Fiscal Multipliers and Phillips Curves with a Consumption Network

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First version: October 2022
This version: January 2026

Abstract

We document systematic differences in how households spend their marginal and average dollars across sectors. Marginal expenditures are disproportionately directed toward sectors employing high-MPC workers, revealing a new redistribution channel that benefits high-MPC households during expansions. We build a Multi-Sector, Two-Agent, New Keynesian model with non-homothetic preferences consistent with these findings. The new redistribution channel increases the fiscal multiplier by 10 percent relative to an equivalent homothetic economy. The model also predicts steeper Phillips curves in sectors with high-MPC workers, a prediction we validate empirically. The resulting sectoral wage dynamics reinforce the redistribution towards high-MPC workers and increase the inflationary impact of fiscal shocks by up to 100 percent.

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We are thankful for their continual support to Adrien Auclert, Luigi Bocola, Eduardo Dávila, Patrick Kehoe, Zhen Huo, Giuseppe Moscarini, and Elena Pastorino. We also thank Costas Arkolakis, Daniele Caratelli, Joel P. Flynn, Matteo Leombroni, Martin Souchier, and seminar participants at Yale University, Stanford University, and the 2023 EEA-ESEM Congress for feedback and comments. We also thank Matteo Leombroni for sharing useful code on the Consumer Expenditure Survey.

1 Introduction

In economies with heterogeneous agents, households differ in their marginal propensity to consume (MPC) out of transitory income changes. As a result, understanding which households are exposed to a shock becomes crucial to determine its propagation. The recent heterogeneous agents literature (Auclert, 2019; Patterson, 2023) has emphasized that when a positive shock redistributes income toward high-MPC households, the resulting Keynesian multiplier is higher, and thus the effects of the shock on output are amplified. However, we still have a limited understanding of the determinants of why households with different MPCs are differently exposed to shocks. Furthermore, relatively little attention has been paid to the consequences of household heterogeneity in MPC for the propagation of inflation.

This paper makes two main contributions. First, it uncovers a new redistribution channel between households operating through a sectoral consumption network, which we refer to as *biased expenditure channel*. Empirically, we document that households spend their marginal and average dollar differently across sectors. Crucially, households' marginal expenditure is disproportionately directed towards sectors whose employees have a higher MPC. Therefore, when shocks such as fiscal transfers increase aggregate income, these expenditure patterns endogenously redistribute toward high-MPC households, thereby amplifying the initial shock. We quantify the aggregate implications of this redistribution channel using a Multi-Sector, Two-Agent, New Keynesian model with sticky wages, input-output linkages, and non-homothetic preferences. We find that the *biased expenditure channel* increases the fiscal multiplier on impact by 10%, an effect that is statistically significant at the 99% level.

The second contribution of the paper is to study the role of household heterogeneity in the propagation of inflation. Using our model, we formalize the new insight that household heterogeneity amplifies not only spending but also inflation. Specifically, mirroring the role of households' MPC in increasing the fiscal multiplier on output, we show that the slope of the sectoral Phillips curve increases with the MPC of workers in that sector, as high-MPC workers demand larger wage increases during sectoral booms. We verify this prediction in the data by extending the approach of Hazell et al. (2022) to estimate the slope of sectoral Phillips curves using a novel identification strategy based on input-output linkages. Combined with the *biased expenditure channel*, this result implies that after a fiscal shock, output expansions are concentrated in sectors with steeper Phillips curves, which magnifies the inflationary pressure of the shock. Furthermore, the two channels reinforce each other: stronger wage increases in sectors with steeper Phillips curves further intensify the redistribution towards high-MPC households initially resulting from the *biased expenditure channel*. Quantitatively, these forces raise the inflationary impact of a fiscal shock by up to 100% relative to a homothetic benchmark economy, indicating that household heterogeneity has quantitatively large implications for both output and inflation.

Compared to a standard model with incomplete markets, households' heterogeneity in our framework matters not only through differences in their MPC, but also through their sector of employment, which determines their exposure to aggregate shocks. We capture this richer heterogeneity parsimoniously using a consumption network with two key forces. The first is the *intensity* of expenditure, governed by the marginal propensity to consume of workers employed in different sectors. The second is the *direction* of expenditure, summarizing how households spend their income *toward* the various sectors of the economy.

To study the MPC of workers in different sectors, we use the Panel Study of Income Dynamics (PSID). Following the well-established methodology in Kaplan, Violante, and Weidner (2014), we classify liquidity-poor households as hand-to-mouth (HTM), a reduced-form indicator that is strongly predictive of household MPC. We uncover substantial heterogeneity across sectors in the share of HTM workers they employ, ranging from about 35 percent in low-HTM sectors to roughly 70 percent in high-HTM sectors.

To study the second key element of our consumption network, the *direction* of expenditure, we use data from the Consumer Expenditure Survey (CEX). We distinguish between *average* consumption shares, which capture average household expenditures across sectors, and *marginal* consumption shares, which characterize how households allocate the marginal dollar of income across sectors. Crucially, it is the latter, typically overlooked, that governs the transmission of shocks. While average consumption shares are straightforward to measure in CEX, marginal consumption shares must be estimated. To do so, we leverage the tax-rebate episode of 2008-2009 and the identification strategies proposed in Parker et al. (2013) and Orchard, Ramey, and Wieland (2025) to estimate the aggregate MPC, enriched to account for the direction of consumption toward different sectors. We find that marginal and average consumption shares differ substantially, and that household marginal spending is biased towards sectors with more HTM employees.

To incorporate these empirical facts into the model, we use Stone-Geary preferences: households need to consume a subsistence level of consumption in each good, and have CES preferences beyond that point. By deviating from the standard assumption of homothetic preferences, the model has well-defined and distinct notions of *average* and *marginal* consumption baskets, which we match to their empirical counterparts in the model's calibration.

To clarify how the *biased expenditure channel* operates in our consumption network, it is useful to consider a simple illustrative example. At the two-digit level, the sector with the highest share of HTM workers is the Accommodation and Food Services sector (NAICS 72), which mostly comprises hotels and restaurants, where more than 70 percent of workers are classified as HTM. At the opposite end of the spectrum, only about 45 percent of workers in the Utilities sector (NAICS 22) are HTM, the fifth-lowest share. When we look at average expenditures, households spend roughly the same amount on utilities as they spend on hotels and restaurants. In contrast, as common wisdom would suggest, marginal consumption shares in these two sectors differ starkly. When households receive a fiscal transfer, they increase their hotel and restaurant expenditures by almost twice as much as implied by the sector's average consumption share. Instead, expenditures on utilities do not increase and, if anything, slightly decline. After a fiscal transfer, we thus expect little action in the utilities sector, but a boom in demand for hotels and restaurants, which raises labor demand in that sector. Since the fraction of hand-to-mouth workers employed in hotels and restaurants is much higher than that in the utilities sector, the burst of first-round expenditures resulting from the fiscal stimulus ends up disproportionately in the pockets of HTM workers, who spend a large fraction of this additional income. This mechanism amplifies second-round expenditures and increases the Keynesian multiplier associated with the fiscal transfer.

The intuition from the illustrative example is formalized in equation (1), which characterizes the fiscal multiplier in a simplified version of our model, as stated in Proposition 1 in Section 4.[1] As $\overline{MPC}$ denotes the average MPC in the economy, the multiplier differs from a standard representative agent model because of a covariance term.

$$dY = \frac{\overline{MPC}}{1-\left[\overline{MPC}+\widetilde{\text{cov}}(MPC_s, MCS_s - ACS_s)\right]} > \frac{\overline{MPC}}{1-\overline{MPC}} \tag{1}$$

The covariance term[2] in Equation (1) depends on a small number of intuitive ob-

[1] The result is derived for a simplified economy with no input-output linkages, where wages and prices are perfectly rigid, and markups are close to zero.

[2] We denote by $\widetilde{\text{cov}}$ the sum of cross-deviations, which is the covariance rescaled by the number of sectors S. The scaling by S arises naturally from the derivation and corrects for the mechanical shrinkage of the covariance as the sectoral classification becomes finer.

jects: MPC_s denotes the MPC of households employed in sector s, while MCS_s and ACS_s represent, respectively, the marginal and the average consumption share of sector s, that is, the share of sector s in households' marginal and average consumption baskets. In a homothetic economy, where households spend marginal and average dollars identically across sectors, we have $MCS_s = ACS_s$, and thus the covariance term is zero. Our empirical evidence from the PSID and CEX instead shows that households' marginal expenditure is biased toward high-MPC sectors, implying $\widetilde{\text{cov}}(MPC_s, MCS_s - ACS_s) > 0$.

While much of the recent consumption network literature assumes either full nominal rigidities (Flynn, Patterson, and Sturm, 2021) or fully flexible prices (Andersen et al., 2022), we provide analytical and quantitative insights into price dynamics in an economy with sticky wages. We derive an analytical expression for the sectoral Phillips curves, yielding the novel insight that sectors employing a large share of HTM workers feature steeper sectoral Phillips curves. The mechanism builds on the well-known idea that labor supply serves as a margin of adjustment to uninsurable income shocks (Pijoan-Mas, 2006). By embedding this insight in a New Keynesian framework with wage rigidities, we show that it has direct implications for wage setting and the slope of the Phillips curve. When sectoral labor demand rises following a shock, HTM households—unable to smooth consumption through savings—demand larger wage increases than Ricardian households. Therefore, sectors employing more HTM workers end up having a steeper Phillips curve.

We validate this theoretical prediction by estimating the slope of sectoral Phillips curves. In practice, we extend recent cross-sectional approaches to Phillips curve estimation, typically applied to regional data, to the sectoral dimension, and we use a novel instrument that exploits fluctuations in downstream sectors as a source of sectoral demand shocks. Our methodology also provides a stepping stone for estimating the aggregate Phillips curve using sectoral data.[3]

In the quantitative section of the paper, we obtain new results on the dynamic response to a fiscal shock that combine our analytical insights on the fiscal multiplier in (1) and on the slope of the sectoral Phillips curve. As aggregate income increases after the fiscal shock, demand is endogenously directed towards sectors employing more HTM households. Since prices and wages respond to sectoral labor tightness, our model predicts a relative surge in wages and prices in these sectors. This redis-

[3]While the average sectoral Phillips curve does not necessarily map into the aggregate Phillips curve, one could use our theoretical model to derive a mapping between estimates of the sector-specific Phillips curves into an estimate of the aggregate Phillips curve, following an approach similar to Hazell et al. (2022), but this goes beyond the scope of this paper.

tributes towards HTM households, extending the mechanism described in equation (1) to an economy with sticky wages. This redistribution through sectoral wage inflation is further amplified because, in our model, Phillips curves are endogenously steeper in sectors with a high share of HTM workers.

Quantitatively, comparing our calibrated economy to a counterfactual with homothetic preferences yields three main results. First, the fiscal multiplier out of a fiscal transfer is approximately 10 percent larger than in the counterfactual homothetic economy, where marginal and average expenditure shares coincide. This amplification is similar in magnitude to that obtained in the simplified static framework with fully rigid prices of Equation (1). Second, the long-run cumulative multipliers also differ between our calibrated economy and a counterfactual with homothetic preferences, making the amplification of fiscal policy persistent rather than short-lived. This difference is driven by redistribution through sectoral wage inflation: stronger and more persistent wage increases in sectors with a higher share of HTM workers redistribute income toward high-MPC households over time. Finally, aggregate inflation is over 100% higher, on impact, than in the homothetic economy. This partly occurs because the non-homothetic economy has a higher fiscal multiplier, and a higher output response puts upward pressure on prices. However, differences in aggregate output cannot quantitatively explain the large differences in inflation between the two economies. The larger response of inflation in the non-homothetic economy occurs because output increases are concentrated in HTM sectors, which have steeper Phillips curves, causing aggregate inflation to rise much more sharply. In the presence of complementarities in production across sectors, sectoral inflation propagates to all other sectors, further increasing average sectoral inflation and thus aggregate inflation.

Related Literature. Households differ in their marginal propensity to consume (MPC) out of transitory income changes, and a growing literature emphasizes the role of redistribution between low- and high-MPC households in the transmission of macroeconomic shocks (Auclert, 2019; Bilbiie, 2020; Almgren et al., 2022), primarily focusing on monetary policy.

Patterson (2023) documents that high-MPC households are more exposed to the business cycle and derives a reduced-form *Matching Multiplier* that is closely related to our Equation (1). That paper adopts a sufficient-statistic approach and is therefore agnostic about the economic mechanisms underlying the differential exposure of high-MPC households to aggregate shocks. We provide new empirical evidence on one such mechanism. Specifically, we show that high-MPC households are more exposed to economic fluctuations because they are disproportionately employed in sectors that experience stronger demand expansions, as households direct their marginal income toward these sectors. Quantitatively, this mechanism explains a substantial share of the amplification documented in Patterson (2023). Moreover, while the focus in Patterson (2023) is on output, we find novel empirical and quantitative results for inflation.

A more recent line of research (Flynn, Patterson, and Sturm, 2021; Andersen et al., 2022; Schaab and Tan, 2023) relies on microdata and disaggregated economic accounts to study the propagation of shocks in economies with rich production and consumption networks. Our paper makes two distinct contributions to this literature.

Our first contribution lies in our measurement of households' consumption baskets. While existing work studies how *different* households purchase different consumption baskets on average, we emphasize that *all* households, when they receive a fiscal transfer, spend disproportionately towards certain sectors, relative to how they spend their average dollar of income.[4] Crucially, we find that accounting for this evidence has important quantitative implications for policy evaluation: using data on *average* consumption baskets—rather than *marginal* consumption baskets—to evaluate the effects of transitory fiscal shocks can lead to misleading conclusions.

The second contribution is to combine theory and data to document a novel channel that links household consumption behavior to the slope of the sectoral Phillips curve, with key implications for the inflationary effects of fiscal transfers. We use the model to show analytically that the sectoral Phillips curve is steeper in sectors with a larger share of hand-to-mouth workers. Then, we empirically test this prediction by estimating how the slope of the sectoral Phillips curve changes across sectors.

The methodology we use to estimate the slope of the sectoral Phillips curve relates to recent work that uses cross-sectional data to estimate the slope of the regional Phillips curve (Fitzgerald et al., 2024; McLeay and Tenreyro, 2020; Hazell et al., 2022). We build on Hazell et al. (2022) to estimate a sectoral Phillips curve, as opposed to a regional Phillips curve. Using variation across sectors and an instrumental variable approach to isolate demand shocks, we document new heterogeneity in the slope of the Phillips curve across sectors in line with that predicted by our model. The methodology also provides a stepping stone to estimate the aggregate Phillips curve using sectoral data, complementing the approach in Hazell et al. (2022).

This paper is also related to a broader literature on the importance of input-output

[4]To clarify the novelty of our approach, note that with non-homothetic preferences two forms of heterogeneity in consumption baskets can arise. First, households with different income levels consume different baskets on average. Second, a given household that faces a temporary income change may allocate the marginal dollar differently from its average dollar across sectors. Our empirical evidence sheds light on this second dimension, whereas existing work has focused on the first.

networks in the propagation of shocks. For instance, Bouakez, Rachedi, and Santoro (2020) and Barattieri, Cacciatore, and Traum (2023) study the propagation of fiscal policy with input-output networks, while Baqaee and Farhi (2018) and Baqaee and Farhi (2022b) study the propagation of shocks through input-output and consumption networks. Compared to this line of research, we emphasize that household consumption behaviour and differences in the slope of the Phillips curve across sectors play an important role in the propagation of shocks.

In a similar spirit as Patterson (2023), contemporaneous work in Andreolli, Rickard, and Surico (2024) documents robust stylized facts for the U.S. post-war business cycle, showing that aggregate spending and earnings in non-essential sectors are substantially more cyclical than in essential sectors. We see our work as complementary to theirs. First, we estimate household-level consumption shares in response to well-identified transitory income changes. Second, we document a novel source of heterogeneity in the slope of the Phillips curve across sectors. Finally, the macro implications also differ: Andreolli, Rickard, and Surico (2024) focus on monetary policy and intertemporal substitution, whereas we re-assess both the expansionary and the inflationary effects of fiscal shocks.

The remainder of the paper is organized as follows. Section 2 illustrates the empirical findings at the heart of our mechanism. Section 3 describes the model setup. Section 4 characterizes analytical results on the dynamics of output and inflation, and uses them to make a first inference on the strength of the *biased expenditure channel*. Section 5 illustrates the main quantitative results, and Section 6 provides empirical evidence on the slope of the sectoral Phillips curve and how it varies across sectors. Section 7 concludes.

2 Empirics

2.1 Heterogeneity in marginal propensity to consume

To study the heterogeneity of workers' propensity to consume across sectors, we need data on both household balance sheets and the sector in which household members work. The PSID (Panel Study of Income Dynamics) provides all such data, allowing us to compute the fraction of Hand-to-Mouth households among workers in each sector. We collect data from 2003 to 2019, corresponding to 9 survey waves.

The PSID reports, for both the reference person and the spouse, whether the person is working and, if so, in which sector. Sectors are classified up to the 4-digit level using Census codes, which we match with NAICS industry codes to facilitate the comparison with the other sources of data we use. Throughout the paper, our sector breakdown will be either the two-digit or the three-digit NAICS code. Since we aggregate balance sheet information at the household level, we also need to assign households to different sectors. To do so, we use the NAICS code of the reference person. This is motivated by the observation that the fraction of reference persons out of employment is only 19.6 percent, while the same figure stands at 61.7 percent for spouses. Using the sector of employment of the reference person thus seems like a natural choice.

Once we have assigned each household to a sector, we proceed to classify them as HTM or non-HTM (Permanent income households in the terminology of the model). Following a methodology proposed in Kaplan, Violante, and Weidner (2014) (henceforth, KVW), we classify households as HTM if their liquid assets fall below half of their biweekly income. The intuition is that such low levels of assets suggest the presence of a binding borrowing constraint, with the household exhausting all the sources of liquidity in proximity to the arrival of the subsequent paycheck. Since these households are close to their borrowing constraint, we expect them to behave as hand-to-mouth, with the constraint breaking the equality of their Euler equation.

To replicate KVW, we classify as liquid assets the sum of checking and savings accounts, plus financial assets other than retirement accounts, from which we subtract liquid debt. Household income is computed as the sum of the labor income of both partners, government transfers, and income from own business. We provide some additional details on the classification in Appendix B.1, and we defer to KVW for a detailed description of the methodology and theoretical background.

By classifying households as HTM if liquid assets are below half of households' biweekly income, we are essentially imposing a zero borrowing constraint. Our results on the heterogeneity of HTM across sectors are essentially unchanged if we instead impose one month of income as the borrowing constraint, an arbitrary threshold often used in the literature (KVW, Almgren et al. (2022)). We find that 53 percent of households are classified as HTM, roughly in line with the 46 percent found in KVW using PSID data.

KVW finds that the HTM status is a strong predictor of the consumption response to transitory shocks. This provides support for the choice of using the fraction of HTM by sector as a proxy for the MPC, rather than directly estimating the MPC in each sector, a choice that we make because of two advantages. Firstly, it directly maps to our model environment with hand-to-mouth and permanent-income households. Secondly, estimating the fraction of HTM is feasible at essentially any level of disaggregation in the PSID, while estimating MPCs might quickly run into sample size issues as we move to disaggregated levels.

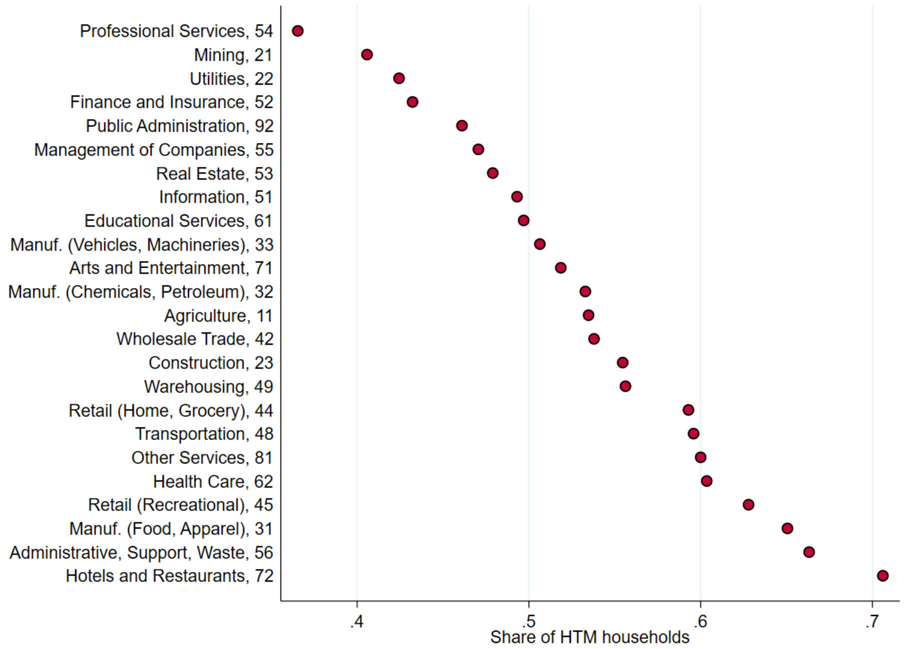

Figure 1: Fraction of Hand-to-Mouth households by industry of employment at the two-digit NAICS code.

The procedures outlined above allow us to compute the fraction of HTM households depending on their sector of employment. We plot our results in Figure 1: sectors are strikingly heterogeneous in the fraction of HTM households they employ, ranging from 35 to 70 percent. This is our main motivating finding. Furthermore, these differences seem to be persistent throughout the two decades considered in our sample, including during the Great Recession. In Figure 2 we plot the average share of HTM households by industry of employment for three sub-samples: between 2003 and 2007, between 2009 and 2013, and finally between 2015 and 2019. One can see that the heterogeneity illustrated in Figure 1 is highly persistent across time, and the only reason why the scatter plot does not lie on the 45-degree line is that the average share of HTM households in the economy was higher before the 2015-2019 expansion. Section B.1.1 shows that the HTM status is also persistent at the household level.

In our model, we will use the results in Figure 1 to calibrate the fraction of HTM across sectors, effectively treating the fraction of HTM workers as an exogenous sector-specific parameter. While we do not take a stance on how this fraction is de-

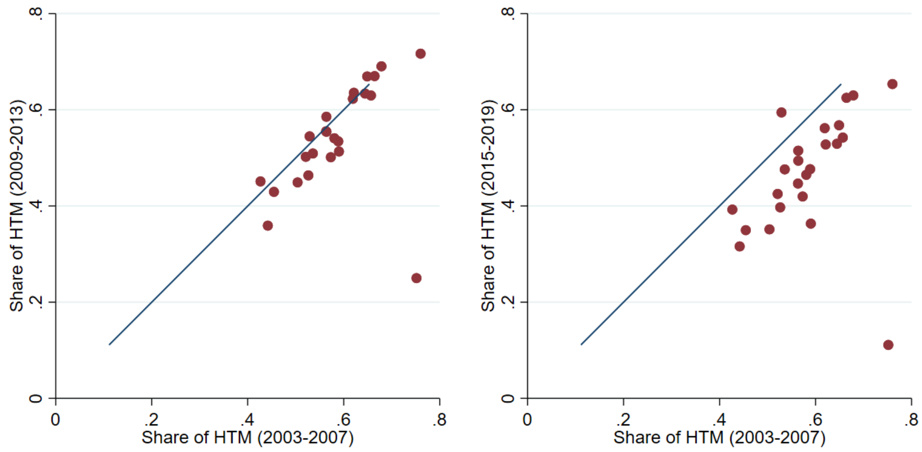

Figure 2: Average fraction of Hand-to-Mouth households by industry of employment (two-digit NAICS code) for the PSID waves (2003-2007) on the x-axis and for the PSID waves (2009-2013) on the y-axis on the left panel, and (2015-2019) on the right panel. The blue line is the 45-degree line.

termined, it is useful to gain a first-pass understanding of the sorting mechanism that gives rise to the striking heterogeneity in the fraction of HTM across sectors. To do so, we run a horse-race Probit regression in which we evaluate the ability of different variables to explain the HTM status of each worker. The results, reported in Panel A of Table 1, show that worker demographic characteristics (education, age, race, and number of kids), which are largely predetermined, have a strong predictive power of their HTM status. Instead, sectoral dummies have very little predictive power. We interpret this evidence as being consistent with a sorting mechanism whereby workers of different types are unevenly distributed across sectors: conditional on a worker's type, their sector of employment has little additional explanatory power for their HTM status.

