How Ricardian Are We?

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Introduction

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  - Micro studies estimate generic MPC, but we need the *MPC out of Debt-Financed Transfers*

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   - Barnichon-Mesters: structural macro equations can be estimated using macro shocks as IVs!
   - Consumption function has many endogenous regressions, so we assemble a large number of well-identified shocks from the literature

Our Contributions (cont.)

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   - GE model: government borrowing crowds out capital

Theoretical Framework

"The debts of a nation are debts due from the right hand to the left."

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"The people who pay the taxes never so estimate them, and therefore do not manage their private affairs accordingly."

— David Ricardo (1820)

Behavioral Consumption Function Ingredients

- Government budget constraint:

$$B_{t-1} + G_t = T_t + Q_t B_t$$

- Household budget constraint:

$$B_{t-1} + R_t^K K_{t-1} + Y_t^N = C_t + T_t + Q_t B_t + K_t$$

- Household Euler Equation

$$Q_t = \beta \tilde{\mathbb{E}}_t \left[\frac{u'(C_{t+1})}{u'(C_t)} \right] + Z_t^d$$

Notes: $\tilde{\mathbb{E}}_t$ is a (possibly) non-rational expectation operator, Z_t^d an exogenous wedge

Behavioral Consumption Function Ingredients (Linearized)

- Household budget constraint:

$$n_{t-1} + y_t = c_t + \tau_t + q_t \overline{B} + \beta n_t$$

- Government budget constraint:

$$b_{t-1} = \tau_t - g_t + \overline{B} q_t + \beta b_t$$

- Household Euler Equation

$$q_t = \beta \tilde{\mathbb{E}}_t[\gamma(c_t - c_{t+1})] + z_t^d$$

Notes: n_t is household financial net worth, steady state returns are β^{-1}, normalize $\overline{C} = 1$

Behavioral Consumption Function: Expectations

- What is $\tilde{\mathbb{E}}_t$?
  - Distorts the rational expectation $\mathbb{E}_t$; relatively general
  - Can apply to all time series or subset
  - Naive or sophisticated (i.e. without or with L.I.E.)

- v_t and $\tilde{v}_t$ denote present values, rational and perceived, e.g.

$$v_t^\tau = \tau_t + \beta \mathbb{E}_t[v_{t+1}^\tau] \qquad \tilde{v}_t^\tau = \tau_t + \beta \tilde{\mathbb{E}}_t[v_{t+1}^\tau]$$

- Assumption: perceived P.V. of future taxes is proportional to true P.V.

$$\tilde{\mathbb{E}}_t[\tilde{v}_{t+1}^\tau] = \theta \mathbb{E}[v_{t+1}^\tau]$$

θ is the *behavioral attenuation* (key parameter)

The Behavioral Consumption Function

Proposition

If expectations satisfy $\tilde{\mathbb{E}}_t[\tilde{v}^{\tau}_{t+1}] = \theta \mathbb{E}[v^{\tau}_{t+1}]$ *then consumption is given by*

$$c_t = (1-\beta)\left(n_{t-1} - \theta b_{t-1} + \tilde{v}^{y}_t - (1-\theta)\tau_t - \theta v^{g}_t + \theta \overline{B} v^{q}_t\right) + \left(\frac{1}{\gamma} - (1-\beta)\overline{B}\right)\tilde{v}^{q}_t + \zeta_t$$

Notes: ζ_t exogenous demand shock (determined by intertemporal wedges)

Empirical Strategy

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- ... but to tell if people are Ricardian, you need the *MPC out of Debt-Financed Transfers* (MPC-DFT)
- Cannot be estimated in (existing) cross-sectional studies because of the *missing intercept problem*
- So we will estimate the consumption function with time series data

Empirical Strategy: Instrumental Variables

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- This plan brings several challenges: develop **B-HIVE** to resolve

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  - Especially problematic here: long horizons in v_t^y etc.

The Bayesian Hybrid Instrumental Variable Estimator

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B-HIVE: State-Space Components

1. A structural equation:

$$c_t = \phi_0 + \phi_n \, n_{t-1} + \phi_b \, b_{t-1} + \phi_\tau \, \tau_t + \sum_{j \in \{y,g,q\}} \tilde{\phi}_j \, v_t^j + \zeta_t$$

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2. A VAR structure for X_t (RHS variables + other observables)

$$X_t = \mu_X + A_1 X_{t-1} + \cdots + A_p X_{t-p} + G\varepsilon_t \quad , \quad \varepsilon_t \sim N(0, I)$$

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3. A measurement equation relating instruments w_t to structural shocks ε_t

$$w_t = \mu_w + M_X X_{t-1} + M\varepsilon_t + \eta_t \qquad \eta_t \sim N(0, \Sigma_\eta)$$

Coefficients can be time-dependent.

