Monetary Policy and Heterogeneity in Consumption in Open Economies*

The Case of Peru

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* Las opiniones expresadas en este estudio corresponden al autor y no deben ser atribuidas al BCRP.

Content

Objectives

- Determine the empirical evidence for Peru of the heterogeneous effects of monetary policy in Ricardian and Keynesian households.
- Develop and estimate a New Keynesian model with three heterogeneous agents and financial frictions.
- Analyze the impact on consumption of monetary policy shocks in various scenarios

Literature review I

- [Galí et al., 2007] present a model with 2 agents: Ricardians and Keynesians, assuming that the former have access to capital markets and that increases in their consumption responds to interest rate changes caused by fiscal impulses.
- [Kaplan et al., 2018] studies the transmission mechanisms of monetary policy to household consumption in a Heterogeneous Agent New Keynesian (HANK) model.
- [Eskelinen, 2021] develop a New Keynesian dynamic stochastic general equilibrium model which features three different types of representative agents (THRANK): the poor hand-to mouth, the wealthy hand-to-mouth and the non-hand-to mouth households.

Literature review II

Transmission of Monetary Policy and Households Heterogeneity

- Direct effect
  - Savings redistribution channel
  - Unexpected inflation channel
  - Interest rate exposure channel
  - Portfolio composition channel
- Indirect effect
  - Earnings heterogeneity channel
  - Income composition channel

Empirical evidence I

- A syntectic indicator of monetary policy shocks is estimated using the SVAR methodology according to [Quintero Otero, 2015].
- Subsequently, a panel data model is used to estimate the effects of monetary policy shocks on the consumption of two types of households (Keynesians and Ricardians) by the method proposed by [Kim and Song, 2022].
- The model

$$c_{it} = \beta_0 shock_t + \beta_1(shock_t \times D_{it}) + \beta_2 mh_{it} + \beta_3 in_{it} + \beta_4(in_{it} \times D_{it}) + \eta_i + \epsilon_{it}$$

where

$$D_{it} = \begin{cases} 1 & \text{, access to financial markets} \\ 0 & \text{, other case} \end{cases}$$

Empirical evidence II

	Coef.	Std. Err.	t	P>t	[95% Conf. Inter]	
$shock_t$	-0.0442481	0.0123543	-3.58	0	-0.0684632	-0.0200329
$shock_t \times D_{it}$	0.0483055	0.0237227	2.04	0.042	0.0018078	0.0948032
nmh_i	0.0895226	0.0018783	47.66	0	0.085841	0.0932042
in_{itx}	0.3366913	0.0034714	96.99	0	0.3298871	0.3434954
$in_{it} \times D_{it}$	0.0026775	0.0004677	5.72	0	0.0017607	0.0035943
$const.$	6.206748	0.0335859	184.8	0	6.140918	6.272578

Table: Panel Data estimation results

Model I

- The model used is of the micro-based Neo-Keynesian type with three types of households ([Eskelinen, 2021]), a firm that produces intermediate and final goods ([De Ferra et al., 2020]), a banking sector ([Aliaga-Díaz and Olivero, 2012]) which provides financial frictions, adjustment costs ([Rotemberg, 1982]), a monetary institution ([Castillo et al., 2009]), and an external sector ([Botero et al., 2013]) that demand and offer goods.

Model II

- **Ricardian household with access to limited credit**

$$\max_{\{C'_t, B'_t, N'_t, H'_t\}} E_0 \sum_{t=0}^{\infty} \beta_{R'}^t u(C'_t, H'_t, N'_t)$$

subject to

$$C'_t + B'_t + \frac{{D^*}_{t-1}(1 + i^*_{t-1})}{\Pi^*_t} e_t + (H'_t - (1 - \delta_H) H'_{t-1})$$
$$= (1 - \tau) w_t N'_t + \frac{B'_{t-1}(1 + i_{t-1})}{\Pi_t} + {D^*}_t e_t + \Delta_t$$

