Consumer Durables and Monetary Policy According to HANK*

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October, 2025

Abstract

Durables' interest-rate sensitivity and their persistent comovement with nondurable spending are hallmarks of monetary policy transmission. We develop a two-sector HANK model that replicates this pattern—both across spending categories and among households sorted by liquid asset holdings, consistent with empirical evidence. Direct effects of real interest rate changes are quantitatively important in reproducing sectoral expenditure comovement, while infrequent information updating is crucial to match the hump-shaped dynamics of sectoral and aggregate expenditures. Income effects are essential to preventing counterfactual declines in nondurable spending resulting from fiscal interventions specifically aimed at stimulating durable purchases.

Keywords: Durable goods, sectoral comovement, monetary policy, HANK

JEL codes: E21, E31, E40, E44, E52.

*We wish to thank Felipe Alves, Yvan Becard, Davide Debortoli, Jeppe Druedahl, Francesco Saverio Gaudio, Erik Öberg, Søren Hove Ravn, Morten Ravn, Petr Sedlacek, as well as participants to the 2023 CEBRA meeting at SIPA Columbia University in NY and the 2024 Annual Conference at the Banco Central do Brasil, for useful comments.

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1 Introduction

Stimulating household expenditure on durables is widely regarded as a key channel through which monetary policy influences aggregate household spending (see, e.g., Mankiw, 1985; Erceg and Levin, 2006; McKay and Wieland, 2021). Consumer durables play a disproportionately large role in explaining variations in both household and aggregate private expenditures (see, e.g., Stock and Watson, 1999; Attanasio, 1999)—a striking feature, considering they account for only a small fraction of total private consumption.[1] Moreover, they exhibit positive and persistent comovement with the nondurable component of household expenditure, in response to monetary policy. However, standard monetary models may struggle to generate positive conditional comovement when asymmetric sectoral price rigidity drives sizable movements in the relative price of durables, thereby increasing the propensity to substitute along the durable–nondurable margin (Barsky et al., 2007).

We study the dynamics of durable and nondurable expenditures in a sticky-information Heterogeneous Agent New Keynesian (HANK) framework where households face idiosyncratic income risk and financial constraints that limit access to liquid financial assets. Under an empirically plausible calibration, the model generates realistic sectoral expenditure dynamics and comovement in response to monetary policy, along with other salient features of household spending.

Within this framework, we examine the relative contributions of different channels of monetary policy transmission: a *direct* (interest-rate) effect—which operates mainly through intertemporal substitution—and *indirect* effects that predominantly influence households' disposable income via general equilibrium effects on labor demand. Given the two-sector structure of the economy, the latter can then be separated into *pure income* and *relative-price* effects. The direct and pure income effects move durable and nondurable spending in the same direction, while the relative-price effect, by construction, shifts the allocation over different spending categories.

We calibrate the demand block of the HANK model using U.S. data and show that, in this setting, the direct effect accounts for a large share of the durable spending response to monetary policy. Pure income effects are secondary, but play a key role in driving the persistence of sectoral expenditure, particularly in nondurables. Concurrently, relative-price changes are modest in the face of monetary policy shocks, so *intratemporal* substitution has limited scope to impair comovement. Sticky information proves key to generating hump-shaped responses in line with the empirical benchmarks for sectoral expenditures. Importantly, comovement across durables and nondurables spending arises also at the household level, with income ef-

[1] Notional consumption of a certain durable good corresponds to the consumption flow derived from owning that good.

fects playing a relatively more important role in shaping the response of liquidity-constrained agents.

Using the Consumption Expenditure Survey (CEX) and the Survey of Consumer Finances (SCF), we construct sectoral expenditure series based on households' holdings of liquid asset. This enables us to analyze how durable and nondurable expenditures respond to monetary policy across household groups with direct counterparts in the model. Positive conditional comovement between durable and nondurable expenditures emerges as a defining feature for both savers and liquidity-constrained households, as in the model. This implies that sectoral comovement is not merely driven by strong income effects disproportionately affecting low-liquidity households, as embodied by standard two-agent NK (TANK) settings (e.g., Monacelli, 2009).

Controlling for income and relative prices, the empirical evidence supports the model's core transmission mechanism. The direct effect is the primary channel driving durable expenditure: both savers and liquidity-constrained households respond similarly, largely due to intertemporal substitution. In contrast, indirect effects are key to generating the persistent response in nondurable spending, particularly among liquidity-constrained households.

Embedding the demand block in a general equilibrium setting with nominal price and wage rigidities generates realistic movements in the relative price of durables under asymmetric sectoral stickiness, while remaining consistent with the partial equilibrium analysis of monetary policy transmission. We use this fully specified HANK model to study the effects of a policy that—unlike standard monetary policy shocks—induces large shifts in the relative price of durables, thereby strengthening incentives for substitution between durables and nondurables. Specifically, we examine the macroeconomic effects of a fiscal subsidy aimed at stimulating durable goods spending and show that income effects are crucial for preventing a counterfactual decline in nondurable consumption—that is, for avoiding negative comovement across expenditure categories following such an intervention. Quantitatively, the overall effect of the subsidy is at best modest, consistent with empirical evidence from temporary "cash-for-clunkers" programs (see, e.g., Mian and Sufi, 2012).

Taken together, our results deliver some important implications for both monetary and fiscal policy. Once consumer durables are explicitly modeled, the *direct* effect of a monetary policy shock becomes quantitatively first-order for expenditure dynamics—unlike otherwise-standard HANK models with only nondurables, where income effects typically dominate the response of *nondurable* expenditure (e.g., Kaplan et al., 2018). The upshot is that the presence of durables—through their pronounced interest-rate sensitivity—(re-)establishes a quantitatively relevant role for the "traditional" interest-rate channel of monetary policy. Yet, pure income effects play an important role in amplifying and prolonging the impact of monetary policy. Moreover, they are key to avoiding a counterfactual crowding out of nondurable spending stemming from fiscal interventions that target durables.

Related literature Our work is inspired by the seminal work of Kaplan et al. (2018), who investigate the effects of monetary policy in New Keynesian models with rich wealth distributions (see also Alves et al., 2020). A main takeaway of this work is that, in the presence of uninsurable income risk, general equilibrium effects affecting household disposable income drive the brunt of the response (of nondurables) to monetary policy shocks. This stands in stark contrast with the predictions of standard Representative Agent NK (RANK) economies, where nearly the entire response is driven by intertemporal substitution. Multi-sector RANK economies featuring durables are no exception to this property, being based on the view that durables' interest-rate sensitivity is primarily dictated by movements in the real rate of interest (Barsky et al., 2007). Instead, we show that *both* direct and indirect effects are key for capturing monetary policy transmission and replicating the realistic expenditure comovement observed in the data. We also relate to McKay and Wieland (2021, 2022), who incorporate durables in a HA setting, emphasizing the role of the extensive margin of adjustment. We instead focus on sectoral expenditure comovement, incorporating household heterogeneity within an otherwise standard two-sector NK model, as in Erceg and Levin (2006).

A large literature has tackled the comovement puzzle plaguing two-sector New Keynesian models with asymmetric price rigidity. Within this baseline setting, some of the remedies to the puzzle have consisted of envisaging devices capable of limiting the sensitivity of the relative price of durables to a monetary tightening. Among these, we recall non-separable preferences between a composite of sectoral consumption goods and labor supply (see, e.g., Katayama and Kim, 2013), and sticky prices of the production inputs: in this respect, Carlstrom and Fuerst (2010) assume sticky wages, while Bouakez et al. (2011) allow for input-output interactions. Other remedies have placed emphasis on the importance of financial frictions. Specifically, Tsai (2016) stress the role of working capital and habits preferences, whereas Monacelli (2009) emphasizes the importance of households' collateralized borrowing. Our framework takes a different approach, emphasizing the distinct roles of changes the real interest rate and disposable income in the presence of market incompleteness.

HANK models with a two-asset structure—one liquid and one relatively illiquid—share similarities with our dual-good model. However we emphasize that, despite their partial illiquidity, durables can serve as an imperfect self-insurance device for liquidity-constrained households (Cerletti and Pijoan-Mas, 2012; Asdrubali et al., 2020), unlike capital, which is typically managed by savers. Relatedly, Auclert et al. (2020) highlight how comovement between aggregate (nondurable) consumption and investment can arise from income effects that disproportionately impact low-liquidity households. In our context, income changes play a non-negligible role in the face of monetary policy shocks, especially for liquidity-constrained households. Yet, the direct effect is *per se* sufficient to reproduce sectoral expenditure comovement, given the modest size of relative price changes.

Structure The paper is structured as follows: Section 2 introduces a partial equilibrium model of household spending on durables and nondurables, assessing its ability to replicate sectoral comovement and key empirical patterns in household expenditures. Section 3 presents novel survey-based evidence on how durable and nondurable expenditures respond to monetary policy shocks across households sorted by their holdings of liquid financial assets. Section 4 devises the general equilibrium economy, and examines the transmission and effectiveness of government subsidies aimed at stimulating durable spending. Section 5 concludes.

2 A model of durable and nondurable demand

We devise a model of household consumption decisions in partial equilibrium. The economy is populated by a continuum of infinitely lived households, indexed by $s \in [0,1]$. Their preferences are defined over nondurable consumption, $C_{n,t}(s)$, and durable services that are proportional to the stock of durables, $D_t(s)$.[2] Households' intertemporal utility reads as[3]

$$\mathbb{E}_0 \left\{ \sum_{t=0}^{\infty} \beta^t \frac{\left(C_{n,t}^{\theta}(s) D_t^{1-\theta}(s) \right)^{1-\sigma}}{1-\sigma} \right\}. \tag{1}$$

We define purchases of new durable goods as $C_{d,t}(s) = D_{t+1}(s) - (1-\delta) D_t(s)$. Household s's budget constraint (deflated by the price of nondurables) is given by

$$C_{n,t}(s) + Q_t C_{d,t}(s) + B_{t+1}(s) = (1 + r(B_t(s))_t)\, B_t(s) + \exp\{e_t(s)\} Y_t - \tfrac{\alpha}{2} \left(\tfrac{C_{d,t}(s)}{D_t(s)} \right)^2 D_t(s), \tag{2}$$

where $B_{t+1}(s)$ denotes bond holdings, Q_t is the price of durables relative to that of nondurables, Y_t denotes aggregate income, α scales the adjustment cost on durables, δ is the depreciation rate and $e_t(s)$ is an idiosyncratic productivity shock with zero mean. Furthermore, $r(B_t(s))_t$ is the real return on bonds when $B_t(s) > 0$, while it equals the real rate plus a borrowing wedge, κ, when $B_t(s) < 0$ (see Kaplan et al., 2018). Finally, households face a borrowing constraint:

$$B_t(s) \geqslant -\psi Y, \tag{3}$$

[2]Our definition of durable goods excludes housing. We do that for two key reasons: i) housing is unique among durables as it can also serve as collateral for borrowing; ii) housing differs from other durable goods in several aspects, including depreciation rates, construction time, and the frequency of price adjustment.

[3]The assumption of Cobb-Douglas preferences is relatively conservative, given that empirical estimates of the elasticity of substitution between durables and nondurables typically range from below one to around one; see Ogaki and Reinhart (1998), Davis and Ortalo-Magné (2011), and Pakos (2011).

where ψ is a scaling parameter and Y denotes steady-state income.

Convex adjustment costs are primarily introduced to limit the interest rate elasticity of durables. This simplifying assumption restricts the model's ability to capture key aspects of durable spending, such as the lumpiness (see, e.g., Caballero, 1993) and sudden surges in purchases. These features are central to McKay and Wieland (2021), McKay and Wieland (2022), and Beraja and Zorzi (2024). Yet, Attanasio et al. (2022) highlight the complementarity between the intensive and the extensive margin. Therefore, modeling only the intensive margin does not inherently bias the model toward generating sectoral comovement in response to a monetary policy shock.

We assume infrequent expectation updating, following Gabaix and Laibson (2002) and Mankiw and Reis (2007). In adopting this approach, we draw on Carroll et al. (2020) and Auclert et al. (2020). Households update their expectations about aggregate states each period with an i.i.d. probability of $1 - \Xi$, while remaining fully informed about their idiosyncratic state. Specifically, households observe their current interest rate, $r(B_t(s))$, and their current income state, $\exp\{e_t(s)\}\, Y_t$, ensuring that they do not violate the borrowing constraint. As shown in Auclert et al. (2020), this feature helps generate hump-shaped IRFs, while still producing high impact marginal propensities to spend, since a one-time income change does not affect future aggregate states.

2.1 Empirical strategy and calibration

Our empirical strategy follows McKay and Wieland (2021) and involves feeding the estimated paths of the real interest rate, total income, and the relative-price changes induced by a monetary policy shock into the model, then matching the responses of aggregate and sectoral expenditures. The impulse response function (IRF) of a generic outcome variable, z_t, to a monetary policy shock is estimated using an instrumental variable extension of the local projection method (LP-IV). Specifically, we estimate:

$$z_{t+h} - z_{t-1} = \alpha^h + \beta^h \Delta r_t + \mathbf{x}_t \boldsymbol{\gamma}^h + \omega_{t+h}, \tag{4}$$

for $h = 0, 1, \ldots, H$, where Δr_t denotes the change in the (ex-ante) real interest rate. The coefficient β^h captures the average dynamic causal effect of this shift. The vector $\mathbf{x}_t$ includes control variables, namely 12 lags of the real interest rate and the dependent variable, along with a linear trend.[4] The change in the real interest rate is instrumented using monetary policy shocks identified by Romer and Romer (2004), as updated by Wieland and Yang (2020), so that the

[4]Olea and Plagborg-Møller (2021) demonstrate that lag-augmented LP inference remains robust in the presence of persistent data, ensuring reliable coverage even at longer horizons. Valid confidence intervals are constructed using heteroscedasticity-robust standard errors.

available sample spans from 1969:Q1 to 2007:Q3.[5]

The estimated IRFs can be interpreted as the local average treatment effect of an exogenous shift in the real interest rate driven by monetary policy shocks (see, e.g., Jordà and Taylor, 2024). To enhance interpretability and ensure comparability between the IRFs for aggregate variables and those we will be estimating for household-level data—which cover a shorter sample—we report IRFs corresponding to a cumulative 100 basis point (bp) increase in the Federal Funds Rate over five years.[6] In the full sample, this normalization implies a contemporaneous increase of the Federal Funds Rate of roughly 15 bp, following the monetary policy tightening.