The importance of demographic characteristics becomes even more pronounced in predicting HTM status at the sectoral level. To make this point, we construct sectoral-level predicted HTM shares by aggregating individual-level predicted HTM status. Panel B of Table 1 shows that broadly predetermined demographic variables explain over 80 percent of cross-sector variation in observed HTM shares. Taken together, these results indicate that sectoral HTM shares, while not strictly exogenous, are largely driven by workforce composition, which supports treating them as exogenous for the purposes of the model's policy experiments. Appendix B.1 provides further details on the composition of the workforce in different sectors.

Our findings and approach are consistent with recent work in Aguiar, Bils, and Boar (2025), which suggests that preference heterogeneity, rather than differences in income processes, is the primary driver of workers' HTM status. The striking demographic heterogeneity across sectors we uncover also resonates with the result in Patterson (2023) that different demographic groups have different MPC. What we highlight here is that distinct demographic groups also tend to sort into different industries, effectively making some sectors high-MPC and others low-MPC, with important consequences for the propagation of shocks. Understanding the underlying reasons for workers' sorting patterns goes beyond the scope of this paper.

	(1)	(2)	(3)	(4)
Demographics	✓	✓		
Income	✓		✓	
Panel A: individual-level				
R^2	0.180	0.151	0.081	-
R^2 adding sector dummy	0.187	0.162	0.096	0.035
Panel B: sectoral-level				
R^2	0.933	0.805	0.767	-

Table 1: We use a probit model to estimate the probability that each household is HTM using as predictors household demographics (years of education, age, white dummy, number of kids) or income, and dummies for the sector of employment at the two-digit level. Panel A shows the Efron R^2 of such *individual-level* Probit model. Panel B reports the Efron R^2 of a *sectoral-level* regression of the actual sectoral HTM share on the predicted HTM share, calculated by averaging the Probit model individual-level fitted values.

2.2 The marginal consumption basket

We use data from the Consumer Expenditure Survey (CEX) to construct estimates of both the marginal and the average consumption baskets. To estimate the marginal propensity to consume across goods produced in different sectors, we exploit the 2008 Economic Stimulus Payments (ESPs), a component of the $100-billion Economic Stimulus Act of 2008 designed to raise consumer demand during the recession that began in December 2007. The ESPs averaged roughly $900 and were distributed to U.S. taxpayers in the spring and summer of 2008. The advantages of using these payments to estimate marginal propensities to consume are well established in the literature (Parker et al., 2013; Broda and Parker, 2014; Orchard, Ramey, and Wieland, 2025).

The CEX records detailed expenditures classified by UCC codes—a product classification system that categorizes household spending by type of good or service. Following Hubmer (2022), we use the mapping developed by Levinson and O'Brien

(2019) to link each UCC code to a NAICS industry code, allowing us to aggregate quarterly household expenditures by industry at both the two-digit and three-digit NAICS levels.

We then divide the data into two samples: a main sample covering 2003–2013, used to estimate the average consumption basket, and a sub-sample covering 2007–2009, used to estimate the marginal consumption basket. Table 9 in Appendix B.2 reports summary statistics and average expenditures by industry.

2.2.1 Estimating MPCs

To estimate the marginal propensity to consume (MPC) across industries, we follow the empirical specification of Parker et al. (2013), which relies on two-way fixed effects. In Appendix B.4, we also report estimates of marginal propensities to consume based on Orchard, Ramey, and Wieland (2025).

The key innovation of our approach relative to Parker et al. (2013) lies in the construction of the dependent variable in equation (2). While prior studies estimate MPCs by broad categories of goods—such as food at home, apparel, or housing services—we estimate marginal propensity to consume toward each industry.

Our identification exploits the randomized timing of the 2008 Economic Stimulus Payments (ESPs). We restrict the sample to households that received an ESP, so that the variation used to estimate MPCs arises solely from differences in the timing of receipt across households. Expenditures are aggregated at quarterly frequencies. Since CEX interviews are conducted on a rolling basis, we can include monthly time fixed effects for the first month of the interview.[5]

The estimating equation is:

$$C_{i,s,t+1} - C_{i,s,t} = \sum_j \beta_{0j} \times \text{ month }_{j,i} + \beta_s ESP_{i,t+1} + \boldsymbol{\beta}'_{X,s}\mathbf{X}_{i,t} + u_{i,t+1} \tag{2}$$

where $ESP_{i,t}$ is the rebate amount received by household i in period t, and $\mathbf{X}_{i,t}$ is a vector of controls including the age of the reference person and changes in family size.

Equation (2) is estimated for each industry s. The estimated coefficients β_s, which we later use to construct the marginal consumption basket, measure how much households spend in industry s when they face a temporary increase in their income of 1$.

[5]For example, some households report expenditures for January–March, while others report for February–April. Thus, we can include monthly fixed effects for the first month of the interviews, that in these two examples would be January and February.

Table 9 in Appendix B.2 reports the estimates of β_s using expenditures aggregated by two-digit industries. Table 9 also reports standard errors for β_s, however, since the main focus of our analysis is the size of the fiscal multiplier, we focus our discussion on the bootstrapped standard errors and confidence intervals for the multiplier in Section 4.2, rather than on standard errors for individual estimates of β_s.

2.2.2 Marginal and average consumption shares

We use the estimated coefficients β_s to construct the marginal consumption basket. Let β denote the coefficient obtained from estimating equation (2) using total expenditure as the dependent variable—that is, the overall marginal propensity to consume. The marginal consumption share of industry s is then defined as:

$$MCS_s = \frac{\beta_s}{\sum_j \beta_j}.$$

Because our goal is to recover relative, rather than absolute, propensities to consume, potential biases in estimating (2) do not affect MCS_s as long as they are proportional across industries.[6]

We construct the average consumption basket using the full CEX sample from 1997–2013. To account for heterogeneous inflation trends across industries, we deflate quarterly expenditure by industry using five price indexes—CPI core, CPI food and beverages, CPI fuel, CPI electricity, and CPI gasoline. For each household and quarter, we compute relative consumption by dividing expenditure in each industry by total expenditure, and then average across households and time. The resulting measure, ACS_s, denotes the share of industry s in the average consumption basket.

Figure 3 compares the estimated marginal consumption shares (MCS_s, in blue) with the average consumption shares (ACS_s, in red) across two-digit industries. The two measures differ substantially, indicating that households' marginal spending responses deviate from their average expenditure patterns. While the marginal basket is known to be biased toward durables, here captured in the durable-goods segment of Manufacturing (33), our estimates reveal broader patterns, with the heterogeneity between average and marginal consumption extending well beyond the durable–nondurable distinction. For instance, towards the low end of the figure, we find that also Hotels and Restaurants (72) and Construction (23) have large marginal consumption shares,

[6]Estimates of MPCs from two-way fixed effects may be biased; see Orchard, Ramey, and Wieland (2025). In Appendix B.4 we estimate marginal consumption shares MCS_s using the estimator proposed by Orchard, Ramey, and Wieland (2025) and we obtain similar estimates for several sectors.

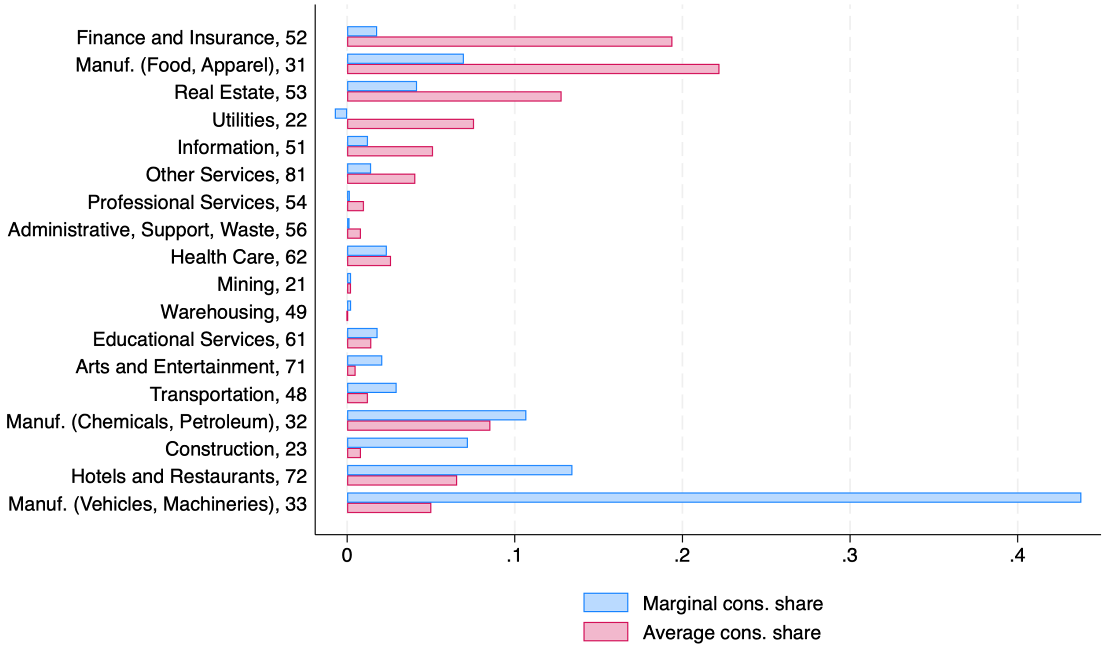

Figure 3: Estimates of marginal consumption shares (MCS) and average consumption shares (ACS) by two-digit industries, ranked from the lowest to the highest $(MCS - ACS)$ difference.

compared to their average ones, capturing households' outsized spending response in these sectors in response to a fiscal transfer. Instead, Finance and Insurance (52), the Food and Apparel segment of manufacturing (31), and Utilities (22) all have low marginal consumption shares, making these sectors less responsive to shocks.

We next combine these results with the sectoral composition of hand-to-mouth (HTM) employment from Section 2.1. Figure 4 shows that industries with a larger share of HTM workers also exhibit higher $(MCS_s - ACS_s)$. In other words, households' marginal expenditures are biased toward sectors employing high-MPC workers. This pattern is central for understanding the aggregate effects of fiscal policy: even if the initial transfer is untargeted across all households, because of this pattern of expenditures, the income increase ends up disproportionately in the pockets of HTM households. Therefore, for a given aggregate MPC, shifting expenditure from the average to the marginal consumption basket increases the fiscal multiplier by redistributing income toward high-MPC households.

Formally, the covariance underlying this mechanism is positive,

$$\widetilde{\text{cov}}\left(HTM_s, MCS_s - ACS_s\right) > 0$$

Since the term $(MCS_s - ACS_s)$ is particularly large for the durable-goods segment of Manufacturing (33), we did not include them in Figure 4 to facilitate the comparison. Further evidence of the expenditure bias are provided in Appendix B.2.

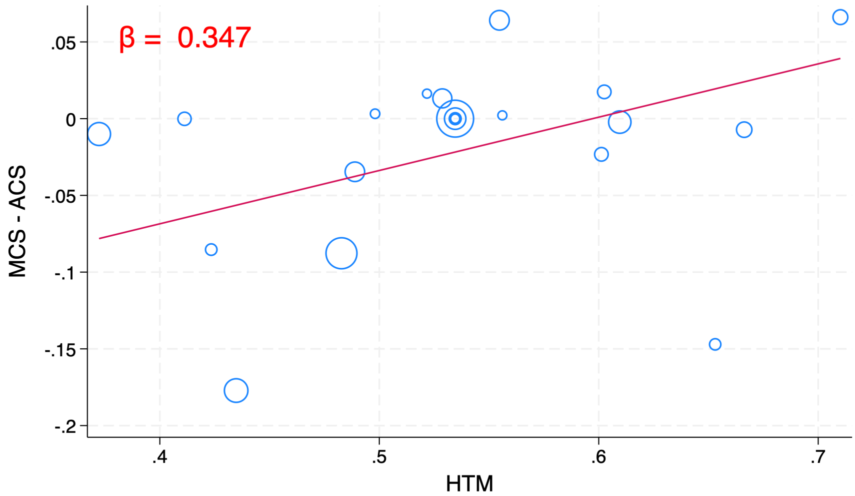

Figure 4: Each circle represents a two-digit industry, weighted by its value-added. The y-axis captures the difference between marginal consumption share and average consumption share ($MCS_s - ACS_s$). On the x-axis, there is the share of hand-to-mouth households employed in that industry. For illustration, we omitted the NAICS 33 industry (Manufacturing, mostly durable goods), which is an outlier on the y-axis.

3 Model

To study and quantify the implications of our empirical findings, we build a Multi-Sector, Two-Agent, new-Keynesian model. The economy is composed of S sectors. Each household is employed in a specific sector, and we assume that labor is immobile: workers cannot change their sector of employment.[7] In the tradition of Two-Agent models of Galí, López-Salido, and Vallés (2010), Bilbiie (2008), there are two types of workers: permanent-income households (PIH), who behave according to the permanent income hypothesis, and hand-to-mouth households (HTM), who do not have access to financial markets and simply consume their income in every period. A worker is thus characterized by type $i \in \boldsymbol{S} \times \{\text{HTM}, \text{PIH}\}$, which captures their sector of employment and HTM status, and cannot change type.

[7]This assumption is often made to simplify the dynamics of multi-sector heterogeneous agents models, in particular in open economies as in Guo, Ottonello, and Perez (2023). This assumption implies that an increase in the wage bill of a given sector increases the labor income of the households employed in that sector, whose MPC is known from Section 2.1. In Appendix B.5 we provide some evidence in support of this assumption, showing that incumbent workers' wages respond to output fluctuations, and that 68% of the variation in the wage bill at the sectoral level is explained by variations in hours and hourly wage of employees, and not by a change in the number of employees.

The share of HTM households employed within each sector is exogenous but is allowed to vary across sectors. Therefore, the model allows for heterogeneity in the average MPC of households employed in different sectors. We allow for non-homothetic preferences, which we model through a subsistence component of demand. In line with our empirical findings, with non-homothetic preferences, the marginal consumption basket can differ from the average consumption basket, in a much more general way than what the standard distinction between durables and non-durables would allow.

On the production side, within each sector, there is monopolistic competition among firms producing heterogeneous varieties of the same good. Firms in sector s use labor and intermediate goods from other sectors to produce, and can sell their products to households as a final good and to other firms as an intermediate good. Firms' profits are rebated to PIH households. Following standard practice in the New Keynesian sticky-wage literature, labor hours are determined by a labor union. We extend Erceg, Henderson, and Levin (2000) and Schmitt-Grohé and Uribe (2005) to our multi-sector economy, where we have sectoral unions and input-output networks.

3.1 Preferences

Throughout the paper, we will use superscripts to denote the type of worker $i \in \boldsymbol{S} \times \{\text{HTM,PIH}\}$, which specifies their sector of employment and HTM status. In contrast, we will use subscripts to denote goods of different sectors.

Households of any type have identical preferences over consumption and labor, given by the separable utility function $U(c_t^i, n_t^i)$:

$$U(c_t^i, n_t^i) = u(c_t^i) - v(n_t^i) \tag{3}$$

In practice, we will work under standard functional forms assumptions: $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$ and $v(n) = \frac{n^{1+\psi}}{1+\psi}$. Households derive consumption utility through the consumption aggregator c_t^i, which aggregates the consumed quantities of goods in each sector according to (4). We follow Fanelli and Straub (2021), and Auclert et al. (2021), and assume agents consume a Stone-Geary CES bundle with a non-negative subsistence need m_s for each sector. Therefore, utility is derived from the total consumption of goods in sector s, q_{st}^i, net of the sector-specific subsistence level of consumption m_s, which is the same for all i. Let us denote the discretionary level of consumption in sector s by $c_{st}^i = q_{st}^i - m_s$. The consumption aggregator from which households derive utility in

(3) is:

$$c_t^i = \Big[\sum_s \alpha_s^{\frac{1}{\eta}} \underbrace{(q_{st}^i - m_s)}_{c_{st}^i}^{\frac{\eta-1}{\eta}}\Big]^{\frac{\eta}{\eta-1}} \tag{4}$$

Notice that total (q_{st}^i) and discretionary (c_{st}^i) consumption are time-varying, while subsistence consumption (m_s) is not.

There is monopolistic competition within each sector s, with a continuum of varieties, with measure one, indexed by j. As we will discuss in greater detail in Section 3.4, this additional layer of varieties is needed because unions will set wages at the firm level, which greatly simplifies the union problem compared to working at the sector level. Both the subsistence and the discretionary demand are a CES aggregate of such differentiated varieties so that the consumption basket by household i at time t from all varieties within sector s is aggregated according to:

$$q_{st}^i = \underbrace{\left(\int_0^1 c_{st}^i(j)^{\frac{\varepsilon-1}{\varepsilon}} dj\right)^{\frac{\varepsilon}{\varepsilon-1}}}_{c_{st}^i} + \underbrace{\left(\int_0^1 m_{st}(j)^{\frac{\varepsilon-1}{\varepsilon}} dj\right)^{\frac{\varepsilon}{\varepsilon-1}}}_{m_{st}} \tag{5}$$

where j denotes different varieties of the goods produced in sector s, and ε is the elasticity of substitution between different varieties of goods produced in sector s. Setting up the problem as in (5) allows for a clean aggregation at the variety level, with producers charging a constant markup over production costs. We defer the derivations of consumption and input at the variety-level to Appendix A.5, and focus here on the choice at the sector-level. Subsistence demand for goods of sector s is m_s by construction, and the total consumption demand for goods produced in sector s is

$$q_{st} = m_s + \alpha_s \left(\frac{P_{st}}{P_t}\right)^{-\eta} C_t \tag{6}$$

where C_t is the sum of individual consumption aggregators c_t^i across all households i.

3.2 Firms

3.2.1 Inputs' choice

All firms in sector s produce with the same CES technology, using labor N_{st} and a composite bundle of intermediate goods from other sectors X_{st}. In the production function in (7), ω_s denotes the sectoral labor share and $\{\delta_{sk}\}_k$ the input shares across sectors.

$$y_{st} = Z_{st}\left(\omega_s^{\frac{1}{\nu}}(N_{st})^{\frac{\nu-1}{\nu}} + (1-\omega_s)^{\frac{1}{\nu}}(X_{st})^{\frac{\nu-1}{\nu}}\right)^{\frac{\nu}{\nu-1}} \tag{7}$$

$$\text{with} \qquad X_{st} = \left(\sum_k \delta_{sk}^{\frac{1}{\gamma}} x_{skt}^{\frac{\gamma-1}{\gamma}}\right)^{\frac{\gamma}{\gamma-1}}, \qquad \sum_k \delta_{sk} = 1$$

There is a continuum of differentiated varieties, denoted by j, of goods produced in sector k. Therefore, x_{skt} is an aggregator of varieties j produced in sector k according to (8), just like for the consumers. For simplicity, we impose that the elasticity of substitution across different varieties ε is the same for households that demand final goods and for firms that demand intermediate goods.

$$x_{skt} = \left(\int_0^1 x_{skt}(j)^{\frac{\varepsilon-1}{\varepsilon}} dj\right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{8}$$

Just like for consumption, we defer to Appendix A.5 the derivation of demand at the variety-level, and focus on the upper nest of sector-level input demand.
The optimal demand for intermediates from sector k by firms in sector s is characterized by (9). Given prices P_{st}, producers will demand:

$$x_{skt} = \delta_{sk}\left(\frac{P_{kt}}{PPI_{st}}\right)^{-\gamma} X_{st} \tag{9}$$

$$PPI_{st} = \left(\sum_k \delta_{sk} P_{kt}^{1-\gamma}\right)^{\frac{1}{1-\gamma}} \tag{10}$$

where PPI_{st} is the *Producer Price Index* faced by producers in sector s for their inputs, which is defined in (10). By solving the outward nest, the demand for labor and the composite bundle of intermediate goods for firms in sector s are characterized in (11), (12).

$$N_{st} = \omega_s\left(\frac{W_{st}}{PC_{st}}\right)^{-\nu} y_{st}/Z_{st} \tag{11}$$

$$X_{st} = (1-\omega_s)\left(\frac{PPI_{st}}{PC_{st}}\right)^{-\nu} y_{st}/Z_{st} \tag{12}$$

where PC_{st} denotes *Producer Cost* in sector s, defined in equation (13).

$$PC_{st} = \left(\omega_s W_{st}^{1-\nu} + (1-\omega_s) PPI_{st}^{1-\nu}\right)^{\frac{1}{1-\nu}} \tag{13}$$

From Equation (11) we can notice that, because the sectoral labor share ω_s is a constant, sectoral output fluctuations will pass through strongly to the sector's employment and ultimately its wage bill. This feature is important for the paper's main mechanism and consistent with evidence in Appendix B.5, which documents a pass-through close to one.

3.2.2 Pricing rule

The optimal pricing rule in a monopolistically competitive environment depends on the total demand of variety j produced by firms in sector k. We show in Appendix A.5 that the total demand for variety j in sector k can be expressed according to (14), where q_k is defined in (6) and x_{skt} is defined in (9).

$$y_{kt}(j) = \left(\frac{P_{kt}(j)}{P_{kt}}\right)^{-\varepsilon} \left[q_{kt} + \sum_s x_{skt}\right] \tag{14}$$

Each firm takes q_{kt}, x_{skt} and P_{kt} as given, and simply choose $P_{kt}(j)$ to maximize profits. Under the assumption of flexible prices, and since $P_{kt}(j) = P_{kt}$, we obtain:

$$P_{kt} = \frac{\varepsilon}{\varepsilon - 1}\frac{PC_{kt}}{Z_{kt}} \tag{15}$$

3.3 Households

There is a unit mass of households in the economy, and we denote the share of households employed in sector s by λ_s. Given our assumption of labor immobility, each household is characterized by a type $i \in \boldsymbol{S} \times \{\text{HTM}, \text{PIH}\}$, which specifies their sector of employment and their HTM status. When needed, the type of worker is denoted by a superscript. For example, $c_t^{s,PIH}$ and $c_t^{s,HTM}$ denote the consumption of HTM and PIH households employed in sector s, where c_t^i is defined in (4).

To parsimoniously incorporate the subsistence consumption in households' problem, we denote by M the sum of subsistence consumption across sectors, $M = \sum_s m_s$, and by P_t^M a price index such that $P_t^M M$ is the total expenditure on subsistence goods.

PIH Households can save or borrow using bonds. They choose consumption and assets to solve a standard consumption-savings problem. Dividends, which we denote by d_t, are rebated to PIH households only, and they are equally distributed to PIH households employed in different sectors.[8] We write the budget constraint of PIH

[8]This assumption is consistent with the idea that HTM households cannot hold assets. If we assumed that dividends are rebated equally to all households, the average MPC in the economy would be higher and the *biased expenditure channel* could be amplified.

households in nominal terms, where $a_t^{s,PIH}$ is nominal asset holdings, and i_{t-1} is a predetermined nominal interest rate. Let T_t^i denote a lump-sum transfer (or tax) to households of type i in period t, and τ_t be a linear labor income tax, whose details are illustrated in Section 3.5. The number of hours worked by each household in sector s, denoted by n_{st}, is simply $n_{st} = N_{st}/\lambda_s$.

