

# Time-Varying Expenditure Shares and Macroeconomic Dynamics\*

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## Abstract

We examine the impact of income heterogeneity on macroeconomic dynamics by analyzing households' expenditure decisions across different goods over the business cycle. Using Chilean transaction-level expenditure data, we observe income-dependent systematic variations in expenditure shares over the business cycle, suggesting a relevant role for non-homothetic preferences. We embed these preferences into a Heterogeneous Agent New Keynesian model and analyze their influence on the transmission of fiscal transfers. We find two novel channels associated with non-homotheticities: aggregate consumption sensitivity to income and insurance through expenditure switching. In a calibration for Chile, we find that non-homotheticities lead to substantial amplification of the effects of fiscal transfers of up to fifty percent.

JEL Codes: D14, D31, E21, E32, E62

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# 1 Introduction

The recent strand of the literature on Heterogeneous Agent New Keynesian (HANK) models has highlighted the role of household heterogeneity on income fluctuation and access to financial markets to shape aggregate demand (see [Kaplan et al., 2018](#); [Auclert, 2019](#)). One of the main channels stressed in this literature is the differences in marginal propensities to consume and how they interact with earnings heterogeneity. However, these contributions are silent about the role of income fluctuations on expenditure switching across different goods.<sup>1</sup> This fact raises the question of how households' expenditure allocation depends on income and how such decisions shape aggregate demand and the business cycle. Previous theoretical literature has not addressed this question because they assume homothetic preferences, such as constant elasticity of substitution (CES), so expenditure *shares* (not the *level* of expenditures) do not depend on income but only on changes in relative prices.<sup>2</sup>

In this paper, we aim to fill this gap by studying the role of income on household expenditure allocation (expenditure shares) and how such decisions shape aggregate demand. The first part of the paper empirically shows that expenditure shares over different sectoral goods correlate with income and fluctuate according to the income elasticities of those goods.<sup>3</sup> Building on previous literature, we present three stylized facts using data from Chile. First, we show that expenditure shares across goods correlate with households' income level ([Cravino and Levchenko, 2017](#); [Cravino et al., 2020](#)). Using survey data, we show that the share of expenditures allocated to food ranges from 35% in the lowest decile of income to 13% in the highest decile. In contrast, the share devoted to services increases from 46% to 69% as we move from the first to the tenth decile of the income distribution.<sup>4</sup> These results indicate a static relationship between income and expenditure shares.

Second, we extend the analysis to a dynamic setting and show that expenditure shares correlate

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<sup>1</sup>For recent empirical evidence about the cross-sectional heterogeneity in expenditure shares among different goods, see [Costa \(2001\)](#), [Hamilton \(2001\)](#), [Almas \(2012\)](#), [Almas and Kjelsrud \(2017\)](#), [Kaplan and Schulhofer-Wohl \(2017\)](#), [Dobrew \(2019\)](#), [Cravino and Levchenko \(2017\)](#) and [Cravino and Sotelo \(2019\)](#).

<sup>2</sup>Another strand of the literature has focused on supply-side forces. In particular, the literature on multisector New Keynesian models has emphasized the role of sectoral heterogeneity on the production side of the economy, stressing the role of differences in technologies, nominal rigidities, and production linkages in the propagation of shocks (see [Pasten et al., 2020](#) and [Baqae et al., 2023](#) among others). Such heterogeneity changes relative price over time, affecting expenditure shares, but income does not play a direct role.

<sup>3</sup>Even though the notion of income elasticity is related to the level of expenditures, throughout the paper, we use this concept to refer to expenditure shares.

<sup>4</sup>While this evidence is particular to Chile, the general patterns associated with differential income elasticities are a more generalized stylized fact, as we show in the appendix for OECD countries. Chile is an interesting case for the analysis as it features similar patterns to the US but more pronounced relationships between consumption shares and income.

with income over the business cycle in a manner consistent with the income elasticities from the static analysis. Using monthly credit and debit card transactions at the municipality level, we show that the change in the expenditure share on food negatively correlates with changes in output. In contrast, the correlation for the share of manufactured goods and services is positive. Notably, our results hold even considering the COVID-19 pandemic period.

Our previous evidence suggests that expenditure shares depend on income and fluctuate over the business cycle. To dig deeper into the nature of such fluctuations, our final empirical exercise studies the effects of fiscal transfers on household expenditure shares in 2018-2021. We find that after a fiscal transfer, the share spent on services increases the most while the share on food declines. This result suggests that income elasticities affect the patterns of expenditure shares in the cross-section of households and generate dynamic effects on sectoral and aggregate consumption. Crucially, our results are robust to control for changes in relative prices and the pandemic period, which included unprecedented fiscal help made by the government and was also characterized by lockdowns that affected sectors asymmetrically.

Our empirical evidence implies that expenditure shares are heterogeneous across the population, time-varying, and endogenous to the business cycle. These facts motivate us to build a HANK model embedded with non-homothetic (NH) preferences, in which heterogeneity in income and consumption exists due to incomplete markets. In our setup, households with different income levels display different expenditure shares, price indices, and average income elasticities.<sup>5</sup> In this framework, the household's average income elasticity is crucial since it determines the sensitivity of the household's consumption composition to income shocks.

This source of heterogeneity interacts with the traditional heterogeneity in marginal propensities to consume (MPCs) due to the occasionally binding financial constraints embedded in HANK models. In particular, our model implies that poorer households feature lower average income elasticities and larger MPCs than wealthy households. At a household level, NH preferences provide insurance by allowing an optimal bundle rebalancing after an income shock, leading to lower consumption variability. At an aggregate level, however, if the economy-wide average income elasticity increases sufficiently in response to an income shock, households become, on average, more sensitive to income changes, amplifying the aggregate consumption response. These channels are, respectively, *insurance* and *average elasticities* mechanisms. We analytically decompose

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<sup>5</sup>We define the average income elasticity of a household as the mean of the income elasticities across goods in the consumption bundle. The income elasticity of a good represents the change in the expenditure share of the good given a change in income.

the effects on consumption between these two channels following [Patterson \(2023\)](#). We show that the aggregate average elasticity, if procyclical, amplifies the effects of income shocks (such as fiscal transfers) given an average MPC, while the covariance between household elasticities and their MPCs generates amplification or dampening of shocks, depending on the sign of this covariance. Ultimately, the response to shocks depends on the relative weight of these two channels.

We quantitatively show that a positive relationship between income elasticities and output tends to appear in general equilibrium. This suggests that whenever the elasticity responds more strongly, there is a higher amplification of fiscal transfer shocks. Crucially, our results do not rely on heterogeneity in the production side of the model and are robust to changes in the monetary policy stance, variations in the cyclicity of labor income inequality, the persistence of shocks, and heterogeneity in price rigidities across sectors.

This paper contributes to the literature in two ways. First, we empirically show, using granular monthly data, that changes in income (idiosyncratic and aggregate) lead to dynamic adjustments in the household's relative demand for different goods. This fact confirms the presence of NH mechanisms that drive fluctuations in expenditure shares. Second, we show that fluctuations in the households' average income elasticity across the income distribution have significant effects on aggregate consumption dynamics, as these elasticities can act as amplifiers (through higher sensitivity) or dampeners (through insurance by bundle switching) of the effects of shocks. We demonstrate the relevance of expenditure switching conditional on fiscal transfer shocks.

Our paper is related to the growing body of literature studying the role of household heterogeneity in shaping the business cycle. The closest papers to ours are [Danieli \(2020\)](#), [Ferrante et al. \(2023\)](#), [Schaab and Tan \(2023\)](#), and [Olivi et al. \(2024\)](#). [Danieli \(2020\)](#) focuses on fluctuations in real labor income over the cycle, showing that households have different expenditure shares and work in different sectors. Her focus is on income inequality and the role of heterogeneous expenditure elasticity in different sectors, working with a Two Agent New Keynesian (TANK) model where some of those features are structural and do not vary over the cycle.<sup>6</sup> Relative to this paper, we show that expenditure elasticities are a time-varying phenomenon with aggregate consequences in the cycle. [Ferrante et al. \(2023\)](#) shows that shifts in expenditure composition have relevant effects on inflation and aggregate dynamics. They estimate a DSGE model with a taste shifter shock that exogenously switches the relative demand for the different goods (services and goods). We extend their findings by including an endogenous bundle switcher with empirical validity that arises

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<sup>6</sup>This is similar to the approach in [Clayton et al. \(2018\)](#) and [Cravino et al. \(2020\)](#).

due to NH preferences. Our paper has similarities with [Schaab and Tan \(2023\)](#), who embed NH preferences into a HANK model with rich heterogeneity on the demand and supply sides of the economy. While they analyze the impact of NH preferences over aggregate demand, their results focus on the heterogeneity of price rigidities and their transmission mechanisms are different. Moreover, our paper presents empirical evidence on the relevance of these mechanisms. Finally, [Olivi et al. \(2024\)](#) also embeds NH preferences into a HANK model. However, their focus is on how such preferences directly impact the slope of the sectoral New Keynesian Phillips curve, which we do not explore here. We focus on the role of income fluctuations over the cycle and its impact on expenditure decisions and their aggregate effect. We see all these contributions as complementary to ours.

The remainder of the paper is organized as follows. Section 2 presents the empirical evidence for expenditure heterogeneity across the income distribution and the dynamic responses of expenditure shares in the business cycle. In section 3, we describe our HANK model with non-homothetic preferences. In section 4, we study the role of these preferences in a HANK that features a distribution of MPCs. We show the quantitative exercises in section 5. Finally, section 6 concludes.

## 2 Empirical Evidence

In this section, we document three empirical facts about the composition of expenditures of Chilean households and their dynamic behavior. First, we analyze data from expenditure surveys to show that the expenditures' composition varies along the income distribution. That implies that different types of goods have different income elasticities in shares. Second, we use data from credit and debit card transactions to show that, over the business cycle, expenditure shares fluctuate in manner consistent with the static elasticities presented by Fact 1. Finally, we show that even after controlling for business cycle variables, expenditure shares respond to fiscal transfers according to the income elasticities shown before.

### 2.1 Data

**Expenditures at the Household Level.** For the analysis of consumption expenditures at the household level from a static perspective, we rely on the Consumption Expenditure Survey (*Encuesta de Presupuestos Familiares* in Spanish, or EPF hereafter). It is a cross-sectional survey that provides information about expenditures and household characteristics (demographics and income). The

main goal of EPF is to construct the relevant consumption basket behind the Consumer Price Index (CPI).<sup>7</sup>

While this is the primary source of information for consumption expenditures in Chile, using this dataset carries two main issues. First, unlike expenditure surveys in the US, such as the Consumer Expenditure Survey (CEX), we cannot follow individuals or households over time but only construct pseudo-panels to analyze expenditure patterns. Therefore, we can not control for unobservable characteristics that might be important to understand consumption patterns. Second, the dataset is not taken at business-cycle frequency (i.e., every quarter) or regular intervals. In particular, the survey's most recent waves were taken in 1996, 2007, 2013, and 2017. Because of these reasons, we base our analysis on the most recent wave of the data (EPF VIII for 2017) to document the heterogeneity in consumption expenditures.<sup>8</sup>

EPF provides information on different sources of income, such as labor income, rents from assets and real estate, and imputed rentals for homeowners. Following the literature ([Cravino et al., 2020](#)), our baseline classification uses total disposable income per capita at the household level, which is the sum of all income sources net of transfers. We then classify each household according to its percentile in this distribution.

Expenditures in EPF VIII are structured into five different levels of aggregation. From more to less disaggregated, these groups are defined by 1,186 products, 285 subclasses, 126 classes, 59 groups, and 12 divisions. We aggregate the 12 divisions to generate three categories: food and beverages, manufactured goods, and services.<sup>9</sup>

**Expenditures at the Municipality Level.** We use monthly data on credit and debit card transactions as a proxy of expenditures from Transbank, a private firm that processes most of Chile's credit and debit transactions. This data allows us to capture the expenditure behavior of different units of individuals over time to study their cyclical behavior.

However, using this data as a proxy of aggregate expenditures has three shortcomings. First, this data distinguishes between in-person and online purchases. We use the former, as online purchases are harder to associate with the buyer's residence and limit us to the panel data analysis

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<sup>7</sup>For this analysis, we follow [Romero \(2022\)](#) closely.

<sup>8</sup>In the appendix we study the robustness of our results considering (i) previous waves of the EPF survey, (ii) alternative percentile classifications using labor income, (iii) a narrow definition of income groups using deciles and, (iv) a more granular classification of the consumption basket. All our qualitative results remain using these alternative characterizations.

<sup>9</sup>We prefer to work with this more coarse classification rather than a granular one in order to (i) use data on prices to estimate key parameters of the model and (ii) be able to compare expenditure patterns over time. See details below.

below. Also, although we can observe the firm and place of the transactions, we do not know the individual who made the purchase. Due to these restrictions, we restrict ourselves to conducting our analysis at the municipality level.<sup>10</sup>

Second, one might be concerned about how well a municipality represents the income distribution of individuals. However, as we show in the appendix, there is almost a one-to-one relationship between the quintile of the individuals in each municipality and the quintile the municipality belongs. Therefore, working with data at the municipality level provides a good picture about the behavior of expenditures in the population.

Third, this data only considers card transactions and hence represents only a fraction of the aggregate consumption in the economy (for example, by excluding cash purchases). Therefore, this data might represent financial development rather than expenditures at the aggregate level. To alleviate this concern, in the appendix we show that the Transbank data captures fluctuations in aggregate consumption quite well. The correlation of the growth of these series with consumption of National Accounts is 0.86 for the period before the pandemic and about 0.93, including the pandemic. The series by services and goods (manufactures plus services) also matches National Accounts well.

**Fiscal Support.** From the Ministry of Social Security and the Chilean Pensions Supervisor, we obtain the total amount of different fiscal transfer programs, allowing us to control for conditional correlation between income and expenditure shares. We have information about direct fiscal transfers from 2018 to 2022 in Chile. The measures considered include the policies undertaken during the COVID-19 pandemic and several other programs starting in 2018.<sup>11</sup>

While this data is available at the individual level, we aggregate it at a municipality level for our empirical analysis as it allows us to draw a direct comparison with our measures for time-varying expenditures from card transactions, only available up to that level of aggregation. Figure 1 shows the programs' size. As the figure shows, there was sizeable fiscal support during COVID-19, especially in 2021. For completeness, we compare those measures with the additional liquidity that households got through three projects, allowing them to withdraw at most ten percent of individual

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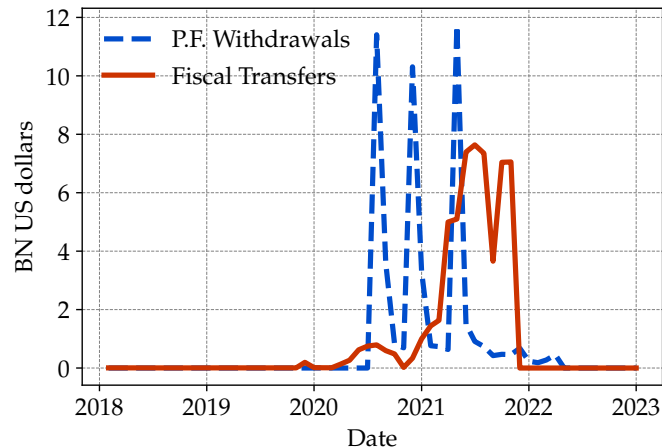
<sup>10</sup>The geographical approach is used, for instance, by Mian and Sufi (2009) and Mian et al. (2013) to study the effects of wealth on consumption. This approach is also extensively discussed by Guren et al. (2020) to disentangle general equilibrium from the partial equilibrium effects of these estimates.

<sup>11</sup>We have eleven programs featuring different sizes, timings, cyclicity, and progressivity. Those programs are (i) Family help check; (ii) Family base check; (iii) Christmas COVID check; (iv) School homework check; (v) Child homework check; (vi) COVID emergency check; (vii) Protection check; (viii) Emergency Income COVID; (ix) Emergency COVID 2020; (x) Guaranteed Minimum Income; and (xi) Universal COVID check.

pension funds three times (P.F. Withdrawals in the plot). Later on, our empirical analysis focuses on the impact of Fiscal Transfers, but controlling for the effect of those withdrawals to properly account for the impact of fiscal support over expenditure shares. In particular, we study the effect of the policies *per unit* of additional liquidity provided to households, conditional on pension fund withdrawals and fluctuations at a country level.

During the pandemics, several establishments closed their operations due to lockdowns, affecting asymmetrically different sectors in the economy. To control for this fact, we include a mobility index that varies at a municipality level, with strength going from an index equal to one (totally restricted) to five (totally open). These restrictions were imposed until mid-2022. We use these indices as measures of openness, which can affect the sectoral allocation of expenditures. The source of these data is <https://www.gob.cl/pasoapaso/>.

FIGURE 1: Fiscal Support in Chile



NOTES: This figure compares the evolution over time of total fiscal support to households with pension fund withdrawals in billions of dollars.

**Aggregate Data.** Finally, we use monthly data on economic activity (IMACEC, the Industrial Production Index used in Chile) and sectoral price indexes from the Central Bank of Chile to control for business cycle covariates, as well as relative prices that might affect expenditure patterns.

## 2.2 Fact 1: Expenditure Shares Vary Along the Income Distribution

Figure 2 presents our first observation that motivates the theoretical and empirical analysis in the following sections: expenditure shares vary along the income distribution. Each panel presents the



expenditure share for the three groups of goods (food and beverages, manufactured goods and services) relative to the total expenditures of each percentile. The figure reveals clear patterns of expenditures across the income distribution. First, low-income households spent relatively more (35 percent) than wealthy households (13 percent) on food and beverages. In between these two points, there is a monotone decreasing pattern. Second, even though manufactured goods seem to have a U-shaped form, the pattern of expenditures is relatively constant across the distribution. For example, the lowest decile spent 19 percent on these goods, the same as the top decile and the median household.