Impulse responses The responses of GDP, the relative price of durables, and the real interest rate are reported in the top-left panel of Figure 1.[7] The monetary tightening is associated with a persistent increase in the real interest rate, leading to a prolonged, hump-shaped contraction in GDP. Furthermore, the relative price of durables rises following monetary tightening, indicating that the price of nondurables contracts more sharply than that of durables. This is consistent with Cantelmo and Melina (2018), who document a positive reaction of the relative price, when focusing on durable goods and excluding housing.[8] The remaining panels of the figure report the responses of aggregate, durable and nondurable expenditures. These all serve as explicit targets of our calibration. The shock induces a contraction in aggregate expenditure, reaching a trough after about two years. This decline is largely driven by durable expenditures, which exhibit relatively strong interest-rate sensitivity, peaking at a response an order of magnitude greater than that of nondurables at the trough. Beyond durables exhibiting greater responsiveness than nondurables, both types of expenditure display significant comovement, reaching a trough in the same quarter as aggregate expenditure, and recovering at a similar pace. This pattern broadly aligns with previous studies using sectoral data, such as Erceg and Levin (2006), Monacelli (2009), and Beraja and Wolf (2021).

Calibration and IRF matching Panel (a) of Table 1 provides an overview of the parameter values assigned in the partial equilibrium model.[9] We set the borrowing wedge, κ, to 0.05 and

[5] Aggregate data are constructed from the the St. Louis Fed FRED database. See A.1 for further details.

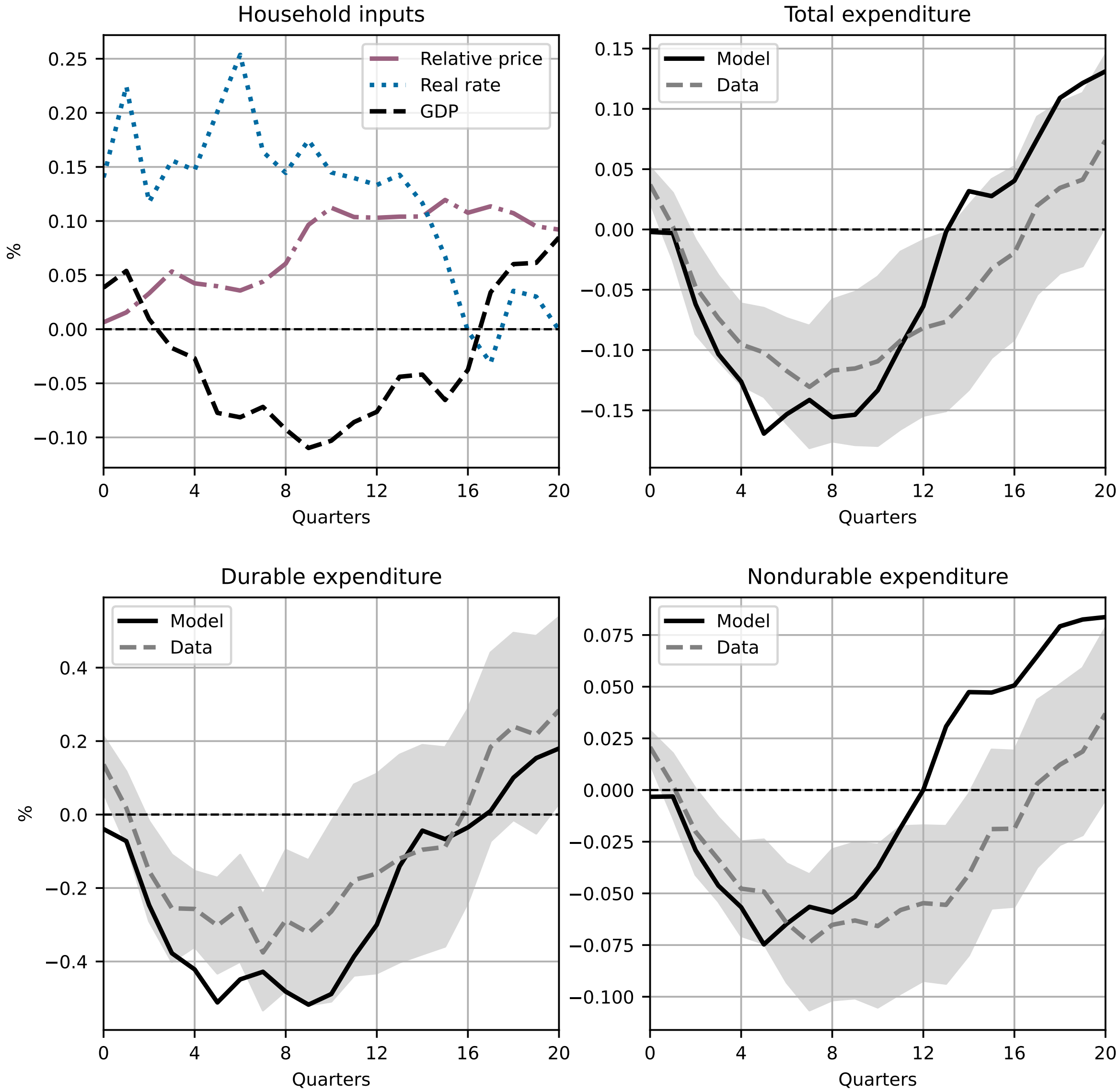
[6] Specifically, for each IRF, we report β_h/κ, where $\kappa = \sum_{j=0}^{19} \beta_{h,FF}$ and $\beta_{h,FF}$ corresponds to the LP coefficients from equation (4), estimated over the relevant sample, taking the Federal Funds Rate as outcome variable. Normalizing by the cumulative IRF helps compare responses across samples by partially accounting for differences in the persistence of the nominal interest rate. This is relevant for our analysis, as disaggregated data are only available from 1982 (see Section 3).

[7] The same responses, together with their confidence intervals, are reported in Figure B.1 (B).

[8] In contrast, when housing is taken as a measure of durable spending, the relative price exhibits a strongly procyclical response, consistent with the evidence that house prices display limited price stickiness. When both components are aggregated into a single price index, Cantelmo and Melina (2018) report a mildly countercyclical response of the relative price.

[9] To obtain household policy functions we use the endogenous grid method algorithm (EGM) of Auclert et al. (2021). In doing so, we normalize steady-state GDP to one.

Figure 1: Expenditure responses: model vs. data



Notes: The top-left panel reports the IRFs of the real interest rate, GDP, and the relative price of durables in response to a monetary policy shock that results in a cumulative 100-basis-point increase in the Federal Funds Rate over 5 years. The remaining panels report the IRFs of aggreage and sectoral expenditures triggered by the same shock (dashed line; the shaded area indicates the 95% confidence interval), against the IRFs of their model counterparts (solid line).

the discount factor, β, to 0.915 to match the steady-state share of liquidity-constrained households and the ratio of total liquid assets to aggregate income (30% and 26%, respectively; see Kaplan et al., 2018). The depreciation rate of durables, δ, is set to 0.054, in line with Fixed Assets

Table 1: Calibrations

(a) Partial equilibrium model

Parameter	Description	Value	Target/Source
σ	CRRA coefficient	2.640	Mom. matching
θ	Cobb-Douglas weight in household consumption utility	0.607	Mom. matching
α	Stock of durables adjustment-cost parameter	8.299	Mom. matching
Ξ	Houseolds' probability of not updating expectations	0.918	Mom. matching
δ	Durables' depreciation rate	0.054	BEA; Laibson et al. (2022)
ψ	Borrowing limit	0.833	Borrowing up to the average labor income
β	Discount factor	0.915	Liquid asset holdings to income = 0.26
κ	Borrowing wedge	0.05	Steady-state share of households with $B = 0$
ρ_e	Autoregressive parameter, households' idiosyncratic income process	0.978	McKay et al. (2016) and Auclert (2019)
σ_e	Standard deviation, households' idiosyncratic income process	0.193	McKay et al. (2016) and Auclert (2019)
r	Steady-state real rate of interest	0.03/4	Erceg and Levin (2006)

(b) General equilibrium model

Parameter	Description	Value	Target/Source
Household			
φ	Inverse of the Frisch elasticity of labor supply	0.250	Mom. matching
ψ_N	Weight of labor disutility	0.373	Mom. matching
Supply side			
ξ_n	Sector n's price-adjustment cost (mapping to a 0.671 Calvo probability)	26.126	Mom. matching
ξ_d	Sector d's price-adjustment cost (mapping to a 0.797 Calvo probability)	71.357	Mom. matching
ξ_w	Nominal wage-adjustment cost (mapping to a 0.802 Calvo probability)	74.716	Mom. matching
ϵ_n, ϵ_d	Sectoral elasticities of substitution across different intermediate-good varieties	6	Monacelli (2009)
ϵ_w	Elasticity of substitution of across different labor services	6	Erceg et al. (2000) and Hagedorn et al. (2019)
Policy rules			
ϕ_τ	Taxation rule: reaction parameter to debt deviations from steady state	0.191	Mom. matching
$\phi_{\bar{\pi}}$	Taylor rule: inflation reaction	1.105	Mom. matching
$\phi_{\bar{y}}$	Taylor rule: real-activity reaction	1.440	Mom. matching
ρ_i	Taylor rule: interest-rate smoothing	0.988	Mom. matching
Information updating			
Ξ	Probability of not updating expectations	0.989	Mom. matching

and Consumer Durable Goods data from the BEA;[10] the steady-state real interest rate, r, is set to 0.03/4, as in Erceg and Levin (2006); the borrowing limit, ψ, is set to 0.833, implying households can borrow up to the average labor income; the idiosyncratic income process parameters, σ_e and ρ_e, are set to 0.193 and 0.978, in line with McKay et al. (2016) and Auclert (2019). The remaining parameters are set to match the IRFs of durable and nondurable expenditures, as well as the yearly intertemporal marginal propensity to spend (i-MPX) after a one-time income transfer (Fagereng et al., 2021). This results in a Cobb-Douglas weight in household utility of $\theta = 0.607$,[11] a CRRA coefficient of $\sigma = 2.640$ (broadly consistent with existing estimates), and an adjustment-cost parameter of $\alpha = 8.299$ (somewhat lower than in alternative calibrations; see, e.g., Erceg and Levin, 2006); the latter is key in targeting the i-MPX.[12] Finally, we set information stickiness such that $\Xi = 0.918$, a relatively high value that helps the model generate hump-shaped macroeconomic responses (Auclert et al., 2020).

[10] This value aligns with Laibson et al. (2022) and reflects our focus on consumer durables, as we exclude inherently illiquid housing.

[11] This value implies a durable expenditure share of 0.193, slightly higher than 0.125, as computed by Laibson et al. (2022).

[12] Our analysis of sectoral comovement does not depend on the presence convex adjustment costs. Within our setting, realistic comovement can also be achieved by reducing durables' interest rate elasticity through a lower intertemporal elasticity of substitution (see B).

2.2 Empirical performance of the model

Figure 1 compares the model-implied expenditure responses to their empirical counterparts. The framework successfully reproduces persistent comovement between sectoral expenditures. Moreover, it closely replicates the hump-shaped responses of both durable and nondurable expenditures observed in the data, though the reversion in nondurable spending is somewhat faster. Focusing on the i-MPX for total private spending—which is an explicit target of our calibration strategy—the left panel of Figure 2 shows that our results are broadly consistent with the evidence in Fagereng et al. (2021). Concurrently, the right panel of Figure 2 reports the steady-state marginal propensities to spend as a function of liquid asset holdings (in thousands of dollars). Both distributions peak at the point where bond holdings are nil due to the borrowing wedge, κ. Fagereng et al. (2021) report a gradual decline in the marginal propensities to spend, as liquidity increases. Our calibrated model produces a similar pattern over the liquid-wealth domain.[13] On average, the quarterly marginal propensity to consume (MPC) is 22.94% for nondurables, falling comfortably within the range commonly reported in the literature (15–25%; Laibson et al., 2022). The average MPX on durables is slightly higher at 24.15%, reflecting a marginally greater sensitivity of durable expenditures to changes in household income.