Model III

- **Ricardian household with financial restrictions**

$$\max_{\{C''_t, B''_t, N''_t, H''_t\}} E_0 \sum_{t=0}^{\infty} \beta_{R''}^t u(C''_t, H''_t, N''_t),$$

subject to

$$C''_t + \frac{D''_{t-1}(1+i_{t-1})}{\Pi_t} + (H''_t - (1-\delta_H)H''_{t-1}) = (1-\tau)w_t N''_t + D''_t + T''_t,$$

$$(1+i_t)D''_t \leq m''_t E_t \left[\Pi_{t+1}(1-\delta_H)H''_t\right].$$

Model IV

- **Keynesian household**

$$\max_{\{C_t''', N_t'''\}} E_0 \sum_{t=0}^{\infty} \beta_{R'''}^t u(C_t''', N_t'''),$$

subject to

$$C_t''' = (1-\tau) w_t N_t''' + T_t''',$$

Model V

- **Aggregates**

$$C_t = \gamma_1 C_t' + \gamma_2 C_t'' + (1 - \gamma_1 - \gamma_2) C_t''',$$

$$N_t = \gamma_1 N_t' + \gamma_2 N_t'' + (1 - \gamma_1 - \gamma_2) N_t''',$$

$$B_t + \gamma_2 B_t'' = \gamma_1 B_t',$$

$$T_t = \gamma_2 T_t'' + (1 - \gamma_1 - \gamma_2) T_t'''.$$

Model VI

- **Firms**

$$\max_{K_t(i),N_t(i),P_t(i)} E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{P_t(i)}{P_t} Y_t(i) - W_t N_t(i) - i_{t-1}^F K_t(i) - \frac{\kappa}{2} \left(\frac{P_t(i)}{P_{t-1}(i)} - \bar{\pi} \right)^2 Y_t \right]$$

subject to

$$Y_t(i) = A_t K_t(i)^{\alpha} N_t(i)^{1-\alpha},$$

- **Phillips Curve**

$$\pi_t(\pi_t - \bar{\pi}) = \beta(\pi_{t+1} - \bar{\pi})\pi_{t+1} \frac{Y_{t+1}\lambda_{t+1}}{Y_t \lambda_t} + \frac{\epsilon}{\kappa} \left(cm_t - \frac{(\epsilon - 1)}{\epsilon} \right).$$

Model VII

- **Commercial Banks**

$$\max_{L_{t+1},D_{t+1}} E_0 \sum_{t=0}^{\infty} \Pi_{j=0}^{t} q_j (1-\tau)\left(i_t^F L + (1 - MC_t - \frac{\kappa}{2}(\pi_t - \bar{\pi}))Y_t - iB_t\right) - \Delta L_t + \Delta B_t$$

subject to

$$(1-\gamma_B)L_t \geq B_t$$

- **Central Bank**

$$\frac{1+i_t}{1+\bar{i}} = \left(\frac{1+i_{t-1}}{1+\bar{i}}\right)^{\phi_i}\left[\left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\phi_\pi}\left(\frac{Y_t}{Y_{t-1}}\right)^{\phi_y}\right]^{1-\phi_i}\exp(MON_t)$$

Model VIII

- **Government**

$$D_t^g e_t = D_{t-1}^g e_t(1 + i_t^*) + GB_t - \frac{P_t^{IMP}(aran_t) IMP_t}{1 + aran_t} - \tau(i_t^F L_t + \pi^{firm} + w_t N_t - i_t B_t)$$

- **Foreign Sector**

$$Y_t = EXP_t + d_t$$

$$\frac{EXP_t}{d_t} = \left(\frac{(1 - wd)P_t^{exp}}{wdpd_t}\right)^{-\sigma d}$$

$$\frac{IMP_t}{d_t} = \left(\frac{(1 - w)P_t^{imp}}{wpd_t}\right)^{-\sigma}$$

Calibration and estimation I

- The proportions of Peruvian households $(\gamma_1, \gamma_2, \gamma_3)$ are obtained using panel data from the National Household Survey of the National Institute of Statistics and Informatics between 2016 and 2019 with a sample of 9,013 households.