Interestingly, note that the expenditure pattern on these goods is more volatile than in the case of food and services. In addition, note that the classification of these goods also considers “industry goods” such as utilities (water, electricity, gas, and other fuels), which tend to have more volatile prices and can be behind these patterns. Finally, even though services are the most important category for all households in the distribution, there is a clear increasing pattern in expenditures. While the lowest decile spent around 46 percent on these categories, the top decile spent 69 percent. All these patterns are robust to consider a more disaggregated level of the data, other points in the income distribution and other waves of the EPF survey (see the appendix for details).

**Income-elasticity Interpretation.** The evidence presented in this section shows expenditure shares that vary across the income distribution. The observed expenditure patterns for food, manufactured goods and services, suggest heterogeneous income elasticities for expenditure shares, with food having the lowest elasticity, and services the highest.

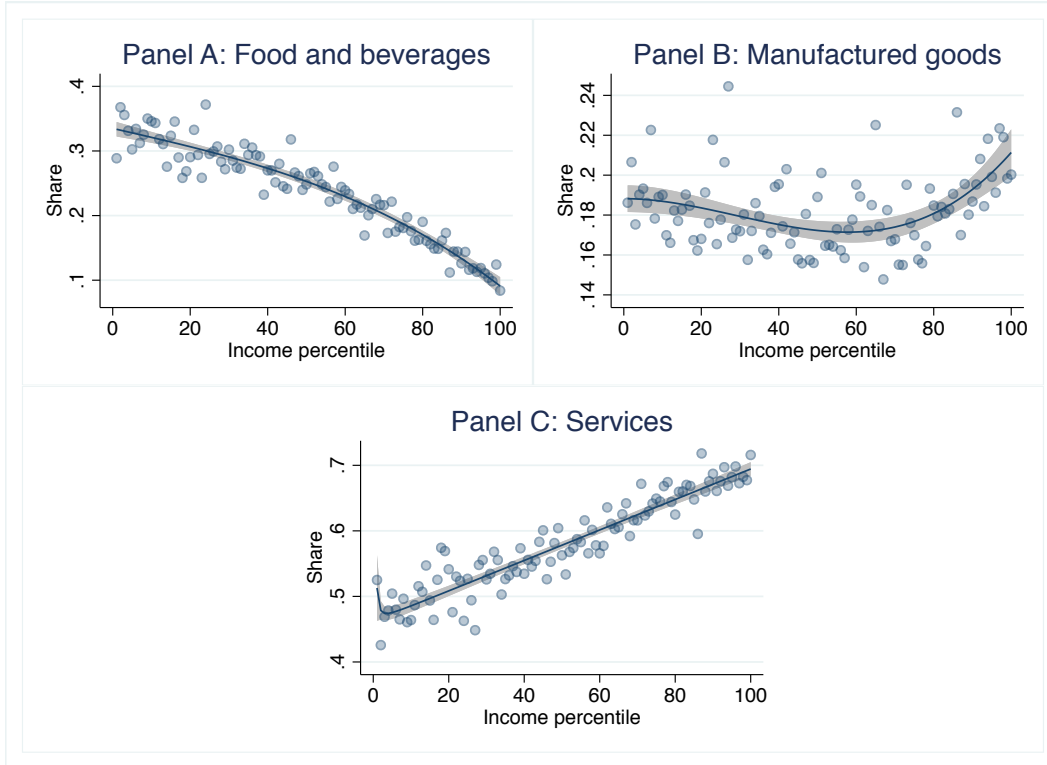
### 2.3 Fact 2: Expenditure Shares Correlate with Income Elasticities over the Cycle

Fact 1 shows there is a static correlation between expenditure shares and income. Up to this point, this might represent an economy in which there are time-invariant differences in preferences across the income distribution (Clayton et al., 2018; Cravino et al., 2020). In this section, we show that expenditure shares fluctuate over the business cycle, consistent with the income elasticities presented in Fact 1.

Defining  $s_{ijt}$  as the expenditure share in category  $j$  in municipality  $i$  in period  $t$ , we run variants of the following specification

$$\Delta \log s_{ijt} = \alpha_j + \beta_j \Delta \log Y_t + \delta_j (\pi_{jt} - \pi_t) + \gamma \Delta \text{Mob}_{it} + \lambda_i + \varepsilon_{jt}, \quad (1)$$

FIGURE 2: Aggregate consumption patterns across income distribution



NOTES: This figure presents the share in consumption expenditures for households in each percentile of the income distribution, considering three aggregate expenditure groups. On every panel, each dot corresponds to a percentile. The solid line corresponds to the local polynomial fit. The grey area denotes 95% confidence interval.

where  $Y_t$  denotes industrial production, while  $\pi_{jt} - \pi_t$  denotes the inflation rate of category  $j$  relative to the aggregate inflation rate, and  $\lambda_i$  is a municipality fixed effect controlling for unobserved invariant characteristics. Because some of our specifications include the COVID-19 period, to avoid that our results are driven by lockdowns during this period, we also include a mobility index ( $Mob_{it}$ ) capturing the time-varying heterogeneity in lockdowns across municipalities (positive changes denote less mobility restrictions). The coefficient of interest is  $\beta_j$ , capturing the differential impact of the business cycle over the expenditure shares of different goods.

Table 1 shows that the cyclicity of expenditure shares by category is consistent with their income elasticities. Panel A presents a negative relationship between the expenditure share in food and a positive relationship with manufactures and services. Moreover, these relationships remain robust even after controlling for relative inflation. This evidence indicates the presence of significant non-homothetic effects, with income represented by industrial production, playing a more significant role in driving fluctuations in expenditure shares than prices.

While the main message of our exercise does not change, including COVID-19 period slightly

TABLE 1: Cyclicity of Consumption Shares at a Municipality Level

	Panel A: 2015-2019			Panel B: 2015-2022		
	Food	Manufactures	Services	Food	Manufactures	Services
$\Delta \log(Y_t)$	-1.338 (0.221)	1.022 (0.307)	1.300 (0.415)	-0.752 (0.217)	0.662 (0.236)	0.937 (0.343)
$\pi_{jt} - \pi_t$	-2.710 (1.010)	0.791 (2.107)	1.968 (3.371)	-0.897 (1.008)	0.833 (1.299)	4.588 (2.558)
$\Delta \text{Mob}_{it}$				-0.017 (0.015)	0.015 (0.008)	0.045 (0.026)
N	16848	16513	16870	28397	27834	28478
Adj. $R^2$	-0.001	-0.006	-0.01	-0.003	-0.001	-0.001

NOTES: This table presents the disaggregate relationship (at the municipality level) between expenditure shares and income.  $\Delta \log(Y_t)$  denotes the monthly change in the industrial production index.  $\pi_{jt}$  is the yearly inflation rate of category  $j$ , while  $\pi_t$  is the yearly aggregate inflation rate.  $\text{Mob}_{it}$  is a mobility index capturing the time-varying heterogeneity in lockdowns across municipalities (higher values denote less mobility restrictions). Standard errors reported in parenthesis.

distorts the previous results, primarily due to the impact of lockdown measures that heavily affected the services sector. As shown in panel B, incorporating the period after January 2020 leads to a decrease of 0.4 points in the cyclicity of the share of services and a decrease of 0.6 in the cyclicity of food shares while maintaining the expected signs and order. These findings highlight the substantial influence of lockdowns on consumption composition, as evident from the effects of the mobility index ( $\text{Mob}_{it}$ ) on the shares, which exhibit similar patterns to  $\Delta \log(Y_t)$  as expected, while nonsignificant.<sup>12</sup>

## 2.4 Fact 3: Expenditure Shares Respond to Income Shocks in Accordance with their Income Elasticities

Facts 1 and 2 present evidence regarding the importance of income in determining expenditure shares: statically and dynamically. Up to this point, it might be the case that preferences are driven by exogenous, heterogeneous, and time-varying taste shifters, as assumed by [Ferrante et al. \(2023\)](#). This section shows that this is not the case and that expenditure shares respond to income shocks. Moreover, we show that those responses are consistent with the income elasticities presented in previous sections.

For this purpose, we study how fiscal transfers, as a proxy for income shocks, affect expenditure shares in 2018-2022. Our empirical approach follows [Misra and Surico \(2014\)](#), who estimate the

<sup>12</sup>In the appendix we present a similar analysis but considering aggregate data. All our qualitative results remain.

effects of 2001 and 2008's rebates in the United States using the Consumer Expenditure Survey.<sup>13</sup> To be able to analyze not only the contemporaneous response of consumption to fiscal transfers shocks but also their dynamic effects, we estimate the following Local Projection like regression

$$\log s_{ijt+h} - \log s_{ijt-1} = \alpha_{jh} + \beta_{jh} \log T_{it} + \Gamma'_{jh} \mathbf{X}_{it} + \lambda_i + \lambda_t + \varepsilon_{jit+h}, \quad (2)$$

for  $h = 0, \dots, H$  and  $j \in \{f, m, s\}$ . Here  $\log s_{ijt+h} - \log s_{ijt-1}$  denotes the log-change in expenditure shares of good  $j$  for municipality  $i$  between periods  $t-1$  and  $t+h$ ,  $T_{it}$  is the total amount of transfers received by municipality  $i$  in period  $t$  and  $\mathbf{X}_{it}$  includes twelve lags of fiscal transfers and pension funds withdrawals.<sup>14</sup> Finally,  $\lambda_i$  and  $\lambda_t$  denote municipality and date fixed effects. The coefficient of interest is  $\beta_{jh}$ , which captures the cumulative response in expenditure shares up  $h$  periods after fiscal support in period  $t$ . Importantly, we expect  $\lambda_t$  to absorb any variation at a country level, so the sequence of  $\beta_{jh}$ 's capture variation in expenditure shares beyond the ones generated by output or other macroeconomic variables.

A few remarks are in order. First, these responses do not correspond to consumption responses to exogenous fiscal transfers, even after controlling for other variables, since it may be that consumption decisions anticipate the rise in transfers. Hence, we do not claim causal identification between transfers and consumption. Second, the responses of *total* expenditures to these transfers are positive and persistent. [García et al. \(2023\)](#) study this question, and we refer the reader to that work.

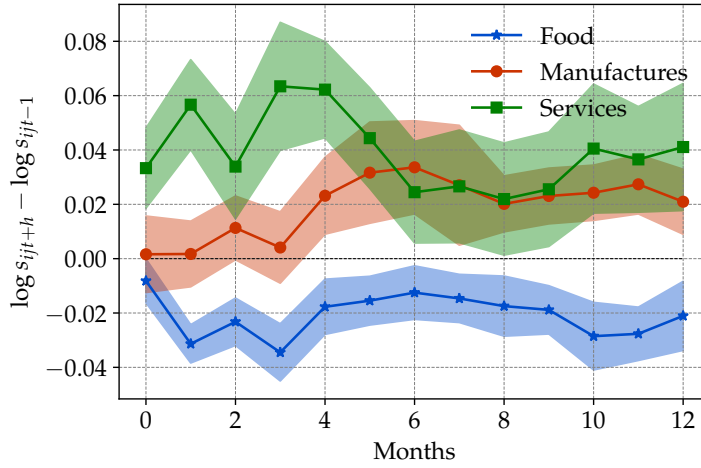
We show in [Figure 3](#) the results of estimating [Eq. \(2\)](#), where we plot the evolution of expenditure shares after fiscal transfers. Several results are worth commenting on. First, transfers have unequal effects on expenditure shares. A rise in transfers at a municipal level raises expenditures in services disproportionately more than manufactures and food in the first six months after the shock. Then, the effect remains positive but similar to manufacturing, which becomes positive and significantly different from zero four months after the shock. This effect is persistent and lasts for at least twelve periods. As expected, to the rise in the shares in manufacturing and services, a fall in food

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<sup>13</sup>[Misra and Surico \(2014\)](#) further studies the heterogeneous effects of those rebates following [Johnson et al. \(2006\)](#) and [Parker et al. \(2013\)](#). [Fuster et al. \(2020\)](#) also uses a similar approach, taking surveys from experiments to study the effects on consumption of raising households' income.

<sup>14</sup>In the appendix we show that our results are robust to consider different lags and controlling for the mobility index that varies along municipalities and over time. We find no significant differences to what we find in the baseline specification. We also include pension funds withdrawals in the regressors because they significantly transferred resources from illiquid accounts to households. [García et al. \(2023\)](#) study the differential effects of fiscal transfers and withdrawals in detail. We abstract from the latter because they coincided with strict lockdowns, mainly affecting services.

FIGURE 3: Response of Consumption Shares to Fiscal Transfers



NOTES: This figure presents the dynamic response of expenditure shares to fiscal transfers ( $\beta_{jh}$  coefficients in Eq. (2)).

expenditure share followed, reaching its lower four months after the shock. Thus, we find that the response to income shocks in the form of fiscal transfers is also consistent with the income elasticities found above: the share in services and manufacturing increases while the share spent in food goes down in response to positive income shocks. Importantly, all these results are not driven by lockdowns associated with the COVID-19 period as we show in the appendix.

In conclusion, we observe heterogeneity in expenditure shares of different goods relative to income. Services show an increasing relationship with income, manufacturing displays a flat relationship, while food exhibits a decreasing relationship. These findings suggest that food has the lowest income elasticity of the three categories, followed by manufacturing, and then services with the highest elasticity. Additionally, analyzing monthly credit and debit card transactions provides evidence that these patterns also hold in the evolution of expenditure shares over time. Specifically, as the economy experiences growth, expenditure patterns shift from food to manufacturing and services. Furthermore, we observe these shifts in expenditure patterns also in response to income shocks in the form of fiscal transfers. What is crucial for us is that these changes in expenditure shares are heterogeneous, time-varying, and endogenous to the business cycle.

Motivated by this evidence, in the next section, we propose a Heterogeneous-Agent New Keynesian model with three sectors and non-homothetic preferences to provide a theoretical explanation and study the aggregate consequences of these findings.

### 3 A Model of Consumption with Heterogeneous and Time-Varying Expenditure Shares

This section presents a Heterogeneous-Agent New Keynesian Model (HANK) with non-homothetic (NH) preferences. To keep the exposition as simple as possible, we describe in detail the problem of households, which is the novel contribution of this paper, and briefly summarize the rest of the economy which is standard. We provide further details in the appendix.

#### 3.1 Households

We assume there is a measure one of households that differ in wealth  $b \in \mathcal{B}$  and productivity  $z \in \mathcal{Z}$ . The  $b$ -dimension is the endogenous state, and the  $z$ -dimension is the exogenous time-varying idiosyncratic shock. We identify each household by  $h$ , which is associated with the tuple  $(b, z)$ .

Households derive utility from consumption and disutility from labor. We assume there is a continuum of  $g \in (0, 1)$  labor tasks that each household can execute. Hence, household  $h$  maximizes its lifetime utility, discounting the future at a factor  $0 < \beta < 1$ , given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_{ht}, \{n_{ht}^g\}_{g=0}^1). \quad (3)$$

Following Galí (2011), we assume a separable utility function of the form:

$$u(c_{ht}, \{n_{ht}^g\}_{j=0}^1) = \frac{(c_{ht})^{1-\gamma}}{1-\gamma} - \chi \frac{\int_0^1 (n_{ht}^g)^{1+\varphi} dg}{1+\varphi},$$

where  $\gamma$  is the inverse of the intertemporal elasticity of substitution,  $\chi$  is the parameter of the disutility of labor, and  $\varphi$  is the inverse of the Frisch elasticity of the labor supply.  $c_{ht}$  is total consumption and  $n_{ht}^g$  is hours supplied by workers from household  $h$  to the task  $g$ . Workers do not choose their labor supply directly due to labor market frictions. The labor supply is determined by a union that represents labor supplied by households to task  $g$ , to maximize the average welfare of all households providing those services. As standard in the literature, in equilibrium  $n_{ht}^g = n_t, \forall h$  holds, and the nominal wage is common across households and denoted by  $W_t$ .

Households maximize (3) subject to the following budget and borrowing constraints

$$E_{ht} + b_{ht+1} = (1 + i_t)b_{ht} + (1 - \tau_t^w)W_t n_t z_t + T_{ht} + D_{ht}, \quad (4)$$

$$b_{ht+1} \geq 0 \tag{5}$$

where  $E_{ht} \equiv P_{ht}c_{ht}$  denotes total expenditures that are also given by

$$E_{ht} = \sum_{j=1}^J P_{jt}c_{hjt}. \tag{6}$$

In our setting, households consume a bundle of  $J$  goods facing a (common) price  $P_{jt}$  and consuming a quantity  $c_{hjt}$ . We denote by  $P_{ht}$  the price index at the household level, while  $c_{ht}$  is the total household consumption  $h$ . As we explain below, our non-homothetic preferences generate household-level price indices, which imply that each household faces a different cost of living, despite observing the same sectoral prices.

Households save in a liquid and risk-free asset  $B_{ht}$  that returns a nominal interest rate  $i_t$ , receive post-tax income from labor  $(1 - \tau_t^w)W_t n_t z_t$ , where  $W_t n_t$  is a common labor income and  $z_t$  is an individual idiosyncratic shock which generates a non-degenerate distribution of income. Households receive a fiscal transfer  $T_{ht}$  and pay proportional labor income taxes where  $\tau_t^w$  is the tax rate common to all households. Finally, total firms' dividends can be distributed unevenly among the different households, denoted by  $D_{ht}$ .