The problem of PIH households employed in sector s is summarized by the budget constraint and by the Euler equation for discretionary consumption:

$$u'(c_t^{s,PIH}) = \beta \mathbb{E}\left[(1+i_t)\frac{P_t}{P_{t+1}}u'(c_{t+1}^{s,PIH})\right] \tag{16}$$

$$P_t^M M + P_t c_t^{s,PIH} + a_t^{s,PIH} \leq a_{t-1}^{s,PIH}(1+i_{t-1}) + W_{st}n_{st}(1-\tau_t) + d_t + T_t^{s,PIH} \tag{17}$$

The discretionary consumption of HTM workers is simply equal to their real income, net of expenditures on subsistence goods:

$$c_t^{s,HTM} = \frac{W_{st}n_{st}(1-\tau_t) + T_t^{s,HTM} - P_t^M M}{P_t} \tag{18}$$

3.4 Unions

Wages in each sector are set by unions, which face quadratic wage adjustment costs. We follow the literature and impose labor rationing so that each worker within the same sector works the same number of hours N_{st}. The problem faced by unions differs from the standard setup in the literature because of the multi-sector structure of the economy and because of input-output networks. We will show that the presence of IO networks is important for wage setting, as it determines the elasticity of labor demand $\partial N_{st}/\partial W_{st}$. We assume that unions set wages at the firm level, rather than at the sector level. In this way, unions take prices in all sectors as given, making the union's problem substantially more tractable.[9]

Unions in sector s set wages W_{st} to maximize a weighted average of households' utility in sector s, subject to quadratic adjustment costs, according to (19):

$$\max_{W_{st}} \quad \sum_t \beta^t \left\{(1-H_s)\times u(c_t^{s,PIH}) + H_s \times u(c_t^{s,HTM}) - v(n_{st}) - \frac{\phi}{2}\left(\frac{W_{st}}{W_{st-1}}-1\right)^2\right\} \tag{19}$$

[9]If unions were to set wages at the sector level, they should take into account not only the effect of their decision on prices in their own sector, but also the effect on prices of other sectors, since quantities produced in each sector will, in turn, affect demand for other goods through the input-output network.

where we used the standard assumption that workers in the same sector work the same number of hours regardless of their HTM status.

When setting wages, unions take into account that they affect the firm's labor demand n_{st}. Since firms within a sector use the same production technology, firm labor demand as a function of wages is simply the firm-level equivalent of sector labor demand in (11).

The optimality condition for the union implies a sectoral non-linear Phillips curve, which is equivalent in spirit to the aggregate Phillips curve in Auclert, Rognlie, and Straub (2024):

$$\pi^w_{st}(1+\pi^w_{st}) = \frac{\zeta_{st}}{\phi} n_{st}\left[v'(n_{st}) - U'(\mathscr{C}_{st})\frac{W_{st}(1-\tau_t)}{P_{st}}\frac{\zeta_{st}-1}{\zeta_{st}}\right] + \beta\pi^w_{s,t+1}(1+\pi^w_{s,t+1}) \quad (20)$$

Current wage inflation in each sector is increasing in marginal labor disutility, and decreasing in average marginal utility of consumption across households, captured by $U'(\mathscr{C}_{st})$, where $U'(\mathscr{C}_{st}) = (1-H_s)u'(c^{s,PIH}_t) + H_s u'(c^{s,HTM}_t)$.

One of the key terms of the Phillips curve is ζ_{st}, the elasticity of labor demand faced by the union. Differentiating the firm-level labor demand equation, we obtain the following expression for the elasticity of each firm's labor demand:

$$\zeta_{st} = -\frac{\partial N_{st}(j)}{\partial W_{st}(j)}\frac{W_{st}(j)}{N_{st}(j)} = \varepsilon \times \left[\frac{W_s N_s}{PC_s y_s/Z_s}\right] + v \times \left[1 - \frac{W_s N_s}{PC_s y_s/Z_s}\right] \quad (21)$$

Equation (21) shows how the presence of IO networks affects the elasticity of labor demand relevant for the union, which is a weighted average between the elasticity of substitution across varieties ε and the elasticity of substitution across labor and intermediate inputs v, where the weights are the cost shares of labor and intermediate inputs. The more the firm is labor-intensive, the more the elasticity of labor demand is disciplined by ε. Conversely, the less the firm is labor-intensive, the more the elasticity of labor demand is disciplined by v. Intuitively, if labor and inputs are strong substitutes, unions may have less ability to demand higher wages without reducing labor demand. This characterization of the union problem in a setting with input-output networks is a stand-alone contribution of the paper, which goes beyond the application in the context of fiscal policy that we discuss throughout the paper.

3.5 Fiscal and monetary policy

In each period, the government can issue debt B_t, implement lump-sum transfers (or taxes) to households $\{T^{s,HTM}_t, T^{s,PIH}_t\}_{s\in S}$, and collect labor income taxes. We consider a linear labor income tax τ_t, so that the disposable income of households is a share $(1-\tau_t)$ of their gross income. The evolution of government debt follows the budget constraint in (22), where G_t is the sum of all period t lump-sum transfers to households. While the government is restricted to running a balanced-budget fiscal policy in the long run, we allow for short-run debt-financed fiscal policy. We parameterize the persistence of government debt by ρ_B according to (23). In the extreme case of $\rho_B = 0$, the government must balance its budget period by period. For any desired path of future transfers $\{G_t\}_t$, the government chooses a sequence of tax rates $\{\tau_t\}_t$ to implement the desired persistency of government debt ρ_B, as imposed in (23), subject to its budget constraint in (22).[10]

$$B_t = (1+r_{t-1})B_{t-1} + G_t - \sum_s \tau_t \times W_{st} N_{st} \tag{22}$$

$$B_t = B_{-1} + \rho_B \big((B_{t-1} - B_{-1}) + (G_t - G_{-1})\big) \tag{23}$$

Finally, the monetary authority sets a Taylor rule for the nominal interest rate according to (24), where π_t is a measure of aggregate price inflation. Since in our framework there is no obvious choice for a price index to be targeted by the monetary authority. For now, we consider a Taylor rule that targets the consumer price index P_t.[11]

$$i_t = i_{ss} + \phi_\pi (\mathbb{E}[\pi_{t+1}] - \pi_{ss}) \tag{24}$$

3.6 Equilibrium

Given an exogenous sequence of transfers $\{T_t^{s,HTM}, T_t^{s,PIH}\}_{t=0}^{\infty}$, and an initial condition for households' assets $\{a_{-1}^{s,PIH}\}_{s\in\boldsymbol{S}}$, an equilibrium is a sequence of quantities, prices, and taxes such that *(i)* all households optimally choose consumption across sectors, *(ii)* permanent-income households optimally choose next-period assets, *(iii)* firms optimally choose labor, intermediate inputs, and goods' prices, *(iv)* unions optimally set wages, *(v)* the government present-value budget constraint is satisfied, *(vi)* all the S goods markets clear, *(vii)* all the S labor markets clear, *(viii)* the asset market clears.

[10] This specification allows us to consider several cases. For instance, the government can fund lump-sum transfers in period $t=0$ using either future lump-sum taxes or future labor income taxes, with or without government debt.

[11] Note that i_{ss}, π_{ss} denote steady-state values for the nominal interest rate and the inflation index.

4 Analytical results

In this section, we introduce some simplifying assumptions that allow us to derive analytical expressions that clarify the role of the *biased expenditure channel* in amplifying the transmission of fiscal policy to output and inflation. We will later relax these assumptions in our quantitative results in Section 5. Throughout this Section, we consider fiscal policy interventions fully financed with government debt, and we abstract from input-output linkages, as laid out in Section 4.1. In Section 4.2, we also assume that wages, and thus prices, are perfectly rigid, and derive transparent expressions for the fiscal multiplier that can easily be mapped to the data. Then, in Section 4.3, we relax the assumption of full nominal rigidity and derive an expression for the sectoral Phillips curve, highlighting the role of HTM households in propagating inflation.

4.1 Simplified Model

To derive a simple expression for the fiscal multiplier, and to highlight how it depends on the *biased expenditure channel*, we focus on the perfectly rigid wages limit of the model, which is achieved when $\phi \to \infty$ in the union problem laid out in (19). Note that from the optimal pricing rule in (15), this condition also implies perfectly rigid prices. This assumption also rules out any dynamics coming from the unions' block of the model.

We restrict our attention to *untargeted* fiscal transfers fully funded with government debt: $\rho_B \to 1$, and the government pays a lump-sum transfer T_0^i in period 0 to each type i, using only future lump-sum taxes $-T_t^i$ proportional to T_0^i to pay the interest on government debt. Note that, since PIH households are Ricardian, this assumption implies that they have a zero MPC out of the government transfer in $t = 0$, as their permanent income is unchanged, a result we show formally in Appendix A. The absence of a response by PIH households rules out any dynamics associated with the Euler equation. Since unions' first-order conditions and households' Euler equation are the only dynamic equations in our model, it follows that any result implied by these assumptions will be static.

Labor is the only input in production, since we abstract from input-output linkages. This assumption is made for transparency, rather than tractability: because our mechanism does not depend on the presence of IO linkages, focusing on the case without such linkages allows us to highlight the mechanism's novelty and differentiate more clearly from related work Flynn, Patterson, and Sturm (2021); Schaab and Tan (2023). In Appendix A.1, we extend our analytical results to the case with IO networks. Finally, we consider a steady-state where government debt is zero. We further impose $\varepsilon \to \infty$, which implies that firms make zero profits and there are no dividend distributions.

Marginal consumption shares in the model. Before proceeding, it is useful to clarify how marginal consumption shares—defined in Equation (25)—map into the model's parameters, as they are a key object determining the fiscal multiplier. Under Stone–Geary preferences, marginal consumption shares simply map to α_s:

$$MCS_s = \frac{d(p_s m_s + p_s c_s)}{d(P_M M + P_C C)} = \alpha_s. \tag{25}$$

4.2 Fiscal Multipliers

In this section, we derive the simple equation (1) discussed in the introduction, which characterizes the fiscal multiplier under the simplifying assumptions of full nominal rigidity and the absence of input–output linkages.

Consumption-network objects. Let $\mathcal{C}, \mathcal{H} \in \mathbb{R}^{S\times S}$. The matrix $\mathcal{C}$ captures the *consumption network*: its column s maps a one-unit increase in production in sector s into induced demand across all sectors. When production in sector s increases by one unit, labor income in that sector rises by the labor share ω_s. Of this additional labor income, a fraction H_s is spent by hand-to-mouth households, and a fraction α_k of that spending is directed toward goods from sector k. Therefore,

$$\{\mathcal{C}\}_{ks} = \alpha_k\, \omega_s H_s. \tag{26}$$

The matrix $\mathcal{H}$ maps per-capita fiscal transfers to workers in sector s into sectoral demand. When per-capita lump-sum transfers are uniform across workers, the impact on aggregate demand depends on the size of the sector, denoted by λ_s:

$$\{\mathcal{H}\}_{ks} = \alpha_k H_s \lambda_s. \tag{27}$$

The primitive demand impulse generated by fiscal transfers is given by $(\mathcal{H}\boldsymbol{dT})$, which corresponds to the first round of a Keynesian cross. This impulse is then amplified through subsequent rounds of spending, captured by a generalized Keynesian multiplier $(\mathcal{I}-\mathcal{C})^{-1} = \mathcal{I}+\mathcal{C}+\mathcal{C}^2+\dots$. Results that incorporate an input–output production network are presented in Appendix A.1.

As we show in Appendix A, the average marginal propensity to consume of workers in sector s out of an untargeted fiscal transfer equals H_s. We therefore use H_s and MPC_s interchangeably. To facilitate comparison with the classic Keynesian multiplier $\frac{\overline{MPC}}{1-\overline{MPC}}$, we will state our main result using the MPC notation. We denote by MPC_s the MPC of households employed in sector s, and by $\overline{MPC}$ the income-weighted average MPC in the economy. Finally, we denote by MCS_s and ACS_s the marginal and average consumption shares of sector s goods, respectively.

Proposition 1. *Consider a stationary equilibrium with no input–output linkages, perfectly rigid prices ($\phi \to \infty$), perfect substitution across varieties ($\varepsilon \to \infty$), and zero government debt ($B_{-1} = 0$). Suppose further that fiscal policy is fully debt-financed ($\rho_B \to 1$). Then, the first-order effect of untargeted transfers on sectoral output, on impact, is given by*

$$dy \;=\; (\mathcal{I} - \mathcal{C})^{-1}(\mathcal{H}\boldsymbol{dT}), \tag{28}$$

and the first-order effect on aggregate output, on impact, is given by

$$dY \;=\; \frac{\overline{MPC}}{1-\left[\overline{MPC} + \widetilde{\mathrm{cov}}\big(MPC_s,\, MCS_s - ACS_s\big)\right]}. \tag{1}$$

Proof: See Appendix A.2.

Proposition 1 captures the essence of the *biased expenditure channel*. Fiscal policy is amplified when households direct their marginal spending disproportionately toward sectors whose workers have high MPCs, thereby making the covariance term positive. We denote by $\widetilde{\mathrm{cov}}$ the sum of cross-deviations, *i.e.*, the covariance rescaled by the number of sectors S, which corrects for the mechanical decline in covariance induced by finer sectoral classifications.

The proposition also makes clear when this channel disappears. Specifically, the biased expenditure channel is absent if: (i) workers' MPCs do not vary across sectors; (ii) households' marginal expenditure shares coincide with their average expenditure shares in all sectors, so that $MCS_s = ACS_s$; or (iii) there is joint variation in MPC_s and $MCS_s - ACS_s$, but the two are uncorrelated. In contrast, we find in the data that sectors are heterogeneous in MPC_s, and that households allocate marginal spending disproportionately toward high-MPC sectors. As a result, $\widetilde{\mathrm{cov}}\big(MPC_s,\, MCS_s - ACS_s\big) > 0$, which raises the fiscal multiplier. In the next subsection, we use Equation (1) to provide a first quantitative assessment of this mechanism.

Finally, for the mechanism in Proposition 1 to operate, increases in sectoral demand must translate into higher sectoral wages. In our model, this occurs because the labor share is acyclical. In Appendix B.5, we show that a demand-driven increase in sectoral sales are passed through to the wage bill.[12]

4.2.1 A Sufficient Statistic Approach

Proposition 1 provides a natural approach to quantify the importance of the *biased expenditure channel* for the fiscal multiplier. Using Equation (1), together with our estimates for MPC_s, ACS_s, and MCS_s from Section 2, we can estimate the size of the fiscal multiplier in the baseline economy. Then, we can compare this to the fiscal multiplier in an equivalent but homothetic economy, in which $ACS_s = MCS_s$ and the covariance term disappears.

$$dY^{\text{homothetic}} = \frac{\overline{MPC}}{1-\overline{MPC}} = 1.15$$

$$dY^{\text{baseline}} = \frac{\overline{MPC}}{1-\left[\overline{MPC}+\widetilde{\text{cov}}\big(MPC_s, MCS_s - ACS_s\big)\right]} = 1.27$$

The 12 percentage points gap between the two fiscal multipliers quantifies the amplification generated by the biased expenditure channel in this simplified setting. In Section 5, we show that this amplification result is comparable to the one obtained using the full quantitative model, with IO networks, sticky prices, and persistent government debt.

An appeal of the sufficient statistic approach is that we can easily construct confidence intervals for the fiscal multiplier from bootstrap samples. The analysis, reported in Figure 5, shows that the amplification associated with the biased expenditure channel—that is, the difference between dY^{baseline} and $dY^{\text{homothetic}}$—, is statistically significant at the 99% confidence level.

In the next subsection, we derive an analytical expression for the sectoral Phillips curve. This will highlight the role of HTM households in the propagation of inflation, which will have an important interplay in the dynamics of the fiscal multiplier in the quantitative model.

[12] We combine wage bill data with the empirical design used in our Phillips curve estimation to show that this pass-through is empirically close to unity.

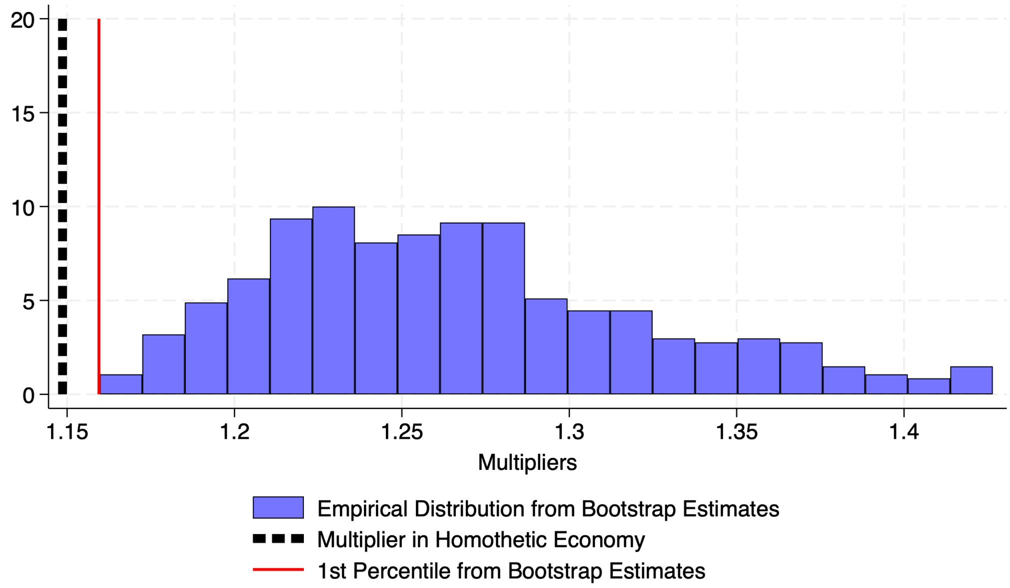

Figure 5: The figure plots a histogram of the fiscal multipliers obtained from the bootstrap samples. We construct 500 bootstrap samples by sampling households with replacement from our dataset: for each sampled household, we include all the consumption expenditure data across years and sectors. The dashed (black) line is the estimate of the fiscal multiplier in the counterfactual homothetic economy. The solid (red) line is the 1st percentile of the empirical distribution of fiscal multipliers. Data points below the 1st percentile and above the 95th percentile are omitted.

4.3 Inflation and Sectoral Phillips curves

This section uncovers a novel link between inflation and the share of HTM households employed in a sector. The key insight is that sectors employing a larger share of HTM workers exhibit a steeper Phillips curve. Interpreted through the lens of the *biased expenditure channel*, this implies that households' marginal spending is tilted toward sectors with steeper Phillips curves, thus amplifying the inflationary effects of a fiscal stimulus.

To maintain tractability, also in this Section we keep abstracting from IO networks. Notice that under this simplifying assumption, wage and price inflation coincide at the sectoral level: $\pi^w_{st} = \pi_{st}$. In this Section, since we allow for partial nominal rigidity, we work with percentage deviations from the steady state, denoted by hatted variables. To derive Proposition 2, we work under the approximation that the Ricardian equivalence holds exactly: $\hat{c}_t^{s,PIH} \approx 0$. In Appendix A, we show that $\hat{c}_t^{s,PIH} = 0$ holds exactly under rigid wages. When considering sticky wages, we verify that this approximation holds almost exactly in the quantitative model in Section 5.

Proposition 2: *Consider an economy with any degree of wage rigidity. Suppose that fiscal policy is fully financed by debt ($\rho_B \to 1$), and there are no input-output networks ($\omega_s \to 1\ \forall s$). Then, under the approximation that the Ricardian equivalence holds exactly for the PIH households ($\hat{c}_t^{s,PIH} = 0$), the first-order effect of untargeted transfers on sectoral inflation, on impact, is characterized by* (29)*:*

$$\pi_{st}^{w} = \upsilon_s^{w}\left[\psi\hat{y}_{st} + \sigma H_s \underbrace{\left(\frac{W_s n_s}{PC_s^{htm}}(\hat{y}_{st} + \pi_{st}^{w}) - \frac{P^M M}{PC_s^{htm}}\pi_t^{M} - \pi_t + \frac{dT_t}{PC_s^{htm}}\right)}_{\hat{c}_t^{s,HTM}}\right] + \beta\pi_{s,t+1}^{w} \tag{29}$$

where $\upsilon_s^{w} = \frac{\varepsilon}{\phi} n_s^{1+\psi}$.

Proof: See Appendix A.4.2.

Corollary: *Rearranging equation* (29) *we obtain:*

$$\pi_{st}^{w} = \underbrace{\frac{\upsilon_s^{w}}{1-\xi_s H_s}\left(\psi + \sigma H_s \frac{W_s n_s}{PC_s^{htm}}\right)}_{\kappa_s}\hat{y}_{st} + \frac{1}{1-\xi_s H_s}\left[-\boldsymbol{b_s}\boldsymbol{\pi}_t + \upsilon_s^{w}\sigma H_s \frac{dT_t}{PC_s^{htm}} + \beta\pi_{s,t+1}^{w}\right], \tag{30}$$

where $\xi_s = \upsilon_s^{w}\sigma\frac{W_s n_s}{PC_s^{htm}}$*. Thus, the slope of the sectoral Phillips curve* κ_s *is increasing in* H_s*:* $\frac{\partial \kappa_s}{\partial H_s} > 0$.

Proposition 2 and the associated corollary show that the slope of the sectoral Phillips curve is increasing in the share of HTM households in that sector. Equation (29), derived from the union's problem, captures the central trade-off between leisure and consumption faced by union members. Unions in a sector will demand wage increases for three reasons. First, when expected inflation is high, the union frontloads some of the wage increases due to the convex wage adjustment costs. Second, during a sectoral output boom $\hat{y}_{st}$, households need to work more hours, which increases their marginal labor disutility. The magnitude of this channel is captured by the Frisch elasticity parameter ψ. Third, during sectoral booms households may increase their consumption, leading to a decline in their marginal utility of consumption. As a result, households reduce their labor supply and demand higher wages to work the same hours.

All three drivers of sectoral wage inflation described above are standard, but market incompleteness substantially amplifies the latter force: as HTM households cannot smooth their consumption using savings, they experience substantial consumption fluctuations in conjunction with sectoral booms and busts, and therefore rely on labor supply adjustments to smooth consumption. Instead, Ricardian households use savings to smooth their consumption and only request wage increases to offset changes in the marginal disutility of labor. As a result, sectors with a higher share of HTM workers exhibit stronger wage—and hence price—responses to temporary shocks, implying a steeper sectoral Phillips curve.

This theoretical finding is connected to a line of research in labor economics that studies how households respond to labor income shocks not only through savings but also by adjusting their labor supply . A well-known insight is that households use labor supply as a margin of adjustment against uninsurable income shocks (Pijoan-Mas, 2006; Heathcote, Storesletten, and Violante, 2014; Blundell, Pistaferri, and Saporta-Eksten, 2017; Mankart and Rigas, 2017). By embedding this insight into a modern incomplete-markets New Keynesian framework, we show that households' ability to smooth shocks with savings—captured in our setting by the share of HTM households—also affects wage-setting behavior, and that this ultimately shapes the slope of the Phillips curve and the inflationary response to shocks.

5 Quantitative model

In this section, we illustrate results for the amplification of output and inflation using the full quantitative model described in Section 3. This allows us to assess both the magnitude of the *biased expenditure channel* for the fiscal multiplier when prices and wages adjust, and to quantify the importance of our channel for inflation and for the dynamic effects of output, two dimensions that cannot be easily quantified in the analytical results.

The spirit of the analytical results from Section 4 carries over to the general framework. For example, the magnitude of the fiscal multiplier in the quantitative model is similar to the analytical multiplier obtained in Section 4.2, which was immediate to quantify in the data, but ruled out any effect related to changes in relative wages and inflation. The reason why introducing flexible prices does not attenuate the amplification of the fiscal multiplier traces to our analytical results on the sectoral wage dynamics outlined in Section 4.3. As we have shown, price flexibility provides a new endogenous redistribution channel in favor of HTM households, as sectors with more HTM households have steeper Phillips curves and will thus experience stronger wage inflation.

5.1 Calibration

In the quantitative version of the model, we have 21 sectors, so that one sector in the model corresponds to a two-digit NAICS sector.[13] There are two sets of parameters that we need to calibrate. The first is the set of classic parameters for the aggregate economy, for which we choose standard values from the literature. The second set of parameters calibrates the consumption network, for which we rely on our results from PSID and CEX. In the baseline calibration, we rely on estimates of marginal consumption shares from Section 2.2 that build on Parker et al. (2013), while in Appendix A.6 we calibrate the model using estimates of marginal consumption shares based on Orchard, Ramey, and Wieland (2025). We obtain similar quantitative results.