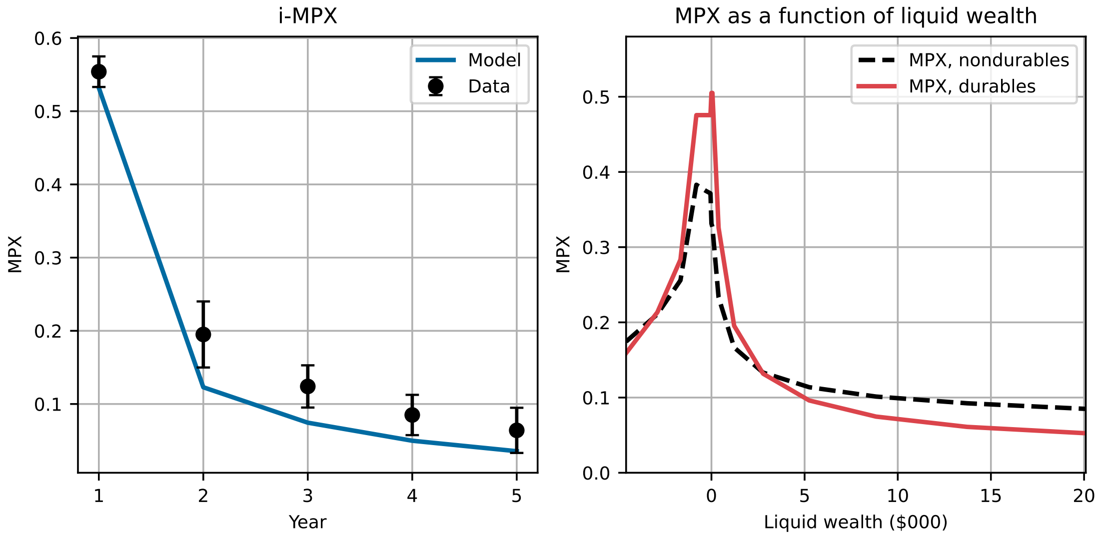
Finally, we assess additional moments that are informative for calibrating models of durable spending: the sensitivity of durable demand to changes in the real interest rate and the price elasticity. The model produces a (yearly) interest rate elasticity of durable expenditures of 3.35, and a durable expenditure price elasticity of 29.59. The former falls within the implicit range established by Baker et al. (2019) (1.1) and Mian and Sufi (2012) (4.3–5.0) for interest rate elasticities, as also reported by McKay and Wieland (2021). Regarding price elasticity, our estimate lies at the upper end of the range reported by Orchard et al. (2025) (26–30), based on Mian and Sufi (2012). Last, we obtain a steady-state skewness of the durable stock relative to nondurable consumption of 0.695—a value remarkably consistent with the microeconomic evidence documented by Bertola et al. (2005).This is notable, as the model excludes adjustments along the extensive margin.

2.3 Dissecting monetary policy transmission

We now turn to the analysis of monetary policy transmission, decomposing the responses of sectoral expenditure—both at the aggregate and household levels—into direct and indirect effects. Following Kaplan et al. (2018), we proceed by total differentiation of the impulse-

[13] For reference, their cutoff based on the (inflation-adjusted) top income quartile is $21,600 in 2006.

Figure 2: i-MPX for total expenditure (left) and MPXs as a function of liquid savings (right).



Notes: The left panel reports the (yearly) i-MPX of total expenditure from a one-off income transfer. The data points and the associated confidence intervals are taken from Fagereng et al. (2021). The right panel reports the steady-state MPX distributions of nondurable and durable expenditure conditional on households' holdings of liquid assets. We set the idiosyncratic income shock, $e(s)$, as well as the stock of durables, $D(s)$, at their respective mean steady-state values.

response path of $\{C_{j,t}\}_{t\geqslant 0}$, for $j = \{n, d\}$:

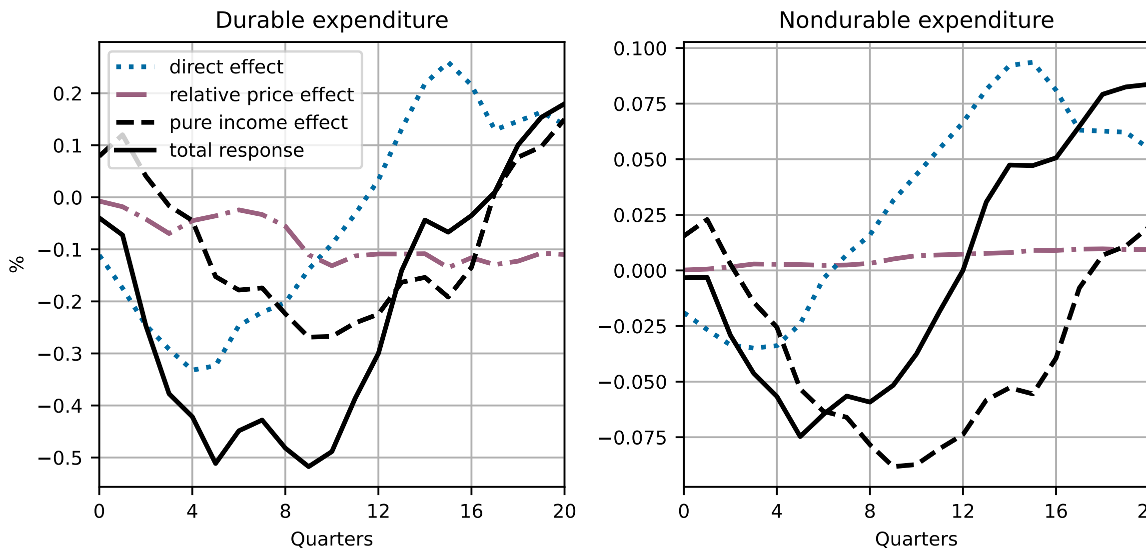
$$dC_{j,0} = \underbrace{\sum_{t=0}^{\infty} \frac{\partial C_{j,0}}{\partial r_t} dr_t}_{\text{direct effect}} + \underbrace{\sum_{t=0}^{\infty} \left(\underbrace{\frac{\partial C_{j,0}}{\partial Q_t} dQ_t}_{\text{relative-price effect}} + \underbrace{\frac{\partial C_{j,0}}{\partial Y_t} dY_t}_{\text{pure income effects}} \right)}_{\text{indirect effects}} \tag{5}$$

Each effect can be computed by moving only one variable at a time, holding fixed all other variables. As we have two goods with distinct prices, indirect effects can be further categorized into a *relative-price* effect—which involves income and substitution effects, along with a wealth effect of durable holdings—and terms that exert *pure income* effects.[14]

In Figure 3 we decompose sectoral expenditure responses. The direct and pure income effects tend to move aggregate durable and nondurable spending in the same direction, whereas the relative-price effect is redistributive by construction, tilting intratemporal trade-offs toward substitution away from durables and toward nondurables. However, this force is too modest to

[14]Numerically, we compute household paths by varying only the relevant inputs of household Jacobians, while holding the remaining terms fixed.

Figure 3: Expenditure response decomposition



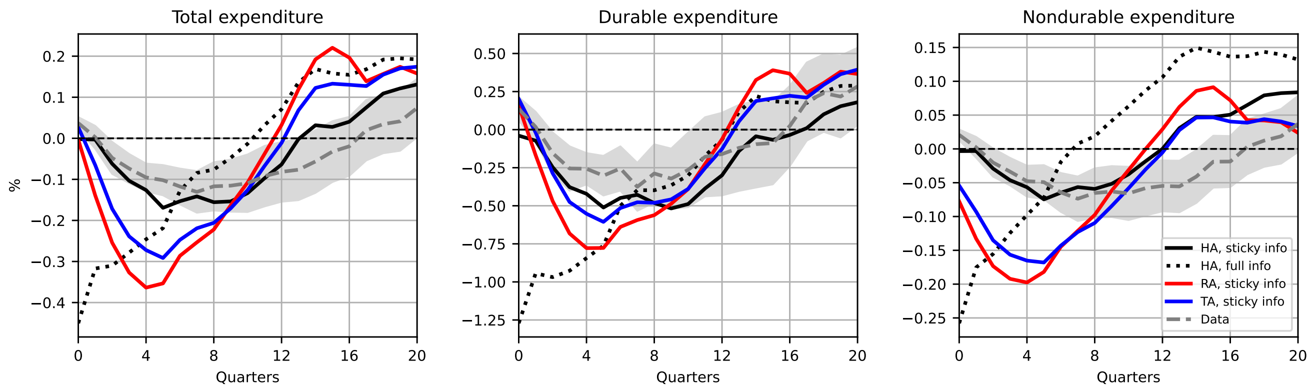
Notes: Decomposition of the response ofdurable and nondurable expenditure into direct, relative-price and pure income effects.

overturn the impetus toward positive comovement generated *per se* by the interest-rate effect. More specifically, in the first few quarters of the monetary tightening, durables are primarily driven by the direct effect; thereafter, pure income effects help prolong the slump. For nondurable expenditure, pure income effects are more important in inducing a persistent contraction, complementing the direct effect after the first year.

To gauge the distinct contributions of *pure income* effects and *sticky information* to tight and persistent comovement, Figure 4 shows the impulse responses from our baseline model alongside those from three counterfactual settings: (i) a sticky-information RANK model with no household heterogeneity; (ii) a sticky-information TANK model with limited heterogeneity; and (iii) a full-information HANK model.[15] Positive comovement already emerges in the RANK model, indicating that income effects are not strictly necessary when relative-price movements are modest and the interest-rate channel is active; however, responses are generally front-loaded and less inertial than those from the HANK benchmark, especially with respect to nondurable expenditure. Introducing limited heterogeneity through the TANK model does not alter these properties. In fact, consistent with Holst Partsch et al. (2024), durables imply very similar aggregate expenditure responses to a monetary disturbance in the RANK and the

[15]To close the model in both the RA and TA settings while preserving steady-state borrowing, we follow Schmitt-Grohe and Uribe (2003) by introducing an infinitesimal bond-holding convenience term into the utility function. We target the same steady-state government debt-to-GDP ratio across all model iterations.

Figure 4: Expenditure responses: alternative model versions



Notes: Expenditure responses in alternative economies: sticky-information RA, sticky-information TA, full-information HA, and baseline sticky-information HA. The dashed-grey line denotes data responses, while the shaded areas are 95% confidence intervals.

TANK models. Removing sticky information from the HANK model results in a large impact response and reduces persistence, reflecting a counterfactually high interest-rate elasticity of durable spending (35.24—over ten times larger than in the baseline model). The presence of sticky information in the baseline restores plausibly hump-shaped dynamics and tight sectoral comovement, consistent with the empirical evidence. In sum, income effects amplify the magnitude and persistence of the transmission of monetary policy, while infrequent information updating is essential to match the observed hump-shaped propagation.

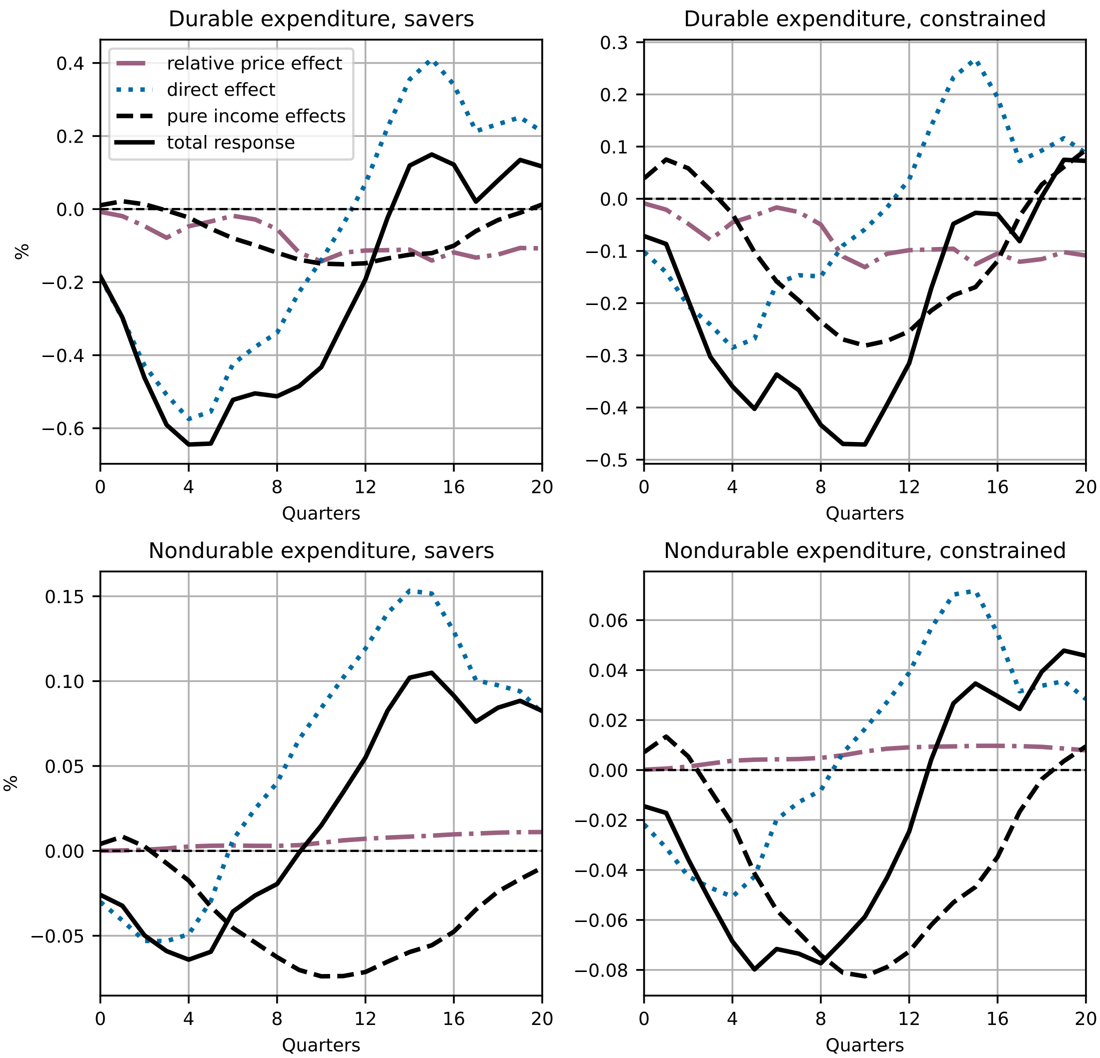
A decomposition based on household holdings of liquid assets Figure 5 breaks down the response of durable and nondurable expenditure for both liquidity-constrained households and savers.[16]

Both household groups exhibit strong interest-rate sensitivity, with respect to durable expenditures. For savers, this effect dominates throughout the response. For liquidity-constrained households, the direct impact of the real-rate hike drives the initial contraction, while income effects sustain the downturn after the first year.