The households' optimization problem can be split into an intra-temporal problem, which describes how households distribute consumption among the different goods, and the inter-temporal problem, which is also affected by allocating resources to the different goods. We study both in turn.

**Intratemporal Problem–The Role of Non-homothetic Preferences.** As mentioned before, households derive utility from the consumption of the  $J$  different goods in the economy (for our quantitative exercises, we can think about the consumption basket as composed of food, manufactures, and services). The consumption aggregator of every household is denoted by  $c_{ht}$  and takes the form of an implicitly additive non-homothetic CES function. It defines total consumption in period  $t$  by<sup>15</sup>

$$1 = \sum_{j=1}^J (\omega_j (c_{ht})^{\epsilon_j})^{\frac{1}{\sigma}} (c_{hjt})^{\frac{\sigma-1}{\sigma}}, \tag{7}$$

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<sup>15</sup>Comin et al. (2021) shows that with these preferences, the intertemporal and intertemporal allocation problems can be separated, as in the case of standard CES utility function.

where  $c_{hjt}$  denotes the consumption of good  $j$  by household  $h$  in period  $t$ ,  $\omega_j$  is a taste parameter for good  $j$ ,  $\sigma$  is the constant elasticity of substitution between sectoral goods, and  $\epsilon_j$  is the constant elasticity of consumption of sectoral good  $j$  with respect to the consumption index  $c_{ht}$  that allows preferences to be non-homothetic. This latter parameter is also understood as the income elasticity with respect to individual consumption goods. Crucially, parameters  $\{\sigma, \epsilon_j, \omega_j\}$  are common across households, so Eq. (7) impose no structural differences across the income distribution: any heterogeneity in consumption bundles arises from differences in income and assets and not from different preferences.

These preferences were introduced by [Hanoch \(1975\)](#) and recently used in the macroeconomics literature by [Comin et al. \(2021\)](#), [Cravino and Sotelo \(2019\)](#), [Matsuyama \(2019\)](#) and [Redding and Weinstein \(2019\)](#), among others, mostly to analyze trade patterns and structural change. Note that we recover the standard homothetic CES specification (H) in the particular case of  $\epsilon_j = 1 - \sigma$  for every  $j$ .

Given a level of total expenditures  $E_{ht} = P_{ht}c_{ht}$ , the intratemporal cost minimization optimization problem derives the following conditions

$$c_{hjt} = \omega_j \left( \frac{P_{jt}}{P_{ht}} \right)^{-\sigma} (c_{ht})^{\epsilon_j + \sigma} \quad (8)$$

$$s_{hjt} \equiv \frac{P_{jt}c_{hjt}}{E_{ht}} = \omega_j \left( \frac{P_{jt}}{P_{ht}} \right)^{1-\sigma} (c_{ht})^{\epsilon_j - (1-\sigma)}, \quad (9)$$

where  $s_{hjt}$  is the expenditure share of household  $h$  in good  $j$ . The household-specific CPI corresponds to the price index that equalizes  $P_{ht}c_{ht} = \sum_{j=1}^J P_{jt}c_{hjt}$  and is defined by

$$P_{ht} = \left[ \sum_{j=1}^J (\omega_j P_{jt}^{1-\sigma})^{\vartheta_j} (s_{hjt} E_{ht}^{1-\sigma})^{1-\vartheta_j} \right]^{\frac{1}{1-\sigma}}, \quad (10)$$

with  $\vartheta_j \equiv (1 - \sigma)/\epsilon_j$ . From these expressions is clear that both the expenditure share and the CPI (characterized by different levels of income and access to financial markets) depend on the level of consumption/expenditures in every period, so are household-specific. Note again that in the case of homothetic preferences ( $\epsilon = 1 - \sigma$ ), the expenditure shares do not depend on the level of consumption, and the CPI is common across households because it only depends on observed prices and not on the level of consumption itself (i.e.,  $\vartheta_j = 1$  holds). At the same time, with non-homothetic preferences, the demand for each good nonlinearly depends on total consumption



through the good-specific income elasticity,  $\epsilon_j$ . For future reference, denote  $\bar{\epsilon}_{ht} \equiv \sum_{j=1}^J s_{hjt} \epsilon_j$  as the average (expenditure-weighted) income elasticity. As we will see next, this object plays a crucial role in determining *intertemporal* consumption.

Eq. (10) suggests that individual CPI is an increasing function of total consumption  $c_{ht}$ . This implies that total expenditures increase non-linearly with respect to total consumption. This reflects that households switch consumption from goods with low-income elasticity to goods with high-income elasticity when they can spend one extra dollar. This is one of the crucial distinctions between a model with homothetic preferences and one with non-homothetic preferences.

**Intertemporal Problem.** The solution of the intertemporal problem can be summarized by the following Euler equation (derived in Appendix B.4)

$$u_c(c_{ht}) = \beta \mathbb{E}_t \left[ (1 + r_t) \frac{\mathcal{E}_{ht}}{\mathcal{E}_{ht+1}} u_c(c_{ht+1}) \right] + \mu_{ht} \mathcal{E}_{ht},$$

where  $\mu_{ht}$  is the Lagrange multiplier of the borrowing constraint and  $\mathcal{E}_{ht} \equiv \frac{p_{ht} \bar{\epsilon}_{ht}}{1 - \sigma}$ . This equation can be written as

$$u_c(c_{ht}) = \beta \mathbb{E}_t \left[ \underbrace{\frac{1 + r_t}{1 + \pi_{ht+1}} \frac{\bar{\epsilon}_{ht}}{\bar{\epsilon}_{ht+1}}}_{\text{Effective Real Rate}} u_c(c_{ht+1}) \right] + \underbrace{\mu_{ht} \frac{p_{ht} \bar{\epsilon}_{ht}}{1 - \sigma}}_{\text{Financial Frictions}}. \quad (11)$$

Eq. (11) is the Euler equation of households of type  $h$  determining the consumption-savings decision and has two key differences relative to standard homothetic preferences. First, with NH preferences, we observe that the *Effective Real Rate* depends on individual variables. In particular, it depends on the expected *individual* inflation defined as  $1 + \pi_{ht+1} = \frac{p_{ht+1}}{p_{ht}} (1 + \pi_t)$ , where  $\pi_t$  denotes aggregate inflation (see details below), and the growth of the average elasticity  $\frac{\bar{\epsilon}_{ht}}{\bar{\epsilon}_{ht+1}}$ , so the effects of inflation are now heterogeneous across the distribution of households. Since expenditure shares are time-varying, households switch their consumption between goods with different inflation rates. That implies that whenever a household moves to a bundle with higher expected inflation, current consumption rises by more (with  $u_c(c_{ht}) < 0$ ). Also, notice that consumption depends on the change in income elasticity out of the steady state. If the bundle becomes more elastic (i.e. if  $\frac{\bar{\epsilon}_{ht}}{\bar{\epsilon}_{ht+1}} < 1$ ), there is an amplifying effect of shocks. That happens because households reallocate expenditures towards more income-elastic goods and are willing to consume fewer units on impact.

However, what matters is the growth of the elasticity between today and tomorrow. Therefore, whenever this average elasticity is expected to grow over time, this implies stronger expenditure reallocation tomorrow than today to smooth consumption. Consequently, households prefer to start consuming more today. Thus, non-homotheticities contribute to consumption fluctuations through this channel.

On top of the real rate channel, NH preferences affect consumption through a financial channel. For some agents,  $\mu_{ht}$  is positive, inducing precautionary motives. However, the shadow price of the financial constraint now interacts with the term  $p_{ht}\bar{\epsilon}_{ht}$ , capturing the effective cost of living of household  $h$ . Depending on the value of the latter variables, the magnitude of precautionary motives can be dampened or amplified depending on income level. That would affect the marginal propensities to consume across the income distribution. The intuition of this result is the following. Households now internalize that whenever they change the composition of their consumption bundle, they change their cost of living,  $p_{ht}$ . This also affects the cost of being close to the borrowing constraint given by  $\mu_{ht}$ , because reallocating to cheaper or less income-elastic bundles implies a lower need to take precautionary savings to keep high utility levels.

The latter observation directly affects the transmission of shocks in the economy: affecting precautionary motives implies distorting the curvature of consumption functions and hence affect the marginal propensities to consume of households. The final effect, though, depends on how the bundle reallocation is distributed across the population. We analyze this in the quantitative section.

**Households' Distribution.** The above consumption-savings problem generates a distribution of households in the space  $\mathcal{B} \times \mathcal{Z}$ , where  $\mathcal{B}$  is determined by the borrowing constraint and  $\mathcal{Z}$  by the stochastic process governing  $z$ . We denote the distribution of households by  $\Psi_t(b, z) = \Psi_t(h)$ , which satisfies  $\int \Psi_t(h) dh = 1$  in every  $t$ . Due to the recursive formulation of the problem, and given the policy functions of households, there is an operator  $F$  that maps  $\Psi_t(h)$  onto  $\Psi_{t+1}(h)$

$$\Psi_{t+1}(h) = F(\Psi_t(h)).$$

The mapping  $F(\cdot)$  is a key object of our analysis because it keeps track of the distribution of households both in the steady state and along the transition path of the economy.

### 3.2 Workers' Union

We assume that for each task  $g$ , there is a union deciding wages  $W_t^g$  and the labor supplied  $n_t^g$ . In this setting, unions have market power as workers' tasks are in monopolistic competition. The union aggregates individual labor such that  $n_t^g = \int n_{ht}^g \Psi_t(h) dh$ . Aggregate labor is combined in a Dixit-Stiglitz fashion, with an elasticity of demand  $\varepsilon_w$  denoting the level of market power.

We also assume nominal wage rigidities à la Rotemberg, in which the cost of changing wages is a convex function  $\Gamma(W_{t-1}^g, W_t^g)$  measured in utility units. The optimization problem of the union is to maximize average welfare of households and, after symmetry, derives the following New-Keynesian Wage Phillips Curve (NKWPC)

$$(\pi_{wt} + 1)\pi_{wt} - \beta\theta_w(\pi_{wt+1} + 1)\pi_{wt+1} = \frac{\varepsilon_w}{\theta_w} n_t \left\{ v'(n_t) - \frac{\varepsilon_w - 1}{\varepsilon_w} \int u_c(c_{ht}) \frac{(1 - \tau_t^w)W_t}{P_{ht}} \frac{1 - \sigma}{\bar{c}_{ht}} \Psi_t(h) dh \right\}, \quad (12)$$

where  $1 + \pi_{wt} = \frac{w_t}{w_{t-1}}(1 + \pi_t)$  denotes wage inflation and  $\theta_w$  is a parameter measuring the degree of wage rigidities. Note that, because the problem of the union depends on households' preferences, Eq. (12) depends on terms governing NH preferences.

### 3.3 Firms

We assume there are  $J$  sectors composed of a final good producer and intermediate producers. Final goods are a composite of a measure one of intermediates that operate in monopolistic competition, operating a CES technology with a common elasticity of substitution  $\varepsilon_p$ . Intermediate producers in sector  $j$  operate a Cobb-Douglas technology that depends on labor. The intensity of labor usage is sector-specific.

As in the case of unions, intermediate producers are subject to nominal price rigidities à la Rotemberg, in which the cost of changing prices is a convex function  $\Theta(P_{jt-1}, P_{jt})$  measured in units of total sectoral output. Assuming that firms discount profits at the real interest rate and after symmetry, the optimization problem derives the following sectoral New-Keynesian Phillips Curve (NKPC)

$$(\pi_{jt} - \bar{\pi}_j)\pi_{jt} = \frac{\varepsilon_p}{\theta_j^p} \left( \frac{mc_{jt}}{p_{jt}} - \frac{\varepsilon_p - 1}{\varepsilon_p} \right) + \mathbb{E}_t \left[ \left( \frac{1}{1 + r_t} \right) (\pi_{jt+1} - \bar{\pi}_j)\pi_{jt+1} \frac{p_{jt+1}y_{jt+1}}{p_{jt}y_{jt}} \right], \quad (13)$$

where  $1 + \pi_{jt} = \frac{p_{jt}}{p_{jt-1}}(1 + \pi_t)$ ,  $mc_{jt}$  denotes marginal costs for sector  $j$  and  $\theta_{jp}$  is the sector-specific degree of price rigidities.

### 3.4 Monetary Authority

The monetary authority sets the nominal interest rate  $i_t$  according to a Taylor rule

$$i_t = i^* + \phi_\pi(\pi_t - \bar{\pi})$$

where we denote by  $\phi_\pi$  the preference parameter for inflation.

### 3.5 Fiscal Policy

The government raises proportional labor income taxes  $\tau_t^w$  and gives lump-sum transfers  $T_{ht}$  to households that amount to  $T_t = \int T_{ht}\Psi_t(h)dh$ . The government also issues debt denoted by  $B_t$  that has as counterpart the savings by households in liquid assets. Government debt pays the real rate. The budget constraint is then given by

$$B_{t+1} = T_t - \tau_t^w w_t N_t + (1 + r_t)B_t.$$

Additionally, we allow the government to finance the transfers with labor income taxes or debt by allowing it to delay the raise in taxes to finance the transfer today. To do so, we assume a tax smoothing parameter  $\rho_T$  governs the debt accumulation process after a fiscal transfer. Therefore, in response to a transfer, debt follows

$$\Delta B_t = \rho_T(\Delta T_t + \Delta B_{t-1}).$$

We use this specification to account for debt accumulation in response to transitory government spending, as observed in the data.<sup>16</sup>

### 3.6 Aggregation

Total consumption expenditures of households are given by

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<sup>16</sup>We account for this possibility because, since our model has financial frictions and the Ricardian Equivalence does not hold, how governments finance expenditures matters for the aggregate effects of fiscal expansions.

$$E_t = P_t C_t = \int p_{ht} c_{ht} \Psi_t(h) dh. \quad (14)$$

We define the aggregate price index (CPI), which is the price of aggregate consumption, as  $P_t = \left( \sum_j \omega_j P_{jt}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$ . We use this expression as the *numeraire* to normalize prices, and the inflation process associated with this index is the one targeted by the central bank. This is the index that would prevail in the case with homothetic preferences. Therefore, aggregate inflation is defined as  $1 + \pi_t = P_t / P_{t-1}$ .

The goods and bond market clearing implies

$$\begin{aligned} GDP_t &= \sum_{j=1}^J P_{jt} Y_{jt} = E_t + \sum_{f=1}^J \Theta_{jt} \\ B_t &= \int b_{ht} \Psi_t(h) dh. \end{aligned}$$

## 4 The Role of Non-homothetic Preferences

Before turning to the quantitative application of our model, we explore the theoretical insights of NH preferences. We first explore consumption dynamics at the household level, and then we solve for an aggregate consumption (and output) equation. This section assumes that sectoral prices do not change over time. Therefore, we see this exercise as a partial equilibrium one to illustrate the NH mechanism.

**Consumption Dynamics at the Household Level.** Starting from Eq. (8), which describes the demand of household  $h$  for good  $j$  given sectoral prices, the response of sectoral consumption to an increase in income  $dy_{ht}$  is given by

$$dc_{hjt} = \underbrace{(\epsilon_j + \sigma) \omega_j \left( \frac{p_{jt}}{p_{ht}} \right)^{-\sigma} (c_{ht})^{\epsilon_j + \sigma - 1} M_{ht}^C dy_{ht}}_{\text{Change through } c_{ht}} + \underbrace{\sigma \omega_j \left( \frac{p_{ht}}{p_{jt}} \right)^{\sigma - 1} \frac{1}{p_{jt}} \frac{\partial p_{ht}}{\partial c_{ht}} M_{ht}^C c_{ht}^{\epsilon_j + \sigma} dy_{ht}}_{\text{Change through } p_{ht}},$$

which is equivalent to

$$dc_{hjt} = s_{hjt} \left[ \frac{\sigma \bar{\epsilon}_{ht} + (1 - \sigma) \epsilon_j}{1 - \sigma} \right] \frac{p_{ht}}{p_{jt}} M_{ht}^C dy_{ht}, \quad (15)$$

and where  $M_{ht}^C$  denotes the marginal propensity to consume (MPC) of household  $h$  and  $dy_{ht}$  the magnitude of the income shock (both taken as given for this exercise). To fix ideas, we focus on the case in which the shock comes only from fiscal transfers, so the marginal propensity to consume captures the marginal response of consumption to an infinitesimal change in transfers.

Note that the response of consumption depends on good-specific characteristics (such as the price and the parameters governing preferences) and household-specific characteristics (such as the MPC or the level of aggregate consumption) through two sources: the change in consumption (as in an H economy) and the change in the individual price index (exclusive to the NH model). Moreover, the consumption response in the NH model differs from the H counterpart as the latter does not depend on the level of consumption and the prices index of the household. Therefore, in the H case, it does not matter the level of consumption/income of the household to determine how its sectoral consumption responds.<sup>17</sup>

**Aggregate Consumption Dynamics.** Assuming the same increase in income across households ( $y_{ht} = y_t, \forall h$ ), we use Eqs. (14) and (15), as well as the definition of total expenditures, to get an expression for the response of aggregate consumption to a uniform increase in income

$$dC_t = \int \sum_{j=1}^N p_{jt} dc_{hjt} \Psi_t(h) dh = \int \mathcal{E}_{ht} M_{ht}^C dy_t \Psi_t(h) dh$$

where  $\mathcal{E}_{ht} \equiv \frac{p_{ht} \bar{c}_{ht}}{1-\sigma}$  as defined before. The previous expression shows that, unlike the homothetic case, in the NH model there is a gap between the marginal propensity to consume,  $M_{ht}^C$ , and the marginal propensity to spend,  $M_{ht}^E \equiv \frac{\partial E_{ht}}{\partial c_{ht}}$ . This is because the aggregate price defining total expenditures in the NH model depends on the level of consumption itself, which is not the case in the H counterpart. It can be shown that  $M_{ht}^E = \mathcal{E}_{ht} M_{ht}^C$  so the gap is given by the term  $\mathcal{E}_{ht}$ , a crucial object for our model.