The set of standard parameters is reported in the first panel of Table 2. We set the elasticity of substitution across varieties within each sector ε equal to 10, and the elasticity of substitution for consumption across sectors η equal to 1, as in Atkeson and Burstein (2008). The production elasticities ν and γ are set equal to 0.8 and 0.1, respectively, broadly in line with Baqaee and Farhi (2022a), Atalay (2017), Herrendorf, Rogerson, and Valentinyi (2013). We provide quantitative results for an alternative calibration that abstracts from complementarities in production in Appendix A.7. We set the Frisch elasticity $\psi = 2$ and the elasticity of intertemporal substitution $\sigma = 1$. We set the persistence of government spending (fiscal transfers) and the persistence of government debt both equal to 0.8, a value in line with the empirical evidence from Galí, López-Salido, and Vallés (2007), Davig and Leeper (2011), Nakamura and Steinsson (2014). We calibrate the scale parameter ϕ that disciplines the intensity of wage rigidity as in Auclert, Rognlie, and Straub (2024).[14] In order to isolate our mechanism more neatly, we consider a steady-state where the initial stock of government debt B is equal to zero. This choice allows to partially abstract from the devaluation, after a shock, of a substantial stock of nominal assets held by PIH households.

The main novelty of our calibration is in the set of sector-specific parameters characterizing the Consumption and input-output networks, as illustrated in the second panel of Table 2. The consumption side of the network is determined by $\{H_s\}_s$, $\{m_s\}_s$, $\{\alpha_s\}_s$. The share of hand-to-mouth households $\{H_s\}_s$ is calibrated to match evidence from the PSID, as described in Section 2.1. The sectoral shares of discre-

[13] We make this choice to keep the computation simple. In Section 4 we use our analytical expression to estimate the fiscal multiplier using data at the two-digit and three-digit NAICS level, and results are similar across the two specifications.

[14] We set the parameter ϕ in order to match a value for υ_s^w averaging 0.1 across sectors, as in Altig et al. (2011). We defined υ_s^w in Equation 29. A formulation of the Phillips curve with υ_s^w defined as in Auclert, Rognlie, and Straub (2024) (κ^w in their notation) is provided in Equation (63) in Appendix A.4.1.

tionary consumption, $\{\alpha_s\}_s$, are calibrated together with the sectoral shares of subsistence consumption, $\{m_s\}_s$, to match the marginal consumption shares and the average consumption shares estimated from CEX, as described in Section 2.2.[15] In practice, following Equation (25), we first set $\{\alpha_s\}_s$ equal to the estimated marginal consumption shares, and then we find values of $\{m_s\}$ so that average consumption shares of the model in steady-state are equal to the estimated average consumption shares. In the estimates reported in Figure 3, the marginal consumption share for the Utility sector is negative; since the model cannot accommodate negative values of α_s, we simply set α_s=0 for that sector, which might slightly dampen the amplification implied by the analytical results.

The production side of the network is characterized by $\{\lambda_s, \omega_s\}_s, \{\delta_{sk}\}_{sk}$, which are, respectively, the share of employment across sectors, and the shares of labor input and intermediate inputs in the production function. We set these parameters to match the cost-based shares of labor and intermediate goods measured from the input-output Accounts Data made available by the Bureau of Economic Analysis (BEA).[16] We set sectoral productivity z_s such that in steady-state the prices of all goods are equal to 1, namely $p_s = 1$ for all s. Note that this way of normalizing prices in steady-state makes steady-state cross-sectoral comparisons more intuitive.

5.2 Fiscal multiplier

We study the size of the fiscal multiplier in a fully dynamic model with sticky wages, thereby generalizing the results from Section 4 to a richer setting. We consider two calibrations of the model: the baseline calibration described in Table 2, and a counterfactual calibration with homothetic preferences.

In the counterfactual calibration, there is no subsistence consumption, namely $m_s = 0\ \forall s$, so that preferences are homothetic, and $\{\alpha_s\}_s$ are calibrated to match the average consumption shares from CEX. All the other parameter values are constant across the two calibrations. As a result, both models match the average consumption shares in CEX, and the values of prices and real variables in steady-state are the same across calibrations.[17] The main difference between the two models lies in their response to shocks, where households with non-homothetic and homothetic preferences behave

[15] For our benchmark homothetic economy, we set subsistence consumption m_s to zero for all sectors, and we choose α_s to match the average consumption shares.

[16] We measure these shares using data for 2007. We choose 2007 as it is the year before the Great Recession and before the Economic Stimulus Payment was implemented.

[17] The only difference lies in the shares of discretionary and subsistence consumption. If households consume the same quantity of good s in steady-state, in one case it will be all discretionary consumption while in the other it will be split between discretionary and subsistence consumption.

Aggregate parameters		
Parameter	Description	Value
γ	Elasticity of substitution across sectors (firms)	0.1
η	Elasticity of substitution across sectors (households)	1
ν	Elasticity of substitution between labor inputs and intermediate goods	0.8
ε	Elasticity of substitution across varieties, within sectors	10
σ	Elasticity of intertemporal substitution	1
ψ	Frisch elasticity	2
β	Households' discount factor	0.98
ϕ	Wage rigidity, adjustment costs (scale parameter)	$\upsilon^w = 0.1$
ρ_B	Persistence of government debt	0.8
ρ_G	Persistence of government spending	0.8

Sector specific parameters		
Parameter	Description	Target
$\{H_s\}_s$	Shares of HTM households	Evidences from PSID (Section 2.1)
$\{m_s\}_s$	Shares of subsistence consumption	Evidences from CEX (Section 2.2)
$\{\alpha_s\}_s$	Shares of discretionary consumption	Evidences from CEX (Section 2.2)
$\{\omega_s\}_s$	Labor share in production	Labor share (BEA IO tables)
$\{\delta_{sk}\}_{sk}$	Intermediates' shares in production	Intermediates' share (BEA IO tables)
$\{z_s\}_s$	Sectoral productivity	Steady-state: $p_s = 1$
$\{\lambda_s\}_s$	Measure of households in sector s	Employment by industry

Table 2: Model's parameters

differently. We define real aggregate value added as the sum of the real sectoral value added:

$$\text{Real value added} = \sum_s \left(\frac{P_s y_s - PPI_s X_s}{P_s} \right)$$

We consider a persistent fiscal transfer equal to 1% of aggregate real value-added, such that each household receives the same per-capita lump-sum transfer in each period. The government sets labor income taxes so that its budget constraint holds in each period. There are no lump-sum taxes. Normalization prices to all be equal to one in the steady-state makes the comparison between the two economies more natural in the dynamics.[18]

The cumulative multipliers for the economies with and without homothetic preferences are plotted in Figure 6, which uncovers two main results. The first main result is about the magnitude of amplification on impact. The fiscal multiplier is approximately 10% (or equivalently 8 percentage points) larger in the economy with non-homothetic preferences on impact: this result is quantitatively similar to the one from Section 4.

[18] Even if the two economies are identical in steady-state, but on the margin, households consume goods produced in different sectors, it would be hard to compare the dynamic behavior of the two economies if, for instance, the goods in the marginal consumption basket were simply "cheaper" in steady-state than the goods in the average consumption basket.

The amplification coming from non-homothetic preference is even larger when we calibrate the model using the marginal consumption shares estimated with the approach from Orchard, Ramey, and Wieland (2025), as we show in Appendix A.6.

The results obtained in the simplified model with perfectly rigid prices do not necessarily provide an upper bound to the amplification of our mechanism. Indeed, flexibility in prices comes with flexibility in wages, and since sectors with many HTM workers have steeper Phillips curves, inflation can further redistribute toward HTM households.

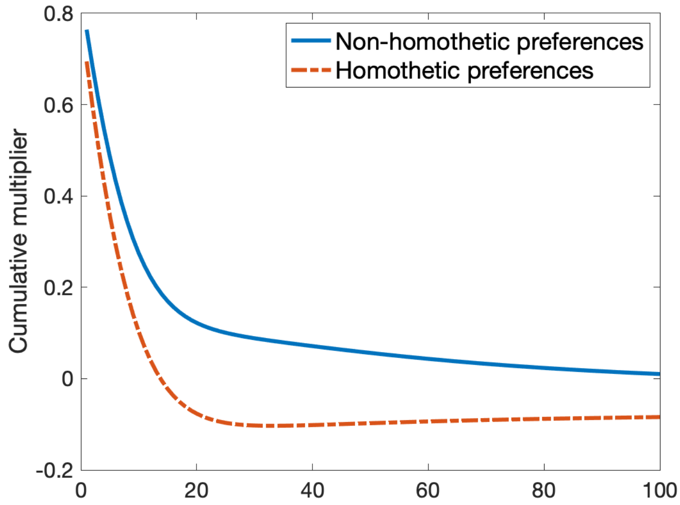

Figure 6: Cumulative fiscal multipliers for the economy with non-homothetic preferences (solid line) and with homothetic preferences (dashed line). On the x-axis, time is expressed in number of periods from the shock, which occurs at $t = 0$.

The second result concerns the long-run cumulative multiplier, which is also larger in the economy with non-homothetic preferences. We find that the long-run cumulative multiplier is negative in the model with homothetic preferences, while it is close to zero when preferences are non-homothetic. This result is surprising because, when transfers are untargeted, we typically expect a full reversal of the initial boom when taxes are levied to repay the initial transfers.[19] Instead, inflation triggers new redistribution forces that explain the larger cumulative response in the non-homothetic economy.[20] Specifically, because in the non-homothetic economy, demand is biased

[19] To clarify the role of redistribution in affecting the cumulative multiplier, in Appendix A.8 we show that, if transfers are explicitly targeted towards HTM households, the cumulative fiscal multiplier is positive even in a one-sector homothetic TANK economy.

[20] One well-known redistribution force triggered by inflation is the devaluation of nominal assets (Fisher effect). Since in our steady-state we have zero nominal debt, we abstract from this channel and focus on the redistribution operating through the consumption network.

towards HTM sectors, such sectors will experience stronger wage increases. Thus, the average wage of HTM households increases relative to the average wage of PIH households. Moreover, as it will be made more clear in the next section, the redistribution channel that operates through wage inflation is amplified by the heterogeneity in the slope of the Phillips curve across sectors: wages will increase more markedly than output in sectors with a steeper Phillips curve, which are exactly the sectors with more HTM households.

If one also considers that wage inflation, as opposed to increases in hours, is persistent, the economy behaves as if the fiscal stimulus was partially targeted toward HTM households, even if everyone receives the same transfer. This result is reminiscent of recent findings in Angeletos, Lian, and Wolf (2024), which find that deficits can finance themselves through a cumulative output increase when there is redistribution across generations, which they achieve through an OLG structure.

5.3 Inflation Dynamics

In this section, we use our full quantitative model to study the inflationary effects of fiscal transfer, building on the analytical insight discussed in Section 4.

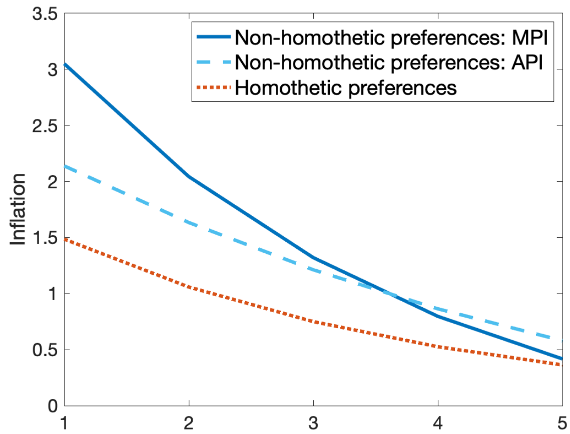

Figure 7: Impulse responses of Inflation for different price indexes. Inflation of the API and MPI (*average* and *marginal* consumption basket price index) in the economy with homothetic preferences (dotted line). Inflation of the API in the economy with non-homothetic preferences (dashed line), and inflation of the MPI in the economy with non-homothetic preferences (solid line).

There is no unique price index in a multi-sector economy with heterogeneous agents. We focus our attention on two consumer price indexes, as they are intuitively similar to the CPI. More precisely, define the marginal price index (MPI) and the average price index (API) as

$$API_t = \left(\sum_s ACS_s \times p_{st}^{1-\eta}\right)^{\frac{1}{1-\eta}} \tag{31}$$

$$MPI_t = \left(\sum_s MCS_s \times p_{st}^{1-\eta}\right)^{\frac{1}{1-\eta}} \tag{32}$$

where ACS_s and MCS_s denote, respectively, the average consumption share and the marginal consumption shares of sector s. Note that in the homothetic economy, $ACS_s = MCS_s$, and the two price indexes coincide.

Figure 7 shows the impulse response of inflation for different price indexes in the two economies. The inflation rate for the marginal price index is more than double in the non-homothetic economy than in the homothetic case. MPI inflation amplification occurs through two channels. First, since the fiscal multiplier is larger in the non-homothetic economy, then prices will also increase more. Second, in the non-homothetic economy, marginal consumption is biased towards sectors with more HTM households, and these sectors have a steeper Phillips curve as shown in Section 4.3. Therefore, for the same increase in sectoral output, wages and prices will increase more in the non-homothetic case.

Complementarities in production, by weakening the substitution response to price increases in HTM sectors, strengthen the propagation of the inflationary pressure that arises from the second channel. These mechanisms also amplify the response of inflation for the average price index, which is somewhat surprising and gives a sense of how strong the inflationary pressure of the shock is in the non-homothetic economy. Indeed, the average price index inflation weights less the sectors where households spend on the margin in the non-homothetic case, and in principle, there is no reason why that should also be larger than in the homothetic case where the average price index is weighting more sectors where households spend on the margin, since $MCS_s = ACS_s$.

To illustrate how inflationary dynamics drive redistribution across households, Figure 8 plots the inflation occurring on impact in each sector after an untargeted fiscal transfer. We notice two patterns. First, even in the counterfactual model with homothetic preferences, prices rise faster in sectors with a high fraction of HTM households. This is the sectoral Phillips curve mechanism at work: as illustrated analytically in Section 4.3, sectors with more HTM households have steeper Phillips curves. Therefore, even if the shock hits all sectors homogeneously, prices rise more in high HTM sectors. Second, in the model with non-homothetic preferences, calibrated to match the empirical evidence on the marginal consumption basket, inflation is even higher in high HTM sectors. This is because, as documented in Section 2.2, marginal expenditure is biased towards high-HTM sectors, and these sectors will thus experience a boom in demand and inflation after a fiscal shock.

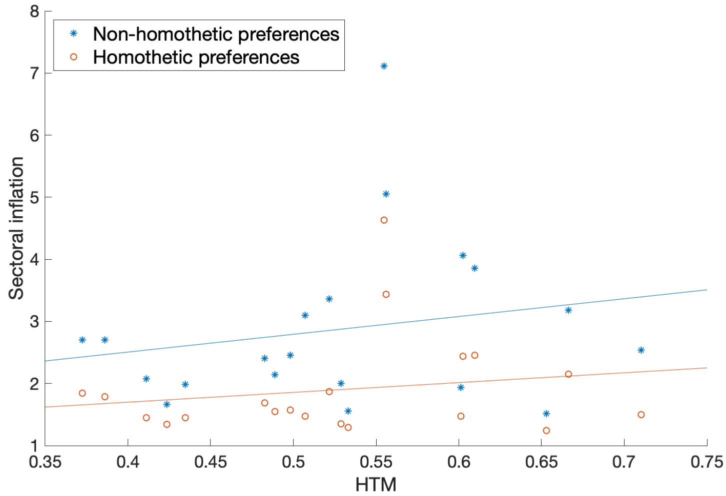

Figure 8: The figure plots, for each sector, the realized inflation on impact against the share of HTM households in that sector. The blue stars plot sectoral inflation in the economy with non-homothetic preferences, while the orange circles plot sectoral inflation in the counterfactual economy with homothetic preferences. We set 10 as the upper limit on the y-axis.

The residual variation around the regression lines in Figure 8 is driven by two additional forces shaping inflation at the sectoral level. First, the model is calibrated to include realistic input-output networks, so sectors downstream to high-inflation sectors will experience a surge in input costs which could lead to higher sectoral inflation. Second, the slope of the sectoral Philipps curve in Equation (20) depends on the elasticity of labor demand of firms in sector s, ζ_{st}, which, when we allow for input-output networks, is a function of the labor share of the sector, as outlined in Equation (21).

6 Sectoral Phillips curves

In this section, we provide empirical evidence on the heterogeneity in the slope of the sectoral Phillips curve across U.S. industries. Consistent with the theoretical predictions in Section 4.3, we show that sectoral Phillips curves are steeper in industries employing a larger share of hand-to-mouth (HTM) households.

Estimating the slope of the Phillips curve poses three well-known challenges. First, the endogeneity of monetary policy and possible regime shifts make aggregate estimates difficult to interpret, as changes in policy systematically respond to inflation and output fluctuations. Second, while inflation responds to both demand and supply shocks, it is important to isolate the variation driven by demand shocks. Third, demand shocks tend to be persistent, so reduced-form estimates may conflate temporary and long-lived fluctuations in activity.

Recent work has proposed strategies to address some of these issues by exploiting cross-sectional variation instead of aggregate data. Studies such as Fitzgerald et al. (2024), McLeay and Tenreyro (2020), Hazell et al. (2022), and Cerrato and Gitti (2022) estimate regional Phillips curves using variation across U.S. regions. The key advantage of disaggregated data is that the central bank sets a single national interest rate and thus cannot offset regional or sectoral demand shocks, reducing the simultaneity problem.

We extend this cross-sectional approach to a multi-sector setting. Specifically, we exploit variation across three-digit industries within the same two-digit sector, holding fixed the aggregate monetary environment.[21]

Our estimation strategy closely follows Hazell et al. (2022), combining disaggregated data, instrumental variables, and the assumption that the driving variable follows an AR(1) process. We estimate the sectoral Phillips curve:

$$\pi_{st} = \kappa_s n_{st} + \beta E_t \pi_{st+1} + \nu_{st}, \tag{33}$$

where π_{st} denotes sectoral inflation and n_{st} measures sectoral activity, proxied either by employment growth or by the sectoral unemployment rate following Şahin et al. (2014).

Following Hazell et al. (2022), we assume that n_{st} follows an AR(1) process, which implies a straightforward mapping between reduced-form and structural parameters:

$$\pi_{st} = \psi_s n_{st} + E_t \pi_{t+\infty} + \omega_{st}, \tag{34}$$

with $\psi_s = \frac{\kappa_s}{1-\beta\rho_n}$, where ρ_n denotes the autocorrelation of n_{st}. This adjustment corrects for the bias induced by the persistence of demand fluctuations.

To address the remaining challenge—separating demand- from supply-driven changes in sectoral activity—we adopt an instrumental variable that exploits input–output linkages between industries, an approach related to Shea (1993). The instrument relies on the idea that when downstream sectors expand, they raise demand for intermediate

[21] We drop observations in which a three-digit industry coincides with a two-digit industry—that is, when a two-digit sector has no further three-digit subclassification.

goods from upstream suppliers, generating exogenous variation in upstream activity that is primarily demand-driven. We discuss the instrument and its validity in detail in the next Section.

In Section 6.1, we begin by estimating the average slope of the sectoral Phillips curve across industries. In Section 6.2, we then turn to our main result: the slope of the Phillips curve is systematically steeper in sectors employing a larger share of hand-to-mouth households.

6.1 Average slope of the sectoral Phillips curve

We begin by estimating the average slope of the sectoral Phillips curve across industries. To this end, we estimate equation (35), which relates sectoral inflation π_{st} to sectoral employment growth n_{st}, controlling for sector and time fixed effects:

$$\pi_{st} = \psi \times n_{st} + \alpha_s + \gamma_t + \omega_{st} \tag{35}$$

The inclusion of sector fixed effects α_s absorbs time-invariant differences across industries, such as structural characteristics that affect the level or volatility of sectoral inflation. Time fixed effects γ_t capture aggregate shocks and common macroeconomic conditions that may influence all sectors simultaneously, such as changes in monetary policy or economy-wide demand fluctuations. This specification, therefore, isolates the within-sector, over-time relationship between employment growth and inflation.

We measure sectoral inflation π_{st} using data for the annual sectoral output price deflator for industries at the three-digit NAICS level between 1990 and 2019, made available by the Bureau of Labor Statistics. We measure n_{st} as the growth rate in annual employment for each industry using data from the Bureau of Labor Statistics.

In another set of specifications, we replace employment growth n_{st} with a measure of the sectoral unemployment rate that we construct using data from the Current Population Survey and a methodology illustrated in Şahin et al. (2014). When using the unemployment rate as a measure of the output gap, we estimate the following equation:

$$\pi_{st} = -\psi \times u_{st} + \alpha_s + \gamma_t + \omega_{st} \tag{36}$$

Estimating the slope of the Phillips curve requires separating demand-driven from supply-driven fluctuations in sectoral activity. A simple regression of inflation on employment growth or sectoral unemployment would yield biased estimates of the parameter ψ. To address this issue, we use an instrumental variables approach that aims to isolate changes in sectoral activity driven by demand factors.

Our instrument exploits the input–output linkages between industries. The idea is straightforward: when downstream sectors expand, these sectors demand more intermediate inputs from their upstream suppliers. This increased demand raises activity in upstream sectors. Crucially, our instrumental variable approach allows us to plausibly identify demand shocks, as both supply and demand shocks in downstream sectors are perceived as demand shocks by upstream sectors. Concretely, let Δ_{sk} denote the share of sector s's output sold as intermediate goods to sector k, measured using the Input–Output Accounts from the Bureau of Economic Analysis (BEA). We then construct an instrument for sectoral employment growth as a weighted average of employment growth in downstream sectors, where the weights are given by Δ_{sk}:

$$\tilde{n}_{st} = \sum_{d \neq s} \Delta_{sd} n_{dt} \tag{37}$$

As an illustrative example, consider the steel industry (upstream) and the automotive industry (downstream). When the automotive industry expands, car producers hire more workers and demand more steel. This demand shock increases steel production and employment, even if there has been no change in steel productivity. In this way, variation in downstream employment provides a source of demand-driven changes in upstream activity.

The key identifying assumption is that employment growth in downstream industries affects upstream inflation only through its impact on upstream demand. Put differently, conditional on time and industry fixed effects, downstream employment growth is uncorrelated with contemporaneous supply shocks in upstream industries.

A potential concern with the instrument $\tilde{n}_{st}$ that we presented so far is that input–output linkages are not purely vertical.[22] Returning to the steel–automotive example, while employment growth in the auto industry increases the demand for steel, the automotive industry could potentially also supply inputs to the steel industry. In this case, a productivity shock that lowers steel prices could reduce input costs for car producers, increasing employment in the automotive industry, and thus feed back into our instrument. As a result, the baseline instrument may inadvertently capture upstream supply shocks.

A further concern arises if the upstream sector s is a large supplier to its down-

[22] It is common that, given two industries s, s', industry s supplies some inputs to sector s' and sector s' also supplies some inputs to sector s. Moreover, it is also common that firms in industry s supply input to other firms in industry s.

stream industries. In this case, a supply shock in s could directly affect production costs in downstream sectors, which would in turn show up as changes in downstream employment. If such downstream employment changes are then used to instrument for n_{st}, the instrument would be contaminated by supply shocks originating in s itself.

In addition to these concerns, violations of the exclusion restriction may also arise from correlated supply shocks and their transmission through the input–output network. For example, if both the steel and auto industries rely on a common upstream supplier, such as the energy sector, a productivity improvement in energy would simultaneously lower costs for both steel and auto producers. In this case, an employment expansion in autos may partly reflect a supply shock originating in energy, which would then contaminate the instrument for steel. More generally, productivity shocks in upstream sectors can propagate forward through lower input prices, raising demand in downstream sectors and thereby mimicking the effects of a demand shock.