Turning to nondurable expenditure, the direct effect remains the primary driver of savers' spending decline, while income effects remain relatively muted. As for liquidity-constrained households, the direct effect is responsible for triggering the contraction in nondurable ex-

[16] In line with Mankiw and Zeldes (1991), we define households with $1,000 or less in liquid assets as liquidity constrained. To ensure comparability with analogous CEX data, we exclude households with negative liquid wealth. For the same reason, we trim the top 7% of the wealth distribution, reflecting the fact that such households are largely underrepresented in the CEX (see, e.g., Malloy et al., 2009). None of these adjustments qualitatively affects the results reported in this section.

Figure 5: Expenditure response decomposition by steady-state liquid asset holdings



Notes: Decomposition of nondurable and durable expenditure responses into direct, relative-price and pure income effects, for households differing with respect to their steady-state holdings of liquid assets. Liquidity-constrained households are defined as those holding $1,000 or less in liquid assets.

penditure, though income effects eventually take over, prolonging the downturn. The relative-price effect exerts only a weak expansionary force later in the response, with constrained households displaying slightly greater sensitivity to relative-price movements.[17]

Household-level decompositions reveal positive comovement between durable and nondurable expenditures across both household groups. Among savers, this comovement is primarily driven by the direct effect. For liquidity-constrained households, the direct effect dominates in the short run, but income effects become increasingly important over time. This mech-

[17]Since these agents lack liquid assets for intertemporal smoothing, their intratemporal allocation between durables and nondurables—closely tied to the relative price and user cost of durables—is more responsive than that of savers.

anism plays a central role in generating realistic sectoral comovement, even at the household level.

3 Household-level empirical evidence

This section assesses the extent to which the mechanisms in our HANK model are consistent with empirical evidence. We present novel evidence on the responses of durable and nondurable expenditures by households sorted by their holdings of liquid financial assets. Using data from the U.S. Consumer Expenditure Survey (CEX) and the Survey of Consumer Finances (SCF), we construct consumption series for savers and liquidity-constrained households, following Attanasio et al. (2002). Liquid assets are defined to include bonds, mutual funds, and liquid accounts such as savings and checking accounts. Households are classified as liquidity-constrained if they hold less than $1,000 in liquid assets. Further details on the construction of household-specific consumption and income series are provided in A.2.[18]

The top row of Figure 6 shows expenditure responses across household groups, obtained using the LP-IV framework described in Section 2.1. Positive comovement between different types of consumption expenditure emerges as a key feature of the data, even after accounting for households' financial status. Notably, while consistent with our baseline model, positive comovement at the household level contradicts the basic mechanics of TANK models with collateralized borrowing (e.g., Monacelli, 2009). As Sterk (2010) notes, generating positive comovement in such models with limited heterogeneity is challenging, due to the interaction between financial constraints and bond market equilibrium. In those settings, following a monetary contraction, savers shift their portfolios toward durables, resulting in negative conditional comovement between their durable and nondurable expenditures.

Some significant differences emerge in the responses of different household groups. Consistent with the results in the bottom panel of Figure 5, nondurable spending by liquidity-constrained households is not only conditionally more volatile than that of savers, but also more inertial, reaching its trough after 16 quarters. As for durables, aside from minor initial differences, the two groups display broadly similar responses in both shape and magnitude.

3.1 Decomposition of household responses

The IRFs retrieved from the LP-IV framework capture an overall response that reflects both direct and indirect effects of monetary policy transmission. To isolate the direct component

[18]Since the CEX collects detailed respondent characteristics only once, individuals are assigned a fixed probability of belonging to a household group, preventing reclassification over time. Ideally, this probability assignment is sharp, ensuring a high likelihood of clear group allocation. In our sample, the representative respondent has a 90% probability of being assigned to either group, making misclassification highly unlikely.

and evaluate its contribution to the total response, we follow Holm et al. (2021) and retrieve counterfactual expenditure responses to a monetary policy shock, holding constant future income and relative-price realizations. Specifically, for each of the consumption expenditures of household group $g = \{\text{savers, liquidity-constrained}\}$, we estimate the following extended model:

$$c_{g,t+h} - c_{g,t-1} = \widetilde{\alpha}^h_g + \widetilde{\beta}^h_g \Delta r_t + \mathbf{x}_{g,t} \widetilde{\gamma}^h_g + \mathbf{w}_{g,t+h} \widetilde{\boldsymbol{\kappa}}^h_g + \epsilon_{g,t+h}, \tag{6}$$

where $\mathbf{w}_{g,t+h}$ captures the h-step-ahead cumulative changes in disposable income (net of interest income) and in the relative price. Otherwise, the setup remains consistent with the baseline specification in equation (4).

The estimated coefficients $\widetilde{\beta}^h_g$ in equation (6) measure the effect of a monetary policy-induced shift in the real interest rate on household-group g's expenditure at horizon h, holding constant the cumulative responses of the relative price and net income at the household-group level.[19] This approach yields an estimate of the direct effect of monetary policy shocks. Any difference between $\widetilde{\beta}^h_g$ in (6) and its counterpart β^h_g, obtained by removing $\mathbf{w}_{g,t+h}$ (as in equation (4)), reflects the indirect effects of monetary policy transmission. These counterfactual responses appear in the middle and bottom rows of Figure 6.

Independent of households' financial position, durable expenditures are largely governed by the direct effect over the first eight quarters of the monetary tightening, explaining the notable uniformity in household responses. In line with the model's predictions, indirect effects play a limited role, primarily extending the contraction of durable spending beyond the trough—particularly for liquidity-constrained households.

For nondurable expenditures, the direct effect remains the primary driver in the first eight quarters for both household types. This is consistent with Holm et al. (2021)'s evidence on Norwegian data. For the savers, indirect effects are stronger in the early stages of the monetary tightening, but fade after the trough. For liquidity-constrained households, income effects play an important role in prolonging the downturn. Notably, after accounting for changes in disposable income, both groups exhibit similar responses, suggesting that the direct effect operates uniformly regardless of financial status.[20] These results are, at least qualitatively, consistent with the decomposition from our baseline model, as shown in Figure 5.

3.2 A further discretization of the assetholding status

We test the robustness of our findings by refining the classification of assetholdings, dividing households into four groups (both in the model and the data): those with less than

[19] To better align with the model's decomposition, we exclude the interest rate component from net income, attributing it to the direct effect, as in Kaplan et al. (2018).

[20] Figure B.2 in B documents major heterogeneity in the income responses of savers and liquidity-constrained households.

Table 2: Decomposition of expenditure responses

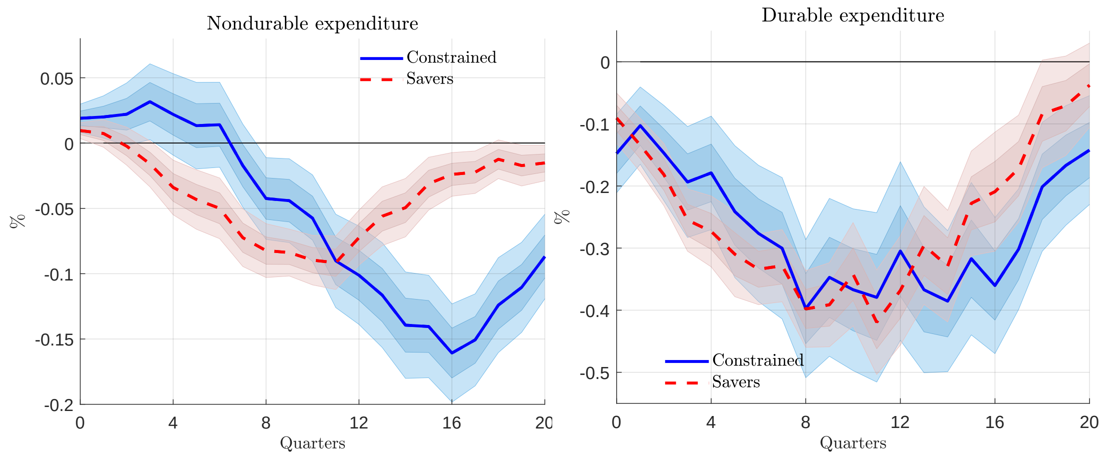
	(a) Durable expenditure			
	$B < 1k$	$1k < B < 10k$	$10k < B < 20k$	$B > 20k$
Data				
Direct Effect	-3.19	-3.24	-3.68	-5.13
Total Response	-3.74	-3.79	-4.22	-6.19
% Contrib. Direct	85.33	85.60	87.17	82.86
Model				
Direct Effect	-1.79	-3.51	-3.89	-4.37
Total Response	-3.02	-4.58	-4.77	-5.94
% Contrib. Direct	59.17	76.56	81.46	73.56
	(b) Nondurable expenditure			
	$B < 1k$	$1k < B < 10k$	$10k < B < 20k$	$B > 20k$
Data				
Direct Effect	-0.12	-0.14	-0.40	-0.85
Total Response	-0.29	-0.16	-0.68	-1.62
% Contrib. Direct	41.64	91.04	58.75	52.44
Model				
Direct Effect	-0.27	-0.24	-0.15	-0.15
Total Response	-0.56	-0.51	-0.41	-0.28
% Contrib. Direct	48.25	47.34	36.91	55.96

Notes: Decomposition of (cumulated) durable and nondurable expenditure responses for households differing in their holdings of liquid assets, B, in both the data and the model. For comparability, we cumulate over a period that is twice as long as that necessary to attain the trough in total expenditure (see Figure 1). This translates into 10 quarters for the model and 14 quarters for the data. For the wealthiest group, which tends to revert much faster than others, we cumulate the response over the entire horizon during which the response is contractionary, in both the model and the data.

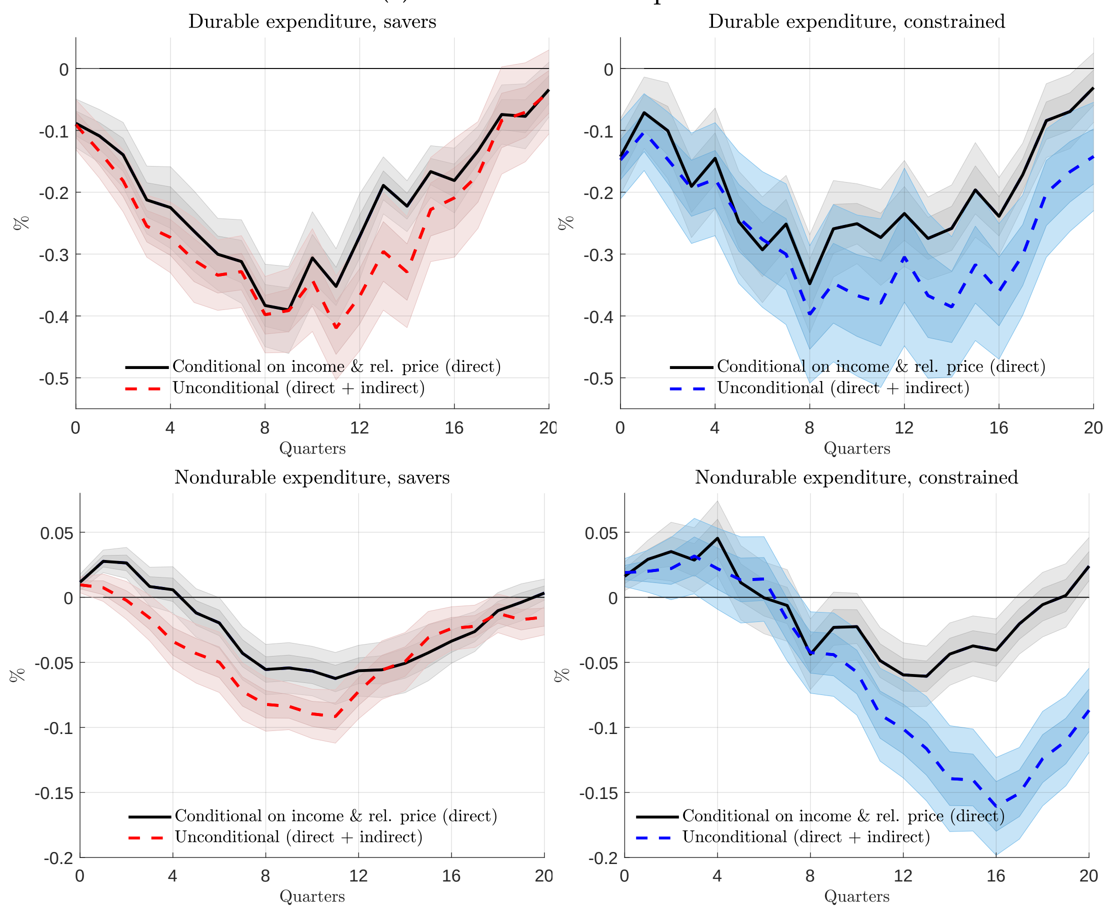
$1,000 in liquid assets, those holding $1,000–$10,000, $10,000–$20,000, and those with more than $20,000.[21] Table 2 summarizes our findings, presenting the decomposition of (cumulated) direct and indirect effects across household groups in both the data and the model. The latter comes close to reproduce the empirical decompositions. Positive comovement between durable and nondurable expenditures remains a consistent feature across all groups. Durable responses are primarily driven by the direct effect, while nondurable responses reflect a more balanced role of direct and indirect effects. A notable exception is the model's durable response for liquidity-constrained households, which appears weaker than both its empirical counterpart and other groups.