Application

Data

- National accounts, everything at household level
  - y_t is personal income (less transfers), τ_t is personal taxes (net of transfers), g_t is expenditures net of residual taxes, n_t is household net worth
  - Normalize everything relative to a nominal GDP trend
- Many many shocks (next slide)
- Baseline: let $\tilde{v}_t^y$, $\tilde{v}_t^q$ be proportional to rational expectations
  - Later: augment with survey forecasts

Classification: External, HFI, Narrative, SVAR

Monetary Policy Shocks: Jarociński and Karadi (2020), Miranda-Agrippino and Ricco (2021), Bauer and Swanson (2023), Swanson (2024), Aruoba and Drechsel (2024), Drechsel (2024)

Government Spending Shocks: Fisher and Peters (2010), Ramey (2016), Romer and Romer (2016), Fieldhouse et al. (2018), Fieldhouse and Mertens (2023),

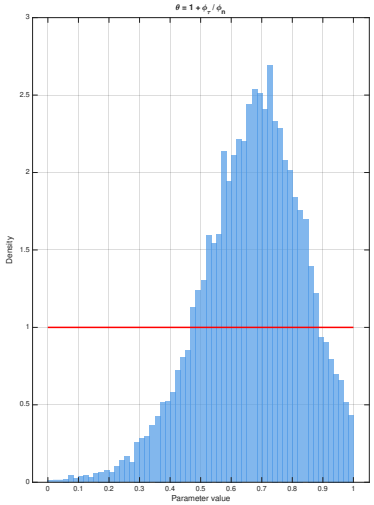
Tax/Borrowing Shocks: Leeper et al. (2012), Phillot (2025), Mertens and Ravn (2012), Lieb et al. (2024)

Technology Shocks: Fernald (2014), Miranda-Agrippino et al. (2025),

Oil Shocks: Kilian (2008), Känzig (2021), Baumeister and Hamilton (2019)

Other Shocks: Kim et al. (2025), Piffer and Podstawski (2018), Chahrour and Jurado (2022), Adams and Barrett (2024)

Posterior Distributions: Not Very Ricardian!



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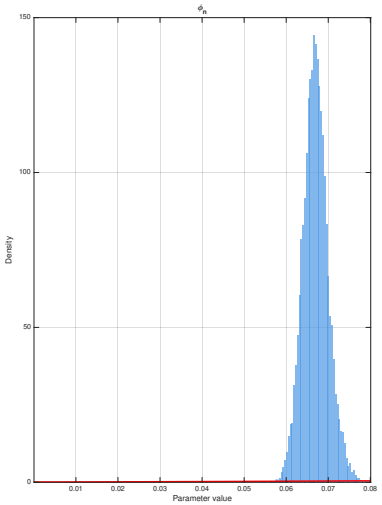

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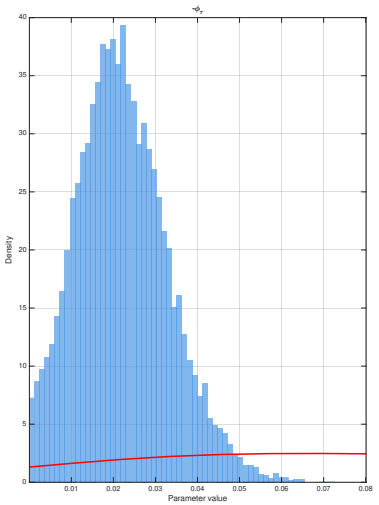

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- MPC (coefficient on net worth n_{t-1}): $\mathbb{E}[1-\beta] = \mathbf{0.07}$
- MPC-DFT (coefficient on $-\tau_t$): $\mathbb{E}[(1-\beta)(1-\theta)] = \mathbf{0.04}$

Point Estimates: Not Very Ricardian!

Specification	Attenuation (θ)	MPC (ϕ_n)	MPC-DFT ($-\phi_\tau$)
Baseline	0.679 [0.376, 0.921]	0.067 [0.062, 0.072]	0.021 [0.005, 0.041]
Non-durable consumption	0.184 [0.016, 0.491]	0.027 [0.021, 0.034]	0.022 [0.013, 0.030]
Survey-based forecasts	0.456 [0.049, 0.908]	0.015 [0.011, 0.019]	0.008 [0.001, 0.015]
Non-separable utility	0.052 [0.005, 0.295]	0.065 [0.059, 0.067]	0.062 [0.042, 0.066]
Variable distortionary taxes	0.206 [0.131, 0.253]	0.036 [0.033, 0.040]	0.029 [0.026, 0.032]
Variable HtM income shares	0.154 [0.048, 0.292]	0.071 [0.066, 0.077]	0.060 [0.049, 0.069]
6 select instruments	0.348 [0.048, 0.757]	0.040 [0.032, 0.051]	0.026 [0.010, 0.038]

Notes: Point estimates are medians of the marginal posterior distributions. The [5%, 95%] credible intervals are reported in brackets.