To address these issues, we construct a more robust version of our instrument in the spirit of Baqaee et al. (2023), which we denote by $\widehat{n}_{st}$, where we exclude input–output links that risk such reverse or reciprocal transmission. Specifically, we drop any downstream sector d from the construction of the instrument for sector s whenever (i) sector d sells more than 1 percent of its output to sector s ($\Delta_{ds} \geq 0.01$), or (ii) sector s supplies more than 5 percent of inputs used by sector d ($\delta_{ds} \geq 0.05$). The first restriction ensures that sector d is not also an upstream sector for sector s, addressing the issue that input–output linkages are not purely vertical. The second restriction prevents supply shocks in sector s from being major drivers of changes in downstream employment. These thresholds balance the need to mitigate identification concerns with the requirement of retaining enough sectoral linkages to construct a valid instrument. We verify that our main results are not sensitive to changes in these cut-offs.

$$\widehat{n}_{st} = \sum_{d \neq s} \mathbf{1}[\Delta_{ds} < 0.01 \;\; \wedge \;\; \delta_{ds} < 0.05] \, \Delta_{sd} \, n_{dt} \tag{38}$$

Finally, to address the issue of potentially correlated supply shocks, we incorporate the "forward equations" from Baqaee and Rubbo (2023). Our identification strategy relies on the backward propagation of demand in quantities: expansions in downstream sectors raise demand for the output of upstream industries. The forward equation provides a complementary control by capturing the forward propagation of supply shocks through prices: when an upstream productivity improvement lowers prices, it induces higher input demand in downstream sectors. In practice, we enrich our baseline specification in equation (35) by controlling for the term π_{st}^F:

$$\pi_{st}^F = \sum_{u \neq s} \delta_{su} \pi_{ut}$$

that captures changes in the output prices of upstream industries, where δ_{su} denotes the share of sector u among the suppliers of sector s.

	OLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
Panel A: sectoral employment growth				
κ	0.085***	0.073***	0.150***	0.122***
	(0.033)	(0.026)	(0.055)	(0.038)
ψ	0.132*	0.247**	0.548**	0.413**
	(0.051)	(0.087)	(0.201)	(0.129)
Panel B: sectoral unemployment rate				
κ	0.011	0.063**	0.125***	0.088***
	(0.014)	(0.026)	(0.035)	(0.030)
ψ	0.104	0.808*	1.616***	1.136**
	(0.123)	(0.331)	(0.452)	(0.381)
Instrument	No	$\tilde{n}_{st}$	$\widehat{n}_{st}$	$\widehat{n}_{st}$
Controls	No	No	No	π_{st}^F
Time FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 3: Slope of the Sectoral Phillips Curve. The table reports OLS and 2SLS estimates of ψ from equations (35) in Panel A and (36) in Panel B, with standard errors clustered at the three-digit industry level. We use $\kappa = \psi(1-\beta\rho_n)$ to map point estimates for ψ into estimates of the slope of the Phillips curve κ. The autocorrelation coefficient ρ_n is re-estimated for each specification. Each sector is weighted by its average level of employment. The sample includes years from 1990 to 2019.

	(1)	(2)	(3)	(4)
Robustness Panel A: cutoffs for Δ_{ds}				
κ	0.122***	0.118*	0.091***	0.062*
	(0.038)	(0.049)	(0.026)	(0.026)
$\Delta_{ds} <$	0.01	0.02	0.1	0.5
Robustness Panel B: cutoffs for δ_{ds}				
κ	0.122***	0.118***	0.058	0.044
	(0.038)	(0.034)	(0.037)	(0.038)
$\delta_{ds} <$	0.05	0.06	0.2	0.5
Instrument	$\widehat{n}_{st}$	$\widehat{n}_{st}$	$\widehat{n}_{st}$	$\widehat{n}_{st}$
Controls	π^F_{st}	π^F_{st}	π^F_{st}	π^F_{st}
Time FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 4: Robustness to alternative construction of the instrument $\widehat{n}_{st}$ for different cutoffs of δ_{ds}, Δ_{ds}. Sectoral employment growth is used as a measure of the output gap. The table reports 2SLS estimates of $\kappa = \psi(1-\beta\rho_n)$. The autocorrelation coefficient ρ_n is re-estimated for each specification. Standard errors are clustered at the three-digit industry level. Each sector is weighted by its average level of employment. The sample includes years from 1990 to 2019.

Estimates of the reduced form coefficient ψ and the structural parameter κ are reported in Table 3. Panel A uses sectoral employment growth as a measure of output gap, thus estimating equation (35). Panel B uses the sectoral unemployment rate as a measure of output gap, thus estimating equation (36). The first column reports OLS estimates. The second column reports estimates obtained using the simple instrument $\tilde{n}_{st}$ defined in equation (37). The third and fourth columns report estimates obtained using our preferred instrument $\widehat{n}_{st}$ defined in equation (38), where the fourth column also controls for the "forward propagation" of supply shocks by including the control π^F_{st}.

Across specifications, the estimated structural slope κ is consistently small —on the order of one tenth— with 2SLS estimates in Columns 2-4, which isolate sectoral demand shocks, yielding values that are closely aligned whether the output gap is measured by sectoral employment growth or by the sectoral unemployment rate. Our preferred 2SLS estimates of κ lie between the two slopes estimated in Rubbo (2023) for the same 1990–2020 period: the CPI Phillips curve slope of 0.085 and the "Divine

Coincidence" price index slope of 0.16. The reduced-form coefficients ψ are of comparable magnitude to those reported by Hazell et al. (2022) for the regional Phillips curve.

Finally, Table 4 shows that estimates of the structural slope κ are robust to modest perturbations of the cutoff rules $\Delta_{ds} < 0.01$ and $\delta_{ds} < 0.05$ used in constructing the instrument $\widehat{n}_{st}$. Column 1 reports our baseline using sectoral employment growth as a measure of output gap; Column (2), which applies closely related thresholds, yields virtually identical estimates. By contrast, Columns 3 and 4 indicate that loosening these cutoffs leads to smaller estimates of κ, consistent with greater contamination from supply-side propagation in the instrument that biases the slope toward zero.

6.2 Heterogeneity in the slope of the sectoral Phillips curve

In the previous section, we proposed a novel approach to estimate the slope of the sectoral Phillips curve with disaggregated data and instrumental variables. In this section, we extend that approach to provide novel empirical evidence about the heterogeneity of the slope of the Phillips curve across sectors.

The main goal of this empirical analysis is to test the model prediction that the sectoral Phillips curve is steeper in sectors with a large fraction of HTM employees (Section 4.3). To this end, we allow the reduced form coefficient ψ to differ for sectors with a share of HTM workers above or below the mean. We further corroborate our finding by showing how the slope of the sectoral Phillips curve is also different in sectors with a high frequency of price adjustments, using data from Pasten, Schoenle, and Weber (2020), and that our result that sectors with a high HTM share have steeper Phillips curve is robust to controlling for the heterogeneous frequency of price adjustment. We denote by fpa_s the frequency of price adjustment in sector s and by H_s the share of employees in sector s that is HTM.

Across the three specifications reported in Table 5, we report group-specific slopes κ for the sectoral Phillips curve separately in Panel A (sectoral employment growth) and Panel B (sectoral unemployment rate). Column 1 splits sectors by the share of hand-to-mouth workers H_s; Column 2 splits them by the frequency of price adjustments fpa_s; Column 3 conditions on both dimensions jointly. Column 1 shows a markedly steeper Phillips curve in sectors with a high share of HTM employees, providing evidence in support of the model prediction. In Panel A, which uses sectoral employment growth as a measure of output gap, we find that the sectoral Phillips curve is approximately 50% larger in sectors with more HTM workers. In Panel B, which uses the unemployment rate as a measure of output gap, we find that the sectoral

Phillips curve is almost twice as step in sectors with more HTM workers. Column 2 indicates that the slope is also steeper in sectors with more frequent price changes, as a standard menu cost model would predict. While not directly relevant to our mechanism, the results in Column 2 provide additional validation for our estimation strategy. Finally, Column 3 shows that conditioning jointly on H_s and fpa_s leaves the H_s gradient essentially intact—κ remains about 50% larger using employment growth and almost twice as steep using unemployment—indicating that the steeper slope in sectors with a large share of HTM employees is not driven by heterogeneity in the frequency of price changes.

	(1) HTM	(2) Freq. of price adj.	(3) HTM and freq. of price adj.
Panel A: Sectoral employment growth			
$\kappa(H_s \leq \text{mean})$	0.093^{*}	—	0.092
	(0.040)		(0.048)
$\kappa(H_s > \text{mean})$	0.143^{**}	—	0.139^{**}
	(0.047)		(0.046)
$\kappa(fpa_s \leq \text{mean})$	—	0.119^{**}	0.150
		(0.042)	(0.086)
$\kappa(fpa_s > \text{mean})$	—	0.182^{*}	0.197^{*}
		(0.086)	(0.084)
Panel B: Sectoral unemployment rate			
$\kappa(H_s \leq \text{mean})$	0.064^{*}	—	0.060^{*}
	(0.025)		(0.022)
$\kappa(H_s > \text{mean})$	0.122^{**}	—	0.116^{**}
	(0.033)		(0.028)
$\kappa(fpa_s \leq \text{mean})$	—	0.096^{**}	0.076
		(0.032)	(0.039)
$\kappa(fpa_s > \text{mean})$	—	0.121^{*}	0.132^{**}
		(0.051)	(0.046)

Table 5: Slope of the sectoral Phillips Curve as a function of the share of employees in the sector who are HTM and the frequency of price adjustments in that sector. Standard errors are clustered at the three-digit industry level. We use $\kappa = \psi(1-\beta\rho_n)$ to map point estimates for ψ into estimates of the slope of the Phillips curve κ. The autocorrelation coefficient ρ_n is re-estimated for each specification. Each sector is weighted by its average level of employment. The sample includes years from 1990 to 2019.

7 Conclusions

In this paper, we combine data and theory to study the role of consumption heterogeneity in propagating output and inflation. We document a new *biased expenditure channel*, that operates through a consumption network by endogenously redistributing income towards hand-to-mouth households during aggregate booms, thus amplifying the effects of aggregate shocks. We show analytically what are the key elements of the consumption network, and we measure them using household data from CEX and the PSID. Crucially, we find that households spend their marginal income disproportionately in sectors whose employees have higher MPC. We build a Multi-Sector, Two-Agent, New Keynesian model enriched with non-homothetic preferences to match these empirical findings. The model yields an insightful analytical characterization of the fiscal multiplier. This allows us to transparently quantify the importance of our mechanism and test its significance: the *biased expenditure channel* raises the fiscal multiplier by approximately 10pp, and this increase is statistically significant at the 99% level.

Our model also uncovers novel implications of household heterogeneity for the propagation of inflation. We show analytically that sectors with more HTM households, who demand stronger wage increases when the sector expands, have a steeper Phillips curve. We provide empirical evidence that confirms the model's prediction, building on a recent literature that uses cross-sectional variation to estimate the Phillips curve. Quantitatively, the *biased expenditure channel* and the heterogeneity in the slope of sectoral Phillips curves amplify the inflationary effects of fiscal shocks by more than 100%. As aggregate booms are biased towards sectors with a steeper Phillips curve, the upward pressure on sectoral prices increases.

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Appendix (for Online Publication)

A Model Appendix and Proofs

A.1 Fiscal multiplier with input-output linkages

To derive a simple expression for the fiscal multiplier, and to highlight how it depends on the *biased expenditure channel*, we focus on the perfectly rigid wages limit of the model. For ease of exposition, we first derive the generic analytical expression with input-output linkages, and then, in the next section (Appendix A.2), we restrict to the subcase with no IO linkages reported in the main body of the paper.

To achieve perfectly rigid wages, we set $\phi \to \infty$ in the union problem laid out in (19). Note that from the optimal pricing rule in (15), this condition also implies perfectly rigid prices. This assumption also rules out any dynamics coming from the unions' block of the model. Another important restriction is to consider *untargeted* fiscal transfers fully funded with government debt, that is, $\rho_B \to 1$, so that the government pays lump-sum transfer T_0^i in period 0 to each type i, using only future lump-sum taxes $-T_t^i$ proportional to T_0^i to pay the interest on government debt. Note that, since PIH households are Ricardian, this assumption implies that they have a zero MPC out of the government transfer in $t = 0$, as their permanent income is unchanged, a result we show formally in the proof of Proposition A.1. The absence of a response by PIH households rules out any dynamics associated with the Euler equation. Since unions' first-order conditions and households' Euler equation are the only dynamic equations in our model, it follows that any result implied by these assumptions will be static. We consider a steady-state where government debt is zero. We further impose $\varepsilon \to \infty$, which implies that firms make zero profits and there are no dividend distributions. To simplify the derivation of proposition A.1, we further assume that the production function is Cobb-Douglas, meaning $\nu = \gamma = 1$. This is without loss of generality, given the assumption of perfectly rigid prices.

Proposition A.1 explicitly characterizes the first-order effect on aggregate output of untargeted transfers fully funded with government debt. Before formally stating the result, let us provide some notation. To be consistent with the data, and specifically with BEA input-output tables, we define aggregate value added as the sum of value added across industries.[23] Sectoral value added is defined as the difference between total output and the composite bundle of intermediates. In the Cobb-Douglas case, sectoral value added is just a share ω_s of sectoral output.

Because of the way we modeled non-homotheticity in households' preferences, the marginal consumption share of sector s, defined in (25), is simply equal to α_s.

$$MCS_s = \frac{d(p_s m_s + p_s c_s)}{d(P_M M + P_C C)} = \alpha_s \tag{25}$$

Let us denote by $\mathcal{C}, \mathcal{T}, \mathcal{H}$ three matrices, with size $S \times S$. We define $\mathcal{C}$ in (39) as the matrix of the consumption network, whose column s maps an increase in production in sector s to an increase in demand in all the other sectors. When production in sector s increases by one unit, the labor income of workers in sector s increases by the labor share ω_s. For each dollar increase in labor income, household expenditure in sector s increases by MPC_s. Though MPC_s is an endogenous equilibrium object, we show in the proof of Proposition A.1 that $MPC_s = H_s$ after an *untargeted* fiscal transfer, since HTM households spend all the extra income, while PIH households do not change their consumption in response to the shock.[24] Therefore, household expenditure increases by $\omega_s H_s$, and a fraction α_k of this increase is spent on sector k's goods.

We define $\mathcal{H}$ in (40) as a matrix that maps per-capita fiscal transfers to workers in sector s into an increase in demand in all the other sectors. When per-capita lump-sum transfers are constant, $\mathcal{H}$ depends on the size of the sector λ_s because large sectors will generate more demand following the same per-capita transfer. Finally, the matrix $\mathcal{T}$ captures the input-output structure of the economy. When production in sector s increases by one unit, firms in sector s increase their intermediate demand by the intermediate share, $(1-\omega_s)$, and this demand is directed across sectors depending on

[23] This definition comes naturally and with fewer concerns than it would in a model with flexible prices. Moreover, the distinction between nominal and real variables is not relevant when working in deviations from steady state, because prices are fully rigid.

[24] The result that PIH households don't change their consumption in response to the shock is more than a Ricardian equivalence. PIH households not only do not respond to the transfer, since they anticipate higher future taxes, but they also do not respond to the economic boom. The reason is that the initial boom reverts to a small recession in future periods since HTM workers cut back consumption to pay the tax. Under rigid prices, this equilibrium persistent recession is precisely large enough that the cumulative discounted output response is zero. Therefore, the permanent income of PIH households is unchanged even after accounting for GE effects.

the input shares δ_{sk}.

$$\{\mathcal{C}\}_{ks} = \alpha_k \omega_s H_s \tag{39}$$

$$\{\mathcal{H}\}_{ks} = \alpha_k H_s \lambda_s \tag{40}$$

$$\{\mathcal{T}\}_{ks} = (1-\omega_s)\delta_{sk} \tag{41}$$

Finally, let us denote by $\boldsymbol{\omega}$ the $(S \times 1)$ vector of labor shares ω_s. This vector is needed to map the changes in sectoral output into changes in sectoral value added.

Proposition A.1: *Consider a stationary equilibrium, with $\phi \to \infty$, $\varepsilon \to \infty$, and $B_{-1} = 0$. The first-order effect of untargeted transfers on the vector of sectoral output, on impact, is is characterized by:*

$$\boldsymbol{dy} = (\mathcal{I} - \mathcal{C} - \mathcal{T})^{-1}(\mathcal{H}\boldsymbol{dT}) \tag{42}$$

and the first-order effect on aggregate output, on impact, is characterized by:

$$dY = \boldsymbol{\omega}' \underbrace{(\mathcal{I} - \mathcal{T} - \mathcal{C})^{-1}}_{\text{amplification}} \underbrace{(\mathcal{H}\, \boldsymbol{dT})}_{\text{first round}} \tag{43}$$

Proof

Suppose that the economy is hit by a fiscal transfer $\boldsymbol{dT}$, which is untargeted across households within each sector but could be generically targeted across sectors. To study the propagation of such shock in our simplified demand-driven framework, it is sufficient to study the demand equation (14). Compared to (14), we can simplify the relative prices of different varieties within a sector, which are all equal in equilibrium. Therefore, the demand for goods of variety in sector k is:

$$y_{kt} = m_k + \alpha_k \left(\frac{P_{kt}}{P_t}\right)^{-\eta} C_t + \sum_s \delta_{sk} \left(\frac{P_{kt}}{PPI_{st}}\right)^{-\gamma} (1-\omega_s) \left(\frac{PPI_{st}}{PC_{st}}\right)^{-\nu} \frac{y_{st}}{Z_{st}} \tag{44}$$

Assuming that the production function is Cobb-Douglas, and dropping time indices for notational convenience, leads to a further simplification:

$$y_k = m_k + \alpha_k \frac{P}{P_k} C + \sum_s \delta_{sk} \frac{PC_s}{P_k} (1-\omega_s) \frac{y_s}{Z_s} \tag{45}$$

Notice that since $\varepsilon \to 0$, $P_s = W_s$. Thus, given the Cobb-Douglas assumption, we get that $PC_s = P_s Z_s$. Therefore (45) becomes:

$$P_k y_k = P_k m_k + \alpha_k \left(\sum_s \lambda_s P c_s \right) + \sum_s \delta_{sk}(1-\omega_s) P_s y_s \tag{46}$$

Differentiating (46) we get:

$$d(P_k y_k) = d(P_k m_k) + \sum_s \alpha_k \lambda_s d(P c_s) + \sum_s \delta_{sk}(1-\omega_s) d(P_s y_s) \tag{47}$$

The key object we need to pin down is $d(Pc_s)$, the change in household discretionary expenditures. By definition of MPC, the change in expenditure is equal to the product of household MPC to the change in household disposable income, inclusive of the transfer. We will discuss at the end of the derivation an explicit formulation of MPC for each type of household. In addition to the transfer, the disposable income changes because of the endogenous change in labor income. In an environment with zero profits, this simply equals the change in sectoral sales, multiplied by the labor share and divided by the mass of households in the sector. Therefore, we get the following expression for the change in consumption expenditures:

$$d(P c_s) = MPC_s d(DI_s) = MPC_s \omega_s \frac{1}{\lambda_s} d(P_s y_s) + MPC_s dT_s \tag{48}$$

Plugging (48) into (47), and noticing that with fixed prices the expenditure on subsistence goods does not change, we obtain:

$$d(P_k y_k) = \underbrace{\sum_s \alpha_k MPC_s \omega_s d(P_s y_s) + \sum_s \delta_{sk}(1-\omega_s) d(P_s y_s)}_{\text{amplification}} + \underbrace{\sum_s \alpha_k MPC_s \lambda_s dT_s}_{\text{first round}} \tag{49}$$

What is the average MPC in each sector? For HTM households the answer is simple: since they consume any amount of income they receive, their MPC is equal to one: $MPC^{HTM} = 1$. Moreover, for a transfer shock fully funded by debt, we have that, on impact:

$$d(P c^{s,HTM}) = d(W_s n_s) + d(T^{s,HTM}) \tag{50}$$

For PIH households, we claim that $MPC^{PIH} = 0$, as it would be in a standard TANK model in response to a fiscal transfer. First, since the interest rate is constant over time because of perfectly rigid prices, the consumption of PIH is also constant over time.

Therefore, in response to a transfer shock total consumption of PIH can either stay constant, permanently increase, or permanently decrease. From the lifetime budget constraint of PIH we have

$$d(Pc^{s,PIH}) = \frac{r}{1+r}\sum_{n=0}^{\infty}\left[\frac{1}{(1+r)^n}d\left(DI_{t+n}\right)+d\left(T_{t+n}^{s,PIH}\right)\right] \tag{51}$$

That is, PIH households internalize higher future taxes. Our approach is to guess and verify that $d\left(Pc^{s,PIH}\right)=0$. If consumption of PIH is constant over time (49) becomes a static equation. Further, notice that (49) can be seen as the row k of a matrix. For compactness, let us denote by $\boldsymbol{dy}$ the vector of changes in sectoral nominal output. Then, under our guess, H_s equals the average MPC in each sector in response to a fiscal shock, and we obtain:

$$\boldsymbol{dy} = \mathcal{C}\boldsymbol{dy} + \mathcal{T}\boldsymbol{dy} + \mathcal{H}\boldsymbol{dT} \tag{52}$$

which implies:

$$\boldsymbol{dy} = (\mathcal{I}-\mathcal{C}-\mathcal{T})^{-1}(\mathcal{H}\boldsymbol{dT}) \tag{42}$$

where, as described in detail in Section 4, we have:

$$\{\mathcal{C}\}_{ks} = \alpha_k\omega_s H_s \tag{39}$$

$$\{\mathcal{H}\}_{ks} = \alpha_k H_s\lambda_s \tag{40}$$

$$\{\mathcal{T}\}_{ks} = (1-\omega_s)\delta_{sk} \tag{41}$$

notice that in $\mathcal{C}$ and $\mathcal{H}$ we have imposed our guess that $MPC_s = H_s$.

We now proceed to verify our guess. In practice, we combine (42) and the per-period budget constraint of the government to compute the elements on the RHS of (51) and show that they sum to zero.

A fiscal transfer $\boldsymbol{dT}$ fully financed by debt requires that in the future the tax rate τ is set such that $WN\tau = r\mathbb{1}'\boldsymbol{dT}$. Since labor income taxes are proportional to income, under the maintained assumption of perfect wage rigidity, this tax scheme is equivalent to a negative tax rebate of $r\mathbb{1}'\boldsymbol{dT}$ in our setting. Therefore, we can immediately summarize the changes in output over time by using our expression in (42):

$$\boldsymbol{dy}_t = (\mathcal{I} - \mathcal{C} - \mathcal{T})^{-1}(\mathcal{H}\boldsymbol{dT}) \tag{53}$$

$$\boldsymbol{dy}_{t+n} = -r \times (\mathcal{I} - \mathcal{C} - \mathcal{T})^{-1}(\mathcal{H}\boldsymbol{dT}) \quad \text{for } n \geq 1 \tag{54}$$

One can now use these two expressions to evaluate the RHS of (51), which verifies the guess $d\left(Pc^{s,PIH}\right) = 0$. Intuitively, future taxes simply undo the initial transfer in present discounted terms. Therefore, the permanent income of PIH households is unchanged, and they do not respond to the fiscal transfer.[25]

Finally, notice that we can map sectoral output into aggregate output by summing sectoral value added. In each sector, a fraction ω_s of production is value-added, while a fraction $(1 - \omega_s)$ of the value comes from input purchase. Therefore:

$$dY = \boldsymbol{\omega}'\boldsymbol{dy} = \boldsymbol{\omega}'(\mathcal{I} - \mathcal{C} - \mathcal{T})^{-1}(\mathcal{H}\boldsymbol{dT}) \tag{43}$$

A.2 Proof of Proposition 1

We now derive Proposition 1, which is effectively the special case of Proposition A.1 when abstracting from input-output networks, a simplification that allows to derive the intuitive expression for the fiscal multiplier in Equation (1).