[21]These groups account for approximately 30%, 40%, 10%, and 20% of survey respondents, respectively, when considering the last decade of our sample.

Figure 6: Household-level responses and decomposition in the data



(a) Household-level responses



(b) Counterfactuals

Notes: The top row of the figure displays the total responses of durable and nondurable expenditures, for savers (dashed line) and liquidity-constrained households (solid line), to a monetary policy shock inducing a cumulative 100-basis-point increase in the Federal Funds Rate over 5 years. The middle and bottom rows display total responses (dashed line) alongside counterfactual responses based solely on the direct effect (solid line), for each household group and spending category. Dark and light shaded areas represent the 68% and 95% confidence intervals, respectively.

4 A two-sector HANK model

The partial equilibrium approach adopted thus far has helped clarify the role of specific mechanisms and transmission channels, but it cannot capture the feedback from spending to wages and prices, nor the policy rules that jointly determine those variables. We therefore extend the demand block to a general equilibrium setting, microfounding the responses of the real interest rate and the relative price of durables by modeling asymmetric sectoral price stickiness and nominal wage rigidity, ensuring that the resulting dynamics align with the data. We then use this framework to investigate the effects of a policy that, unlike standard monetary policy shocks, induces large relative-price movements and intensifies pressure towards durable–nondurable substitution. Accordingly, we embed the same household block in a two-sector HANK model with monetary and fiscal policy. This environment endogenizes the income and relative price paths used above, allows us to quantify how nominal and informational rigidities and policy rules shape the magnitude and persistence of sectoral comovement, and provides a coherent platform for counterfactual analysis. We begin with a brief overview of the model; the full specification is provided in Appendix C.

Households We extend the model of consumption decisions between durable and nondurable goods by assuming that households supply labor to firms in either sector of production, incurring in no frictions to move across sectors. Along with engaging in financial decisions, being subject to idiosyncratic risk and potentially incurring in a liquidity constraint, households are now subject to lump-sum taxation and receive dividends proportional to their productivity.

Wage setting Wages are set in a staggered fashion following Erceg et al. (2000). Each household supplies differentiated labor services, which are aggregated into effective labor by perfectly competitive labor packers. A union sets nominal wages in the presence of Rotemberg-type adjustment costs (Rotemberg, 1982), leading to a New Keynesian wage Phillips curve.

Production Each of the two sectors—durables and nondurables—features a two-layer production structure. Final-goods producers operate under monopolistic competition and face price-setting frictions à la Rotemberg (1982). Their production technology combines intermediate goods, which are produced by intermediate-goods producers using a linear technology that relies solely on labor as an input.

Government The government consists of two branches. Monetary policy is set by the central bank according to a Taylor rule that adjust the nominal rate of interest in response to aggregate inflation and output deviations from steady state, with a certain degree of interest rate inertia. Fiscal policy is pursued by issuing one-period nominal bonds and adjusting lump-sum taxes as in Auclert et al. (2020). Budget balance is ensured through a feedback mechanism linking taxes to government debt.

4.1 Calibration and IRF matching

We calibrate the general equilibrium model by retaining all parameter values from the partial equilibrium setting, as discussed in Section 2.1.[22] To match the impulse responses of the real interest rate, the relative price of durables, and GDP, we jointly estimate the parameters of the fiscal and monetary policy rules, the inverse of the Frisch elasticity of labor supply, as well as the parameters governing sectoral price and wage rigidities, and information stickiness. The model is fed with a sequence of monetary policy shocks, parameterized using a second-order spline to closely replicate the path of the response of the real interest rate observed in the data.

Panel (b) of Table 1 reports the selected parameters. The fiscal and monetary policy parameters align with standard values in the literature (see, e.g., Taylor, 1993), while the inverse of the elasticity of labor supply is close to the lower bound of the values commonly considered in macroeconomic models, in line with the recommendations of Chetty et al. (2011). Both durable and nondurable expenditures exhibit significant price stickiness, with durable goods' prices being slightly more rigid. This is essential to generate an increase in the relative price of durables, following a monetary policy shock.[23] Bils and Klenow (2004) show that, after accounting for product substitution, the frequency of price adjustments for durable goods falls between that of nondurables and services. Similarly, Nakamura and Steinsson (2008) highlight heterogeneity in durable goods' price stickiness, noting that transportation goods are relatively flexible, whereas household furniture and recreational goods rank among the stickier categories.[24] The rate of information updating is lower than the value estimated in the partial equilibrium setting, but remains broadly consistent with Auclert et al. (2020). Finally, wage rigidity helps dampen overall price fluctuations and stabilizes the relative price of durables (see, e.g., Carlstrom and Fuerst, 2010). Our estimated degree of wage stickiness is consistent with Barattieri et al. (2014), who find that roughly one-fifth of nominal wages adjust each quarter.

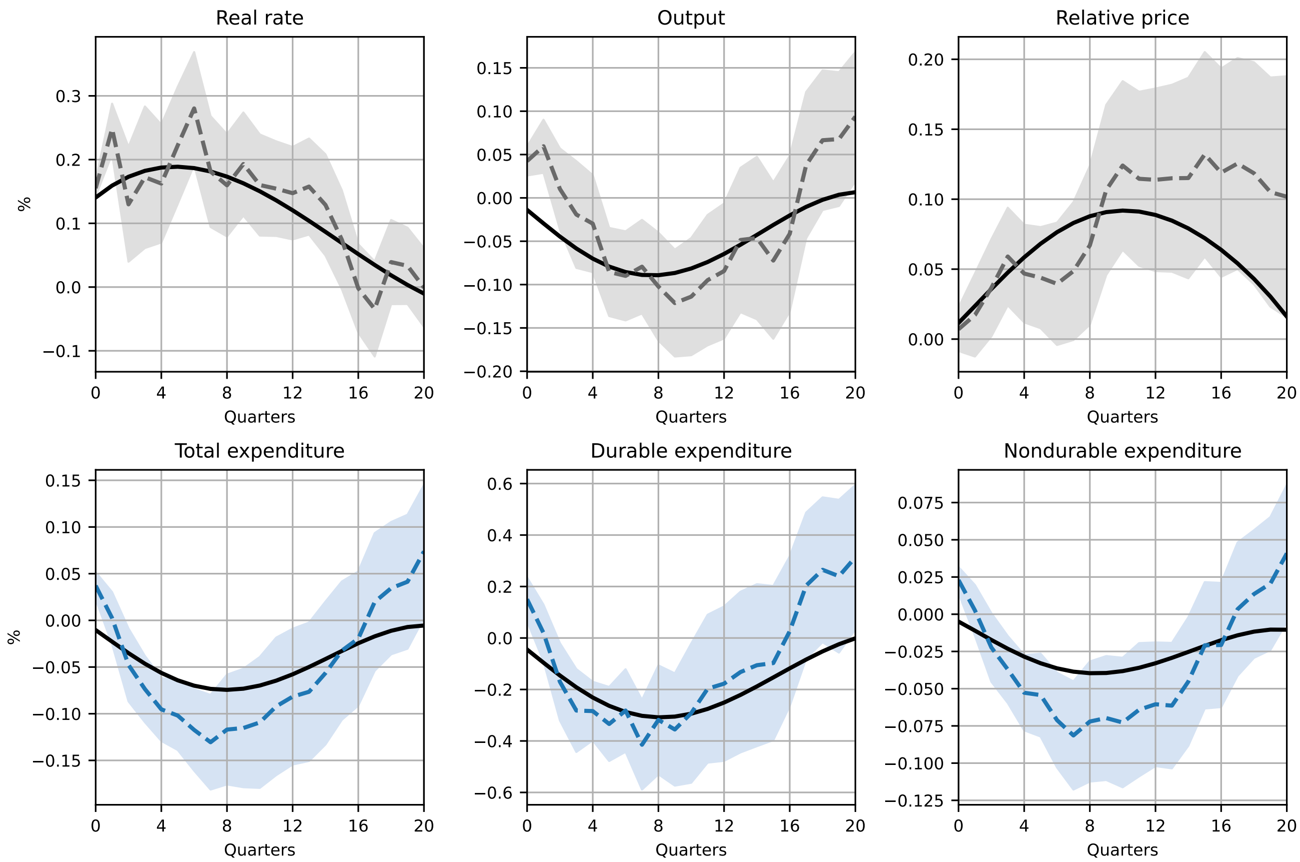
Figure 7 compares the model-implied impulse responses with their empirical counterparts.

[22]The only exception is the parameter indexing expectation stickiness, which is re-estimated in the general equilibrium setting. This choice is motivated by two considerations. First, we complement the demand block with *forward-looking* price- and wage-setting behavior on the supply side of both goods and labor markets. Second, this parameter is crucial for replicating the *persistence* observed in the responses of a broader set of variables, relative to what we had in partial equilibrium.

[23]Figure B.7 in B shows that the model reproduces comovement between durable and nondurable expenditures even when durable goods' prices are more flexible than nondurables' prices. In this case, the relative price of durables is procyclical, yet both expenditure categories contract following a monetary tightening, albeit more limitedly. This is consistent with the limited role of relative-price effects in our setting.

[24]More broadly, durable goods tend to display greater price rigidity than several nondurable categories, including food, utilities, and travel expenses. In fact, Klenow and Malin (2010) find no significant relationship between durability and price flexibility.

Figure 7: IRFs to a monetary policy shock



Notes: The top row reports the *targeted* IRFs of the real interest rate, GDP, and the relative price of durables to a sequence of monetary policy shocks that replicate the observed path of the real interest rate (dashed-grey line), alongside the corresponding IRFs from the HANK model (solid-black line). The bottom row shows the IRFs of aggregate and sectoral expenditures from the model (solid-black line), together with their *untargeted* empirical counterparts (dashed-blue line). Shaded areas represent 95% confidence intervals for the empirical estimates.

The top row highlights the model's ability to replicate the targeted dynamics: it closely matches the persistent decline in the real interest rate and the hump-shaped response of GDP, capturing not only the magnitude and timing of the peak effect but also the pace of its reversal. The modest and sustained movement in the relative price of durables is also matched, though with somewhat less persistence than observed in the data. The bottom row shows that the model broadly matches the magnitude and persistence of expenditure responses—both in aggregate and across spending categories—even though these moments were not directly targeted in estimation. Notably, the sharp reversal in nondurable expenditure observed in partial equilibrium disappears in general equilibrium.

4.2 Macroeconomic effects of government subsidies for durable spending

We examine the macroeconomic effects of a fiscal intervention designed to stimulate durable goods spending, with a focus on the role of different transmission channels.[25] Specifically, we analyze the impact of a two-period 10% subsidy on durable expenditures, financed through debt. This measure is loosely inspired by the U.S. Car Allowance Rebate System (CARS), though our framework abstracts from key features of "cash-for-clunkers" programs, such as their vehicle replacement requirement (see, e.g., Attanasio et al., 2022).

A large, temporary reduction in the relative price of durables naturally incentivizes households to substitute away from nondurables. Yet, while the effectiveness of such subsidies is debated, there does not seem to be any evidence pointing to negative spillovers to other spending categories. For instance, Gayer and Parker (2013) report that *"households that purchased new vehicles under the CARS program did not reduce other consumption during the time of the program"*. The absence of negative spillovers also characterizes housing purchase subsidies (see Berger et al., 2020, 2023). Accordingly, we do not expect negative comovement across spending categories in response to this policy intervention.

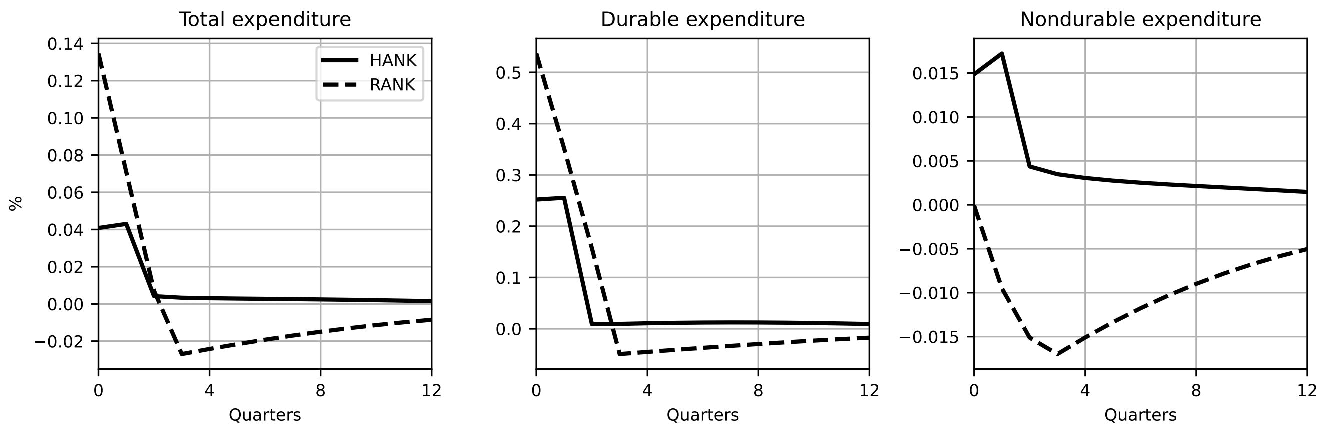
Figure 8 reports expenditure responses to the policy intervention in both HANK and RANK settings (first row), and a decomposition of the HANK responses into interest rate, income, and relative-price effects (second row). The subsidy causes a sharp, temporary drop in the relative price of durables, accompanied by a modest rise in the real interest rate. In both models, the fall in the relative price of durables creates an incentive to reallocate spending toward durables. In the RANK model, the subsidy triggers a counterfactual negative comovement between durables and nondurables, as responses are almost entirely driven by the relative-price effect.[26] Moreover, the initial expansion in total expenditure is followed by a persistent contraction. By contrast, accounting for liquidity-constrained households in HANK generates a strong expansionary income effect that boosts both durable and nondurable spending. For nondurables, the income effect is strong enough to offset the contractionary force induced by the drop in the relative price of durables. Thus, the subsidy spills over to nondurable spending, yielding positive comovement in sectoral expenditures.