To gain intuition, note that the response of aggregate consumption to changes in income can be written as

$$dC_t = \bar{\mathcal{E}}_t \bar{M}_t^C dy_t + cov(\mathcal{E}_{ht}, M_{ht}^C) dy_t, \quad (16)$$

where  $\bar{X}$  denotes the cross-sectional average of variable  $X$ . Eq. (16) allows us to study the effects

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<sup>17</sup>The homothetic counterpart of Eq. (15) can be written as  $dc_{hjt} = \omega_j (p_{jt})^{-\sigma} M_{ht}^C dy_t$ .

of NH preferences with respect to the benchmark H case. From our simplifying assumptions, the change in expenditures with NH preferences is characterized by two terms. On the one hand, there is an *average* effect characterized by  $\bar{\mathcal{E}}_t \bar{M}_t^C$ . After a positive income shock, households reallocate their expenditures toward more income-elastic goods. This implies an increase in the expenditure share of goods associated with a higher value of  $\epsilon_j$  and, therefore, we expect  $\bar{\mathcal{E}}_t > 1$  to hold. Combined with the fact that, on average, the marginal propensity to consume is positive ( $\bar{M}_t^C > 0$ ), the average effect generates an amplification of transfer shocks.

On the other hand, there is a *cross-sectional* effect coming from the term  $cov(\mathcal{E}_{ht}, M_{ht}^C)$ . After a positive income shock, we expect that the reallocation towards more income-elastic goods affects high-income households more strongly, so  $\mathcal{E}_{ht}$  increases in the cross-section. However,  $M_{ht}^C$  moves in the opposite direction because high-income households tend to have lower marginal propensities to consume. Therefore, we expect that  $cov(\mathcal{E}_{ht}, M_{ht}^C) < 0$  holds. We interpret this latter effect as an insurance mechanism for households. Instead of just changing their level of consumption after income shocks, households can rebalance their expenditures to keep utility as stable as possible. That interpretation of the covariance is static. A dynamic interpretation is that, in the business cycle, the distributions of  $\mathcal{E}_{ht}$  and  $M_{ht}^C$  fluctuate, generating changes in the covariance term. In response to a transfer shock, we expect the elasticity of low-income households to rise by more than that of high-income households, lowering  $cov(\mathcal{E}_{ht}, M_{ht}^C)$  in absolute value. That may lead to an additional effect absent from models with H preferences.

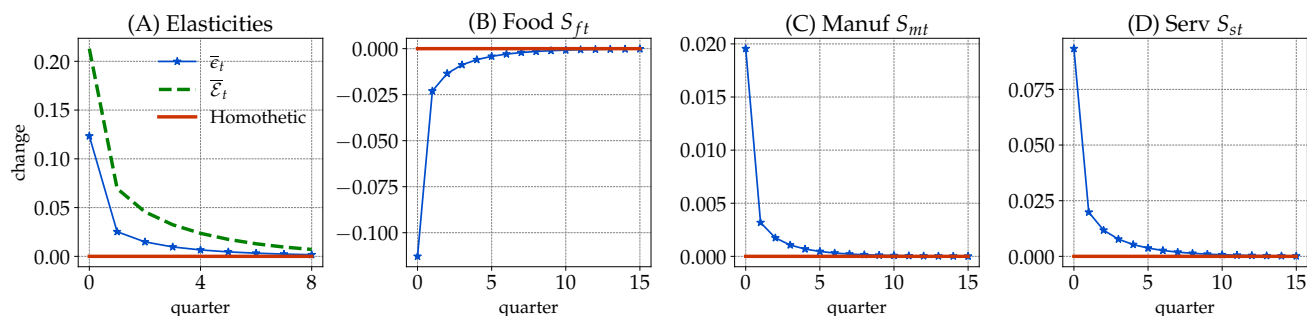
How does this compare with the H economy? Note that in such case,  $\mathcal{E}_t = 1$  holds, and the counterpart of Eq. (16) is just  $dC_t = \bar{M}_t^C dy_t$ . Therefore, in the H case, the economy has an unambiguous positive response to income shocks that only depend on the average marginal propensity to consume.

In summary, the response of aggregate consumption depends on two effects, the average and cross-sectional responses. The final response of expenditures and consumption to an income shock is a quantitative result and depends on the shock (its relative strength and persistence) and the distribution of income.

**Intertemporal Responses.** The previous section studies the response of consumption on impact. Now we focus our attention to analyzing the sequence of responses of household variables over time. Auclert et al. (2023) dubbed these responses as *intertemporal MPC* (iMPC) for the case of consumption, but the same logic applies for other variables as well. In what follows, we analyze

the corresponding intertemporal responses for all household variables in the H and the NH cases to illustrate the differences between both models dynamically but still in a partial equilibrium framework.<sup>18</sup>

FIGURE 4: Change in Expenditure Shares and Income Elasticity to a One-Time Unitary Fiscal Transfer



NOTES: This figure shows the dynamic response of elasticities and the share of food, manufacturing, and services to a one-time increase in household transfers.

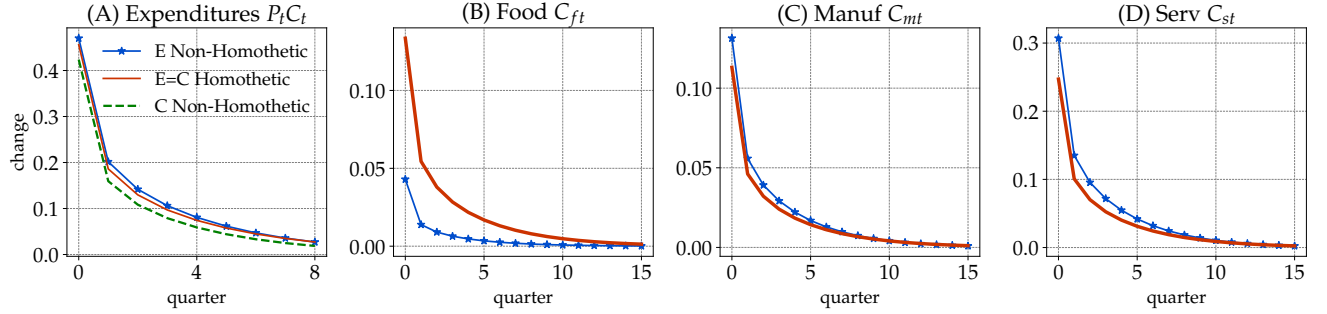
Figure 4 illustrates the intertemporal responses of household variables comparing the H and NH cases in a calibrated version of the model (see details below). We show the responses of three goods (food, manufactures, and services) and the aggregate average elasticity,  $\bar{\epsilon}_t$ . While there are no changes in expenditure shares in the H model after an income shock, we observe a sizable effect in the NH model. There is a substantial decrease in the share of food, with a rise in manufacturing and services. Consequently, the average expenditure elasticity strongly responds to the shock in the NH model while remaining constant in the H case. Therefore, Figure 4 shows that our model can replicate the empirical evidence presented in Section 2: the share of food in total expenditures goes down, and the share of services and manufactures goes up after an income shock.

The responses in expenditure shares and the average elasticity affect the responses of consumption in the different goods and the response of expenditures in the NH case. Figure 5 shows that, as we expected, the responses of the different goods follow the income elasticities and the response of the expenditure shares. In the NH case, food consumption rises by less than the rise in manufactured goods and services in our calibration. Notice also that in the NH case, the iMPC is slightly lower than in the H case, but the intertemporal propensity to spend lies above the iMPC in H. This result suggests that the response of the elasticity shown in Panel (A) of Figure 4 contributes to the rise in expenditures, hence, generating amplification.

<sup>18</sup>Auclert et al. (2023) shows that in models with heterogeneous agents, these intertemporal MPCs arise naturally, in contrast with other types of modeling like Two-Agent models (Bilbiie, 2008) in which the responses to one-time income shock have only effects in the period of the shock.



FIGURE 5: 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.

## 5 Propagation of Fiscal Transfers

This section studies the quantitative implications of non-homothetic preferences after an income shock. We start by describing our calibration strategy to then present the impulse-responses to the shock.

### 5.1 Calibration

**Estimation of Income Elasticities.** As noticed by [Comin et al. \(2021\)](#), the model's predictions for observable variables remain invariant to any scaling of all income elasticities and taste shifters ( $\epsilon_j$  and  $\omega_j$ ) by a constant factor. Therefore, we can normalize all these parameters relative to a base good,  $j = v$ . Using Eq. (9), this implies that for any  $j \neq v$ , the expenditure share in good  $j$ , relative to the base good, of household  $i$  in period  $t$  can be written as

$$\log \left( \frac{s_{ijt}}{s_{ivt}} \right) = (\epsilon_j - 1) \log(s_{vt}) + (1 - \sigma) \log \left( \frac{p_{jt}}{p_{vt}} \right) + (\epsilon_j - 1)(1 - \sigma) \log \left( \frac{E_{it}}{p_{vt}} \right), \quad (17)$$

for any  $j \neq v$ , which defines a  $J - 1$  system of demand equations. The key element to notice from Eq. (17) is that it provides an expression for the consumption shares of all other goods in terms of observable variables. For our empirical estimation, we set manufactures as the baseline good ( $v = m$ ) and normalize  $\epsilon_m = 1$ .

We estimate this empirical specification with the cross-sectional data presented in Section 2 to replicate the expenditure patterns observed across the income distribution. As [Comin et al. \(2021\)](#),

we assign a percentile-specific price for the three goods, which imperfectly captures the fact that different households might not face the same prices, and impose the same parameters across the  $J - 1$  equations. The estimation is carried out using Feasible Generalized Nonlinear Least Squares (FGNLS) as [Herrendorf et al. \(2013\)](#) and [Cravino and Sotelo \(2019\)](#).<sup>19</sup> As in [Comin et al. \(2021\)](#) and [Cravino and Sotelo \(2019\)](#), the identification assumption is that shocks to income and relative prices are not correlated to changes in demand shifters  $\omega_j$ , so preferences do not change over time, other than by the income effect.

Table 2 reports the results. The elasticity of substitution  $\sigma$  is significantly below one and close to zero, implying a high degree of complementarities in consumption. On the other hand, the income elasticity of food is close to zero, while the income elasticity of services is above one. These results indicate that services are more income elastic than manufactures and food.<sup>20</sup>

TABLE 2: Demand system estimates

	Coefficient	Std. Error
$\sigma$	0.271	(0.023)
$\epsilon_f$	0.000	(·)
$\epsilon_s$	1.113	(0.036)
Observations	100	

NOTES: This table presents the estimates of the demand system given by Eq. (17).  $\sigma$  denotes the elasticity of substitution between goods, while  $\epsilon_j$  denotes the income elasticity of good  $j \in \{f, s\}$ . Robust standard errors reported in parenthesis.

**Households.** We set the elasticity of intertemporal substitution equal to one ( $\gamma = 1$ ). We calibrate the disutility of labor  $\psi$  to match a normalized level of labor given by  $N = 1$  in steady state, and the Frisch elasticity of labor is equal to one ( $\varphi = 1$ ). We calibrate the discount factor and the average bond holdings to match a quarterly interest rate of 0.5% and a share of hand-to-mouth workers of 0.39 ([García et al., 2023](#)). This calibration strategy delivers total liquid holdings of 16.5 percent of GDP and a discount factor of  $\beta = 0.94$ . Total liquid holdings are slightly lower than in [García et al. \(2023\)](#). Finally, we assume an ad-hoc rule of profits distribution in which we distribute profits proportional to the idiosyncratic productivity as in [Kaplan et al. \(2018\)](#).

We calibrate the income risk process to match the cross-sectional variance of the first difference of log income (0.19) and the variance of the log of income (0.72) at a quarterly frequency.<sup>21</sup> We

<sup>19</sup>For the estimation, we constraint the elasticities to be positive to ensure that the consumption aggregator is concave.

<sup>20</sup>For comparison purposes, note that [Comin et al. \(2021\)](#) finds  $\sigma = 0.26$ ,  $\epsilon_f = 0.2$  and  $\epsilon_s = 1.65$  for the U.S., using panel data from the Consumption Expenditure Survey (CEX) for the period 1999-2010.

<sup>21</sup>Also reported in [García et al. \(2023\)](#).

discretize this process in eleven points using the Rouwenhorst method. To estimate the idiosyncratic income process, we use administrative data with information on the universe of formal workers at a quarterly frequency. Finally, we assume workers' unions face an elasticity of substitution equal to  $\varepsilon_w = 10$  and calibrate the adjustment cost to obtain a slope of the New Keynesian Wage Phillips curve equal to 0.1.

**Firms.** For consistency with our empirical results, we assume three sectors: food, manufactures, and services. For simplicity, we assume all firms face the same elasticity of demand,  $\varepsilon_p$ , which equals 10. In the baseline calibration, we set the adjustment cost parameters to obtain slopes of the Phillips curves equal to 0.1 in all goods. Additionally, we assume decreasing returns to scale in labor, setting  $\alpha = 0.33$ .

To isolate the effects from consumption to output, we assume firms are equal in how they produce but not in the demands they face. The last parameters we have left to calibrate this economy are the taste parameters  $\omega$ , which we calibrate to match the average expenditure shares on each group of goods in steady state. We target an average expenditure share in food, manufactures, and services of 0.204, 0.185, and 0.611. Our calibrated parameters are  $\omega_f = 0.274$ ,  $\omega_m = 0.228$  and  $\omega_s = 0.553$ .

**Monetary and Fiscal Policy.** The Taylor rule only responds to inflation. In both the homothetic and non-homothetic cases, it targets the average inflation given by the aggregate price index. We set  $\phi_\pi = 1.5$ .

For fiscal policy, we assume that the government finances transfers and interest rate payments with distortionary labor income taxes. Those transfers are lump-sum and equal to all workers so we abstract from progressivity. We assume the persistence of the transfers to be 0.75, which means a half-life of two quarters. We calibrate the level of the proportional labor tax ( $\tau^w$ ) to satisfy the government's budget constraint to a value of  $\tau^w = 0.145$  and target a value of aggregate fiscal transfers equal to ten percent of GDP in steady-state. Finally, we set the autoregressive process governing the dynamics of fiscal debt to  $\rho_T = 0.75$ , which implies that the government accumulates debt initially and starts decreasing debt in the following periods by raising labor income taxes.

**Solution Method.** The steady-state equilibrium is obtained by solving the model equilibrium for seven parameters and prices. To solve the value function, we use [Carroll \(2005\)](#)'s endogenous grid method. Finally, we use a Newton method to solve for  $\beta$ ,  $B$ ,  $\varphi$ ,  $p_2$ ,  $p_3$ ,  $\omega_1$ , and  $\omega_2$  which satisfy

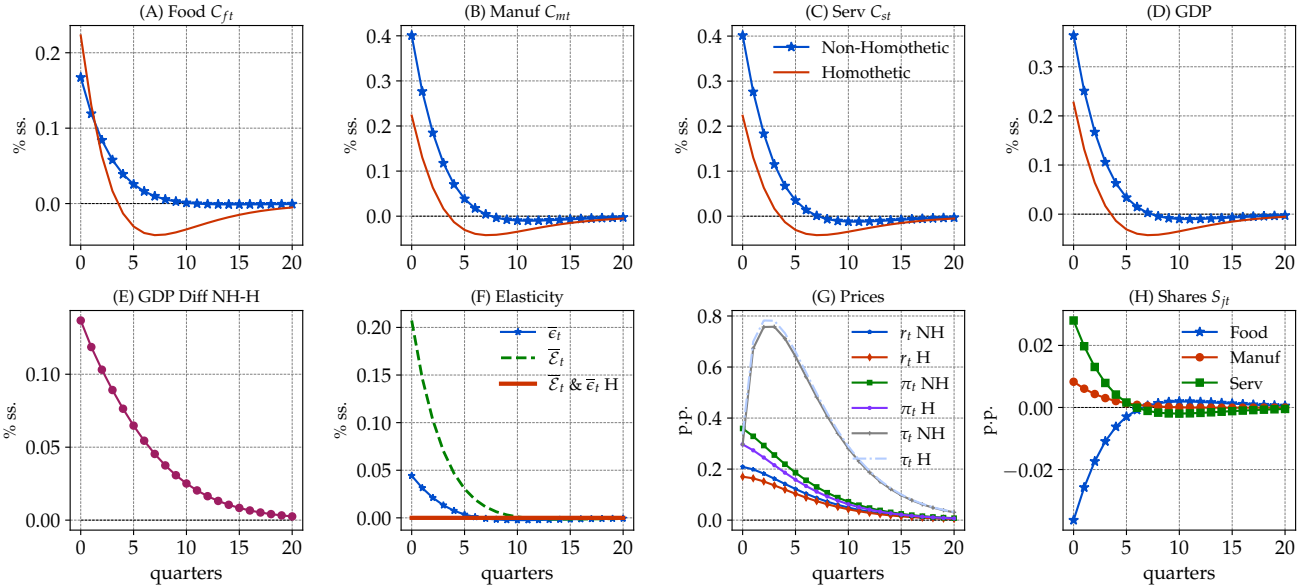
the equilibrium conditions in steady-state. To solve for the dynamics of the model with aggregate shocks, we follow [Auclert et al. \(2021\)](#), who propose to write the model in its Sequence-Space form and linearize it around this system of equations. The method relies on the fact that any model without aggregate uncertainty can be written as a sequence of equations. This is, if we assume shocks are unexpected and the path is known (MIT shocks), we can write the system as a sequence of equations in the transitional dynamics. This system of equations given by  $T \times M$ , with  $T$  the horizon of the transition and  $M$  the number of equations to solve, can be linearized around the steady state. This linearization leads to Jacobians of all variables with respect to others, and the composition of these Jacobians delivers the impulse-response functions. This method is based on the result by [Boppart et al. \(2018\)](#) that shows that the solution from transitional dynamics is close to the linearized solution if shocks are small. The method is fast, accurate, and robust relative to methods like [Reiter \(2009\)](#). We refer the reader to the paper for more details on the method.