	Access to the Financial System		No access to the financial system
Year	*Ricardian*	*Ricardian* with financial restrictions	*Keynesian*
2015	3.20%	22.99 %	73.81 %
2016	4.17 %	27.25 %	68.58%
2017	5.03%	29.09 %	65.88 %
2018	6.12 %	29.39 %	64.48%
2019	6.09%	30.72 %	63.19 %

Table: Proportion of households

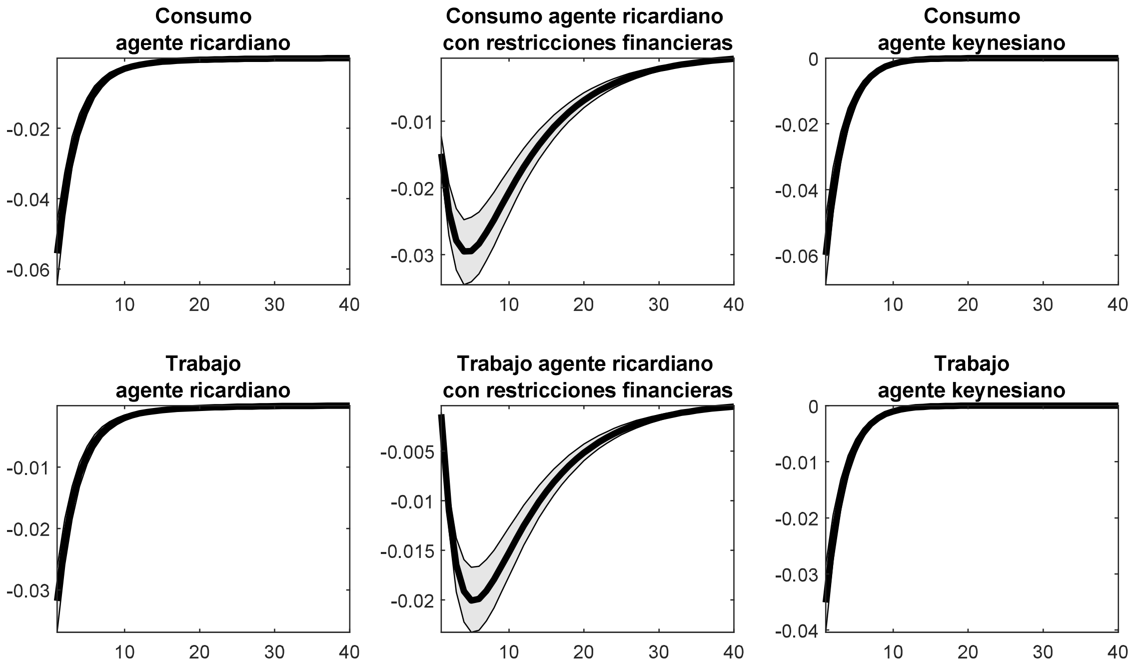
Calibration and estimation II

- The results of the Bayesian estimation

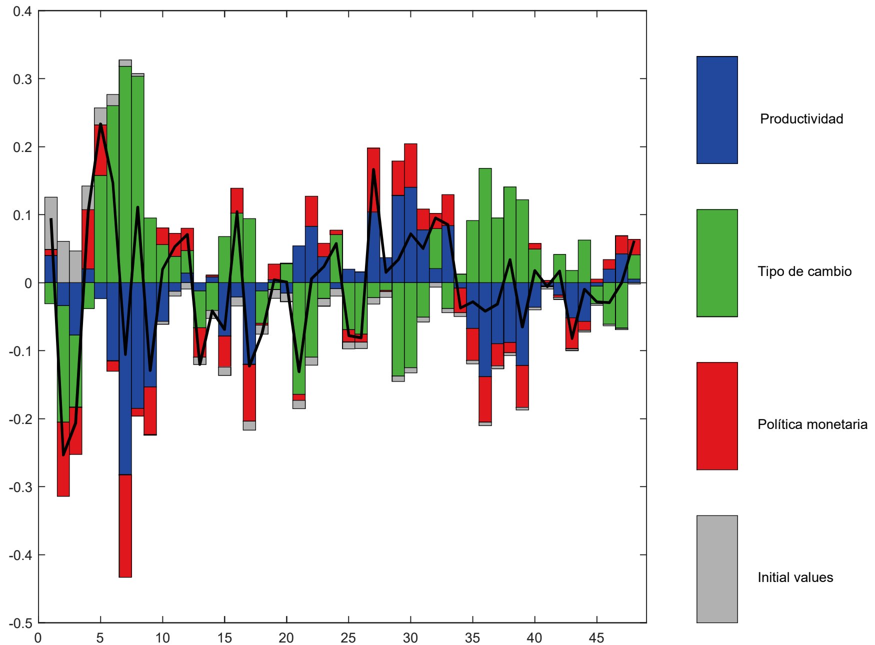
Parameters	Prior	Prior mean	Post Mean	Prdev90% HPD interval	Pstdev
w_d	beta	0.87	0.837	0.03	0.019
w_e	beta	0.96	0.948	0.03	0.007
σ_e	norm	-2	-2.0143	0.1	0.0101
σ_d	norm	1.5	1.4828	0.1	0.0062

