to achieve a balanced HtM and governmental budget constraint, respectively.

Calibration

Fitting - US

Moments	Data	Model	Moments	Data	Model
Mean					
R_t	0.8885	0.8912	Π_t	1.4028	1.2852
Standard Deviation			*Auto-Correlation*		
y_t	1.5278	1.8796	$corr(y_t, y_{t-1})$	0.8779	0.9178
c_t	1.2481	0.7818	$corr(c_t, c_{t-1})$	0.8909	0.8343
x_t	7.0489	6.9979	$corr(x_t, x_{t-1})$	0.8532	0.9511
w_t	0.9329	0.2090	$corr(w_t, w_{t-1})$	0.7074	0.9694
h_t	1.9474	1.6701	$corr(h_t, h_{t-1})$	0.9276	0.8315
u_t	3.2484	2.4141	$corr(u_t, u_{t-1})$	0.8993	0.8970
R_t	0.9365	0.7355	$corr(R_t, R_{t-1})$	0.9701	0.9842
Π_t	0.6079	0.7192	$corr(\Pi_t, \Pi_{t-1})$	0.9038	0.9349
Correlation					
$corr(y_t, c_t)$	0.8796	0.7932	$corr(y_t, u_t)$	0.8777	0.6230
$corr(y_t, x_t)$	0.9214	0.8232	$corr(y_t, R_t)$	0.2021	-0.4609
$corr(y_t, w_t)$	0.1196	0.5958	$corr(y_t, \Pi_t)$	0.1160	-0.2736
$corr(y_t, h_t)$	0.8702	0.8959	$corr(\Pi_t, R_t)$	0.6651	0.9113

Note: All data, except nominal interest rates and inflation, are in logs, HP-filtered, and multiplied by 100 to express them in percentage deviation from trend. Nominal interest rates and inflation are directly expressed in percentage points. We omitted model fit for the mean and auto-correlation for a lag of five in the interest of space.

Fitting - Brazil

Moments	Data	Model	Moments	Data	Model
Mean					
R_t	3.6402	4.0196	Π_t	1.5861	1.6439
Standard Deviation			*Auto-Correlation*		
y_t	1.758	1.7623	$corr(y_t, y_{t-1})$	0.74388	0.69098
c_t	1.29	1.1464	$corr(c_t, c_{t-1})$	0.55825	0.48726
x_t	3.9761	4.5304	$corr(x_t, x_{t-1})$	0.60349	0.89865
w_t	2.0259	0.10741	$corr(w_t, w_{t-1})$	0.6087	0.94596
h_t	2.3639	2.0404	$corr(h_t, h_{t-1})$	0.71218	0.62762
u_t	1.6326	1.6537	$corr(u_t, u_{t-1})$	0.77985	0.69937
R_t	1.3517	1.3567	$corr(R_t, R_{t-1})$	0.67623	0.60661
Π_t	0.87585	0.24949	$corr(\Pi_t, \Pi_{t-1})$	0.49848	0.66197
Correlation					
$corr(y_t, c_t)$	0.77616	0.7664	$corr(y_t, u_t)$	0.90875	0.56632
$corr(y_t, x_t)$	0.67929	0.74621	$corr(y_t, R_t)$	0.12665	-0.76572
$corr(y_t, w_t)$	-0.38174	-0.050341	$corr(y_t, \Pi_t)$	0.23915	0.40929
$corr(y_t, h_t)$	0.49078	0.64953	$corr(\Pi_t, R_t)$	0.35504	-0.55523

Note: All data, except nominal interest rates and inflation, are in logs, HP-filtered, and multiplied by 100 to express them in percentage deviation from trend. Nominal interest rates and inflation are directly expressed in percentage points. We omitted model fit for the mean and auto-correlation for a lag of five in the interest of space.

Calibration