## 5.2 Aggregate and Sectoral Responses to Fiscal Transfer Shocks

This section presents the sectoral and aggregate responses to a fiscal transfer shock under our baseline calibration. The experiment is that the government increases the aggregate lump sum transfer by one percent of GDP on impact and distributes it evenly among households (i.e., all households receive the same amount). In all our analyses, we compare the response of the non-homothetic (NH) model with its homothetic (H) counterpart, where the H counterpart follows by setting  $\epsilon_j = 1 - \sigma, \forall j$ .

**Baseline Calibration.** Figure 6 presents the economy's responses after the fiscal transfer shock. Panels (A)-(C) show the response setoral production, while panel (D) shows the responses of GDP. The blue-star lines correspond to the responses in the NH model, while the red-solid lines are the responses in the H counterpart.

FIGURE 6: IRFs under Baseline Calibration



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

Since we study a shock that increases the income level in the economy, all the sectoral and aggregate responses increase consumption and activity, regardless of the distinction between an NH or an H model. That is due to the fact that our model features high iMPCs. However, there are important quantitative differences between the two economies. Regarding sectoral consumption (panels A-C), we observe a less pronounced response in food expenditures in the NH model but a stronger response in manufactures and services expenditures relative to the H case. This is in line with our previous discussion, in which after a positive income shock, there is a rebalancing in expenditures from less to more income-elastic goods. These differences have important implications for aggregate activity. In panel (D), we observe that the response of GDP is about 60 percent larger on impact and is more persistent in the NH economy than in its H counterpart. Such difference can also be noticed by looking at panel (E), which shows the differences in the response between GDP in the NH case relative to the H counterpart.

The key feature of the NH model comes from the fact that expenditure shares directly depend on income. Therefore, we expect that those expenditure shares react in general equilibrium according to the elasticities in response to an income shock. Panel (H) in Figure 6 shows that this is the case, with a positive response in expenditure shares in manufactures and services (larger response in the latter) and a negative response in expenditure shares of food in the NH model. Also, even though relative prices are also changing in general equilibrium, the response of expenditure shares

is muted in the H version of the model due to our assumption of an equal degree of price rigidities across sectors.

The response of sectoral expenditure shares affects the average income-elasticity at the household level,  $\bar{\epsilon}_{ht} = \sum_j s_{hjt} \epsilon_j$ , which determines the final impact of the real interest rate determining consumption, as in Eq. (11). As shown in panel (F) in Figure 6, the average income-elasticity strongly responds to the shock, given the reallocation towards more income-elastic goods. This is not the case in the H model, in which, by definition, such elasticity is constant. Therefore, we expect an increase in the cross-sectional average income elasticity captured by the  $\bar{\epsilon}_t$ , which amplifies the response to shocks due to the average marginal propensity to consume.

The differences between the NH model and its H counterpart are not only reflected in the response of real variables but also in the response of prices. As shown in panel (G) of Figure 6, even though the response of fiscal variables is similar in both models, there are sizeable differences in the response of aggregate inflation. In the NH model, the response of inflation is stronger and more persistent than in the H model, which translates into a stronger response of monetary policy to contain such inflation. Therefore, even with a stronger response of monetary policy, we find that NH preferences amplify the response of GDP to fiscal transfers.

Our analysis does not rely on sectoral-specific shocks to generate asymmetric sectoral responses, as we study an aggregate shock. Therefore, our results shed light on the importance of analyzing the role of income in understanding changes in demand composition over the business cycle and how such changes account for the response and persistence of aggregate variables. Hence, we conclude that considering a mechanism that generates expenditure reallocation can be important for the response of aggregate variables and the response of inflation, on top of the mechanism proposed by heterogeneous price rigidities. This point has been highlighted by Ferrante et al. (2023) but considering an exogenous expenditures-reallocation shock.

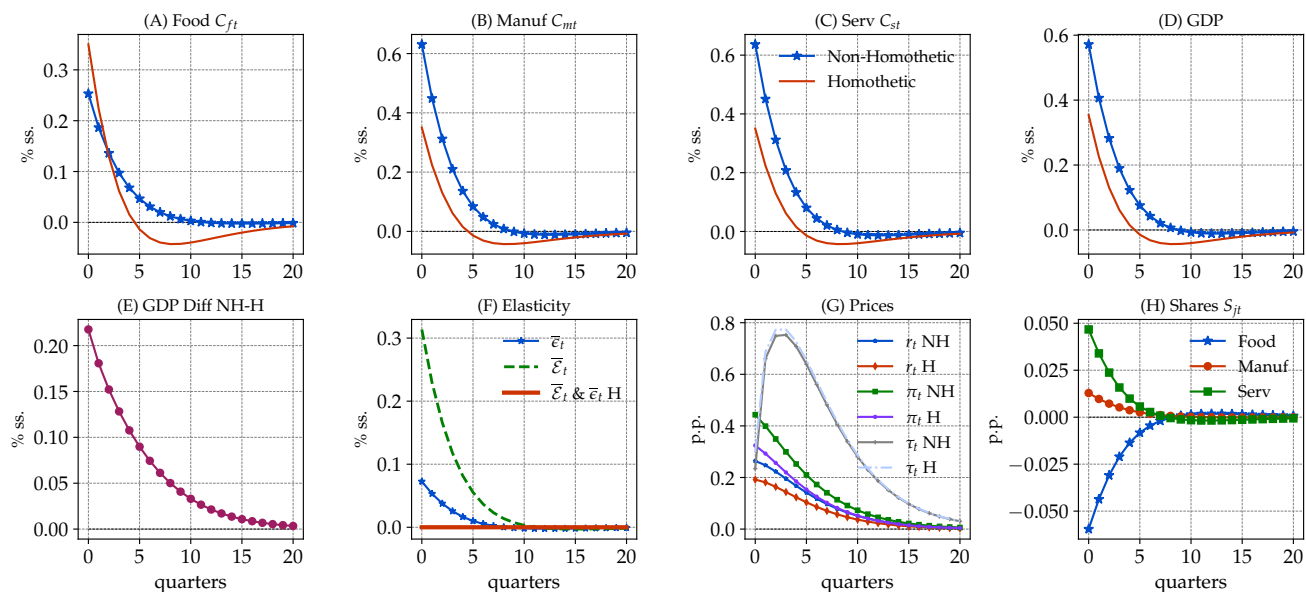
**With Countercyclical Labor Income Inequality.** Our baseline experiment assumes that labor income and transfers affect all households similarly, so the only sources of heterogeneity (over the business cycle) are bond and profit holdings. A more realistic assumption would be that low-income households face more procyclical labor income fluctuations. Hence, there is a stronger redistribution of resources in the cycle towards households with high MPCs, and with lower income elasticities.<sup>22</sup>

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<sup>22</sup>For evidence about this fact, see Aldunate et al. (2023).

Figure 7 investigates the effects of fiscal transfers in which the labor income of low-income households responds more strongly to shocks. In this exercise, we take a stance similar to [Alves et al. \(2020\)](#) who include incidence functions, representing a heterogeneous cyclicality of labor income into the HANK model in [Kaplan et al. \(2018\)](#). We use  $N_{it} = N_t \exp\{z_i \xi(N_t - N_{ss})\} / N_0$ , with  $\xi = -2$  as our incidence function.<sup>23</sup> This function generates a more procyclical response of labor income in the lower part of the labor income distribution.

FIGURE 7: 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.

The results of Figure 7 show that with more countercyclical inequality, the response of GDP gets amplified in both the NH and the H cases. This is, there is amplification because income is distributed more procyclically towards households with higher MPCs. More interestingly, the amplification we observe in the baseline economy is augmented by the countercyclical inequality. This is because the response of the cross-sectional average elasticity is stronger than in the baseline calibration. These results imply that the covariance between the elasticities and the MPCs is also becoming less negative, contributing to the amplification effects. Therefore, we conclude that NH preferences amplify more through expenditure reallocation when the shock is distributed more strongly towards high-MPC households.

<sup>23</sup>With  $N_0 = \int \exp\{z_i \xi(N_t - N_{ss})\} dz$

**Additional Exercises.** In Appendix C we provide three additional exercises to show the robustness of our results regarding the amplification mechanism provided by NH preferences. First, we study the role of the persistence of fiscal transfers in the aggregate responses of the economy. We learn that a lower persistence decreases the amplification provided by NH preferences, because the average elasticity quickly converges to its steady state value, reducing the intertemporal responses of consumption.

Second, we study how monetary policy affects our results. In particular, we analyze the case in which monetary policy responds one to one to inflation ( $\phi_\pi = 1$ ). A looser monetary policy implies a lower response of the real rate, which is amplified by changes in the average income elasticity. Therefore, we find a stronger amplification of NH preferences.

In our baseline calibration we abstracted from the heterogeneity coming from the supply side of the model and assumed the same degree of prices stickiness across sectors. Our final exercise studies the implications of heterogeneous nominal rigidities by focusing in a case in which food has more flexible prices than manufactures and services, in line with [Nakamura and Steinsson \(2008\)](#). From this last exercise we also obtain amplification in the NH case relative to its H counterpart. However, and more interesting, we find that in the homothetic model the expenditure share in food increases, while the expenditure share in services decreases. These results are at odds with our empirical evidence, showing that the H version of the model can not replicate the basic empirical facts presented in this paper, while the NH model does.

## 6 Conclusion

In this paper, we analyze the role of income heterogeneity in determining expenditure shares and aggregate consumption. We provide evidence on how expenditures are distributed across the income distribution, showing that richer households spend relatively more on services and less on food and manufacturing. Moreover, we show that these expenditure shares change over the business cycle and respond to income shocks, with stronger responses in the share of services than manufactures or food. This is, we show a reallocation towards more income-elastic goods over the business cycle.

Motivated by this evidence, we build a Heterogeneous Agent New Keynesian (HANK) model considering non-homothetic preferences (NH) to study how income determines expenditure patterns and consumption. Our key result is that NH preferences affect the consumption response, at



the household level, to fiscal transfers both intratemporally (by reallocating consumption towards more income-elastic goods) and intertemporally (through a real interest rate channel and a financial frictions channel). In the aggregate, we find that NH preferences amplify the impact of the shock through the interaction of the average marginal propensity to consume and average expenditure elasticity of income coming from expenditure reallocation. Furthermore, our quantitative results are robust to a battery of modifications of the baseline model, such as the conduct of monetary policy, the persistence of shocks, the degree of cyclicity in income inequality, and heterogeneous price rigidities.

Our paper contributes to a growing literature analyzing the role of income shocks in determining business cycles and how microeconomic behavior shape aggregate responses. In particular, we contribute by studying the role of income in determining expenditure shares, the reallocation of consumption baskets, and how these elements shape aggregate demand. The endogenous spending reallocation mechanism that we propose also contributes, from a theoretical perspective to the literature on the cyclical behavior of marginal propensities to consume (see [Gross et al., 2020](#)) by incorporating an additional margin arising from a time-varying aggregate income elasticity.

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## A Empirical Appendix

This appendix provides additional empirical results. First, we study the robustness of our static evidence presented in Section 2.2. Then, we present suggestive evidence on the role of non-homothetic preferences across a panel of countries, which helps us to give external validation to our approach. After that, we present comparisons between our micro-level data and aggregate data on expenditure patterns, as well as the representativity of income at the municipality level. Finally, we provide additional evidence related to the time-varying behavior of expenditure shares presented in Sections 2.3 and 2.4.

### A.1 Additional Static Evidence

#### A.1.1 Disaggregated Expenditure Patterns

Table A.1 presents additional evidence for selected percentiles in the income distribution and a more disaggregated level of consumption categories. As shown in the table, the key message of the aggregate expenditures division remains when we decompose into a more disaggregated level of consumption. This is, expenditure shares in consumption categories within food and beverages (services) groups are decreasing (increasing) across the income distribution.

#### A.1.2 Consumption Patterns Across Labor Income Distribution

In the main text, the cross-sectional heterogeneity is constructed considering all sources of income of households. Figure A.1 compares consumption expenditures between labor income and total income distributions. As can be seen, both present a similar picture, in which low-income households (measured either by labor income or total income) spent a larger fraction of their income in food and beverages, while richer households spent more on services. While both distributions are closely correlated for those goods (above 90 percent), larger differences are presented for manufactured goods, in which the correlation is just 23 percent.

#### A.1.3 Expenditure Patterns Across Different Waves of the Consumption Expenditure Survey

Our baseline evidence uses the most recent wave of the Consumption Expenditure Survey of 2017. How consistent are those patterns across time?

Figure A.2 compares the distribution of consumption expenditures across different waves of

TABLE A.1: Consumption expenditure of households

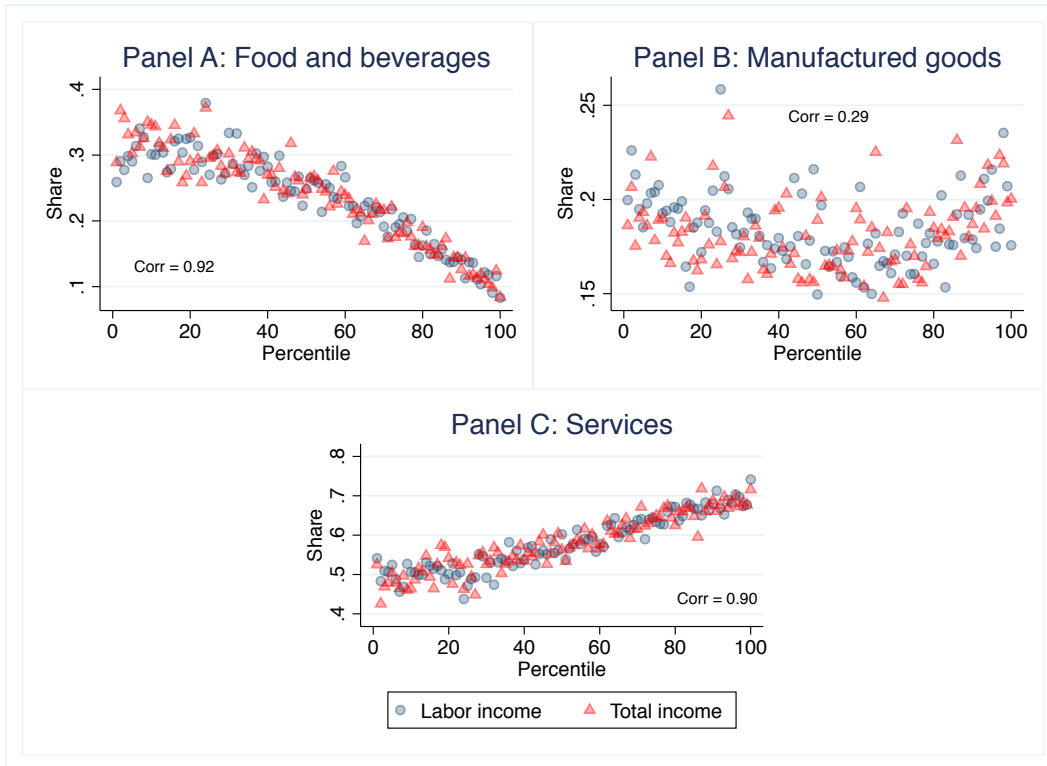
Code	Consumption division	Income percentile					Average
		P10	P25	P50	P75	P90	
Panel A: Food and beverages							
01	Food and non-alcoholic beverages	0.325	0.276	0.232	0.160	0.110	0.186
02	Alcoholic beverages, tobacco	0.021	0.020	0.016	0.021	0.016	0.018
	Total	0.346	0.295	0.248	0.181	0.126	0.204
Panel B: Manufactures							
03	Clothing and footwear	0.047	0.043	0.037	0.032	0.033	0.035
04	Housing, water, electricity, gas and other fuels	0.100	0.098	0.110	0.078	0.068	0.087
05	Furnishings, household equipment	0.043	0.037	0.042	0.060	0.086	0.062
	Total	0.190	0.178	0.189	0.170	0.187	0.185
Panel C: Services							
04.1	Rentals	0.043	0.034	0.035	0.053	0.062	0.053
06	Health	0.036	0.076	0.094	0.072	0.069	0.072
07	Transport	0.093	0.137	0.122	0.165	0.159	0.156
08	Communication	0.050	0.058	0.069	0.063	0.044	0.052
09	Recreation and culture	0.058	0.053	0.064	0.115	0.133	0.086
10	Education	0.088	0.053	0.063	0.032	0.051	0.046
11	Restaurants and hotels	0.045	0.046	0.043	0.069	0.078	0.067
12	Miscellaneous goods and services	0.052	0.070	0.073	0.080	0.090	0.078
	Total	0.464	0.527	0.563	0.649	0.687	0.611

NOTES: This table presents the share in consumption expenditures for households in selected percentiles of the income distribution, considering the 12 division of expenditure groups. Codes corresponds to the 12 divisions in the Classification of Individual Consumption by Purpose (COICOP). Panel A presents the decomposition for Food and Beverages categories. Panel B presents the decomposition for Manufactures, housing and utilities. Panel C presents the decomposition for Services. Each column denotes percentiles 10, 25, 50, 75 and 90, and average consumption, respectively.

the Consumption Expenditure Survey, EPF. The baseline sample corresponds to EPF VIII of the year 2017 (x-axis on each panel), while the alternative samples corresponds to EPF V of 1996 (green squares on each panel), EPF VI of 2006 (red triangles on each panel), and EPF VII of 2014 (blue dots on each panel). On each panel, every point shows the expenditure share in the respective kind of good in EPF VIII against other waves of the survey. As can be seen, with the exception of manufactured goods, the expenditure patterns documented in the main text are relatively stable over time. In the case of food and beverages, correlations with respect to the baseline year are above 0.9, while for services they are above 0.8.<sup>24</sup> Note that the largest differences in levels are observed with respect to EPF V, because of the distance in time with EPF VIII (20 years). In particular, food and beverages account for a greater fraction of expenditures in EPF V, while the opposite happens

<sup>24</sup>More precisely, the correlation of food are 0.93, 0.94 and 0.91 for EPF V, EPF VI, and EPF VII, respectively. For services, those correlations are 0.83, 0.91 and 0.86.