Proposition 1. *Consider a stationary equilibrium with no input-output linkages, perfectly rigid prices ($\phi \to \infty$), perfect substitution across varieties ($\varepsilon \to \infty$), and zero government debt ($B_{-1} = 0$). Suppose further that fiscal policy is fully financed by debt: $\rho_B \to 1$. Then, the first-order effect of untargeted transfers on the vector of sectoral output, on impact, is is characterized by:*

$$dy \;=\; (\mathcal{I} - \mathcal{C})^{-1}(\mathcal{H}\boldsymbol{dT}) \tag{28}$$

and the first-order effect on aggregate output, on impact, is characterized by:

$$dY \;=\; \frac{\overline{MPC}}{1 - \left[\overline{MPC} + \widetilde{\text{cov}}\big(MPC_s,\, MCS_s - ACS_s\big)\right]} \tag{1}$$

Proof

We start from the general expressions with IO networks derived in Proposition A.1,

[25] A corollary of this proof is that it provides an expression for the cumulative fiscal multiplier, defined as the present discounted sum of changes in output. When wages are perfectly rigid and the fiscal transfer is untargeted, the cumulative fiscal multiplier is zero. Appendix A.8 covers this aspect in greater detail.

(42) and (43), and we make the simplifying assumption that there are no IO networks ($\delta_{sk} = 0, \forall s,k$). Therefore, $\mathcal{T} = 0$ and $\boldsymbol{\omega} = \mathbb{1}$. The vector of sectoral output responses in Equation (42) simplifies directly to yield Equation (28):

$$dy \;=\; (\mathcal{I} - \mathcal{C})^{-1}(\mathcal{H}\boldsymbol{dT}) \tag{28}$$

The general fiscal multiplier in Equation (43) simplifies instead to:

$$dY = \mathbb{1}'\boldsymbol{dy} = \mathbb{1}'(\mathcal{I} - \mathcal{C})^{-1}(\mathcal{H}\boldsymbol{dT}) \tag{55}$$

Let us now proceed to the derivation of (1). First of all, recall that, when $\boldsymbol{\omega} = \mathbb{1}$, we get $\mathcal{C}_{sk} = \alpha_s H_k = \alpha_s MPC_k$ and $\mathcal{H}_{sk} = \alpha_k MPC_s \lambda_s$.

Let $\boldsymbol{\alpha}$ be the vector of marginal consumption shares, $\boldsymbol{\beta}$ be the vector of marginal propensities to consume, and $\boldsymbol{\gamma}$ be a vector whose entries are $\gamma_k = MPC_k\lambda_k$. Then, we can rewrite $\mathcal{C} = \boldsymbol{\alpha}\boldsymbol{\beta}'$, which is the average MPC weighted by the marginal consumption shares, and $\mathcal{H} = \boldsymbol{\alpha}\boldsymbol{\gamma}'$.

Notice that

$$(I - \mathcal{C})^{-1} = I + \frac{1}{1-c}\mathcal{C}$$

where $c = \sum_s \alpha_s MPC_s = \boldsymbol{\alpha}'\boldsymbol{\beta}$.

Therefore, the fiscal multiplier reads:

$$\begin{aligned} dY &= \omega'(\mathcal{I} - \mathcal{C})^{-1}(\mathcal{H}\boldsymbol{dT}) \\ &= \mathbb{1}'(\mathcal{I} + \frac{1}{1-c}\mathcal{C})(\mathcal{H}\boldsymbol{dT}) \\ &= \mathbb{1}'\mathcal{H}\boldsymbol{dT} + \mathbb{1}'\frac{1}{1-c}\mathcal{C}(\mathcal{H}\boldsymbol{dT}) \\ &= \underbrace{\mathbb{1}'\boldsymbol{\alpha}}_{=1}\boldsymbol{\gamma}'\boldsymbol{dT} + \frac{1}{1-c}\underbrace{\mathbb{1}'\boldsymbol{\alpha}}_{=1}\underbrace{\boldsymbol{\beta}'\boldsymbol{\alpha}}_{=c}\boldsymbol{\gamma}'\boldsymbol{dT} \\ &= \underbrace{\boldsymbol{\gamma}'\boldsymbol{dT}}_{\text{first-round}} + \underbrace{\frac{c}{1-c}\boldsymbol{\gamma}'\boldsymbol{dT}}_{\text{amplification}} \\ &= \frac{1}{1-c}\boldsymbol{\gamma}'\boldsymbol{dT} \end{aligned} \tag{56}$$

The relevant multiplier for first-round expenditures is the transfer-weighted MPC

$MPC^{TW} = \boldsymbol{\gamma}'\boldsymbol{dT}$, while further rounds of expenditures are governed by c, the MCS-weighted MPC, since households receive additional income depending on sectoral MCS.

Let us now focus on the denominator, which captures the amplification of additional rounds of expenditure. We want to open up the definition of c, the MCS-weighted MPC, to show how non-homotheticity matters, that is, to highlight how differences between ACS and MCS affect the value of c and of the fiscal multiplier. Using the definition of c we get:

$$
\begin{aligned}
c &= \sum_s \alpha_s MPC_s \\
&= \sum_s ACS_s MPC_s + \sum_s (\alpha_s - ACS_s) MPC_s \\
&= \overline{MPC} + \sum_s (MCS_s - ACS_s) MPC_s \\
&= \overline{MPC} + \widetilde{\text{cov}}\big((MCS_s - ACS_s), MPC_s\big)
\end{aligned} \tag{57}
$$

where we denoted $\widetilde{\text{cov}}\big((MCS_s - ACS_s), MPC_s\big) = S \times \text{cov}\big((MCS_s - ACS_s), MPC_s\big)$. Notice that to have the covariance term appear, we made use of the fact that $\sum_s (MCS_s - ACS_s) = 0$.

Therefore, the fiscal multiplier to a generic transfer scheme is:

$$
dY = \frac{MPC^{TW}}{1 - [\overline{MPC} + \widetilde{\text{cov}}\big((MCS_s - ACS_s), MPC_s\big)]} \tag{58}
$$

The numerator $MPC^{TW} = \boldsymbol{\gamma}'\boldsymbol{dT}$, which is the weighted average MPC of the economy using as weights the composition of the fiscal transfer, simply reflects the fact that when a fiscal transfer is targeted toward high-MPC households, the fiscal multiplier becomes larger.

In the absence of IO networks and firm profits, we have that labor income in each sector equals sector sales. Because the sales of sector s are a fraction ACS_s of total sales, we also get that total labor income of households in sector s is a fraction ACS_s of aggregate labor income, and therefore household-specific labor income is a fraction $\frac{1}{\lambda_s} ACS_s$ of total labor income. That is, $W_s n_s \lambda_s = W_s N_s = ACS_s \sum_k W_k N_k$, where $\sum_k W_k N_k$ is the level of expenditure in the economy. If a fiscal transfer of one dollar is distributed in proportion to household labor income, $dT_s = \frac{1}{\lambda_s} ACS_s$ then we obtain that $MPC^{TW} = \boldsymbol{\gamma}'\boldsymbol{dT} = \sum MPC_s \lambda_s dT_s = \sum MPC_s ACS_s = \overline{MPC}$.

Therefore, the fiscal multiplier to a transfer proportional to labor income reads:

$$dY = \frac{\overline{MPC}}{1 - [\overline{MPC} + \widetilde{\text{cov}}\big((MCS_s - ACS_s), MPC_s\big)]} \tag{1}$$

In the case of an untargeted fiscal multiplier, we can use the result in Appendix A.1 that $MPC_s = H_s$, and we can thus also rewrite (1) as:

$$dY = \frac{\overline{H}}{1 - [\overline{H} + \widetilde{\text{cov}}\big((MCS_s - ACS_s), H_s\big)]} \tag{59}$$

which is only a function of parameters.
Notice that the role of S in $\widetilde{\text{cov}}$ is simply that of scaling. For example, if we move from two-digit to three-digit NAICS, the consumption shares are mechanically going to get smaller, reducing the level of the covariance term. The term S simply corrects for this mechanical change in the covariance.

A.3 Sector-Specific Spending Multipliers

The analysis in this paper is mostly focused on aggregate fiscal shocks and their amplification through sectoral dynamics. However, the heterogeneity in MPC we uncover in the data also raises questions regarding the effects of sector-specific spending shocks. Thanks to the characterization of the fiscal multiplier to a generic transfer in equation (28), we can provide a clear answer to this question.

Under the same assumptions of Proposition 1, we can study the effect on aggregate output of targeted transfer to workers in sector s fully funded with government debt ($dT_s = 1, \quad dT_j = 0 \quad \forall j \neq s$). The first-order effect of such fiscal shock, on impact, is characterized by (60):

$$dY = \underbrace{\frac{1}{1 - \left[\overline{MPC} + \widetilde{\text{cov}}(MPC_s, MCS_s - ACS_s)\right]}}_{\text{second-rounds}} \underbrace{MPC_s}_{\text{first-round}} \tag{60}$$

Equation (60) shows that targeting high-MPC sectors gives the greatest bang for the buck, thanks to a higher first-round expenditure MPC. The second-round term is identical to that of the aggregate spending multiplier. This should not be surprising:

once the first-round expenditures are set in motion, the initial source of the shock is irrelevant in our model.

To make the role of targeting even starker, we now study the effect of targeted transfer in sector s, funded by levying a tax proportional to labor income in all sectors ($dT_s = 1 - \frac{w_s N_s}{WN}, \quad dT_j = -\frac{w_j N_j}{WN} \quad \forall j \neq s$). The first-order effect of such measure, on impact, is characterized by (61).

$$dY = \underbrace{\frac{1}{1 - \left[\overline{MPC} + \widetilde{\text{cov}}(MPC_s, MCS_s - ACS_s)\right]}}_{\text{second-rounds}} \underbrace{(MPC_s - \overline{MPC})}_{\text{first-round}} \tag{61}$$

When the transfer is financed by concurrent taxation, as in (61), we find that the transfer is expansionary if and only if it targets a sector with a higher MPC than average. Intuitively, targeting a low-MPC sector would be equivalent to redistributing towards low-MPC households, and would provoke a recession.

A.4 Inflation and Sectoral Phillips Curves

The source of nominal rigidity in our economy is the wage adjustment cost in the union equation. As shown in Auclert, Rognlie, and Straub (2024), the first-order condition of the union can be rearranged to obtain a wage Phillips curve. In this section, we extend their derivation to our setting with a multi-sector economy. Following essentially the same steps, we obtain a sectoral Phillips curve. Then, we combine it with the spending of hand-to-mouth households to obtain the expression for the Phillips curve in Proposition 2, characterizing how its slope depends on the share of hand-to-mouth households.

A.4.1 Derivation of the sectoral Phillips Curves

The optimality condition of unions in sector s can be rearranged to yield the following sectoral non-linear wage Phillips curve:

$$\pi^w_{st}(1+\pi^w_{st}) = \frac{\zeta_{st}}{\phi} n_{st}\left[v_N(n_{st}) - U'(C_s)\frac{W_{st}(1-\tau_t)}{P_{st}}\frac{\zeta_{st}-1}{\zeta_{st}}\right] + \beta \pi^w_{st}(1+\pi^w_{st}) \tag{62}$$

where $U'(C_s)$ is the average marginal utility of P_t dollars across the two agents,[26] and $\zeta_{st} = -\frac{\partial N_{st}}{\partial W_{st}}\frac{W_{st}}{N_{st}}$ is the elasticity of labor demand.

Given the absence of IO networks and TFP shocks, the pricing equation implies that we can interchangeably talk about sectoral wage or price inflation: $\pi^w_{st} = \pi_{st}$. In this proof, we choose to keep the superscript for clarity, although we drop it when presenting the main result in Proposition 2. Now, we will impose two of the assumptions of Proposition 2 to derive a simple expression for the linear Phillips curve. First, we assume that there are no input-output networks. This is useful in our setting because ζ_{st}, the elasticity of labor demand, collapses to the parameter ε, capturing the elasticity of substitution across varieties, as illustrated in equation (21). Second, we assume that fiscal expenditures are fully financed by debt, and no tax is levied on households, $\tau = 0$.

Under such assumptions, we can plug the functional form for the utility of consumption and disutility of labor into (62) and linearize the expression to obtain the linear Phillips curve:

$$\pi^w_{st} = \upsilon^w_s \left[\psi \hat{N}_{st} - \hat{Z}_{st} + \sigma \hat{C}_{st} \right] + \beta \pi^w_{s,t+1} \tag{63}$$

where

$$\upsilon^w_s = \frac{\varepsilon}{\phi} n_s^{1+\psi}$$

A.4.2 Proof of Proposition 2

To study the inflationary effect of spending shocks, we simplify the expression of the linear Phillips curve in (63) by ignoring TFP shocks ($\hat{Z}_{st} = 0$) and by assuming that only hand-to-mouth agents respond to the temporary spending shock by changing their consumption level. Appendix A.1 proves this result exactly for the case with fixed prices. With partial nominal rigidities, we need to rely on an approximation. Since in the steady state all households consume the same quantity,[27] $\hat{C}^{pih}_s = 0$ im-

[26] We follow the notation of Auclert, Rognlie, and Straub (2024). Our functional form for utility is $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$. Then, we will set $U'(C_s) = C_s^{-\sigma}$, where $C_s = [(1-H_s)c^{-\sigma}_{s,pih} + H_s c^{-\sigma}_{s,htm}]^{-\frac{1}{\sigma}} = U^{-\frac{1}{\sigma}}$, so that $U'(C_s)$

[27] Since hours are rationed, labor income is identical among HTM and PIH households. Furthermore, we are focused on a zero liquidity steady state with $B_{-1} = 0$ and on a case with $\varepsilon \to \infty$, therefore, PIH households receive no income from bond holdings and no dividend rebates in the steady state. Without such assumptions, we would simply need to keep track of the relative importance of HTM and PIH

plies $\hat{C}_{st} = H_s \hat{C}_s^{htm}$.

Linearizing the budget constraint of the hand-to-mouth households in (18) leads to:

$$\hat{C}_{st}^{htm} = \frac{W_s n_s}{PC_s^{htm}}(\hat{N}_{st} + \hat{W}_{st}) - \frac{P^M M}{PC_s^{htm}} \hat{P}_t^M - \hat{P}_t + \frac{dT_t}{PC_s^{htm}} \tag{64}$$

We now evaluate this expression on impact, so that the deviations from steady state of the price indexes are simply the inflation measure corresponding to that price index.[28] Evaluated on impact, we obtain the following impact sectoral IS equation:

$$\hat{C}_{st}^{htm} = \frac{W_s n_s}{PC_s^{htm}}(\hat{y}_{st} + \pi_{st}^w) - \frac{P^M M}{PC_s^{htm}} \pi_t^M - \pi_t + \frac{dT_t}{PC_s^{htm}} \tag{65}$$

where π_t^M and π_t are, respectively, the inflation rates corresponding to the subsistence and the marginal consumption baskets.

Considering the case with constant TFP, we can plug in the impact sectoral IS equation (65) into the sectoral PC equation (63), to get the expression in Proposition 2:

$$\pi_{st}^w = \upsilon_s^w \left[\psi \hat{y}_{st} + \sigma H_s \underbrace{\left(\frac{W_s n_s}{PC_s^{htm}}(\hat{y}_{st} + \pi_{st}^w) - \frac{P^M M}{PC_s^{htm}} \pi_t^M - \pi_t + \frac{dT_t}{PC_s^{htm}} \right)}_{\hat{c}_t^{s,HTM}} \right] + \beta \pi_{s,t+1}^w \tag{66}$$

This equation pins down sectoral wage inflation as a function of the sectoral output gap, transfer shock, and aggregate inflation indexes. Again, recall that given the absence of IO networks and TFP shocks, we get that $\pi_{st}^w = \pi_{st}$.

A.4.3 Inflation Leontief

In this subsection, we manipulate (66) to obtain an expression for the Inflation Leontief of the economy.

expenditures, and we would have $\hat{C}_{st} = H_s \frac{C_s^{htm}}{C_s} \hat{C}_s^{htm}$.

[28] In subsequent periods, the inflation terms in equation (29) should be replaced with the cumulative inflation, that is, the percentage deviation of the price index from the steady state. We choose to provide the result on impact, which delivers the clearest intuition.

First of all, we can rewrite (66) as in (30):

$$\pi^w_{st}(1-\xi_s) = \upsilon^w_s\Big(\psi + \sigma H_s \frac{W_s n_s}{PC^{htm}_s}\Big)\hat{y}_{st} - \upsilon^w_s \sigma H_s \Big(\frac{P^M M}{PC^{htm}_s}\pi^M_t + \pi_t\Big) + \upsilon^w_s \sigma H_s \frac{dT_t}{PC^{htm}_s} + \beta \pi^w_{s,t+1} \tag{30}$$

where recall that $\xi_s = \upsilon^w_s \sigma H_s \frac{W_s n_s}{PC^{htm}_s}$.

Then, we can rewrite (30) in vector form as:

$$\pi^w_{st}(1-\xi_s) = a_s \hat{y}_{st} + \boldsymbol{b}_s \hat{\boldsymbol{\pi}}_t + d^\pi_s \frac{dT_t}{PC^{htm}_s} + \beta \pi^w_{s,t+1}$$

where

$$a_s = \upsilon^w_s\Big(\psi + \sigma H_s \frac{W_s n_s}{PC^{htm}_s}\Big)$$

$\boldsymbol{b}_s$ is a row vector whose entries are

$$b_{sk} = \upsilon^w_s \sigma H_s \Big(\frac{P_k m_k}{PC^{htm}_s} + \alpha_k \big(\frac{P_k}{P}\big)^{1-\eta}\Big)$$

and

$$d^\pi_s = \upsilon^w_s \sigma H_s$$

Finally, we can aggregate the sectoral inflation equations to obtain the representation of the inflation Leontief:

$$(I - \Xi_\pi)\boldsymbol{\pi}_t = A\hat{\boldsymbol{y}}_t + B\boldsymbol{\pi}_t + D_\pi d\hat{\boldsymbol{T}} + \beta \boldsymbol{\pi}_{t+1} \tag{67}$$

where Ξ_π is a diagonal matrix with entries $\Xi_\pi(s,s) = \xi_s$, D_π is a diagonal matrix with entries $D_\pi(s,s) = d^\pi_s$, and B is a matrix with rows $\boldsymbol{b}_s$. For compactness, we have rewritten the fiscal shock as $d\hat{T}$, where $d\hat{T}_s = \frac{dT_s}{PC^{htm}_s}$ is the fiscal transfer as a proportion of discretionary expenditures.

More compactly, we can write the Inflation Leontief as in (68):

$$\boldsymbol{\pi}_t = (I - \Xi_\pi + B)^{-1}(A\hat{\boldsymbol{y}}_t + D_\pi d\hat{\boldsymbol{T}} + \beta \boldsymbol{\pi}_{t+1}) \tag{68}$$

A.4.4 Linearized sectoral demand equation

To derive the aggregate Phillips curve, we need to combine the inflation Leontief in (68) with an expression for $\hat{y}_{st}$. In the main body of the paper, we have derived an expression for dY in equation (42) linearizing sectoral demand equations. We need to deviate from (42) for two reasons. First, (42) is derived under the assumption of rigid prices, while here we are deriving the joint responses of output and inflation to a fiscal shock. Second, (42) is in levels, which is more elegant when working with fixed prices, but not suitable for working with prices. To overcome these limitations, we linearize (6) without assuming fixed prices, working under the same assumptions of Proposition 2. Since we are interested in the case without IO networks, which substantially simplifies our analysis, equation (6) reads:

$$y_{st} = m_s + \alpha_s \left(\frac{P_{st}}{P_t} \right)^{-\eta} C_t \tag{6}$$

Noticing that m_s is constant, we obtain a linearized version of (6) as:

$$\hat{y}_{st} = \frac{c_s}{y_s} \left(-\eta [\hat{P}_{st} - \hat{P}_t] + \hat{C}_t \right) \tag{69}$$

where $\frac{c_s}{y_s} = \frac{\alpha_s (P_s/P)^{-\eta} C}{m_s + \alpha_s (P_s/P)^{-\eta} C} \in [0,1]$. This ratio captures the discretionary demand component of a sector, a notion related to its cyclicality, which is higher the larger its discretionary demand α_s and the smaller its subsistence demand m_s.

Using our assumption that only HTM households respond to a fiscal shock, we can write $\hat{C}_t = \sum_k H_k \frac{C_k^{htm}}{C} \hat{C}_{kt}^{htm} = \sum_k H_k \hat{C}_{kt}^{htm}$, where the last step follows because in our steady state HTM and PIH households consume the same quantity. We have derived an expression for $\hat{C}_{kt}^{htm}$ on impact after a fiscal shock, in (65). We can thus use such expression and evaluate (69) on impact, so that price deviations from the steady state can be rewritten as an inflation term:

$$\hat{y}_{st} = \underbrace{\frac{c_s}{y_s}}_{\text{cyclicality}} \left(\underbrace{-\eta [\pi_{st} - \pi_t]}_{\text{substitution eff.}} + \underbrace{\sum_k H_k \left[\frac{WN}{PC_k^{htm}} (\hat{y}_{kt} + \pi_{kt}) - \frac{P^M M}{PC_k^{htm}} \pi_t^M - \pi_t + \frac{dT_t}{PC_k^{htm}} \right]}_{\text{income effect}} \right) \tag{70}$$

Notice that as wages become perfectly rigid ($\phi \to \infty$), the sectoral multiplier above can be aggregated across sectors to obtain our summary statistic equation (1).[29]

[29]Notice that the sectoral fiscal multipliers in equation (70) and (71) are written in percentage deviation from SS, which is more tractable when working with flexible prices. Instead, our analytical results in Equation (1) and Section 4 were obtained in levels, which allows for simpler derivations and more intuitive results when prices are fixed.

Finally, (70) can be written in matrix form as a flexible-price Fiscal Multiplier Leontief:

$$\hat{\boldsymbol{y}}_t = (1-\Xi_y)^{-1}(F\boldsymbol{\pi}_t + D_y d\hat{\boldsymbol{T}}) \tag{71}$$

where Ξ_y captures the income effects from higher output, which amplifies the fiscal multiplier in a Keynesian fashion, F captures both the income and substitution effects of inflation and D_y captures the first-round effects of transfers on consumption.

Components of the Matrices in the Output Leontief

$\Xi_y(s,k)$ captures the MPC of workers in sector k and how much of their consumption is directed toward sector s:

$$\Xi_y(s,k) = \frac{c_s}{y_s} H_k \frac{W_s n_s}{PC_k^{htm}}$$

$F(s,k)$ captures the effect of inflation in sector k on demand for sector s goods through income and substitution effects:

$$F(s,k) = \frac{c_s}{y_s}\left(-\eta[\mathbb{1}_{s=k} - q_k^P] + H_k \frac{W_s n_s}{PC_j^{htm}} q_k^P - H_k \sum_j \left[\frac{P_k m_k}{PC_j^{htm}} + q_k^P\right]\right)$$

where $q_k^P = \alpha_k \left(\frac{P_k}{P}\right)^{1-\eta}$ is the weight of sector k in the marginal consumption basket.

Finally, $D_y(s,k)$ captures the first-round expenditures of households in sector k on sector s goods:

$$D_y(s,k) = \frac{c_s}{y_s} H_k$$

A.4.5 Aggregate Phillips Curve

We have derived an inflation leontief, in (68), and a demand Leontief characterizing $\hat{\boldsymbol{y}}_t$ in (71). By combining (68) with (71), we can obtain an expression relating inflation and output across all sectors for any shock $d\hat{\boldsymbol{T}}$: an aggregate Phillips curve in our economy with fiscal shocks.

Equation (71) can be rewritten as:

$$d\hat{\boldsymbol{T}} = D_y^{-1}[(1-\Xi_y)\hat{\boldsymbol{y}}_t - F\boldsymbol{\pi}_t] \tag{72}$$

plugging (72) in the inflation equation (68), after some algebra, leads the desired result:

$$\boldsymbol{\pi}_t = \mathcal{A}\hat{\boldsymbol{y}}_t + \mathcal{B}\boldsymbol{\pi}_{t+1} \tag{73}$$

where:

$$\begin{aligned}
\mathcal{A} &= (1 - \Xi_\pi + B + D_\pi D_y^{-1} F)^{-1}[A + D_\pi D_y^{-1}(1 - \Xi_y)] \\
\mathcal{B} &= (1 - \Xi_\pi + B + D_\pi D_y^{-1} F)^{-1}\beta
\end{aligned}$$

Intuition for the Aggregate PC

Equation (73) is a relation between output and inflation that holds for any shock $d\hat{\boldsymbol{T}}$, under the assumptions of Proposition 2.