While our framework abstracts from real-world complexities—such as eligibility restrictions and the lumpy nature of durable purchases, both of which could further dampen the macroeconomic effect—our findings suggest that, even in an idealized setting, durable goods

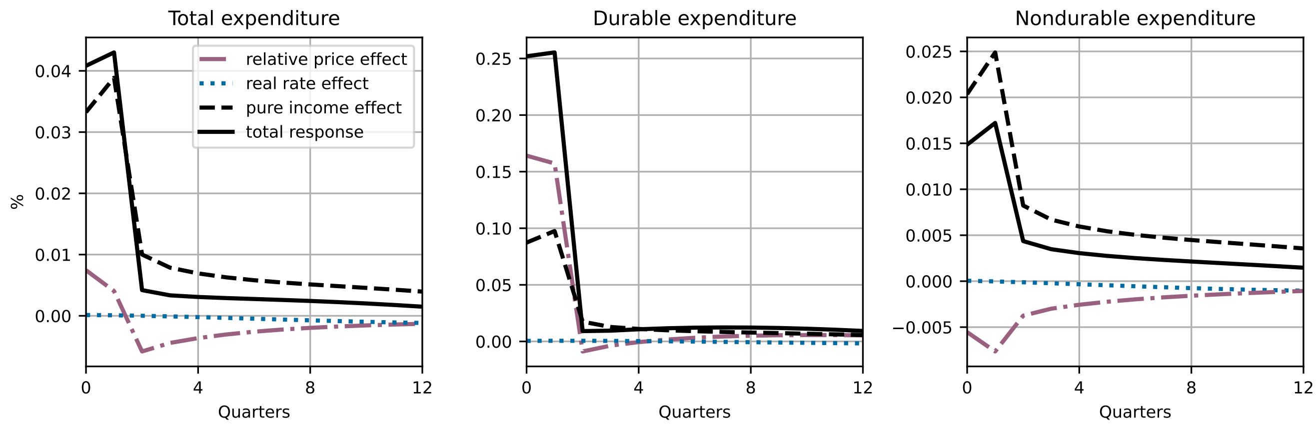
[25] Various forms of government subsidies for car purchases have been widely adopted in countries such as the U.S., Germany, Japan, and France as a way to stimulate the economy after the Great Recession. Broader durable goods subsidies have also featured in stimulus packages, including the U.S. Energy Star Rebate Program (2009), South Korea's Home Appliance Subsidy Program (2019), and the EU's Renovation Wave Strategy (2020).

[26] The large response of durable expenditure reflects an excessively high price elasticity in the RANK setting, as emphasized by Barsky et al. (2007). Given the relatively muted movements in the real interest rate in this experiment, the exaggerated sensitivity of durables stems primarily from the strong influence of the relative price channel—unmitigated by income effects that are absent in RANK.

Figure 8: Expenditure responses to a government subsidy to durable purchases



(a) HANK vs. RANK



(b) Response decomposition in HANK

Notes: Expenditure responses to a two-period 10% subsidy to durable goods purchases, financed through debt. Panel (a): HANK vs. RANK. Panel (b): decomposition of the HANK responses into real rate, pure income, and relative-price effects.

subsidies have limited impact. To contextualize the macroeconomic effect, the peak aggregate response is roughly one-third of that of a modest monetary policy shock.[27] This is consistent with evidence from transitory "cash-for-clunkers" programs, which also demonstrate a limited macroeconomic impact of such policies (see, e.g., Mian and Sufi, 2012).

[27]Comparing the observed responses to those in Figure 1—which correspond to an initial interest rate increase of 15 basis points and a cumulative increase of 100 basis points—the fiscal stimulus has a peak effect roughly one-third as large as that of the monetary policy shock.

5 Concluding remarks

We have introduced durable goods into a sticky-information New Keynesian model with heterogeneous households subject to idiosyncratic income risk and constrained access to liquid assets. We show that the direct effect of interest rate changes is sufficient, on its own, to generate positive comovement between durable and nondurable expenditures in the presence of a modest relative-price response, as is typically observed in the face of monetary policy shocks. Income effects play a complementary role by sustaining the response of nondurable expenditures and reinforcing the persistence of sectoral comovement over time. These mechanisms remain salient when examining household-level responses: positive comovement emerges across asset-rich and liquidity-constrained households alike, aligning our model with our novel evidence from micro data.

Income effects are essential to prevent a counterfactual negative spillover when fiscal policy is specifically aimed at supporting durable consumption. Absent sizable income effects, durable purchase subsidies would depress nondurable spending, resulting in negative sectoral comovement. Therefore, while our analysis highlights a strong role for interest-rate effects in monetary transmission, capturing income effects—particularly in the presence of rich household heterogeneity—is crucial for accurately assessing the distributional and aggregate consequences of both monetary and fiscal interventions in a multi-sector economy.

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A Data

We outline the construction of the aggregate and survey data employed in the analysis.

A.1 Aggregate data

Aggregate data are constructed from the the St. Louis Fed FRED database. Below, we provide a list of the variables used along with their corresponding FRED mnemonics:

- Personal Consumption Expenditures: Durable Goods (PCDG)
- Personal Consumption Expenditures: Nondurable Goods (PCEND)
- Personal Consumption Expenditures: Services (PCES)
- Personal Consumption Expenditures: Housing Services (DHSGRC0)
- Durable Goods Price Index (DDURRD3Q086SBEA)
- Nondurable Goods Price Index (DNDGRG3M086SBEA)
- Services Price Index (DSERRG3M086SBEA)
- Housing Services Price Index (DHUTRG3Q086SBEA)
- Disposable Income (DSPI)
- Personal Income Receipts on Assets: Personal Interest Income (PII)
- Interest payments (B069RC1)
- Fed Fund Rate (FEDFUNDS)
- Real GDP (GDPC1)
- Population (B230RC0Q173SBEA)

Monthly nominal data on expenditure and income are aggregated to quarterly levels by summing all monthly values within the quarter. For prices, we instead take the average of the values within the quarter.

Nondurable and services expenditures, along with their corresponding price index, are constructed by aggregating nondurable goods and services, excluding housing services. Total consumption expenditures and their price index are then obtained by combining nondurables, services, and durable expenditure components.

To construct aggregate real expenditure data from disaggregated components, we follow McKay and Wieland (2021). The process involves two components of nominal expenditure, X_{1t} and X_{2t}, such that aggregate nominal spending obtains as $Y_t = X_{1t} + X_{2t}$. Thus, we define the share of good 1 in nominal expenditure as $s_{1t} \equiv X_{1t}/Y_t$. Both components of nominal expenditure have an associated price index, P_{1t} and P_{2t}, and our goal is to derive the aggregate price index P_t for Y_t. To this end, we first compute the growth rate of nominal spending as $y_t = \ln(Y_t) - \ln(Y_{t-1})$. The growth rate of the aggregate price index is then computed as $p_t = s_{1t-1}p_{1t} + (1 - s_{1t-1})p_{2t}$. From this, we derive P_t and the growth rate of real expenditure, $y_t - p_t$, from which aggregate real expenditure is obtained. When subtracting a given component from an expenditure aggregate, we follow the same procedure. For instance, we subtract the housing services component, yielding $Y_t = X_{2t} - X_{1t}$, with the share of housing services in nondurable expenditure now given by $s_{1t} = -X_{1t}/Y_t$. With these adjustments, real expenditure and the price index are computed.

The relative-price series for durables is defined as the price of durables divided by the price of nondurables and services. The real interest rate, expressed in terms of nondurables, is the Federal Funds Rate net of realized nondurable inflation over the next four quarters. For the counterfactual decomposition in Section 3.1, we compute disposable income net of interest income and interest payments on assets. This is used to normalize income (net of interest) for each assetholding group of interest (see A.2).

All variables are converted to per-capita terms dividing by population size.

A.2 Household data

This section outlines the procedure for constructing expenditure series for household groups classified by their holdings of liquid financial assets.[28] Following Mankiw and Zeldes (1991), we classify liquidity-constrained households as those with total liquid assets (including liquid accounts) below \$1,000.

To estimate consumption expenditure in durables and nondurables for different household groups, we use data from the CEX for the 1980–2017 period, complemented by SCF data available over the 1989–2016 time span.[29] While the CEX records whether a household holds "stocks, bonds, mutual funds, and other such securities" along with checking and savings accounts, it does not capture indirect asset holdings, potentially underestimating households' participation in financial markets. To address this shortcoming, we implement an imputation

[28]For a detailed description of the dataset and the restrictions applied to the original sample, see Gaudio et al. (2023).

[29]The CEX, produced by the Bureau of Labor Statistics (BLS), is an annual U.S. survey providing household-level data on consumption expenditure, income, and financial and demographic characteristics, representing the non-institutionalized civilian population. The SCF, conducted triennially by the Federal Reserve, collects detailed information on income and wealth holdings but does not include consumption expenditure.

procedure along the lines of Attanasio et al. (2002) and Malloy et al. (2009). Using SCF data, we estimate a probit model for the probability of a household holding assets, based on observable characteristics available in both the SCF and CEX. These characteristics include age, education (and their interaction), race (white or non-white), year dummies, log income, and a dummy indicating financial income (dividends plus interest income). The assetholding status is captured by a dummy equal to 1 if total (direct or indirect) holdings of stocks, bonds, and liquid accounts exceed \$1,000. The coefficients from the model estimated on SCF data are then used to derive assetholding probabilities for comparable households in the CEX.[30]

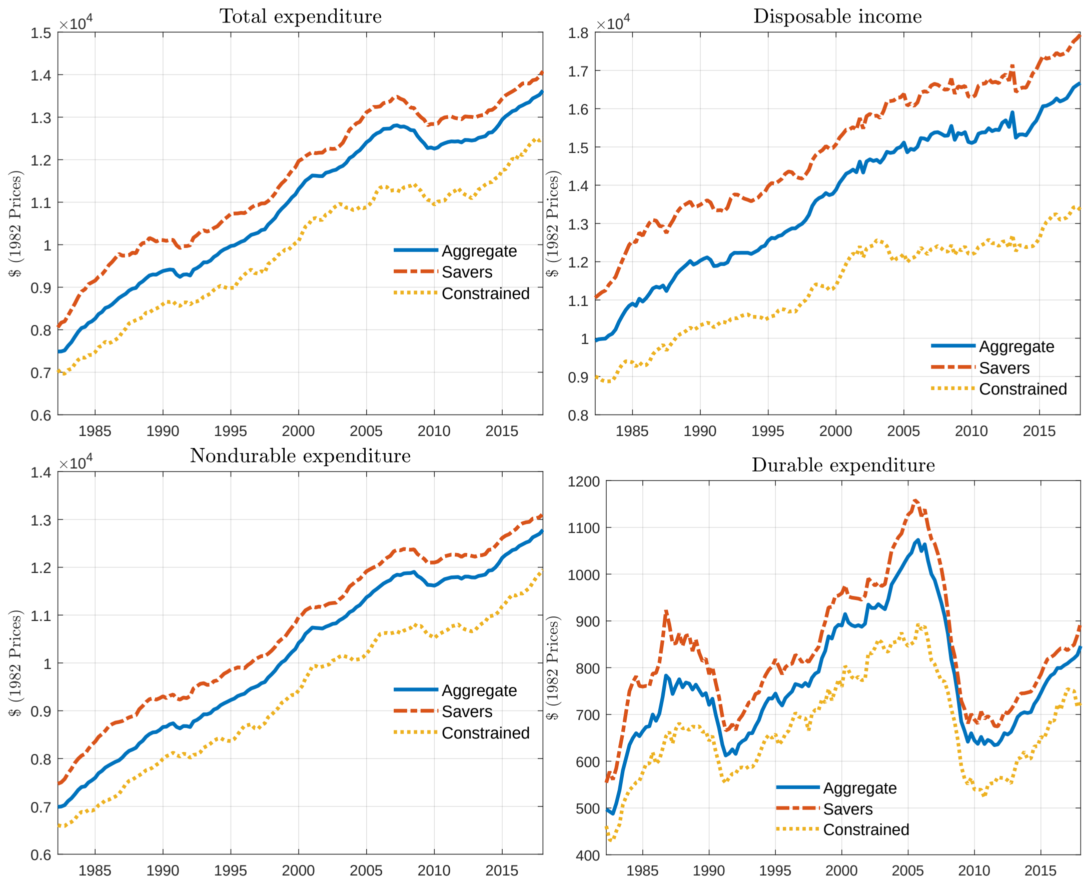
We then construct representative-household expenditure series for nondurable goods and services, as well as durable goods. The nondurables and services category includes food, alcoholic beverages, apparel and services, gasoline and motor oil, household operations, utilities, tobacco, public transportation, fees and admissions, personal care products, reading, other vehicle expenses, and other entertainment-related expenditures. Durable goods expenditures include purchases of vehicles, household furnishings, and TV and audio equipment.

Savers' raw per-capita expenditures (in each good category) are obtained by weighting each household's population-weighted consumption by the estimated probability of holding assets above the \$1,000 threshold, then dividing by the total population of savers and the Consumer Price Index (CPI). Non-savers' expenditure is computed symmetrically, using the complement to one of the imputed assetholding probability. The resulting series are smoothed using a backward-looking moving average over four quarters (including the current and previous three) to address seasonal adjustment issues and the noise inherent in survey data. The group-level series are then scaled to match National Income and Product Accounts (NIPA) aggregates. Specifically, we adjust for total nondurable and services expenditures and durable goods expenditures using the methodology detailed in A.1. Income series for both household groups are constructed in a similar fashion.