FIGURE A.1: Consumption patterns across: aggregate vs labor income distribution



NOTES: This figure compares the share in consumption expenditures for households in each percentile of the income distribution vs percentiles in labor income distribution, considering three aggregate expenditure groups. On every panel, each dot/triangle corresponds to a percentile.

in services.

## A.2 Expenditure Patterns in Other Countries

Our empirical evidence focuses in the case of Chile. How representative are those expenditure patterns for other countries?

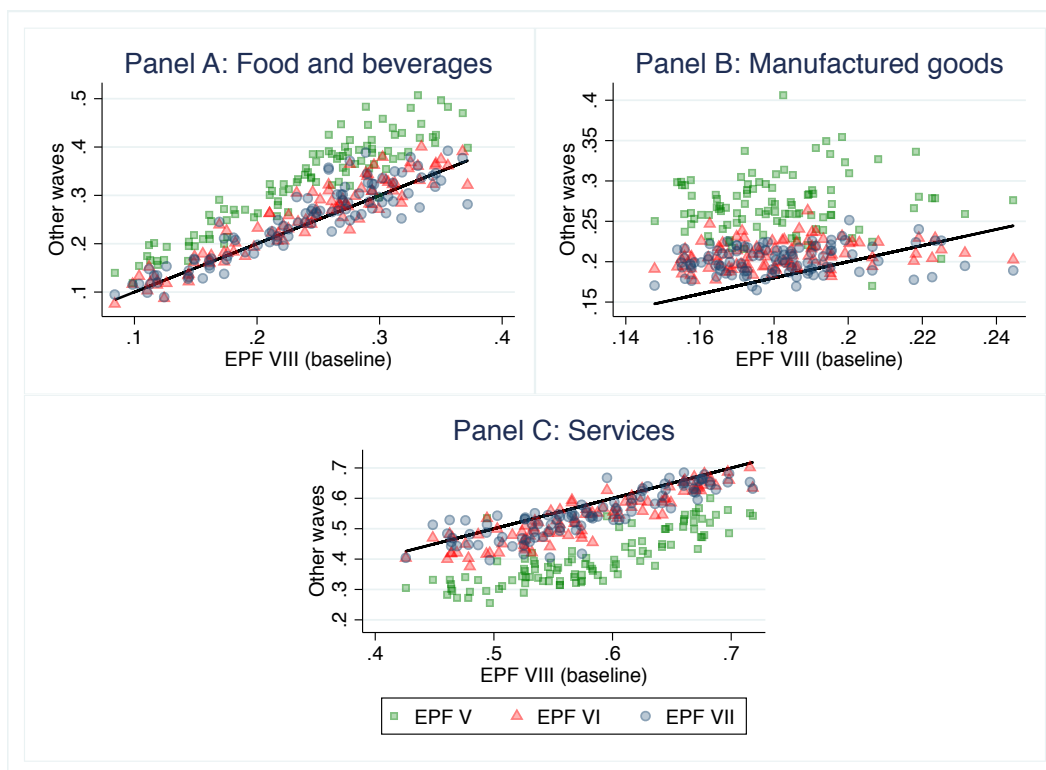
While comparing expenditure patterns in the cross-section of different countries is a difficult task, we do our best to provide further evidence supporting the generality of our results for other countries. For this, we rely on data from the OECD about distributional consumption expenditures.<sup>25</sup> This data is an unbalanced panel for 13 countries in the period 1999-2019.<sup>26</sup> Different to the Chilean data, we only observe expenditures (in domestic currency) for the (equivalized) disposable income quintiles and not at the household level. To make progress, we define a dummy variable

<sup>25</sup>See the section of Annual National Accounts at <https://stats.oecd.org>.

<sup>26</sup>The list of countries is: Australia, Canada, Czech Republic, France, Ireland, Israel, Mexico, the Netherlands, New Zealand, Slovenia, Sweden, United Kingdom, and the United States.



FIGURE A.2: Consumption patterns across different waves of the Consumption Expenditure Survey



NOTES: This figure compares the share in consumption expenditures for households in each percentile of the income distribution between different waves of the Consumption Expenditure Survey (EPF). On every panel, each point corresponds to a percentile. Black solid line denotes 90 degree line.

$Q_k$  taking value equal to one for observations corresponding to quintile  $k = 1, \dots, 5$ , and zero otherwise. As in the Chilean data, we observe expenditures for the 12 divisions in the Classification of Individual Consumption by Purpose (COICOP) (see Table A.1 for details) and we aggregate into our three-goods classification to have the expenditure share in food, manufactures and services. Those goods are indexed by  $j$ .

To study the expenditure patterns across the income distribution for different countries and periods, we run the following regression:

$$s_{jkit} = \alpha + \sum_{k=2}^5 \beta_k Q_k + \delta X_{it} + \varepsilon_{jit},$$

for every  $j = 1, \dots, 3$ . In the previous specification, the dependent variable  $s_{jkit}$  denotes the expenditure share of quintile  $k$  group of country  $i$ -period  $t$  in good  $j$ , and  $X_{it}$  denote controls that vary across country and time. Because the previous specification excludes the effect of the first quintile, the coefficients of interest,  $\beta_k$  denote expenditure shares in goods  $j$  relative to the lowest

share of the population.

Table A.2 presents the results, where we control for GDP per capita as well as country and year fixed effects. Column (1) presents the results for expenditures on food. Similar to the Chilean case, our results show a decreasing pattern across the income distribution. For example, households in the second quintile spend 1.3% less than the first quintile, while the highest quintile spends 7.9% less. We observe a similar pattern (and magnitudes) in column (2) for the case of manufactures. Finally, column (3) shows the results for services. As in the case of Chile, expenditures in services are increasing in income. The second quintile spends 2.8% more than the first quintile. For the highest quintile this figure is five times larger, with an expenditure share 13.4% higher.

Also note that the effect of aggregate income, measured by GDP per capita, is consistent with the disaggregate patterns: a higher level of income is associated with a lower expenditure share in food and a higher expenditure share in services.

TABLE A.2: Consumption expenditures in OECD countries

	Food (1)	Manufactures (2)	Services (3)
Quintile 2	-0.013 (0.004)	-0.015 (0.005)	0.028 (0.003)
Quintile 3	-0.028 (0.007)	-0.031 (0.009)	0.060 (0.006)
Quintile 4	-0.047 (0.010)	-0.045 (0.013)	0.092 (0.011)
Quintile 5	-0.079 (0.017)	-0.055 (0.019)	0.134 (0.019)
Log (GDP pc)	-0.108 (0.007)	-0.075 (0.055)	0.183 (0.058)
Observations	370	370	370
Adj R2-within	0.649	0.471	0.824

NOTES: This table presents estimates of the relationship between consumption expenditures and quintiles of the income distribution. All regressions include country and year fixed effects. Standard errors clustered at the country and year level.

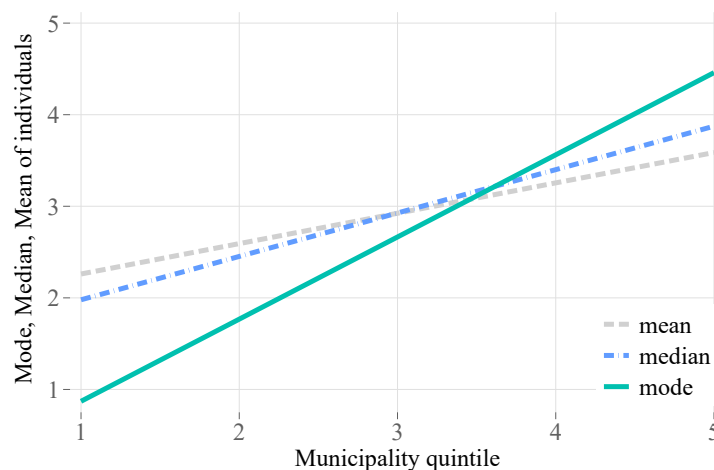
### A.3 Data Validation

While the focus of this paper is in the response of households to income shocks and their aggregate consequences, Sections 2.3 and 2.4 rely on data at the municipality level. How well this data approximate household heterogeneity and inequality? At the same time, our microdata collects information about expenditures using transaction level data. How well this data approximates

aggregate expenditures?

Figure A.3 shows that the income classification at the municipality level tracks quite well the mode, median and average income of individuals within a municipality. This is, the “representative” agent at the municipality level tracks the income strongly correlates with the level of income of the municipality itself. Therefore, studying the response of expenditure shares gives valuable information about the response of expenditure shares across the income distribution of individuals.

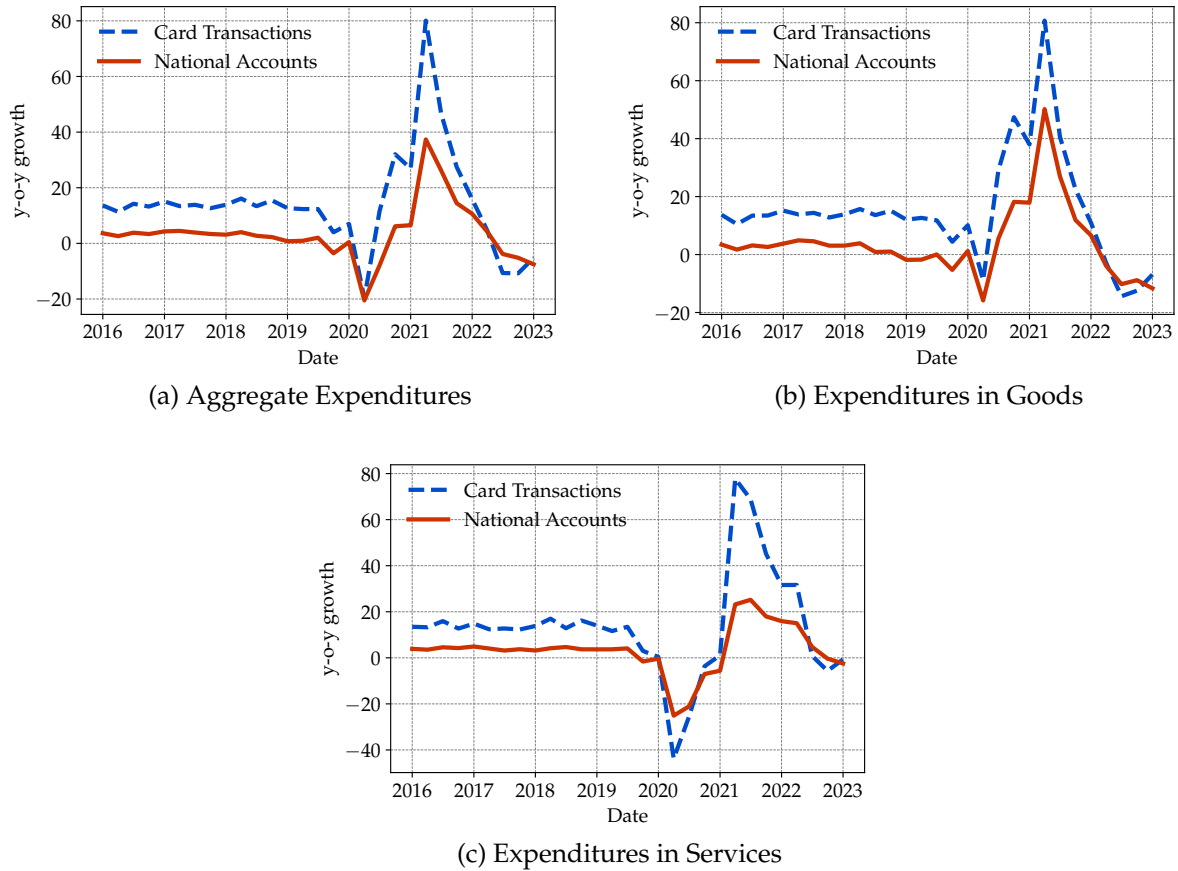
FIGURE A.3: Income Classification at the Municipality level vs Individual Level



NOTES: This figure presents the relationship between income classification at the municipality level and the mode, median and mean of income across individuals within a municipality.

Regarding the validity of our data to capture the evolution of consumption, Figure A.4a compares aggregate consumption (taken from the National Accounts produced by the Central Bank of Chile) and aggregate expenditures coming from our Transbank microdata. As can be seen, our data tracks remarkably well the aggregate expenditure patterns of consumption. Moreover, this not only holds in the aggregate, but at the sectoral level, as shown in Figures A.4b and A.4c. The correlation of our transaction data are close to one even in the periods before COVID.

FIGURE A.4: Comparison of Transbank microdata with National Accounts



NOTES: This figure compares the evolution of sectoral consumption in Chile with sectoral expenditures coming from Transbank microdata. Panel **a** compares aggregate expenditures, while Panels **b** and **c** compares expenditures in goods and services respectively.

## A.4 Additional Time-varying Evidence

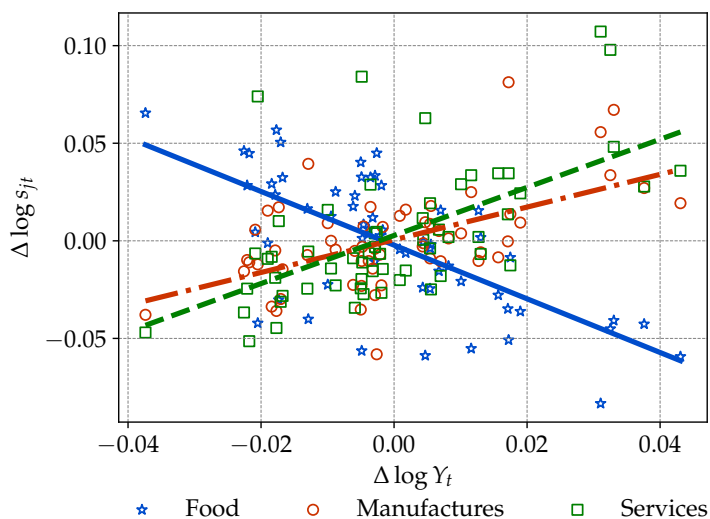
This section provides additional empirical evidence regarding the time-varying behavior of expenditures presented in Sections 2.3 and 2.4.

### A.4.1 Cyclicity of Aggregate Expenditure Shares in the Full Sample

First, we present aggregate evidence regarding the cyclical behavior of aggregate expenditure shares. Defining  $s_{jt}$  as the expenditure share on category  $j$  (food, manufactures, and services) in period  $t$  at the aggregate level, Figure A.5 presents the relationship of the different expenditure shares (in the vertical axis) and the log-change of industrial production (in the horizontal axis) for the period January 2015 to December 2019, while Figure A.6 presents a similar figure for all the

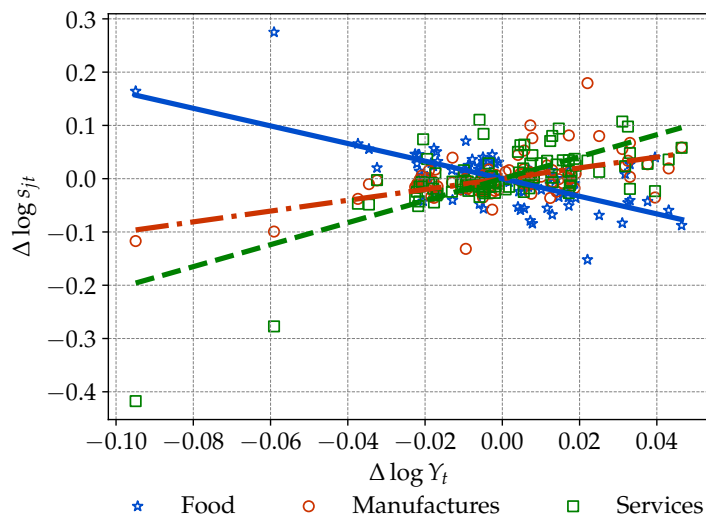
available data, including the COVID-19 period. The key observation from Figure A.5 is that the composition of expenditures at the aggregate level is time-varying and moves in a similar fashion as in the more granular data. Moreover, Table A.3 presents regressions similar to those in Eq. (1), showing that the results of Section 2.3 remains when considering more aggregate data.

FIGURE A.5: Ciclicality of Aggregate Expenditure Shares



NOTES: This figure presents the unconditional correlation between the business cycle of sectoral expenditure shares and aggregate production index.

FIGURE A.6: Ciclicality of Aggregate Expenditure Shares. Full Sample.



NOTES: This figure presents the unconditional correlation between the business cycle of sectoral expenditure shares and aggregate production index, including the COVID-19 period.