An expression for aggregate inflation can be obtained by premultiplying (73) by one's preferred choice of weighting scheme. For example, using $\{\alpha_s\}_s$ as weights would lead to the marginal price index inflation.

We now provide intuition for the elements of the matrix $\mathcal{A}$, which captures the multi-dimensional slope of the aggregate Phillips curve in (73). When the vector of sectoral output increases by one unit, the direct effect on inflation is captured by $[A + D_\pi D_y^{-1}(1 - \Xi_y)]$. A captures the direct effect of output on sectoral inflation through the Frisch and the wealth effect of workers in that sector. The term $D_y^{-1}(1 - \Xi_y)$ essentially translates units of output increases into units of the initial fiscal transfer. The reason why we care separately about whether household income has increased because of output or because of transfers is that when it comes through output, then we also have the Frisch term (as in A), while when it comes through transfers, we only have the wealth effect (as in D_π). This is also apparent in the single-dimensional Phillips curve in (29).

The denominator captures the second-round amplification of inflation. Ξ_π and B capture how each percentage point of inflation affects wage setting, respectively, through wealth effects of workers and the loss of purchasing power. $D_\pi D_y^{-1} F$ plays a similar role to the last term in the numerator, by separating the inflation increases stemming from endogenous inflation increases, which have second-round amplification through Ξ_π and B, from those stemming directly from the fiscal transfer. Specifically, $D_y^{-1} F$ maps the inflation vector into the initial transfer dT, and D_π captures its direct effect on inflation.

A.5 Demand for varieties

In the main body of the paper, we have derived consumption demand (c^i_{st}) and input demand (x_{skt}) for goods produced in different sectors. We here delve deeper into the problem faced by households and firms in choosing across varieties within a sector when purchasing consumption goods or production inputs. Ultimately, this is simply an additional CES nest. The contribution lies in showing that, despite non-homotheticity and an input-output network, we can define such a variety nest so that this layer is well-behaved and gives rise to a typical monopolistic markup.

A.5.1 Demand for consumption varieties

We now solve the optimal demand of variety j in sector s, given the total demand for sector s goods c^i_{st}. The optimal choice of varieties within each sector, for discretionary consumption $c^i_{st}(j)$, solves (74).

$$\max_{\{c^i_{st}(j)\}_j} \left(\int_0^1 c^i_{st}(j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \quad \text{s.t. } P_{st} c^i_{st} = \int_0^1 c^i_{st}(j) P_{st}(j) dj \tag{74}$$

which leads to the optimal discretionary demand:

$$c^i_{st}(j) = \left(\frac{P_{st}(j)}{P_{st}} \right)^{-\varepsilon} c^i_{st} \tag{75}$$

The optimal choice of varieties for subsistence consumption within each sector solves (76). Since all firms within a sector are equal and they charge the same price in equilibrium, we can use the same notation for the sectoral price index P_{st} in (74) and (76).

$$\max_{\{m_{ist}(j)\}_j} \left(\int_0^1 m_{ist}(j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \quad \text{s.t. } P_{st} m_{ist} = \int_0^1 m_{ist}(j) P_{st}(j) dj \tag{76}$$

The resulting demand functions for subsistence consumption is:

$$m_{st}(j) = \left(\frac{P_{st}(j)}{P_{st}} \right)^{-\varepsilon} m_s \tag{77}$$

Notice that while m_s, the subsistence level consumption of goods in sector s by households, is fixed in the preferences, households are free to satisfy this basic consumption need by shopping across different producers. Intuitively, households face a subsistence demand for food, but are free to pick whatever shop they like for their groceries. Finally, the total consumption demand for variety j of goods produced in sector s is

$$q_s(j) = \left(\frac{P_{st}(j)}{P_{st}}\right)^{-\varepsilon} \left[m_s + \alpha_s \left(\frac{P_{st}}{P_t}\right)^{-\eta} C_t\right] \tag{78}$$

$$\text{with } C_t = \sum_i c_t^i$$

A.5.2 Demand for input varieties

Demand for variety j of sector k by firms in sector s is

$$x_{skt}(j) = \left(\frac{P_{kt}(j)}{P_{kt}}\right)^{-\varepsilon} x_{skt} \tag{79}$$

where P_{kt} is the price aggregator for varieties in sector k according to (80).

$$P_{kt} = \left(\int_0^1 P_{kt}(j)^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}} \tag{80}$$

Since different firms within a sector differ only in the variety they produce, we have

$$P_{kt}(j) = P_{kt}$$
$$x_{skt}(j) = x_{skt}.$$

A.5.3 Total demand for varieties

We have shown in the previous two subsections that demand for variety j produced in sector k has two components: demand for *intermediate goods* $\sum_s x_{sk}(j)$ characterized in (81) and demand for *consumption goods* $q_k(j)$ characterized in (82), which is, in turn, the sum of subsistence and discretionary component. We report here the full expression for variety demand, which clarifies the dependence of the demand for the product of each firm on all the upper nests.

$$x_{skt}(j) = \left(\frac{P_{kt}(j)}{P_{kt}}\right)^{-\varepsilon} \delta_{sk} \left(\frac{P_{kt}}{PPI_{st}}\right)^{-\gamma} (1-\omega_s) \left(\frac{PPI_{st}}{PC_{st}}\right)^{-v} \frac{y_{st}}{Z_{st}} \tag{81}$$

$$q_{kt}(j) = \left(\frac{P_{kt}(j)}{P_{kt}}\right)^{-\varepsilon} \left[m_k + \alpha_k \left(\frac{P_{kt}}{P_t}\right)^{-\eta} C_t\right] \tag{82}$$

Therefore, the total demand for goods of variety j in sector k is:

$$y_{kt}(j) = \left(\frac{P_{kt}(j)}{P_{kt}}\right)^{-\varepsilon} \underbrace{\left[\underbrace{m_k + \alpha_k \left(\frac{P_{kt}}{P_t}\right)^{-\eta} C_t}_{q_{kt}} + \sum_s \underbrace{\delta_{sk} \left(\frac{P_{kt}}{PPI_{st}}\right)^{-\gamma} (1-\omega_s) \left(\frac{PPI_{st}}{PC_{st}}\right)^{-\nu} \frac{y_{st}}{Z_{st}}}_{x_{skt}} \right]}_{y_{kt}} \tag{14}$$

A.6 Alternative Calibration: estimates from Orchard, Ramey, and Wieland (2025)

Aggregate parameters		
Parameter	Description	Value
γ	Elasticity of substitution across sectors (firms)	0.1
η	Elasticity of substitution across sectors (households)	1
ν	Elasticity of substitution between labor inputs and intermediate goods	0.8
ε	Elasticity of substitution across varieties, within sectors	10
σ	Elasticity of intertemporal substitution	1
ψ	Frisch elasticity	2
β	Households' discount factor	0.98
ϕ	Wage rigidity, adjustment costs (scale parameter)	$\upsilon^w = 0.1$
ρ_B	Persistence of government debt	0.8
ρ_G	Persistence of government spending	0.8

Sector specific parameters		
Parameter	Description	Target
$\{H_s\}_s$	Shares of HTM households	Evidences from PSID (Section 2.1)
$\{m_s\}_s$	Shares of subsistence consumption	Evidences from CEX (Section 2.2)
$\{\alpha_s\}_s$	Shares of discretionary consumption	Evidences from CEX (Appendix B.4)
$\{\omega_s\}_s$	Labor share in production	Labor share (BEA IO tables)
$\{\delta_{sk}\}_{sk}$	Intermediates' shares in production	Intermediates' share (BEA IO tables)
$\{z_s\}_s$	Sectoral productivity	Steady-state: $p_s = 1$
$\{\lambda_s\}_s$	Measure of households in sector s	Employment by industry

Table 6: Model's parameters

In this Section, we provide quantitative results using empirical estimates of marginal consumption shares (MCS) from Appendix B.4 obtained using the estimator proposed by Orchard, Ramey, and Wieland (2025). These estimates are constructed as described in Appendix B.4, by combining detailed CEX microdata on household consumption across sectors with the approach in Orchard, Ramey, and Wieland (2025). Relative to the baseline calibration in Section 5, this exercise allows us to discipline the heterogeneity in sectoral marginal propensities to consume using estimates that do not rely on the research design of Parker et al. (2013).

We take all other parameters from the baseline calibration reported in Table 2. Hence, the only difference with respect to the benchmark model lies in the degree of heterogeneity in sectoral MCS. This exercise therefore isolates the role of empirically measured consumption heterogeneity in shaping the model's quantitative implications for fiscal transmission and inflation dynamics.

Fiscal multipliers.

Figure 9 reports the cumulative fiscal multipliers for the model calibrated using the ORW-based estimates of sectoral MCS, compared with the baseline case in Figure 6. The model calibrated with the empirical MCS distribution delivers a larger fiscal multiplier on impact and a more persistent cumulative response. Therefore, estimates of marginal consumption shares that build on Orchard, Ramey, and Wieland (2025) imply a stronger bias of marginal consumption towards high-HTM sectors, amplifying the redistribution channel.

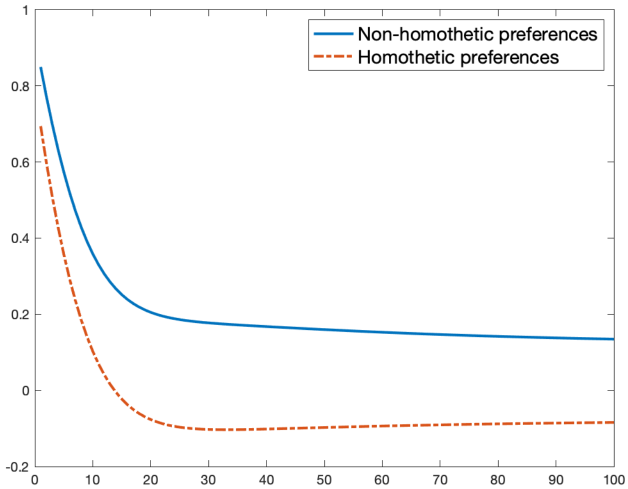


Figure 9: Cumulative fiscal multipliers using MCS estimates from Orchard, Ramey, and Wieland (2025). Solid line: model with non-homothetic preferences calibrated to ORW-based MCS. Dashed line: homothetic preferences.

Inflation dynamics.

The corresponding inflation responses are displayed in Figure 10. This alternative calibration slightly dampens the inflation response. Consequently, the inflationary impact of the fiscal transfer is dampened both in the marginal price index and in the average price index.

Overall, the model calibrated with the ORW-based estimates confirms the main quantitative conclusions of the paper. Empirical heterogeneity in marginal propensities to consume magnifies both the fiscal multiplier and the inflation response, strength-

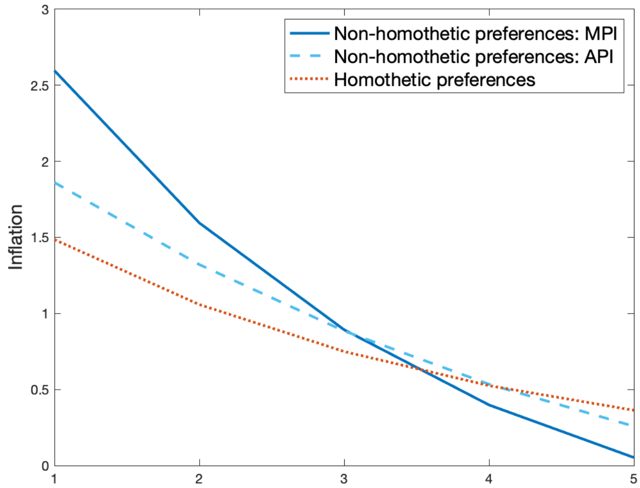


Figure 10: Inflation dynamics following a fiscal transfer using MCS estimates from Orchard, Ramey, and Wieland (2025).

ening the redistribution and amplification mechanisms emphasized in the baseline model.

A.7 Alternative Calibration: Cobb-Douglas

In this Section, we provide quantitative results for an alternative calibration where the production function and the consumption function aggregators are Cobb-Douglas. As in Section 5, we set the elasticity of substitution across sectors η equal to 1 as in Atkeson and Burstein (2008). We abstract from complementarities in production, and we set ν and γ equal to 1. In order to focus mostly on our mechanism, we consider an economy where both the intertemporal elasticity of substitution and the Frisch elasticity are equal to one, as in Berger, Bocola, and Dovis (2023). All the other parameters are the same as in the main calibration of the model.

Fiscal multiplier

As in Section 5, we consider two calibrations of the model: the baseline calibration described in Table 7, and a counterfactual calibration with homothetic preferences. In the counterfactual calibration, there is no subsistence consumption, namely $m_s = 0\ \forall s$, so that preferences are homothetic, and $\{\alpha_s\}_s$ are calibrated to match the average consumption shares from CEX. All the other parameter values are constant across the two calibrations. As a result, both models match the average consumption shares in

	Aggregate parameters	
Parameter	Description	Value
γ	Elasticity of substitution across sectors (firms)	1
η	Elasticity of substitution across sectors (households)	1
ν	Elasticity of substitution between labor inputs and intermediate goods	1
ε	Elasticity of substitution across varieties, within sectors	10
σ	CRRA	1
ψ	Frisch elasticity	2
β	Households' discount factor	0.98
ϕ	Wage rigidity, adjustment costs (scale parameter)	$\upsilon^w = 0.1$
ρ_B	Persistence of government debt	0.8
ρ_G	Persistence of government spending	0.8

Table 7: Model's parameters: Cobb-Douglas case

CEX, and the values of prices and real variables in steady-state are the same across calibrations. We consider a persistent fiscal transfer equal to 1% of aggregate real value added.

The cumulative multipliers for the economies with and without homothetic preferences are plotted in Figure 11. The results are similar to those illustrated in Figure 6. First, the fiscal multiplier is approximately 13% (or equivalently 10 percentage points) larger in the economy with non-homothetic preferences on impact.

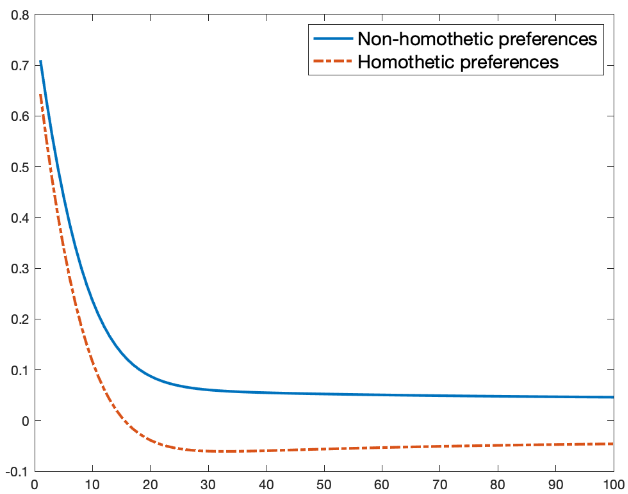


Figure 11: Cumulative fiscal multipliers for the economy with non-homothetic preferences (solid line) and with homothetic preferences (dashed line). On the x-axis, time is expressed in number of periods from the shock, which occurs at $t = 0$.

The second result concerns the cumulative multiplier, which is also larger in the economy with non-homothetic preferences, with similar magnitudes as the results in Figure 6.

Inflation Dynamics

Figure 12 shows the impulse response of inflation for different price indexes in the two economies. The inflation for the marginal price index is more than double in the non-homothetic economy compared to the homothetic case. The first two channels illustrated in the paper are still present (ie. higher output in the non-homothetic case and heterogeneity in the slope of the sectoral Phillips curve), but the third channel operating through complementarities in production is muted. Therefore, the differences in inflation of the two price indexes between the homothetic case and the non-homothetic case are slightly lower than illustrated in Figure 7.

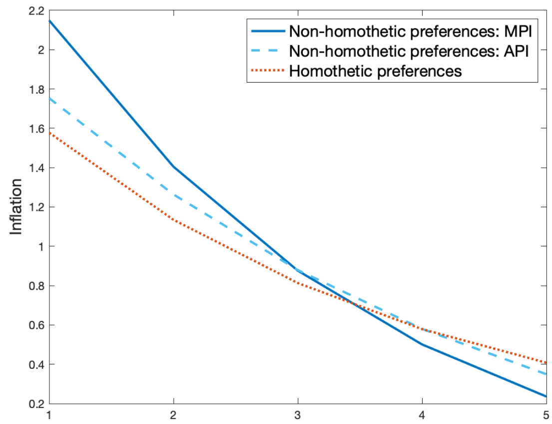


Figure 12: Impulse responses of Inflation for different price indexes: inflation of the API and MPI in the economy with homothetic preferences (dotted line), inflation of the API in the economy with non-homothetic preferences (dashed line), and inflation of the MPI in the economy with non-homothetic preferences (solid line).

A.8 Redistribution and cumulative multipliers

In the dynamic response of our economy, we find that the cumulative output response is approximately zero with homothetic preferences, while it is positive in the case of non-homothetic preferences. Intuitively, with non-homothetic preferences, a fiscal shock entails a redistribution towards HTM agents, since the marginal consumption is directed towards high-HTM sectors, and there is a wage boom in that sector. This result is reminiscent of recent research in Angeletos, Lian, and Wolf (2024), which finds that fiscal shocks can finance themselves through a cumulative output increase when there is redistribution across generations, which they achieve through an OLG structure.

To highlight more transparently the role of redistribution in shaping the cumulative multiplier, we consider a one-sector economy with homotheticity in consumption. This is a particular case of our consumption network, with $S = 1$, $m_1 = 0$, and $\alpha_1 = 1$. Alternatively, we could consider a multi-sector symmetric economy. We calibrate the economy to have half PIH households and half HTM households ($H_s = 0.5$), all employed in sector 1.

To analyze the role of redistribution, we consider a transfer shock, fully financed by debt, in which stimulus checks are either (i) *untargeted*, that is, sent to all households, (ii) *targeted* sent to HTM households only. The results of this exercise are reported in Figure 13.

The first result is that, unsurprisingly, the *targeted* fiscal transfer has a larger impact effect. This is intuitive, as we are explicitly targeting high MPC households. The more remarkable difference occurs in the dynamics. When the transfer is *untargeted*, the cumulative multiplier returns to zero, that is, the transfer creates an initial boom at the cost of a persistent slump when households have to repay the debt. Instead, when the transfer is *targeted*, the cumulative multiplier is positive: the ensuing recession is small compared to the initial boom.

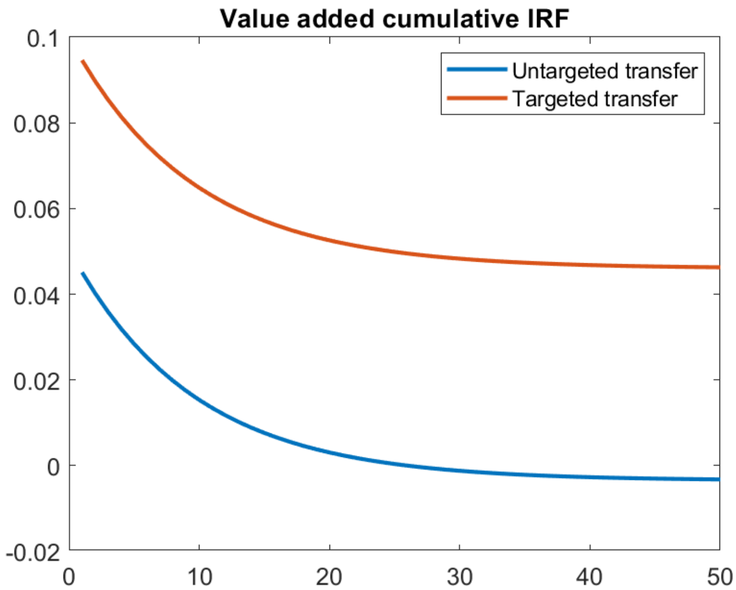


Figure 13: Cumulative Fiscal Multiplier in a one-sector TANK economy for targeted and untargeted fiscal transfer, fully funded by debt.

To gain better intuition behind the mechanism at play, Figure 14 displays the (non-cumulative) impulse responses of consumption of PIH and HTM in the two cases. If the fiscal transfer is *untargeted*, there is no redistribution. The initial boom, fueled by HTM household consumption, is fully reversed when future taxes compress their nominal income by an equivalent amount. Instead, if the transfer is *targeted*, the initial transfer is larger than the subsequent taxes from the perspective of the HTM households. Therefore, cumulative HTM consumption stays positive.

PIH consumption is essentially flat in both cases. When the transfer is untargeted, the reason is clear: their permanent income is unchanged, so PIH behave as Ricardian agents, as we have formally shown in Appendix A. Instead, at first sight, the fact that PIH consumption is also flat in the *targeted* case is puzzling: the PIH are net losers of the transfer scheme, and should therefore suffer a decline in their permanent income and cut their consumption accordingly. However, the boom created in the economy by HTM consumption, which is not fully offset by future drops in output, increases the permanent income of PIH households in a fashion that perfectly offsets the negative effects of being excluded from the fiscal transfer.

To fix ideas, consider the case of a fixed price benchmark. For each dollar of the targeted transfer, there is a redistribution of 50 cents, since the transfer will be repaid equally by the two groups of households with future taxes. Therefore, this causes a direct loss of 50 cents of permanent income for PIH agents. On the other hand, such 50 cents in net transfer raises the income of HTM in a way that is not reversed by future taxes (the HTMs are only liable to repay the remaining 50 cents). Since the fiscal multiplier associated with a transfer to HTM in this simple economy is $1/(1-H_s) = 2$, the 50-cent net transfer to HTM generates 1 dollar in extra spending and income. Thus, PIH income increases by 50 cents, since they earn half of the labor income. Therefore, when a fiscal shock causes a redistribution towards high-MPC households, this leads to a boom that is not reversed in the long run.

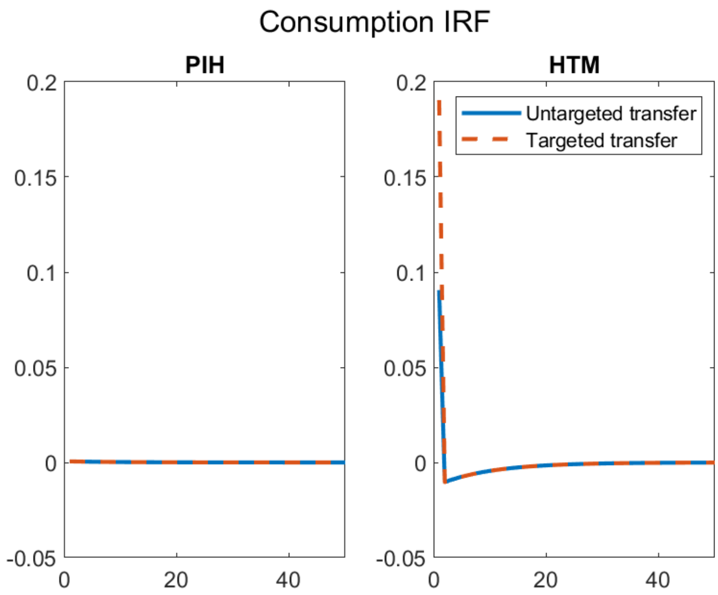


Figure 14: Consumption IRF of PIH and HTM in a one-sector TANK economy for targeted and untargeted fiscal transfer, fully funded by debt.

B Data Appendix

B.1 PSID: determinants of sectoral heterogeneity

The Panel Study of Income Dynamics (PSID) is a panel survey on income, employment, consumption, wealth, and other variables following families since 1968. From 1968 to 1996, the survey was yearly. Since 1997 the survey has taken place biennially in odd years. Since most of the employment data are only available since the survey of 2003, we only use the nine biennial surveys from 2003 to 2019. We obtain a panel with 16,685 households and 81,545 household-year observations.