General Equilibrium

GE Model Summary

- Simple behavioral RBC:
  - Capital investment, inelastic labor, risk-free debt
  - Many shocks
  - Cognitive discounting over taxes *only*

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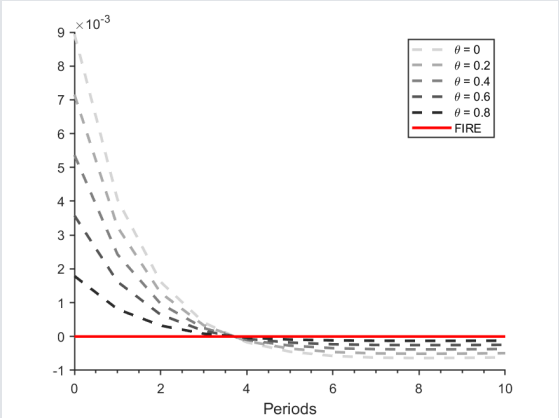

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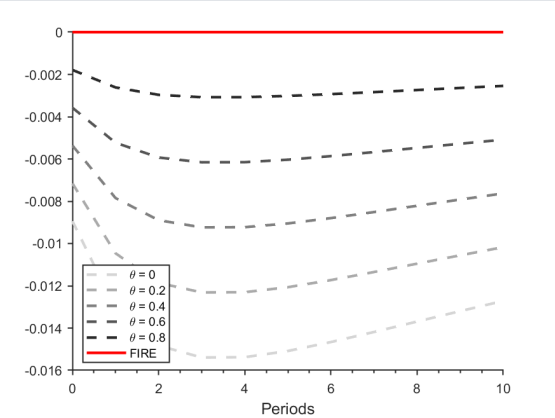
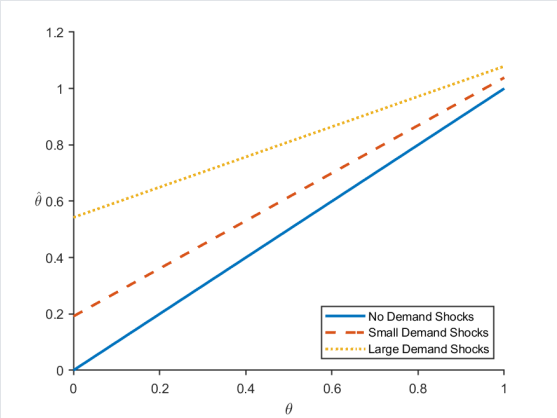
- $\Longrightarrow$ consumption $\uparrow$
- $\Longrightarrow$ investment $\downarrow$ $\Longrightarrow$ recession



Estimates of the Model's Consumption Function



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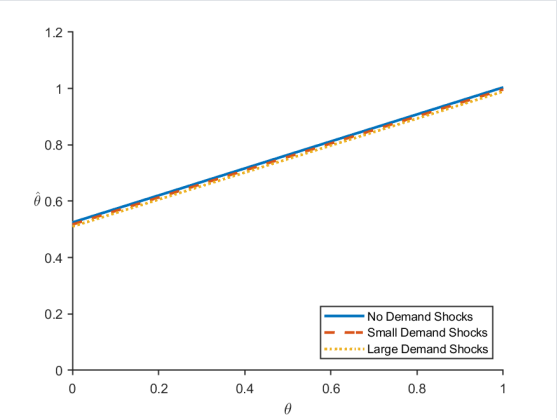

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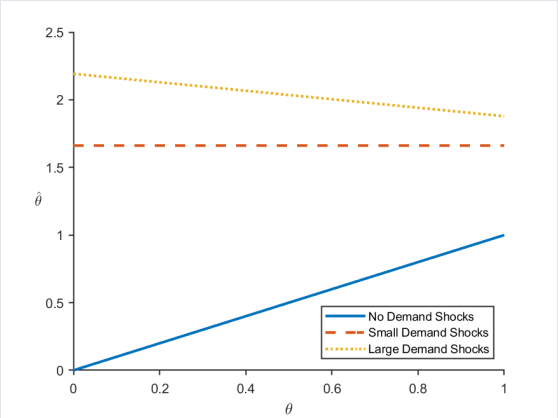

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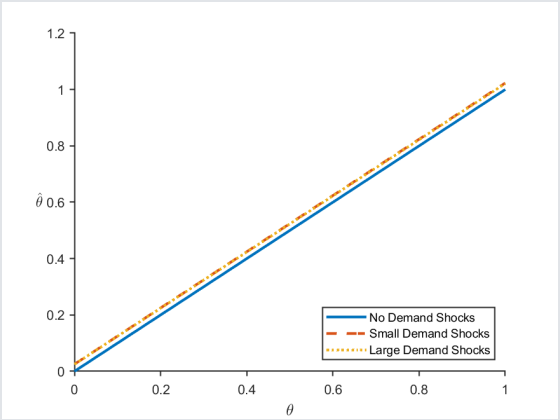

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- Lagged aggregates: only works without demand shocks (or if i.i.d.)
- Macro IVs: always works!

Conclusion

- How Ricardian Are We? *Not very.*
- Behavioral non-Ricardianism is useful, likely, and doesn't require an other-wise non-rational model.
- Serious macro implications!
- **B-HIVE** extremely useful for "identifying modern macro equations with old shocks"
  - We'll release the code (easy to adapt!)
  - Please reuse the library of structural shocks (on my website)

References

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