Time-Varying Expenditure Shares and Macroeconomic Dynamics

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Expenditure Reallocation over the Business Cycle

- Multisector New Keynesian models are built for supply-side phenomena
- Limited insights on how demand drives reallocation between sectors and its consequences
- CES assumption:
  - Barely constant consumption shares (with price rigidities)
  - No role for income
- **This paper:** Study how endogenous expenditure shares affect the transmission of shocks introducing **Non-Homothetic** preferences in a HANK model

This Paper

Three empirical facts (for Chile)

- Expenditure shares in food, manufacturing and services vary with income
- The cyclicality of expenditure shares is related to their income elasticities
- Expenditure shares respond to income shocks according to their elasticities

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Does Time-Varying Expenditure Shares Affect the Transmission of Aggregate Shocks?

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Does Time-Varying Expenditure Shares Affect the Transmission of Aggregate Shocks?

A HANK model

- Income heterogeneity + borrowing constraints
- **Non-homothetic preferences (NH)**
  - Expenditure shares depend on income and are heterogeneous and time-varying
  - Heterogeneous CPI indexes

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Preview of the findings:

- NH amplify the effect of income (transfer) shocks both:
  - Intra-temporally as HH endogenously move to more income elastic baskets
  - Inter-temporally by affecting real rates and financial constraints

Related Literature

Household Heterogeneity and the Transmission of Shocks

- Coibion et.al (2017); Cravino and Levchenko (2017); Clayton et.al (2018); Kaplan et.al (2018); Auclert (2019); Cravino et.al (2019); Jaravel (2021)
- **This paper:** Endogenous expenditure shares (NH preferences) + Distribution of expenditure shares

Nominal Rigidities and Multisector Models

- Carvalho (2006); Nakamura and Steinsson (2008); Carvalho and Schwartzman (2015); Galesi and Rachedi (2019); Pasten et.al (2020); Cesa-Bianchi and Ferrero (2021); McKay and Wieland (2021)
- **This paper:** Income, through household preferences, drive the reallocation between sectors

Heterogeneity and Non-Homothetic preferences

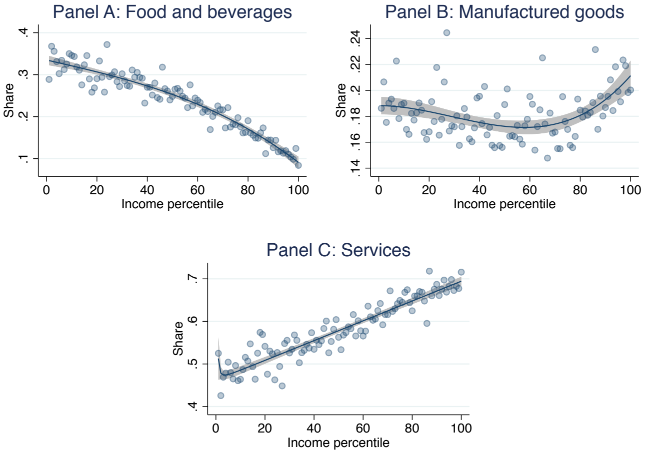
- Schaab and Tan(2023), Boehnert, de Ferra, Hochmuth, Mitman and Romei(2023).
- **This paper:** Focus on fiscal transfers and expenditure heterogeneity.

This Presentation

1. Empirical Facts
2. Model
3. Theoretical Insights
4. Dynamics in the Quantitative Model
5. Conclusion

1. Three Empirical Facts

Fact # 1: Expenditure shares are heterogeneous across the income distribution

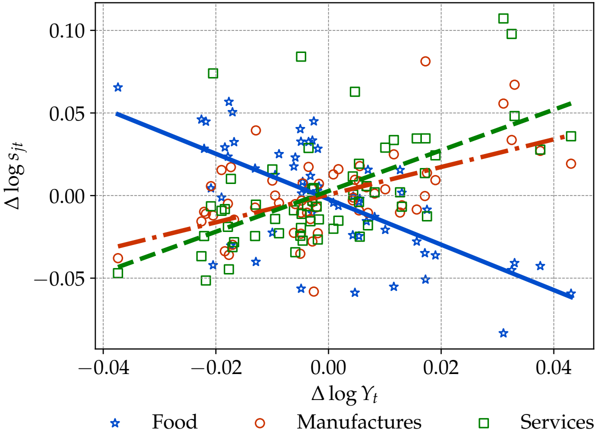


Source: own estimates based on *Encuesta de Presupuestos Familiares* 2017

Fact # 2: Consumption shares fluctuate over the business cycle

According to their income elasticities

- Data on credit and debit card transactions (Transbank)
- Monthly frequency from Jan2015-Feb2023. Analysis by municipality