Table: Bayesian estimation for sensitivity parameters in foreign trade

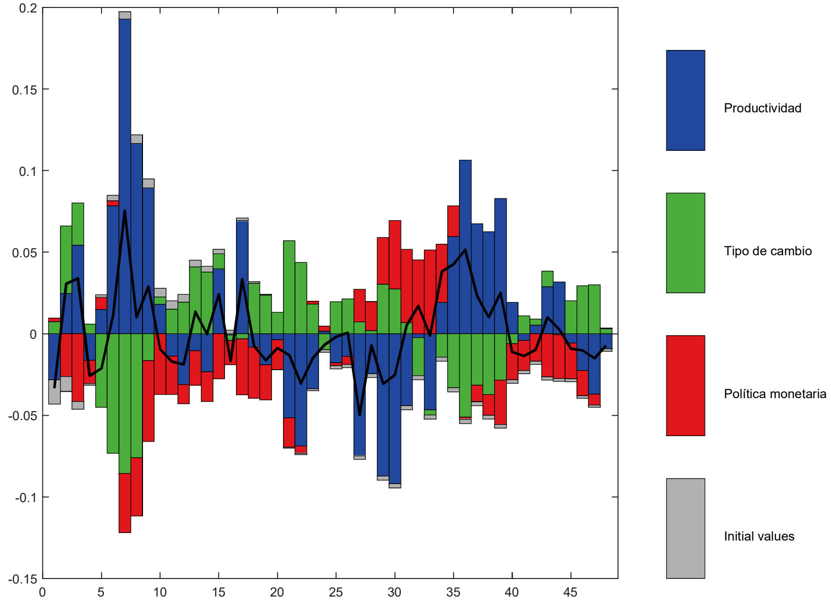
Results: Monetary policy shock diference by consuming agent



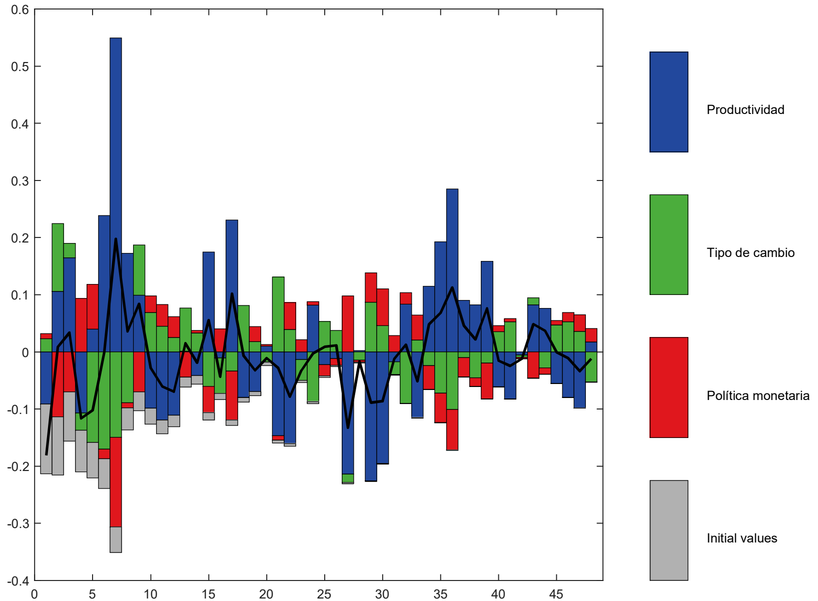
Results: Decomposition of Ricardian agent consumption



Results: Decomposition of Ricardian agent consumption with financial constraints



Results: Decomposition of Keynesian agent consumption



Conclusions

- This research work shows how the heterogeneity of households affects the transmission mechanisms of monetary policy for Peru, through a DSGE model.
- It is shown that changes in the Taylor rules do not present differences in the impact of monetary policy shocks on household consumption and work. This may imply that if the monetary entity modifies its optimal monetary policy in order to increase welfare, this change will not be significant. ([Hansen et al., 2023])

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