To achieve a finer discretization of the assetholding status, we employing a similar methodology. The main difference consists of using SCF data to estimate a multinomial logit model to determine the probability of belonging to a specific wealth group. The resulting probabilities are then used to classify CEX respondents, thus constructing synthetic expenditure series for four assetholding groups: (a) below \$1,000; (b) between \$1,000 and \$10,000; (c) between \$10,000 and \$20,000; and (d) above \$20,000. Figures A.1 and A.2 report the series resulting from our computation.

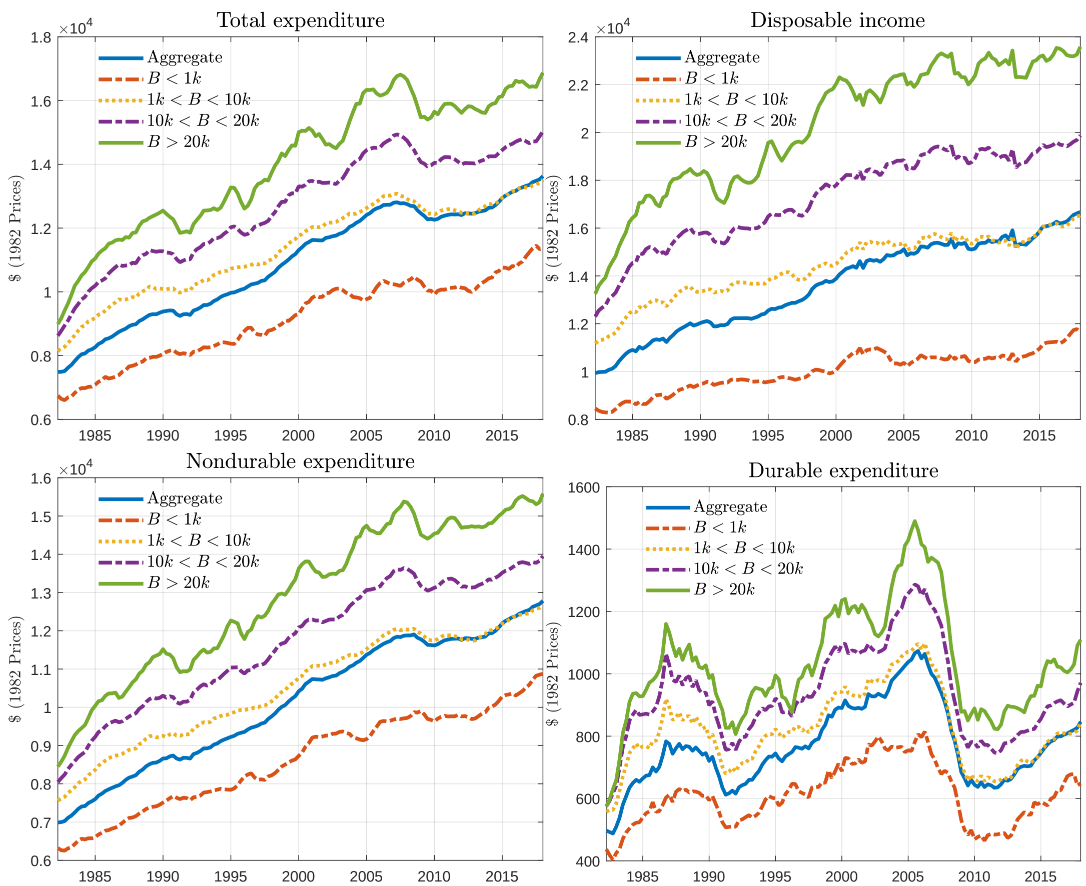
[30] Households missing responses to any variable used in the regression are assigned an assetholding probability of zero.

Figure A.1: Aggregate and household-level income and expenditure series



Notes: Quarterly expenditures and income for the representative household from the NIPA (blue line), alongside the representative saver (red line) and the representative liquidity-constrained household (yellow line), estimated through the probability-weighted assetholding status in the CEX.

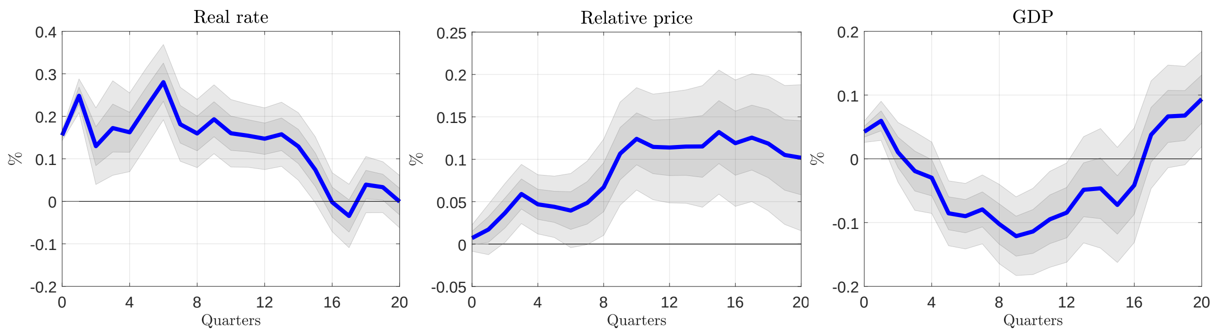
Figure A.2: Aggregate and household-level income and expenditure series: finer discretization



Notes: Quarterly expenditures and income for the representative household from the NIPA (blue line), alongside representative households with different levels of liquid wealth, B, as estimated through the probability-weighted assetholding status in the CEX.

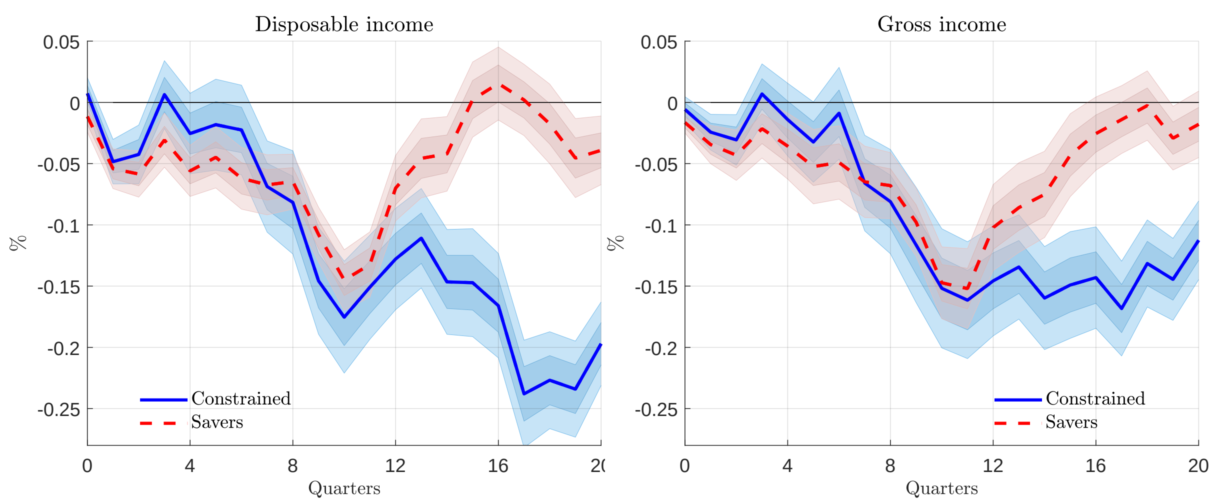
B Additional figures and tables

Figure B.1: Aggregate responses to a monetary policy shock



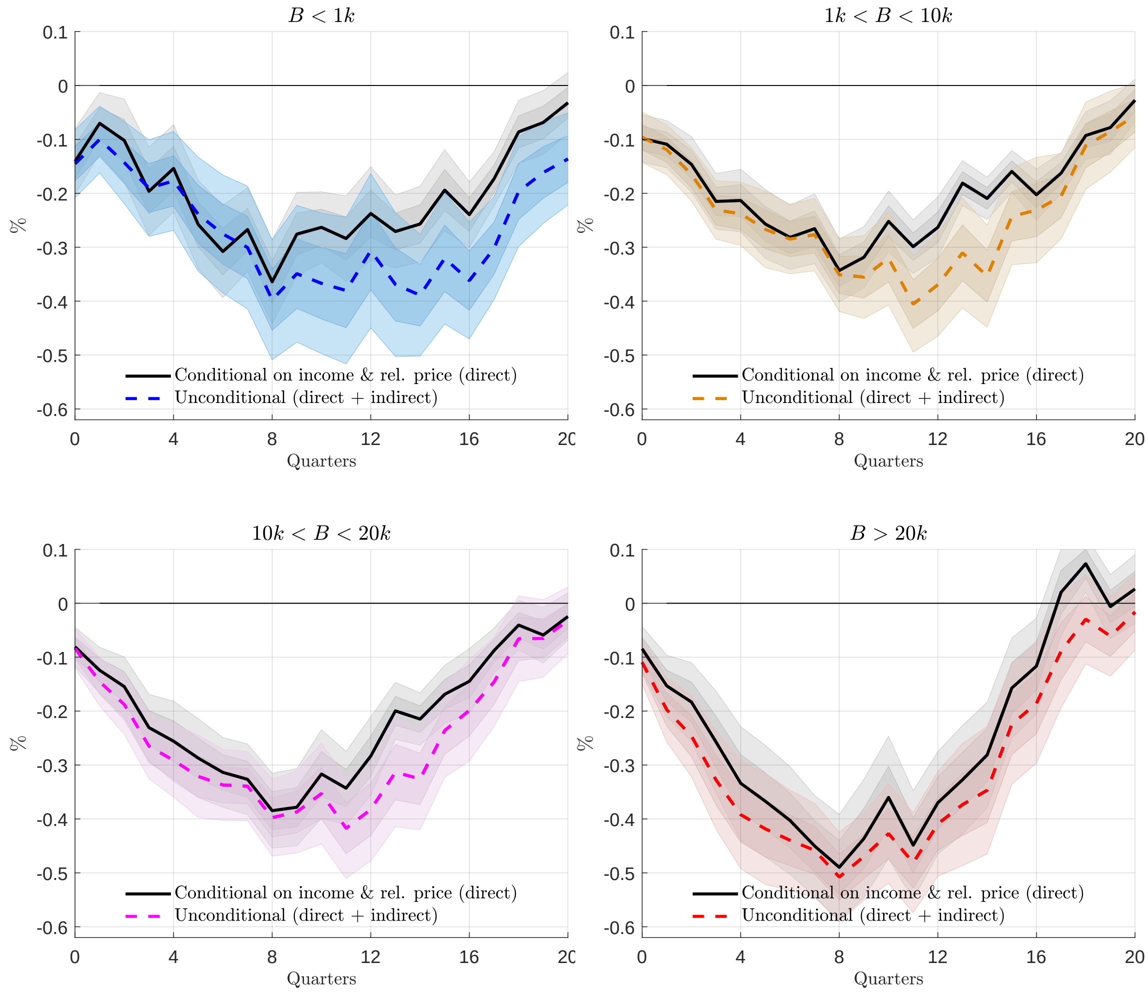
Notes: IRFs of the real interest rate, the relative price of durables and GDP in response to a monetary policy shock inducing a cumulative 100-basis-point increase in the Federal Funds Rate over 5 years. Dark and light shaded areas represent the 68% and 95% confidence intervals, respectively.

Figure B.2: Income responses and decomposition



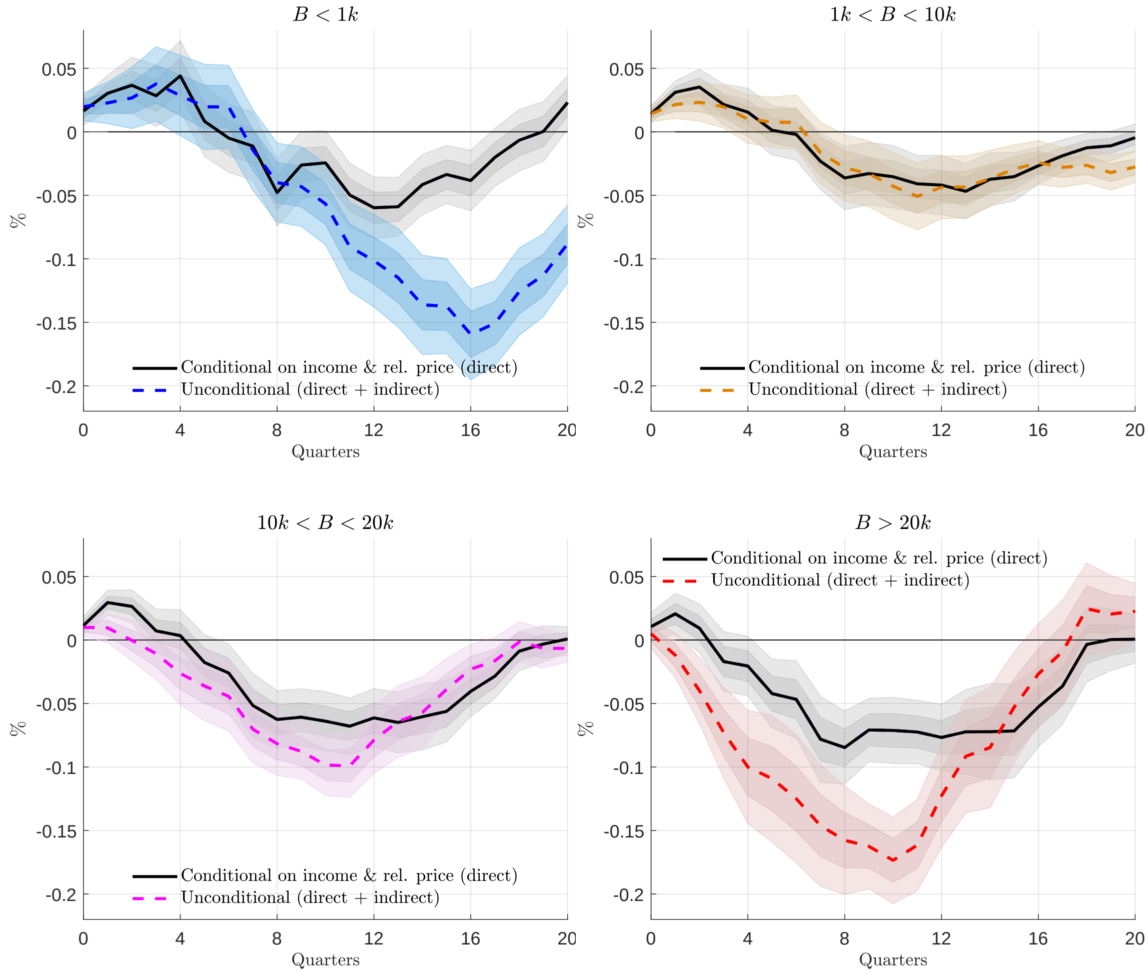
Notes: IRFs of disposable income (left panel) and gross income (right panel), for savers (dashed line) and liquidity-constrained households (solid line), to a monetary policy shock inducing a cumulative 100-basis-point increase in the Federal Funds Rate over 5 years. Dark and light shaded areas represent the 68% and 95% confidence intervals, respectively.