The PSID reports, for both the reference person and the spouse, whether the person is working and, if so, in which sector, which is classified up to the 4-digit level using Census codes. To match these with NAICS industry codes, we use the crosswalk from the U.S. Census Bureau. This procedure matches over 99.8 percent of reported sectors in PSID.

Following Kaplan, Violante, and Weidner (2014), we classify as liquid assets the sum of checking and savings accounts, plus financial assets other than retirement accounts (money market funds, certificates of deposit, savings bonds, and Treasury bills plus directly held shares of stock in publicly held corporations, mutual funds, or investment trusts), from which we subtract liquid debt. Before 2011, liquid debt was categorized as Debt other than mortgages, while after 2011 it only includes credit card debt. Household income is computed as the sum of the labor income of both partners, government transfers, and income from own business.

In Figure 15, we report the breakdown by sector of the demographic characteristics that we used in the Probit regression of Table 1.

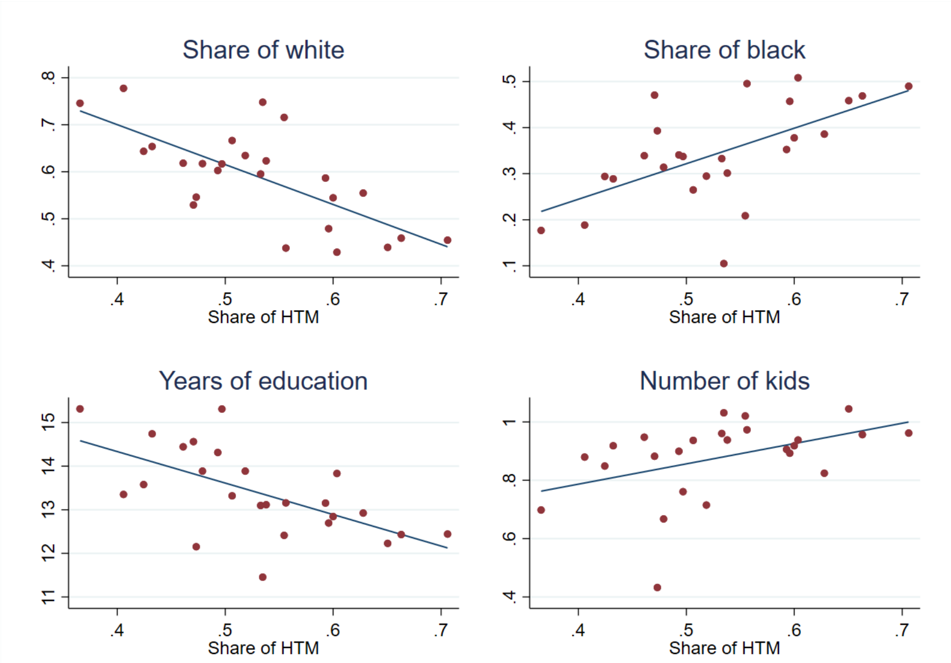


Figure 15: Sectoral characteristics at the two-digit NAICS level. The x-axis displays the share of HTM workers in each sector. The y-axis reports households' demographic characteristics in each sector. Race and years of education are those of the reference person in the household. A linear regression line is displayed.

B.1.1 Transitions in and out of HTM status

Figure 2 in Section 2.1 showed that the share of HTM workers is highly persistent across decades at the sectoral level. Here, we provide some additional details about the persistence of the HTM status at the individual level. Table 8 reports such persistence at the two- and four-year marks (that is, after one and two PSID surveys). An HTM household that is classified as HTM in a given survey has a 75 percent chance of being again classified as HTM after two years, which slightly drops to 70 percent after four years.

	2-year	4-year
HTM $\rightarrow$ HTM	0.75	0.7
non-HTM $\rightarrow$ HTM	0.26	0.27

Table 8: Transition rates out of hand-to-mouth (HTM) status over two-year and four-year horizons.

B.2 CEX: Data Description and Additional Results

The Consumer Expenditure (CE) interview survey contains data on income, demographic variables, and detailed expenditures of a stratified random sample of US households. Approximately 10,000 addresses are contacted each calendar quarter which yields approximately 6,000 useable interviews. Households are interviewed four times, at three-month intervals, about their spending over the previous three months. Particularly relevant for our analysis are data on monthly expenditure for each good category, where each good category coincides with a UCC code. In our data, there are 588 different UCC codes. We adjust expenditure in each UCC code to make aggregation coherent with personal consumption expenditure (Parker et al., 2013; Orchard, Ramey, and Wieland, 2025). Then, we follow Hubmer (2022) and use a mapping constructed in Levinson and O'Brien (2019) to map each UCC code into a NAICS industry code. This way we construct a measure of monthly expenditure by NAICS code for each household in our sample. In practice, we aggregate monthly expenditures by industry at the two-digit NAICS level. Finally, we aggregate all expenditure data at the quarterly level to reduce the amount of noise for good categories associated with low-frequency purchases.

We use data from interview surveys for the period 1997:2013. Questions about the 2008 ESPs were added to the Consumer Expenditure survey in interviews conducted between June 2008 and March 2009, which coincides with the time during which the payments were disbursed to households. Households were asked if they received any "economic stimulus payments...also called a tax rebate" and, if so, the amount of each payment they received and the date the payment was received. Let us just emphasize how the crucial aspect of our estimation strategy is that the timing of ESP disbursement was effectively randomized across households. Indeed, within each disbursement method (mostly bank account or mail), the timing of the payment was determined by the last two digits of the recipients' Social Security numbers, which are effectively randomly assigned.

We split the data into two samples: the main sample, including all the data 1997:2013, and a sub-sample with data 2007:2009. We use the entire sample to estimate the average consumption basket, and we use the sub-sample to estimate the marginal consumption basket. In Table 9, we report summary statistics on average quarterly expenditure by industry for the 2007–2009 sub-sample. We also compare expenditures between all households in the sample and those that received a tax rebate at least once during that period, and find that average expenditure levels are similar across the two groups.

The average amount received by households from ESP, conditional on receiving something, is $942 in our data, according to the last column of the first panel of Table 9. One can see that households concentrate their expenditure in some industries: Utilities (22), Manufacturing (31-33), Finance and Insurance (52), Real Estate (53), Accommodation and Food Services (72), and Other Services (81).

Households' average expenditure and estimates of β_s				
Two-digit industry	Expenditure: All Households	Expenditure: Rebate Recipients	$100 \times \hat{\beta}_s$	$100 \times \text{SE}(\hat{\beta}_s)$
Mining, 21	32.20	23.05	0.14	(0.46)
Utilities, 22	593.54	555.62	-0.45	(0.79)
Construction, 23	129.65	123.36	4.35	(3.29)
Manuf. (Food, Apparel), 31	1,624.57	1,567.59	4.21	(2.64)
Manuf. (Chemicals, Petroleum), 32	890.42	757.27	6.46	(2.41)
Manuf. (Vehicles, Machineries), 33	788.29	769.64	26.46	(14.62)
Transportation, 48	134.23	140.03	1.78	(1.84)
Warehousing, 49	3.11	2.57	0.14	(0.10)
Information, 51	359.68	335.86	0.75	(0.57)
Finance and Insurance, 52	2,032.70	1,900.12	1.08	(3.24)
Real Estate, 53	650.49	805.27	2.52	(2.87)
Professional Services, 54	109.19	113.13	0.10	(2.58)
Administrative, Support, Waste, 56	80.70	76.86	0.09	(0.51)
Educational Services, 61	186.99	234.92	1.10	(3.35)
Health Care, 62	303.11	276.94	1.43	(2.44)
Arts and Entertainment, 71	57.31	58.20	1.27	(0.65)
Accommodation and Food Services, 72	672.90	693.98	8.12	(2.47)
Other Services, 81	381.92	367.59	0.87	(2.76)

Table 9: The second column shows households' quarterly average expenditure by industry for all households in the sample 2007:2009. The third column shows households' quarterly average expenditure by industry for all households in the sample 2007:2009 who received at least one rebate. The fourth and fifth columns report point estimates and standard errors for β_s.

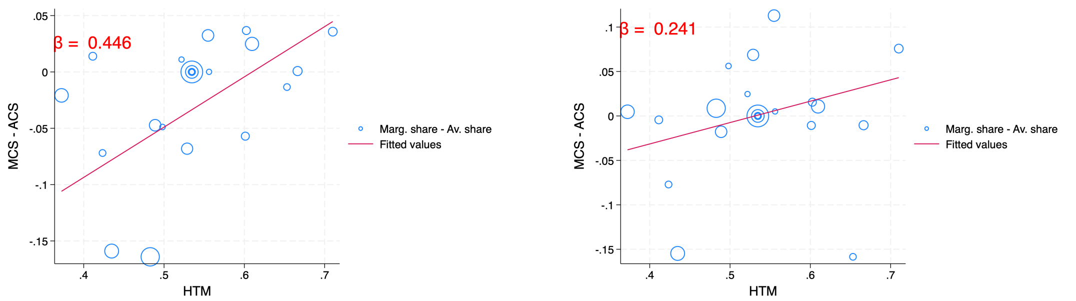
B.3 CEX: The Biased Expenditure Channel by Income Group

Our results on the biased expenditure channel should not be confused with the well-documented evidence that rich households tend to consume goods and services produced by rich households, while poor households consume those produced by poor households (Jaravel, 2018; Comin, Lashkari, and Mestieri, 2021; Jaravel and Lashkari, 2023). One might be concerned that our estimates could reflect this pattern rather than the mechanism we emphasize, especially since the 2008 tax rebates were primarily received by middle- and lower-income households.

Two features of our empirical design address this concern. First, our estimation of marginal propensities to consume (MPCs) relies exclusively on the sample of rebate recipients. Identification, therefore, comes only from variation in the timing and size of rebate payments across these households. Thus, households that receive the rebate are never compared with rebate recipients to estimate the marginal consumption shares.

Second, to provide further evidence that our results are not driven by differences across income groups, we re-estimate marginal and average consumption shares separately for households with income above and below the sample median. We then recompute the covariance term that captures the strength of the biased expenditure channel within each group, $\widetilde{\text{cov}}(MCS_s - ACS_s, HTM_s)$.

We find that this covariance remains positive and significant within both income groups. Hence, the biased expenditure channel we document does not simply reflect rich and poor households consuming different goods, but rather an intrinsic feature of how households—regardless of income—reallocate spending toward sectors employing high-MPC workers in response to transitory income shocks.



(a) Households with income below the median. **(b)** Households with income above the median.

Figure 16: Correlation between the difference in marginal and average consumption shares ($MCS_s - ACS_s$) and the share of hand-to-mouth (HTM) households employed in each industry, by income group. Each circle represents a two-digit industry, weighted by its value added.

As shown in Figure 16, the positive correlation between $(MCS_s - ACS_s)$ and the share of HTM workers (HTM_s) holds within both income groups. The left panel corresponds to households with income below the median, and the right panel to those above it. If the biased expenditure channel we document were absent, the marginal and average consumption baskets would coincide, implying $(MCS_s - ACS_s) = 0$ for all sectors. Instead, the systematic positive relationship we find within both groups confirms that the biased expenditure channel operates even when comparing households of similar income levels.

B.4 CEX: Estimates of Marginal Consumption Shares from Orchard, Ramey, and Wieland (2025)

We re-estimate the sectoral marginal consumption shares, MCS_s, using the econometric framework introduced by Orchard, Ramey, and Wieland (2025) to estimate heterogeneous consumption responses to the 2008 U.S. tax rebates. Their identification strategy builds on the randomized timing of rebate receipt across households and the staggered distribution schedule tied to the last two digits of Social Security numbers, as in Parker et al. (2013). However, their approach extends the baseline specification by showing that not controlling for lagged treatment exposure, omitting lagged spending, or pooling heterogeneous treatment effects across cohorts biases the estimated marginal propensity to consume (MPC) upward. Following their approach, we estimate heterogeneous treatment effects of rebate receipt on household consumption expenditures in the Consumer Expenditure Survey (CEX).

Specifically, we adapt main specification from Orchard, Ramey, and Wieland (2025) to estimate industry-specific consumption responses:

$$C_{i,s,t+1} - C_{i,s,t} = \sum_m \beta_{0,m,s}\, \text{month}_{m,i} + \boldsymbol{\beta}'_{1,s}\mathbf{X}_{i,t} + \sum_{e=0}^{T} \beta_{2,e,s} I(ESP_{i,t+1}) I(ESP_{i,e}) + \sum_{e=0}^{T} \beta_{3,e,s} I(ESP_{i,t}) I(ESP_{i,e}) + \beta_{4,s} C_{i,s,t} + u_{i,s,t+1}. \tag{83}$$

In this specification, $C_{i,s,t}$ denotes household i's expenditure in industry s and period t. The variable $I(ESP_{i,t})$ is an indicator equal to one if household i received an Economic Stimulus Payment (ESP) in period t, and zero otherwise. The term $\mathbf{X}_{i,t}$ includes household-level controls, such as the age of the reference person and changes in family size, while month dummies control for aggregate shocks. The inclusion of $C_{i,s,t}$ on the right-hand side accounts for lagged consumption behavior and corrects for autocorrelation in spending.

The interaction terms $I(ESP_{i,t+1})I(ESP_{i,e})$ and $I(ESP_{i,t})I(ESP_{i,e})$ allow for heterogeneous treatment effects across households that received their rebates at different times, preventing "forbidden comparisons" between treated and untreated groups emphasized by Sun and Abraham (2021) and Borusyak, Jaravel, and Spiess (2024). In the absence of these terms, standard two-way fixed-effects regressions would implicitly pool units at different stages of treatment, leading to bias in the estimated contemporaneous MPC. Controlling for lagged ESP exposure further ensures that we isolate spending responses to truly transitory income shocks, rather than to anticipated payments.

In addition, including the lagged dependent variable, $C_{i,s,t}$, mitigates serial correlation and adjusts for habit formation or smoothing motives in consumption. Failing to include this term, as noted by Orchard, Ramey, and Wieland (2025), leads to upward-biased estimates of $\beta_{2,0,s}$ because temporary spikes in consumption may persist into subsequent periods even without new income shocks. Their structural interpretation of consumption dynamics draws on insights from Kaplan and Violante (2014), emphasizing that consumption responses to transitory income shocks depend on household liquidity constraints and heterogeneity in marginal propensities to consume. By jointly controlling for lagged ESP exposure and lagged spending, the Orchard, Ramey, and Wieland (2025) specification (ORW) specification yields smaller and noisier estimates of the marginal propensity to consume compared to Parker et al. (2013).

Relative Importance Across Sectors

In our context, we use the estimated coefficients from equation (83) to construct the share of each industry s in the marginal consumption basket:

$$MCS_s = \frac{MPC_s}{\sum_j MPC_j}. \tag{84}$$

where MPC_s denotes the marginal propensity to consume towards industry s. Since our analysis focuses on the *allocation* rather than the *aggregate level* of consumption, the key object of interest is the relative share of each sector in marginal spending and not the overall marginal propensity to consume.

This normalization focuses the analysis on relative spending patterns across industries rather than on the overall level of marginal propensities to consume. Consequently, even if alternative estimators yield different absolute MPCs, our conclusions about the biased expenditure channel are unaffected as long as the implied distribution of marginal consumption shares across sectors is similar.

Comparison with Baseline Estimates

Figure 17 compares our estimated marginal consumption shares based on Parker et al. (2013) (blue bars) with those obtained using the Orchard, Ramey, and Wieland (2025) specification (red bars). Each bar represents the marginal consumption share of a two-digit NAICS industry in total household spending out of the 2008 tax rebates.

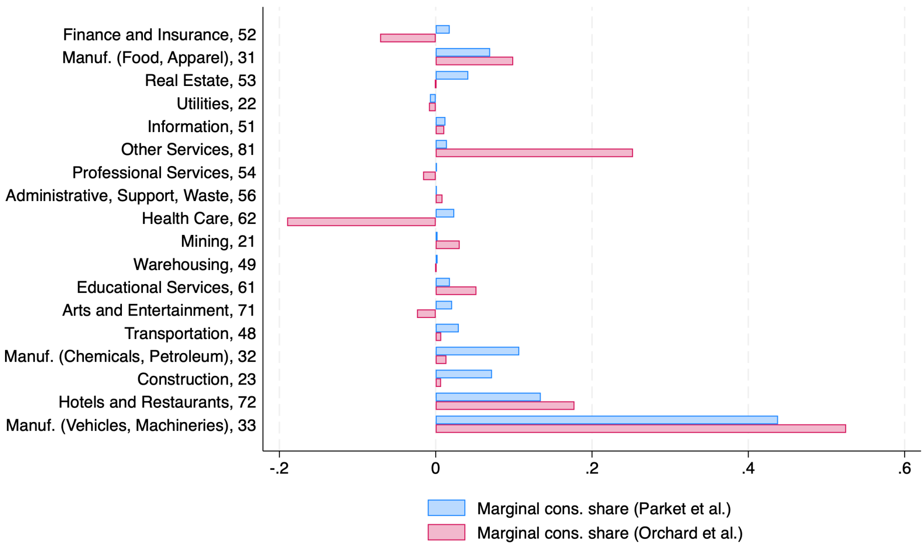


Figure 17: Comparison of sectoral marginal consumption shares estimated using Parker et al. (2013) and Orchard, Ramey, and Wieland (2025). Each bar shows the fraction of total rebate spending allocated to a given two-digit NAICS industry.

Both approaches yield broadly similar patterns of heterogeneity across sectors. Sectors producing durable goods—such as *Motor Vehicles and Machinery (NAICS 33)*—exhibit the highest marginal shares, as shown in Figure 3. Moreover, a substantial share of the marginal expenditure is tilted towards the sector *Hotels and Restaurants (NAICS 72)*, similarly to what we find using the estimator from Parker et al. (2013).

B.5 Pass-through to sectoral wages

The amplification mechanism proposed in this paper works through the consumption response of workers employed in different sectors. Crucially, for the mechanism to bite, the labor income of incumbent workers employed in a sector must respond to changes in sectoral value output. We now use sectoral wage bill data from the Quarterly Census of Employment and Wages (QCEW) to test for such pass-through. To do so, we leverage the empirical design amd IO instrument of our Phillips curve estimation outlined in Section 6. Intuitively, the slope of the sectoral Phillips curve can be interpreted as the pass-through from sectoral employment (or unemployment) growth to sectoral inflation. Similarly, we are interested in estimating the pass-through of sectoral output growth to sectoral wage inflation. We therefore use the same empirical design and instruments, but replace the growth in the sectoral wage bill on the left-hand side, and the growth in sectoral output on the right-hand side. This isolates the pass-through of changes in sectoral output that are driven by demand shocks, precisely the object of interest for our model mechanism.

Table 10 reports the estimated pass-through to changes in both real and nominal sectoral output. Across all IV specifications, the pass-through from real output to sectoral wage bill is very close to the one-to-one benchmark implied by our model. Nominal output pass-through is slightly lower, which may reflect the less persistent nature of price fluctuations, but is still above 0.5 in all IV specifications, and close to unity in some.

	OLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
Panel A: real output pass-through				
dy_{st}	0.404***	0.980***	0.930***	0.814***
	(0.0417)	(0.0937)	(0.143)	(0.177)
Panel B: nominal output pass-through				
dy_{st}	0.348***	0.883***	0.688***	0.570***
	(0.054)	(0.058)	(0.089)	(0.088)
Instrument	No	$\tilde{n}_{st}$	$\widehat{n}_{st}$	$\widehat{n}_{st}$
Controls	No	No	No	π^F_{st}
Time FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 10: Pass-through of real (Panel A) or nominal (Panel B) sectoral output growth into sectoral wage bill from QCEW. The table reports OLS and 2SLS estimates, with standard errors clustered at the three-digit industry level. The sample includes years from 1990 to 2019.

B.5.1 Pass-through and incumbent workers' wages

Changes in a sector's total wage bill reflect both the labor income response of incumbent workers and the labor income accruing to new workers hired in the sector. To further support the mechanism in our model, which abstracts from sectoral mobility, we are particularly interested in the former effect. We provide two additional pieces of evidence consistent with a pass-through to incumbent workers' wages. First, we construct a decomposition of fluctuations in the sectoral wage bill, which shows that around 70 to 80 percent of its variation is attributable to variation in hours worked and hourly wages, rather than changes in the number of employees. Second, in Subsection B.5.1, we directly study the pass-through to incumbent workers' wages.

We use information from the CPS March Supplement for the period that goes from 2001 to 2019 (Sarah Flood and Westberry (2022)) to obtain individual-level information on annual labor income annual (INCWAGE), total hours worked last week (AHRSWORKT), total weeks worked last year (WKSWORK1), employment status (EMPSTAT), and sector of employment (IND1990).[30] We use individual-level data from our CPS sample to construct the following aggregate series at annual frequencies for each sector: total number of employees N_{st}, average number of hours per employee H_{st}, average hourly wage of employees W_{st}. Given these aggregate series, the wage bill in sector s is equal to

$$\text{wage bill}_{st} = N_{st} \times H_{st} \times W_{st}$$

Let us define $g_{st}, \hat{g}_{st}$ respectively as the percentage change of the aggregate wage bill in sector s and the percentage change in sector s keeping constant the number of employees as

$$g_{st} = \log(N_{st} \times H_{st} \times W_{st}) - \log(N_{st-1} \times H_{st-1} \times W_{st-1}) \tag{85}$$

$$\widehat{g}_{st} = \log(N_{st-1} \times H_{st} \times W_{st}) - \log(N_{st-1} \times H_{st-1} \times W_{t-1}) \tag{86}$$

For each sector s we evaluate the R-squared of the regression that projects g_{st} on $\hat{g}_{st}$. The larger the R-squared of this regression, the larger the variation in the sectoral wage bill that is explained only by changes in average hours and the average wage. We report our results in Table 11

[30]We use data for this limited time periods for two reasons. First, there is a break in the aggregate time series implied by this sample in 2000, because of some changes on how data are collected. Second, there is recent evidence, as in Garin, Pries, and Sims (2018), that the relevance of sectoral shocks and the nature of sectoral fluctuations has changed over time, which is why we think it is more informative to focus on the last two decades.

	Raw data	Cyclical component
R-squared	0.81	0.68

Table 11: The table reports the average R-squared across sectors from the regression of g_{st} on $\hat{g}_{st}$. In the first column, we reported the average R-squared obtained using the raw series for $g_{st}, \hat{g}_{st}$, as they are defined in (85), (86). In the second column, we reported the average R-squared obtained using the cyclical component of $g_{st}, \hat{g}_{st}$ obtained by applying an HP-filter to the raw series defined in (85), (86).

The second test we propose is to directly measure the pass-through of changes in sectoral output into the wages of incumbent workers. To do so, we use CPS March Supplement data described in the previous subsection to construct an index of the wage level of incumbent workers at the sectoral level, following the methodology in Beraja, Hurst, and Ospina (2019). The approach consists of controlling for a series of demographic characteristics–for which we include age, education, and sex–and holding them fixed at the previous year; this ensures that changes in the wage level are due to changes within the demographic group, rather than from compositional shifts across groups which may be driven by the entry of new workers in the sector. Using this index as a proxy for the wage of incumbent workers in a sector, we measure its response to changes in sectoral output, again instrumented with our IO demand shifter. Results are reported in Table 12.

	OLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
Panel A: real output pass-through				
dy_{st}	0.0257	0.344*	0.582*	0.672*
	(0.0605)	(0.155)	(0.249)	(0.272)
Panel B: nominal output pass-through				
dy_{st}	0.0518	0.235*	0.355**	0.424**
	(0.0455)	(0.107)	(0.110)	(0.137)
Instrument	No	$\tilde{n}_{st}$	$\widehat{n}_{st}$	$\widehat{n}_{st}$
Controls	No	No	No	π_{st}^{F}
Time FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 12: Pass-through of sectoral output into sectoral weekly wage growth index calculated with CPS data using the methodology of Beraja, Hurst, and Ospina (2019). The table reports OLS and 2SLS estimates, with standard errors clustered at the three-digit industry level. The sample includes years from 1996 to 2019.