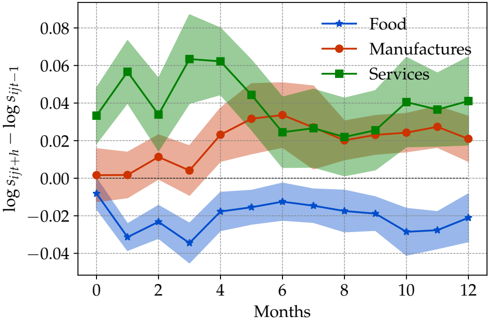


Fact # 3: Expenditure shares change with income shocks

According to their income elasticities

- T_{it} Fiscal Transfers to municipality i from 2018 to 2022
- X_{it} includes lockdowns in covid times and lags of T_{it}

$$s_{jit+k} - s_{jit-1} = \alpha_k + \beta_k T_{it} + \Gamma_k' X_t + \lambda_i + \psi_t \varepsilon_{ik}, \quad \text{for} \quad k = 0, ..., K,$$



2. Model

Model

Heterogeneous Agent New Keynesian (HANK) model–Main Ingredients Details

- **Households** [A household (i) is characterized by wealth (b) and productivity (z)]

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \mathcal{U}\left(c_{it}, \{n_{it}^g\}_{g=0}^1\right) \quad \text{s.t.} \quad \boldsymbol{E_{it}} + b_{it+1} = (1+i_t)b_{it} + W_t N_t z_{it} + T_{it} - \tau_{it} + D_{it}$$

$$\boldsymbol{E_{it}} = p_{it} c_{it} = \sum_{j=1}^{J} p_{jt} c_{jit}$$

$$b_{it+1} \geq 0$$

where c_{it} is a consumption index.

- **Plus:** J sectors with price rigidities, wage rigidities, fiscal policy, and monetary policy

Model: Consumption Side

Consumption Aggregator: $1 = \sum_{j=1}^{J} \left[\omega_j \left(\boldsymbol{c_{it}}\right)^{\boldsymbol{\epsilon_j}}\right]^{\frac{1}{\sigma}} \left[c_{jit}\right]^{\frac{\sigma-1}{\sigma}}$, (Hanoch, 1975)

$\boldsymbol{\epsilon_j}$: good j's income elasticity [H case: $\epsilon_j = 1 - \sigma$]

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Intratemporal Cost Minimization

1. $c_{jit} = \omega_j \left(\frac{p_{jt}}{\boldsymbol{p_{it}}}\right)^{-\sigma} [c_{it}]^{\boldsymbol{\epsilon_j}+\sigma}$,
2. $s_{jit} \equiv \frac{p_{jt} c_{jit}}{E_{it}} = \omega_j \left(\frac{p_{jt}}{\boldsymbol{p_{it}}}\right)^{1-\sigma} [c_{it}]^{\boldsymbol{\epsilon_j}-(1-\sigma)}$
3. $\boldsymbol{p_{it}} = \left[\sum_{j=1}^{J} [\omega_j p_{jt}^{1-\sigma}]^{\vartheta_j} \cdot [s_{jit} E_{it}^{1-\sigma}]^{1-\vartheta_j}\right]^{\frac{1}{1-\sigma}}, \quad \vartheta_j \equiv (1-\sigma)/\epsilon_j$

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Intertemporal

$$\mathcal{U}_{c,it} = \beta \mathbb{E}_t \left\{ \frac{1+i_t}{1+\boldsymbol{\pi_{it+1}}} \frac{\boldsymbol{\overline{\epsilon}_{it}}}{\boldsymbol{\overline{\epsilon}_{it+1}}} \mathcal{U}_{c,it+1} \right\} + \mu_{it} \boldsymbol{p_{it}} \frac{\boldsymbol{\overline{\epsilon}_{it}}}{\boldsymbol{1-\sigma}}, \quad \left[\overline{\epsilon}_{it} = \sum_j s_{jit} \epsilon_j\right]$$

3. Theoretical Insights

MPCs and MPEs

Under our setup with NH, changes in expenditures (observed in the data) are not equivalent to changes in the consumption index (unobserved construct).