TABLE A.3: Cyclicity of Aggregate Consumption Shares

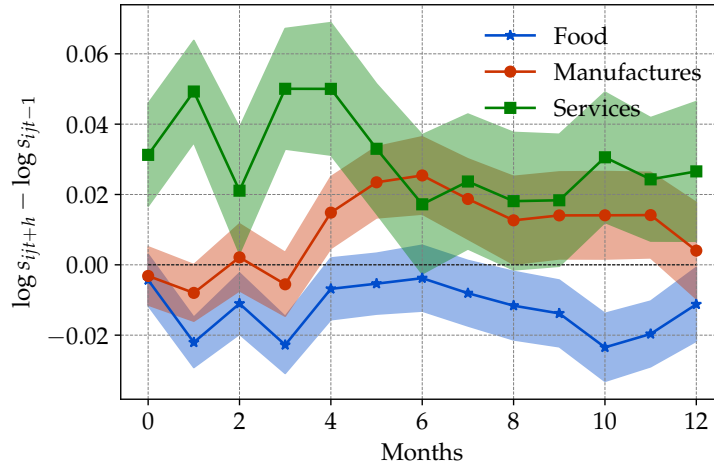
	Panel A: 2015-2019			Panel B: 2015-2022		
	Food	Manufactures	Services	Food	Manufactures	Services
$\Delta \log(Y_t)$	-1.499 (0.234)	0.84 (0.215)	1.157 (0.248)	-1.754 (0.209)	0.868 (0.182)	2.311 (0.259)
$\pi_{jt} - \pi_t$	-1.516 (1.048)	0.433 (1.481)	0.932 (2.530)	-0.416 (1.000)	0.747 (1.283)	3.532 (2.563)
N	50	50	50	86	86	86
Adj. $R^2$	0.463	0.166	0.34	0.457	0.405	0.503

NOTES: This table presents the aggregate relationship between expenditure shares and income.  $\Delta \log(Y_t)$  denotes the monthly change in the industrial production index.  $\pi_{jt}$  is the yearly inflation rate of category  $j$ , while  $\pi_t$  is the yearly aggregate inflation rate. Each regression controls for up to nine lags of inflation differentials (not reported). Standard errors reported in parenthesis.

#### A.4.2 Robustness of Local Projections

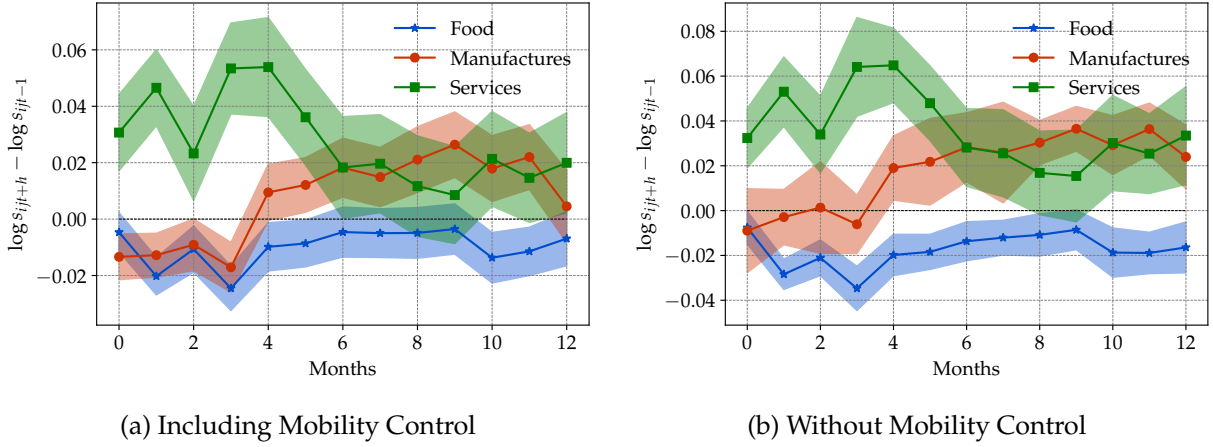
Figure A.7 presents the response of expenditure shares in our local projection like exercise, controlling for the mobility index at the municipality level. As can be seen, the qualitative message presented in Section 2.4 remains.

FIGURE A.7: Response of Consumption Shares to Fiscal Transfers—Controlling for Mobility with 12 lags



NOTES: This figure presents the dynamic response of expenditure shares to fiscal transfers ( $\beta_{jh}$  coefficients in Eq. 2), controlling for the mobility index.

FIGURE A.8: Response of Consumption Shares to Fiscal Transfers Controlling for 8 Lags



NOTES: This figure presents the dynamic response of expenditure shares to fiscal transfers ( $\beta_{jh}$  coefficients in Eq. 2), controlling for the mobility index. Panel a controls for mobility while Panel b does not.

## B Model Appendix

This section provides a self-contained description of the model presented in Section 3 that we implement in the quantitative section. In particular, we focus on the problem faced by households, labor unions and firms.

### B.1 Households

There is a measure of one of households that differ in wealth  $b$  and productivity  $z$ . The  $b$ -dimension is the endogenous state, and the  $z$ -dimension is the exogenous time-varying idiosyncratic shock. We identify the type of households by  $i$ , which is associated to the tuple  $(b, z)$ .

Households derive utility from consumption and disutility from labor. We assume there are a continuum of  $g \in (0, 1)$  labor tasks that each household  $(b, z)$  can execute. Hence, household  $i$  maximizes its lifetime utility, time-discounted at a factor  $0 < \beta < 1$ , given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_{it}, \{n_{it}^g\}_{g=0}^1) \quad \text{with} \quad u(\{n_{it}^g\}_{g=0}^1) = \frac{(c_{it} - 1)^{1-\gamma}}{1-\gamma} - \chi \frac{\int_0^1 (n_{it}^g)^{1+\varphi} dg}{1+\varphi},$$

where  $\gamma$  is the inverse of the intertemporal elasticity of substitution,  $\chi$  is the parameter of the disutility of labor, and  $\varphi$  is the inverse of the Frisch elasticity of the labor supply,  $c_{it}$  is total consumption and  $n_{it}^g$  is hours supplied by workers from household  $i$  to the task  $g$ . Workers do not

choose their labor supply directly due to labor market frictions. The labor supply is determined by a union that represents labor supplied by households to task  $g$ , in order to maximize the average welfare of all households providing those services. We first show the individual problem and in the next subsection, the wage-setting process faced by the union. The implication of that assumption is that  $n_{it}^g = n_t, \forall i$ . Consequently, nominal wages are common across households and equal to  $W_t$ .

Households maximize their lifetime utility subject to the following budget constraint

$$E_{it} + B_{it+1} = (1 + i_t)B_{it} + W_t n_t z_t + T_{it} - \tau_{it} + D_{it},$$

where  $E_{it} \equiv P_{it} c_{it}$  denotes total expenditures that are also given by

$$E_{it} = \sum_{j=1}^J P_{jt} c_{ijt}.$$

In our setting, households consume a bundle of  $J$  goods facing a (common) price  $P_{jt}$  and consuming a quantity  $c_{ijt}$ . We denote by  $P_{it}$  the price index at the household level, while  $c_{it}$  is the total consumption of household  $i$ . As we explain below, our non-homothetic preferences generate household-level price indices, which imply that each household face a different costs of living, despite observing the same sectoral prices.

Households save in a liquid and risk-free asset  $B_{it}$  that returns a nominal interest rate  $i_t$ , receive income from labor  $W_t n_t z_t$ , where  $W_t n_t$  is a “common” labor income and  $z_t$  is an individual idiosyncratic shock which generates a non-degenerate distribution of income. Households receive a fiscal transfer given by  $T_{it}$  and pay lump-sum taxes  $\tau_{it}$ . Both fiscal instruments can have either a progressive or a flat profile. Finally, there are firms’ dividends  $D_{it}$  that can also be distributed unevenly among the different households.

As described in the main text, the households’ optimization problem can be split into an intratemporal problem, which describes how households distribute consumption among the different goods (which in our setup are nontrivial), and the intertemporal problem, which is also affected by the allocation of resources to the different goods.

**Intratemporal Problem** Households derive utility from the consumption of the  $J$  different goods in the economy (for our quantitative exercises we can think about the consumption basket as composed of food, manufactures, and services). The consumption aggregator of every household is



denoted by  $c_{it}$  and takes the form of an implicitly additive non-homothetic CES function. It defines total consumption in period  $t$  by

$$1 = \sum_{j=1}^J (\omega_j (c_{it})^{\epsilon_j})^{\frac{1}{\sigma}} (c_{ijt})^{\frac{\sigma-1}{\sigma}},$$

where  $c_{ijt}$  denotes the consumption of good  $j$  by household  $i$  in period  $t$ ,  $\omega_j$  is a taste parameter for good  $j$  (common across households),  $\sigma$  is the constant elasticity of substitution between sectoral goods, and  $\epsilon_j$  is the constant elasticity of consumption of sectoral good  $j$  with respect to the consumption index  $c_{it}$  that allows preferences to be non-homothetic. This latter parameter is also understood as the income elasticity with respect to individual consumption goods.

Given a level of total expenditures  $E_{it} = P_{it}c_{it}$ , the intratemporal cost minimization optimization problem derives the following conditions

$$c_{ijt} = \omega_j \left( \frac{P_{jt}}{P_{it}} \right)^{-\sigma} (c_{it})^{\epsilon_j + \sigma}$$

$$s_{ijt} \equiv \frac{P_{jt}c_{ijt}}{E_{it}} = \omega_j \left( \frac{P_{jt}}{P_{it}} \right)^{1-\sigma} (c_{it})^{\epsilon_j - (1-\sigma)},$$

where  $s_{ijt}$  is the expenditure share of household  $i$  in good  $j$ . The household-specific CPI corresponds to the price index that equalizes  $P_{it}c_{it} = \sum_{j=1}^J P_{jt}c_{ijt}$  and is defined by

$$P_{it} = \left[ \sum_{j=1}^J (\omega_j P_{jt}^{1-\sigma})^{\vartheta_j} (s_{ijt} E_{it}^{1-\sigma})^{1-\vartheta_j} \right]^{\frac{1}{1-\sigma}},$$

with  $\vartheta_j \equiv (1 - \sigma)/\epsilon_j$ . From these expressions is clear that both the expenditure share and the CPI of each household (characterized by different levels of income and access to financial markets) depend on the level of consumption/expenditures in every period. Note again that in the case of homothetic preferences ( $\epsilon = 1 - \sigma$ ), the expenditure shares do not depend on the level of consumption, and the CPI is common across households because it only depends on observed prices and not on the level of consumption itself (i.e.,  $\vartheta_j = 1$  holds). At the same time, with non-homothetic preferences, the demand for each good nonlinearly depends on total consumption through the good-specific income elasticity,  $\epsilon_j$ . For future reference, denote  $\bar{\epsilon}_{it} \equiv \sum_{j=1}^J s_{ijt}\epsilon_j$  as the average (expenditure-weighted) income elasticity. As we will see next, this object plays a crucial role in determining *intertemporal* consumption.

**Intertemporal Problem.** The intratemporal problem of the household derives the following Euler equation

$$u'(c(b, z)) = \beta \mathbb{E}_t \left[ \frac{1+r}{1+\pi(b', z')} \frac{\bar{e}(b, z)}{\bar{e}(b', z')} u'(c(b', z')) \right] + \beta \mu(b', z') \frac{p(b, z) \bar{e}(b, z)}{1-\sigma}.$$

**Households' Distribution.** The above consumption-savings problem generates a distribution of households in the space  $\mathcal{B} \times \mathcal{Z}$ , where  $\mathcal{B}$  is determined by the borrowing constraint and  $\mathcal{Z}$  by the stochastic process governing  $z$ . We denote the distribution of households by  $\Psi(b, z) = \Psi(i)$ , which satisfies  $\int \int \Psi(i) di = 1$ . Due to the recursive formulation of the problem, and given the policy functions of households, there is an operator  $F$  that maps  $\Psi(i)$  onto  $\Psi'(i)$

$$\Psi'(i) = F(\Psi(i)).$$

The mapping  $F(\cdot)$  is a key object of our analysis because it keeps track of the distribution of households both in the steady state and along the transition path of the economy.

## B.2 Workers' Union

We assume that for each task  $g$ , there is a union that decides wages  $w_t^g$  and the labor supplied  $n_t^g$ . In this setting, unions have market power as workers' tasks are in monopolistic competition. The union aggregates individual labor such that  $n_t^g = \int \int n_t^g(b, z) db dz$ . Then, we assume there is a Dixit-Stiglitz aggregator that determines aggregate labor, given by

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

where  $\varepsilon$  is the elasticity of the demand for labor tasks, which is also a measure of the market power of the union. The Dixit-Stiglitz aggregator gives rise to the following demand for each task  $g$ :

$$n_t^g = \left( \frac{w_t^g}{w_t} \right)^{-\varepsilon} N_t. \tag{B.1}$$

We assume nominal wages are sticky and their changes are subject to the following Rotemberg adjustment costs that are measured in utility units

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

where  $\theta_w$  is the nominal wage adjustment cost parameter. Then, the problem of the union is to choose the optimal labor, the nominal wage, and the wage inflation rate by solving:

$$\max_{n_{it}^g, W_{it}^g, \pi_{wt}^g} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[ \int \int \{U(c_{it}) - v(n_{it}^g)\} \Psi_t(i) di - \Gamma^s \left( \frac{W_t^g}{W_{t-1}^g} - 1 \right) \right], \quad (\text{B.3})$$

subject to (B.1), and given that wage inflation is defined as  $\pi_{wt}^g = \frac{W_t^g - W_{t-1}^g}{W_{t-1}^g}$ . After imposing symmetry, this maximization problem leads to:

$$(\pi_{wt} + 1)\pi_{wt} = \frac{\varepsilon_w}{\theta_w} n_t \int \int \left\{ v'(n_t) - \frac{\varepsilon_w - 1}{\varepsilon_w} U'(c_{it}) \frac{W_t}{P_{it}} \frac{1 - \sigma}{\bar{\varepsilon}_{it}} \right\} \Psi_t(i) di + \beta \theta_w (\pi_{wt+1} + 1)\pi_{wt+1},$$

which is the New Keynesian Wage Phillips Curve (NKWPC). The NKWPC relates the nominal wage inflation with hours worked and worker's preferences; it is a version of the wage Phillips curve described by Galí (2013) adapted to heterogeneity, Rotemberg adjustment costs, and non-homoteticities. Due to labor market frictions, all workers supply  $N_t$  hours at a real wage  $w_t$ . The NKWPC shows that non-homoteticities also enter the labor supply schedule through the average income elasticity of the different households  $\bar{\varepsilon}_{it}$ . This implies that not only fluctuations in total consumption affect the labor supply but the composition of expenditures represented by this elasticity. To be more clear, let us write the labor supply implied by these expressions and our assumed preferences:

$$\psi N_t^\varphi = \frac{1}{\mathcal{M}_{wt}} W_t \int \int \left( \frac{(1 - \sigma)}{\bar{\varepsilon}_t(b, z) P_{it}(c_{it})^\gamma} \right) \Psi_t(i) di. \quad (\text{B.4})$$

Equation (B.4) is the labor schedule in this economy. It has implicit the fact that unions have market power and wages are rigid through the dependence on  $\mathcal{M}_{wt}$  which is the wage markup that workers get. We can rewrite this expression by multiplying by aggregate consumption (to the power of  $\gamma$ ) to obtain:

$$\mathcal{M}_{wt} \psi N_t^\varphi C_t^\gamma = \frac{W_t}{P_t} \int \int \left( \frac{(1 - \sigma) P_t}{\bar{\varepsilon}_{it} P_{it}} \left( \frac{C_t}{C_{it}} \right)^\gamma \right) \Psi_t(i) di. \quad (\text{B.5})$$

### B.3 Firms

We assume there are  $J$  sectors composed of a final good producer and intermediate producers. Final goods are a composite of a measure one of intermediates that operate in monopolistic competition. All sectors demand workers, but at a different levels. We describe the setup and optimality conditions for a given sector, denoted by  $j$ .

**Final Goods Producers.** In a given sector  $j$ , a competitive representative firm produces a final good by aggregating a continuum of measure one intermediate good with the following production function

$$Y_{jt} = \left( \int_0^1 y_{jt}^m \frac{\varepsilon-1}{\varepsilon} dm \right)^{\frac{\varepsilon}{\varepsilon-1}}.$$

In this setting, the final firm decides how to allocate its demand among the different intermediate goods. After cost minimization, the demand for each intermediate good  $m$ , and the sector  $j$  price index writes:

$$y_{jt}^m = \left( \frac{p_{jt}^m}{p_{jt}} \right)^{-\varepsilon} Y_{jt}, \quad \text{and} \quad p_{jt} = \left( \int_0^1 (p_{jt}^m)^{1-\varepsilon} dm \right)^{\frac{1}{1-\varepsilon}}. \quad (\text{B.6})$$

**Intermediate Goods Producers: Labor Demands.** Each intermediate good  $m$  in sector  $j$  is produced by a monopolistically competitive producer using labor  $n_{jt}^m$  according to the production function

$$y_{jt}^m = A_{jt} n_{jt}^{1-\alpha}.$$

Each intermediate producer hires workers at a nominal wage  $W_t$ . Therefore, the demand satisfies

$$W_t = mc_{jt}(1 - \alpha)N_{jt}^{-\alpha},$$

where  $N_{jt}$  is hours worked in sector  $j$  and  $mc_{jt}$  is the nominal marginal cost of sector  $j$ . Moreover, we can define the price markup of sector  $j$  as  $\mathcal{M}_{jt}^p = \frac{p_{jt}}{mc_{jt}}$ , which is different from one due to monopolistic competition and fluctuates due to price rigidities.