- MPE: $M_{it}^{E} = \frac{\partial E_{it}}{\partial y_t}$
- MPC: $M_{it}^{C} = \frac{\partial C_{it}}{\partial y_t}$

However, a simple equivalence can be constructed using our previous definitions:

$$M_{it}^{E} = \frac{p_{it}\bar{\epsilon}_{it}}{1-\sigma} M_{it}^{C} = \mathcal{E}_{it} M_{it}^{C}.$$

and then

$$dE_t = \int M_{it}^{E} dy_t di = \int \mathcal{E}_{it} M_{it}^{C} dy_t \Psi(i) di.$$

$$dE_t = \overline{\mathcal{E}}_t \overline{M}_t^{C} dy_t + cov(\mathcal{E}_{it}, M_{it}^{C}) dy_t$$

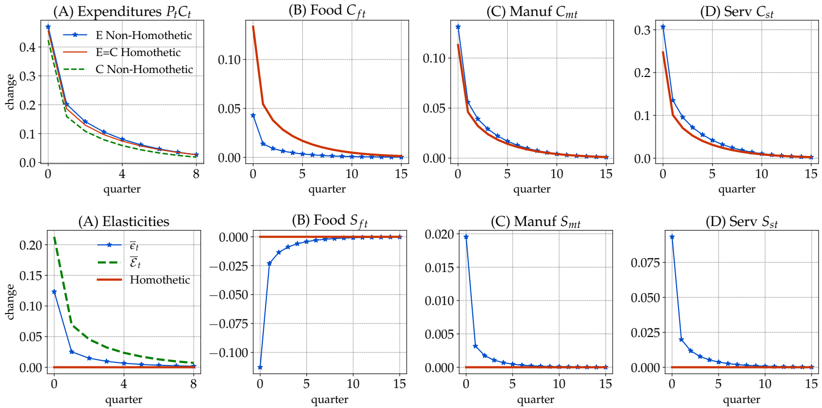
MPCs and MPEs

$$dE_t = \overline{\mathcal{E}}_t \overline{M}_t^C dy_t + cov(\mathcal{E}_{it}, M_{it}^C) dy_t$$

- Average effect: after income shock, overall reallocation towards more income elastic goods
- Cross sectional effect: Higher income is associated both with *higher* $\mathcal{E}_{it}$ and *lower* M_{it}^C

Intertemporal MPCs and MPEs

Figure: Changes in Expenditures and Consumption to a One-Time Unitary Transfer (iMPC, iMPE)



NOTES: This figure shows the dynamic response of consumption, expenditures, and consumption of the different goods to a one-time increase in household transfers. These responses are analogous to the partial Jacobians proposed by **?** for consumption they call *iMPCs*.

4. Quantitative Results

Quantitative Results

Calibration

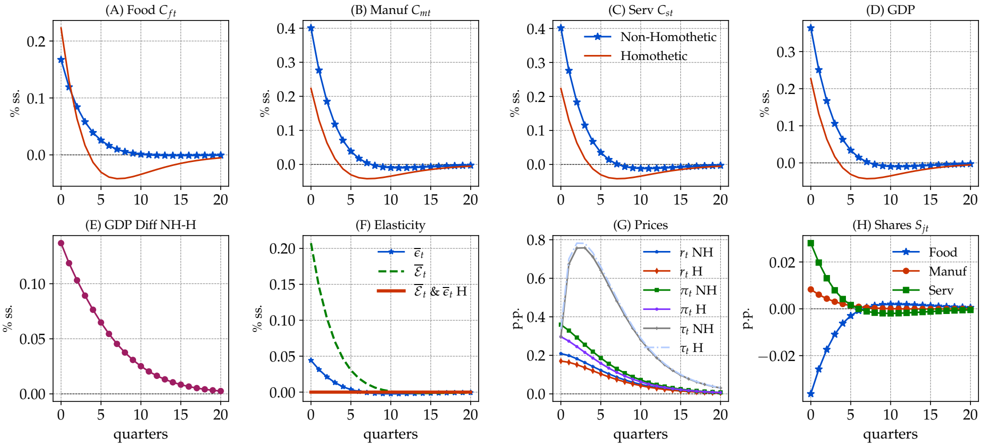
Households

- IES $= 1$ / Frisch elasticity $= 1$ / Labor disutility to match $N = 1/3$ / Interest rate $= 5\%$
- Discount factor (β) to match average bond holding of 20% relative to GDP
- Income risk: Rouwenhorst method to match var $\{\log(y_t)\} = 0.72$ and var $\{\Delta \log(y_t)\} = 0.20$
- Elasticity of subst workers $= 10$ / Adj costs $\rightarrow$ slope of 0.1 in the NKWPC
- NH Utility params: $\sigma = 0.271$, $\epsilon_f = 0$, $\epsilon_m = 1$, $\epsilon_s = 1.113$ Details

Firms

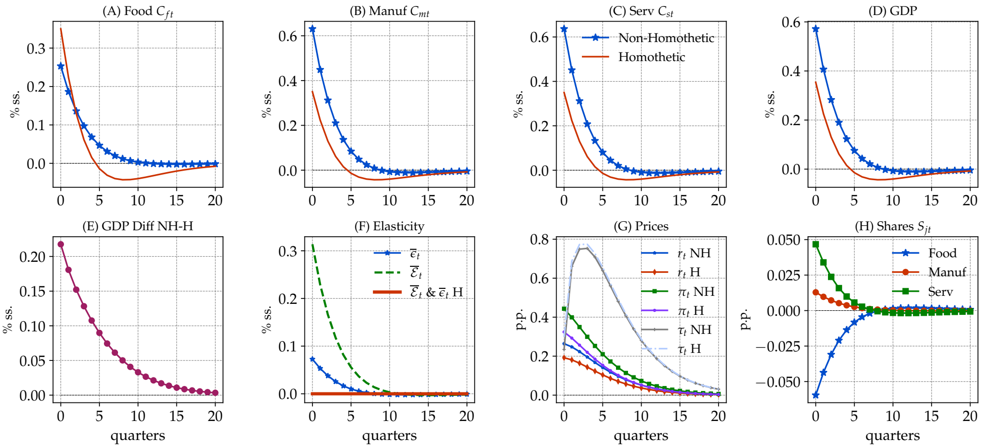
- $J = 3$: food (f), manufactures (m) and services (s)
- Elasticity of substitution (intermediate inputs) $= 10$ / Sectoral adj cost $\rightarrow$ slopes of 0.1 in the NKPC
- Decreasing returns to scale in labor: $\alpha = 0.33$

IRFs under Baseline Calibration



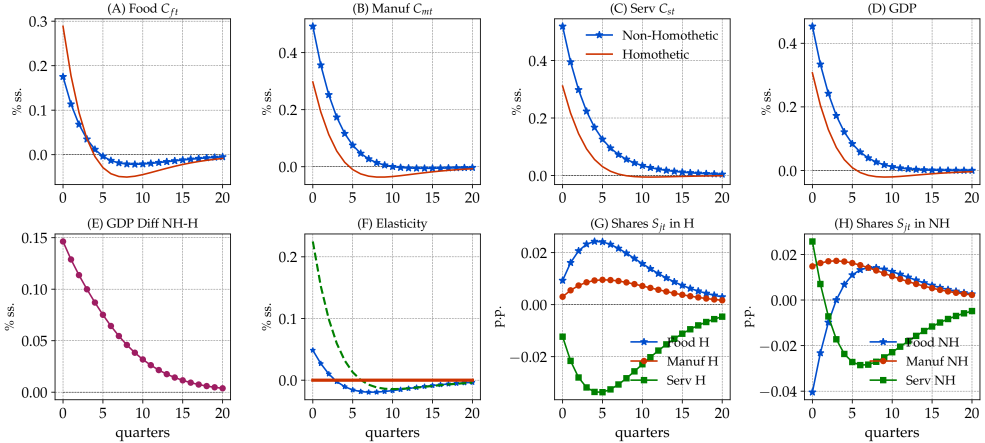
NOTES: This figure shows the sectoral and aggregate responses to a fiscal transfer shock under our baseline calibration.

IRFs with Countercyclical Labor Income Inequality



NOTES: This figure shows the sectoral and aggregate responses to a fiscal transfer shock under a countercyclical labor income inequality.

IRFs with Heterogeneity in Price Rigidities



NOTES: This figure shows the sectoral and aggregate responses to a fiscal transfer shock under heterogeneous price rigidities.

Conclusions and Next Steps

- We show that expenditure shares are heterogeneous and change over time
  - Income-elastic goods such as services respond more to income shocks
- Build a HANK model with non-homothetic preferences
  - Heterogeneous agents + MP/FP + **endogenous changes in expenditure shares**
- Model with NH preferences change the effects of fiscal transfers
  - Amplificatition through both intra and inter - temporal channels.