**Intermediate Goods Producers: Price Setting.** Each intermediate producer chooses its price to maximize profits subject to Rotemberg (1982) price adjustment costs. These adjustment costs are quadratic in the rate of price change  $\frac{p_{jt}^m}{p_{jt-1}^m} - 1$  and are expressed as a fraction of output  $Y_t$

$$\Theta_{jt}^m = \frac{\theta_j^p}{2} \left( \frac{p_{jt}^m}{p_{jt-1}^m} - 1 \right)^2 Y_t \quad (\text{B.7})$$

Therefore, each intermediate producer chooses  $\{p_{jt}^m\}_{t \geq 0}$  to maximize

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \left( \frac{1}{1+r_t} \right) \{ \Pi_t(p_{jt}^m) - \Theta_t \},$$

with

$$\Pi_{jt}^m(p_{jt}^m) = \left( \frac{p_{jt}^m}{P_{jt}} - mc_{jt} \right) \left( \frac{p_{jt}^m}{P_{jt}} \right)^{-\varepsilon} y_{jt},$$

where we assume that  $\left( \frac{1}{1+r_t} \right)$  is the relevant discount factor of the firm, and  $mc_{jt}$  is the marginal cost. Given the assumptions above, the inflation rate (after the intermediate firms' optimization) is determined by the following New Keynesian Phillips curve for sector  $j$

$$(\pi_{jt} - \bar{\pi}_j)\pi_{jt} = \frac{\varepsilon}{\theta_j^p} \left( \frac{mc_{jt}}{p_{jt}} - \frac{\varepsilon - 1}{\varepsilon} \right) + \mathbb{E}_t \left[ \left( \frac{1}{1+r_t} \right) (\pi_{jt+1} - \bar{\pi}_j)\pi_{jt+1} \frac{p_{jt+1}y_{jt+1}}{p_{jt}y_{jt}} \right],$$

with  $\pi_{jt} = \frac{p_{jt}}{p_{jt-1}}\pi_t$ . Intermediate firms generate each period an aggregate amount of profits given by

$$D_{jt} = (p_{jt} - mc_{jt}) Y_{jt} - \frac{\theta_j}{2} \pi_{jt}^2 Y_{jt} + mc_{jt} \alpha Y_{jt}$$

$$D_{jt} = p_{jt} Y_{jt} - w_t N_{jt}.$$

#### B.4 Intertemporal Problem

The problem of the household can be written in the following recursive formulation, where we drop the time index and define next-period variables with a prime (recalling  $h = (b, z)$ ,  $h' = (b', z')$ )

$$V(b_{ht}, z_t) = \max_{b_{ht+1}, c_{ht}} u(c_{ht}, n_t) + \beta \mathbb{E}_t V(b_{ht+1}, z_{t+1}), \quad (\text{B.8})$$

subject to

$$p_{ht}c_{ht} + b_{ht+1} = (1 + r_t)b_{ht} + (1 - \tau_t^w)w_tN_tz_t + T_{ht} + D_{ht}$$

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

$$1 = \sum_{j=1}^J (\omega_j c_{ht}^{\epsilon_j})^{\frac{1}{\sigma}} c_{hjt}^{\frac{\sigma-1}{\sigma}}.$$

Note that the budget constraint of this problem is now defined in terms of the numeraire of the economy, which is aggregate consumption (see details below). Therefore, all lower case nominal variables (such as prices and bonds) are expressed relative to that numeraire and  $1 + r_t = (1 + i_t)/(1 + \pi_{t+1})$ , where  $\pi_{t+1}$  is the aggregate rate of inflation.

Defining  $\mathcal{E}_{ht} \equiv \frac{p_{ht}\bar{c}_{ht}}{1-\sigma}$ , the first order conditions of problem (??) are:

$$u_c(c_{ht}) = \lambda_{ht}\mathcal{E}_{ht} \tag{B.9}$$

$$\lambda_{ht} = \beta\mathbb{E}_t V_b(b_{ht+1}, z_{ht+1}) + \mu_{ht} \tag{B.10}$$

$$V_b(b_{ht}, z_{ht}) = \lambda_{ht}(1 + r_t) \tag{B.11}$$

where  $\mu_{ht}$  is the Lagrange multiplier of the financial constraint,  $b_{ht+1} \geq 0$ , and  $\lambda_{ht}$  is the Lagrange multiplier of the budget constraint. We interpret  $\mathcal{E}_{ht}$  as the excess elasticity households face with respect to an homothetic economy (which is  $1 - \sigma$ ), priced at the household specific CPI. Since  $p_{ht}$  and  $\bar{c}_{ht}$  are increasing in income,  $\mathcal{E}_{ht}$  is also increasing in income and wealth.

Combining (B.9)–(B.11), we obtain the following Euler equation:

$$u_c(c_{ht}) = \beta\mathbb{E}_t \left[ (1 + r_t) \frac{\mathcal{E}_{ht}}{\mathcal{E}'_{ht+1}} u_c(c_{ht+1}) \right] + \mu_{ht}\mathcal{E}_{ht},$$

which can be written as

$$u_c(c_{ht}) = \beta\mathbb{E}_t \left[ \underbrace{\frac{1 + r_t}{1 + \pi_{ht+1}} \frac{\bar{c}_{ht}}{\bar{c}_{ht+1}}}_{\text{Effective Real Rate}} u_c(c_{ht+1}) \right] + \underbrace{\mu_{ht}\mathcal{E}_{ht}}_{\text{Financial Frictions}}. \tag{B.12}$$

## C Quantitative Appendix

**On the Role of Shocks' Persistence** The aggregate response of the economy after an income shock crucially depends on how households reallocate expenditures. This force is intertemporally driven by the persistence of shocks and how they change the average income-elasticity,  $\bar{\epsilon}_{it}$  at the household level. Also, as discussed in Section 4, the response in the (cross-sectional) average income-elasticity (also by  $\bar{\epsilon}_t$ ), has implications over the static average and cross-sectional forces, which might amplify or dampen shocks. How important is the persistence of shocks in driving aggregate responses?

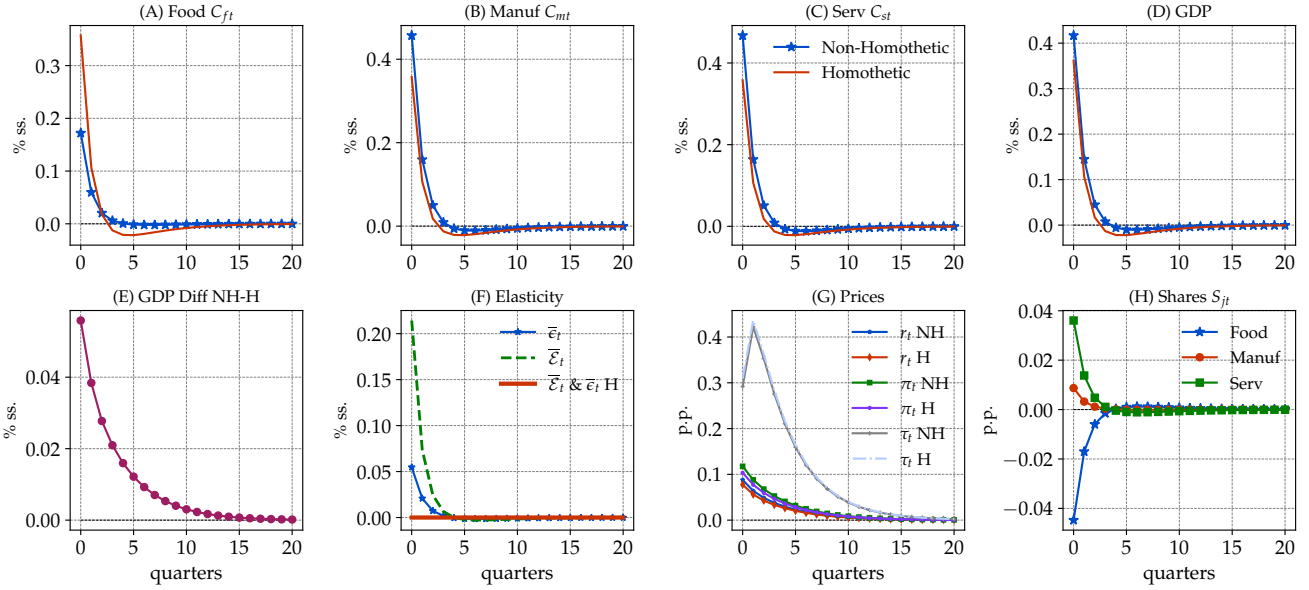
Figure C.1 analyzes the aggregate responses of the economy, considering a lower persistence of the transfer shock, from 0.75 in the baseline scenario to only 0.25. Even though all the qualitative insights of the baseline economy remain, we observe a higher response of GDP to a less persistent transfer. In the baseline, the government has to raise taxes more strongly because there are more periods in which the transfer occurs. Hence the transfer is less expansionary overall. This is a result of our calibration; if we assume a more debt-financed transfer this result may not hold.

However, this exercise generates a complementary result which is that due to the less persistent transfer, the elasticity remains high for a shorter time than in the baseline, and that generates a weaker contribution of NH. As Eq. (16) shows, there is an interaction between  $\bar{\epsilon}_t$  and the intertemporal MPCs that drive the effects of the transfers. Such interaction is weaker when the shock is less persistent, implying a smaller contribution of NH to the response in expenditures. This is observed in panel (F) in Figure C.1, which shows that the elasticity has a half-life of about one period while that of the baseline calibration is about two periods. This is the main driver of the amplification observed in the baseline analysis, which we break in this exercise.<sup>27</sup>

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<sup>27</sup>We tried for several calibrations of  $\rho_T$  (0.9 and 0.95) and the persistence of transfers, and we conclude the same.

FIGURE C.1: IRFs with Lower Persistence in Transfers



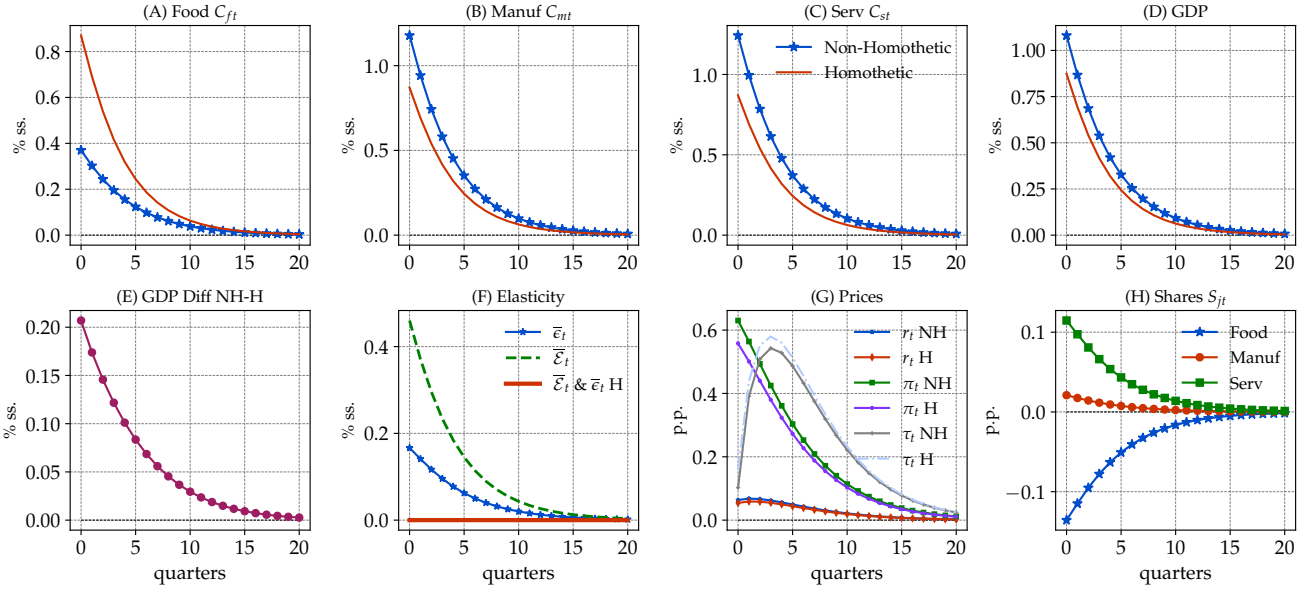
NOTES: This figure shows the sectoral and aggregate responses to a fiscal transfer shock under a less persistent one.

**On the Role of Monetary Policy** Our previous exercises were conducted by assuming a monetary policy authority following the Taylor principle and reacting more than one-to-one to inflation. This behavior is crucial to contain the demand-driven pressures in the economy by affecting the effective real rate presented in Eq. (B.12). What are the implications of having a looser monetary policy?

We consider the aggregate responses of the economy to the fiscal transfer shock, with a response to inflation in the Taylor rule of  $\phi_\pi = 1$ . Figure C.2 presents the results. A looser monetary policy implies a lower real rate response, which is strongly amplified by the variation in the average income elasticity. This has a strong impact on sectoral reallocation and expenditures, and aggregate GDP, with responses that are more than two times larger relative to the baseline scenario. Because these mechanisms are not present in the H model, the differences in the response of aggregate GDP between the two models are also stronger and more persistent. Moreover, the response of aggregate inflation doubles and is highly persistent over time.



FIGURE C.2: IRFs under Loose Monetary Policy



NOTES: This figure shows the sectoral and aggregate responses to a fiscal transfer shock under a looser monetary policy.

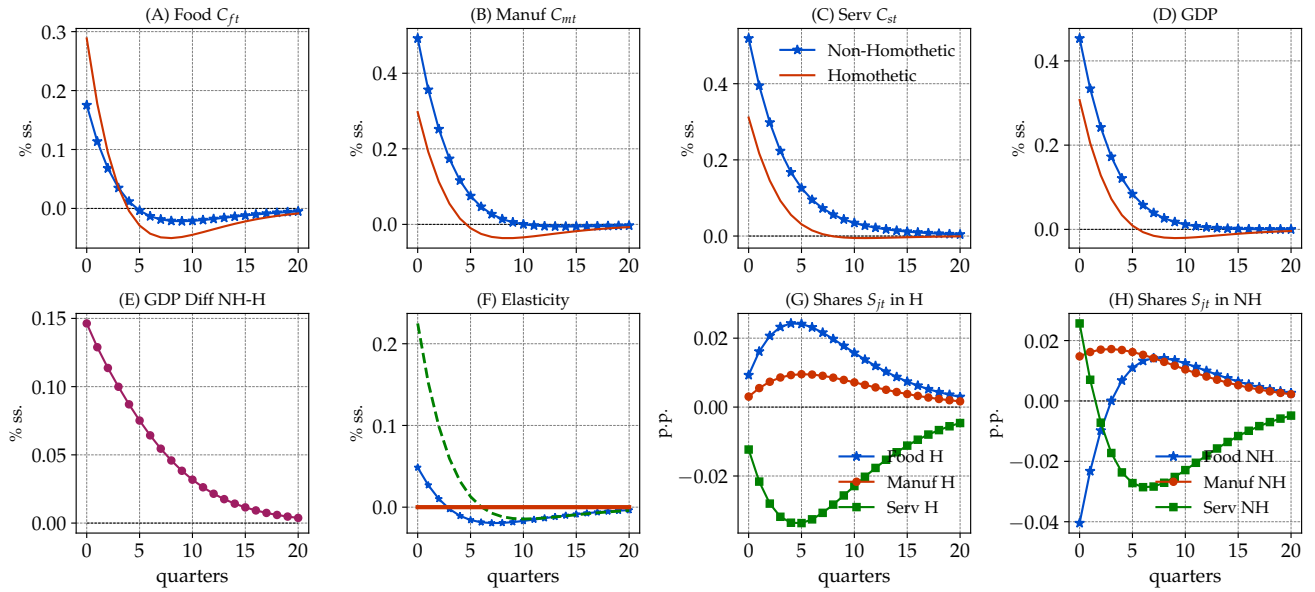
**Heterogeneity in Price Rigidities.** Finally, we study the effects of fiscal transfers considering an alternative explanation for the responses of expenditure shares, the fact that the different types of goods have different price rigidities. In particular, we consider the case in which services have more rigid prices than manufacturing, and manufacturing goods have more rigid prices than food. This evidence is stressed by [Nakamura and Steinsson \(2008\)](#). In principle, this may generate more real effects on services production, generating changes in expenditure shares more concentrated in services.

However, this interpretation might be imprecise. Recall that aggregate expenditure shares are defined as  $P_{jt}C_{jt}/GDP_t$ . Hence, expenditure shares vary both due to relative changes in prices and quantities, and it is not clear that more rigidities in more income-elastic goods generate more amplification or even the cyclicality of the expenditure shares we observe in the data. Recall that in our baseline exercise, we assume the same slope of the Phillips curve for the three sectors equals 0.1. Now we break this assumption and assume that the slope of the NKPC of food is 0.15, while for manufacturing and services is 0.1 and 0.05, respectively. This alternative calibration captures the idea that services have more rigid prices than manufactures and food.

Figure C.3 shows the result of this exercise. Notice that, on impact, we obtain a similar effect in the response of expenditure shares in the NH model, as shown in panel (H). However, the

expenditure shares in the H case (see panel G) are inconsistent with the empirical facts presented in Section 2: in the H economy we observe that expenditures in food and manufacturing go up while expenditures in services go down, while in the data we show that the expenditure shares have the opposite patterns for food and services. Hence, we conclude that the most likely driver of the expenditure shares are income elasticities and not heterogeneity in price rigidities when we study the effects of fiscal transfers.

FIGURE C.3: IRFs with Heterogeneity in Price Rigidities



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