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Model Details

Back

Worker's Union

- Aggregator:

$$N_t = \left(\int_0^1 \left(n_t^g \right)^{\frac{\varepsilon - 1}{\varepsilon}} dg \right)^{\frac{\varepsilon}{\varepsilon - 1}}$$

- Nominal rigidities:

$$\Gamma \left(\frac{W_t^g}{W_{t-1}^g} - 1 \right) = \frac{\theta_w}{2} \left(\frac{W_t^g}{W_{t-1}^g} - 1 \right)^2$$

- NKWPC:

$$(\pi_{wt} + 1)\pi_{wt} = \frac{\varepsilon_w}{\theta_w} n_t \int \int \left\{ v'(n_t) - \frac{\varepsilon_w - 1}{\varepsilon_w} U'(c_t(b, z)) \frac{W_t}{P_{st}(b,z)} \frac{1-\sigma}{\bar{\epsilon}_t(b,z)} \right\} \Psi_t(b, z) dbdz + \beta\theta_w(\pi_{wt+1} + 1)\pi_{wt+1}$$

Model Details

Back

Firms

- Sectoral aggregator:
$Y_{jt} = \left(\int_0^1 y_{jt}^{m \, \frac{\varepsilon-1}{\varepsilon}} dm \right)^{\frac{\varepsilon}{\varepsilon-1}}$
- Intermediate good producers:
$y_{jt}^m = A_{jt} n_{jt}^{1-\alpha}$
- Nominal rigidities:
$\Theta_{jt}^m = \frac{\theta_j^p}{2} \left(\frac{p_{jt}^m}{p_{jt-1}^m} - 1 \right)^2 p_{jt}^m y_{jt}^m$
- Sectoral NKPC:
$(\pi_{jt} - \overline{\pi}_j)\pi_{jt} = \frac{\varepsilon}{\theta_j^p} \left(\frac{mc_{jt}}{p_{jt}} - \frac{\varepsilon-1}{\varepsilon} \right) + \mathbb{E}_t \left[\left(\frac{1}{1+r_t} \right) (\pi_{jt+1} - \overline{\pi}_j)\pi_{jt+1} \frac{p_{jt+1} y_{jt+1}}{p_{jt} y_{jt}} \right]$
- Sectoral inflation:
$\pi_{jt} = \frac{p_{jt}}{p_{jt-1}} \pi_t$

Model Details

Back

Monetary policy

- Taylor rule: $i_t = i^* + \phi_\pi(\pi_t - \overline{\pi}) + \varepsilon_t^{mp}$
- MP shock: $\log(\varepsilon_t^{mp}) = \rho_{mp}\varepsilon_{t-1}^{mp} + u_t^{mp}$

Fiscal policy

- Budget constraint: $B_{t+1}^g = T_t - \tau_t + (1 + r_t)B_t^g$
- Transfer and tax functions: $\tau_t = z_t \cdot \tau$

Aggregation

- Consumption: $C_t = \int\int p(b,z)c(b,z)\Psi(b,z)dbdz$
- Aggregate price index (numeraire) + MP target: $P_t = \left(\sum_j \omega_j P_{jt}^{1-\sigma}\right)^{\frac{1}{1-\sigma}}$
- Goods market clearing: $GDP_t = \sum_{j=1}^{J} p_{jt} Y_{jt}$
- Bonds market clearing: $B_t^g = \int\int b\Psi(b,z)dbdz$

Calibration: Demand System Estimation Back

- Predictions are invariant to the scale of elasticities ϵ_j and taste parameters ω_j
  - Set manufactures as baseline good $\rightarrow \epsilon_m = \omega_m = 1$
- The demand system reads as

$$\log\left(\frac{s_{jt}(h)}{s_{mt}(h)}\right) = (\epsilon_j - 1)\log(s_{mt}(h)) + (1-\sigma)\log\left(\frac{p_{jt}}{p_{mt}}\right) + (\epsilon_j - 1)(1-\sigma)\log\left(\frac{E_t(h)}{p_{mt}}\right) + \nu_t$$

- Estimate with FGNLS using the cross-sectional distribution of EPF (2017)
- Set taste parameters to match average expenditures in good j

	Coefficient	Std. Error
σ	0.271***	(0.023)
ϵ_f	0.000	$(\cdot)$
ϵ_s	1.113***	(0.036)
Observations	100	