Figure B.3: Assetholding status and decomposition of durable expenditure responses



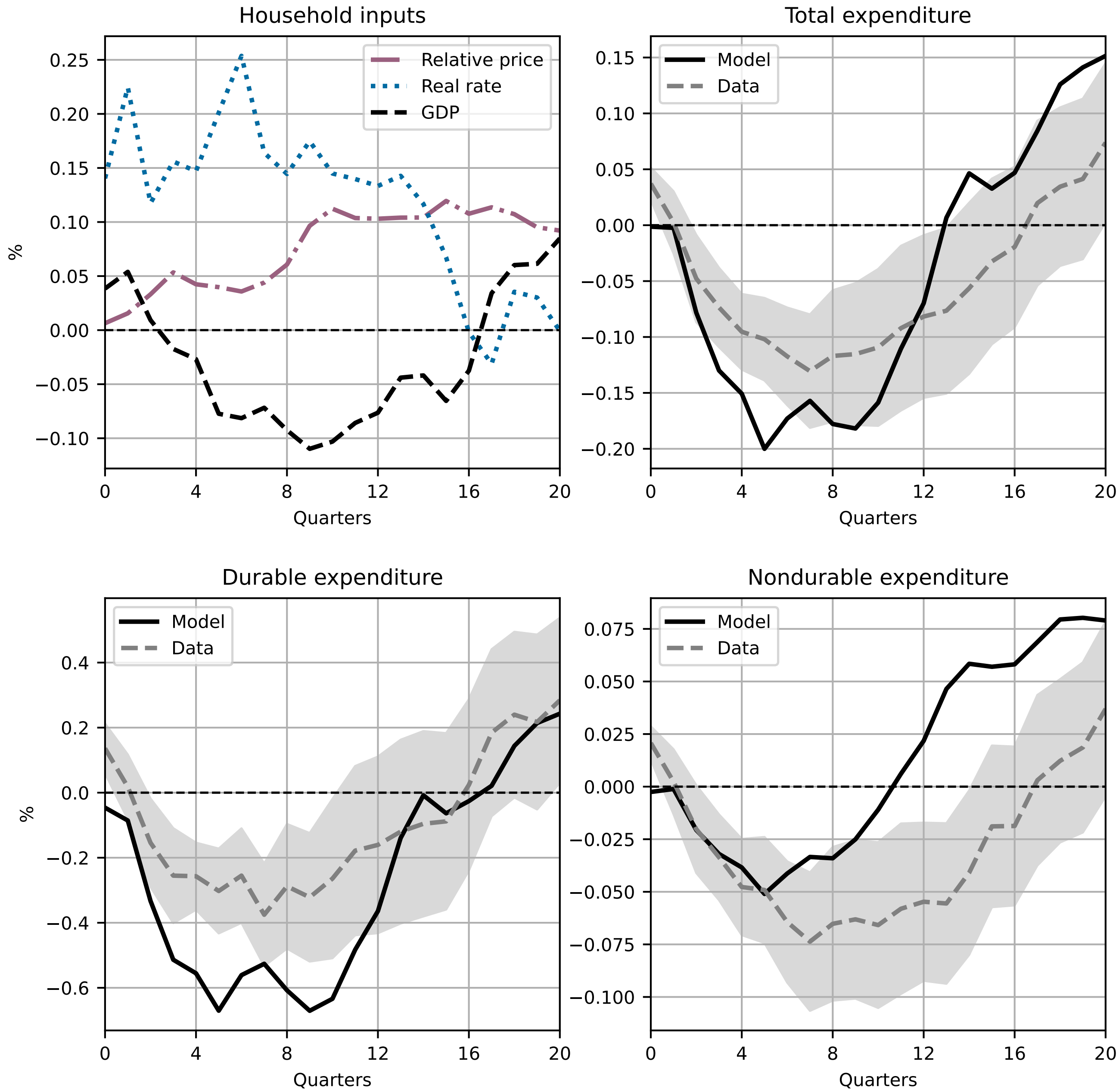
Notes: Total responses of the durable expenditures of different household groups to a monetary policy shock inducing a cumulative 100-basis-point increase in the Federal Funds Rate over five years (dashed line), alongside the responses attributable to the direct effect alone (solid line). Dark and light shaded areas represent the 68% and 95% confidence intervals, respectively. We consider households below \$1,000 of liquid assets, between \$1,000 and \$10,000, between \$10,000 and \$20,000, and above \$20,000.

Figure B.4: Assetholding status and decomposition of nondurable expenditure responses



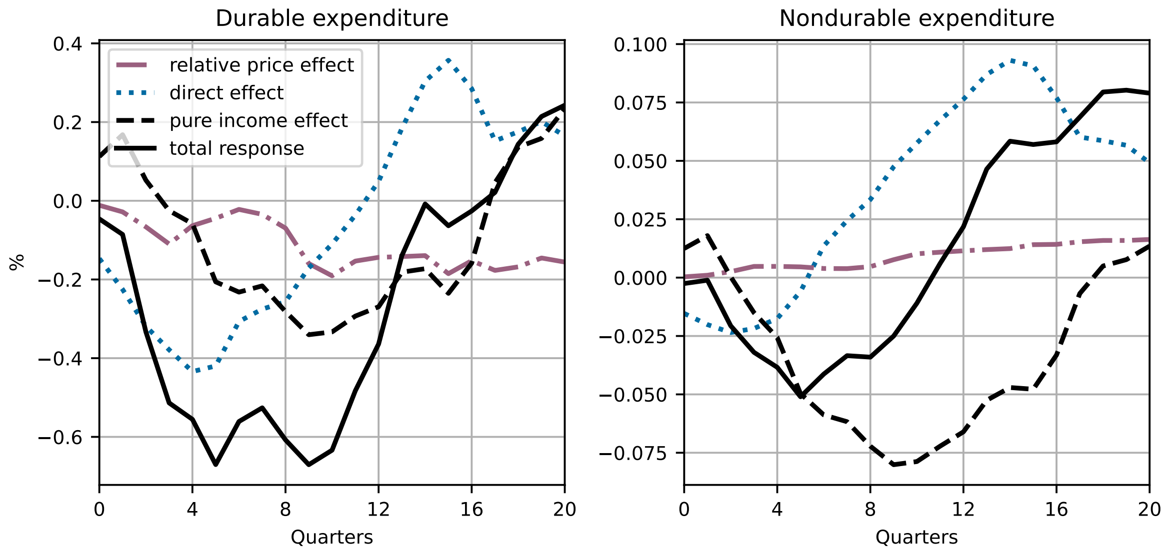
Notes: Total responses of the nondurable expenditures of different household groups to a monetary policy shock inducing a cumulative 100-basis-point increase in the Federal Funds Rate over five years (dashed line), alongside the responses attributable to the direct effect alone (solid line). Dark and light shaded areas represent the 68% and 95% confidence intervals, respectively. We consider households below \$1,000 of liquid assets, between \$1,000 and \$10,000, between \$10,000 and \$20,000, and above \$20,000.

Figure B.5: IRF matching under lower IES



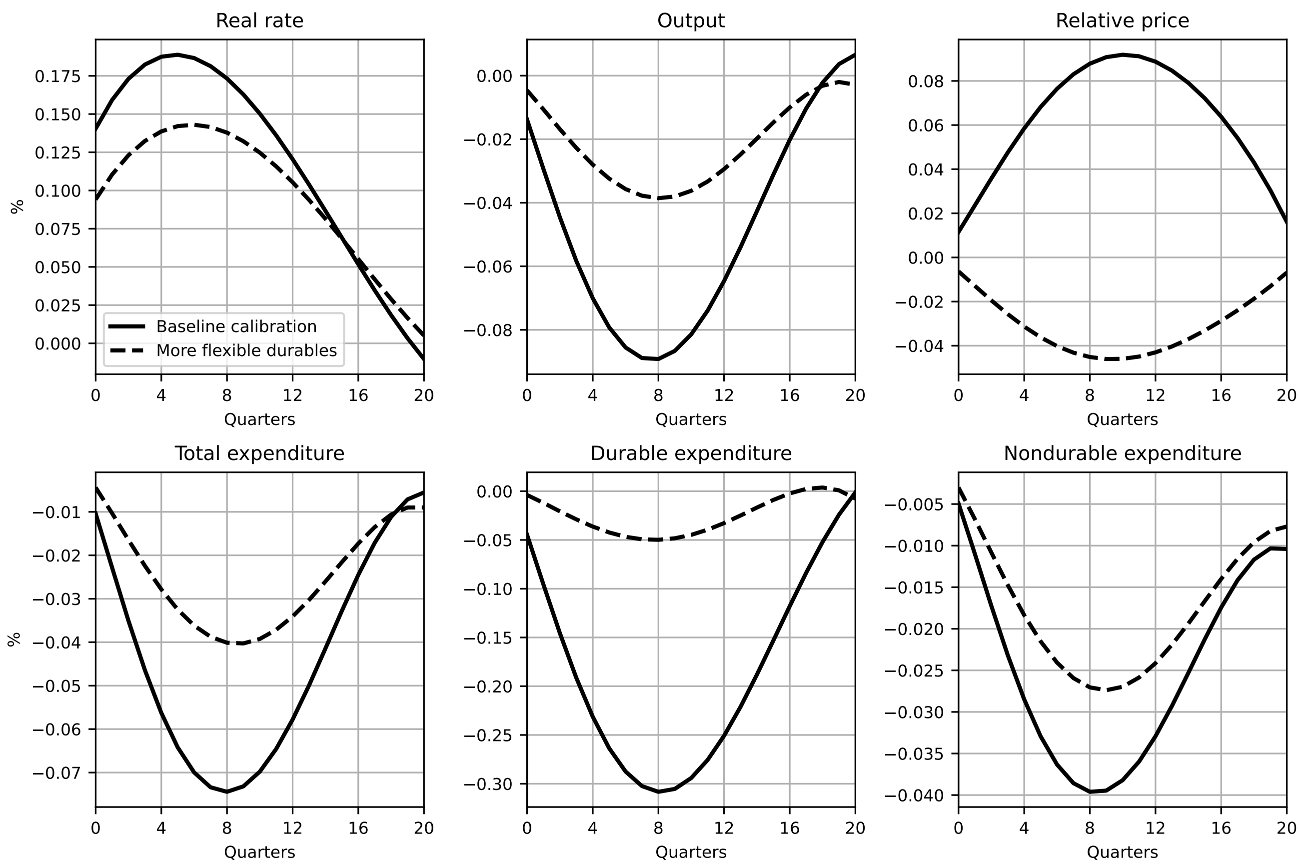
Notes: The top-left panel reports the IRFs of the real interest rate, GDP, and the relative price of durables in response to a monetary policy shock that results in a cumulative 100-basis-point increase in the Federal Funds Rate over 5 years. The remaining panels report the IRFs of aggreage and sectoral expenditures triggered by the same shock (dashed line; the shaded area indicates the 95% confidence interval), against the IRFs of their counterparts from a model where we set $\alpha = 4$ and $\sigma = 3.2$, and re-calibrating the share of liquidity constrained households and total liquid wealth holdings results in $\beta = 0.888$, $\kappa = 0.065$ (solid line), holding all other parameters at their baseline values.

Figure B.6: IRF decomposition under lower IES



Notes: In this model iteration, we set $\alpha = 4$ and $\sigma = 3.2$—while re-calibrating the share of liquidity constrained households and total liquid wealth holdings results in $\beta = 0.888, \kappa = 0.065$ (holding all other parameters at their baseline values)—and decompose the response of expenditures into direct, relative-price and pure income effects.

Figure B.7: Robustness: baseline calibration vs. stickier prices of nondurable goods



Notes: Comparison between the model's responses to a monetary policy shock under our baseline calibration (solid line)—where nominal frictions are stronger in the durable-goods sector—with an alternative calibration in which durables have more flexible prices than nondurables. All other model parameters remain unchanged.

C General equilibrium model

In Section 4 we complement the household block in Section 2 by assuming households supply labor hours to intermediate-goods firms operating in a regime of monopolistic competition. Intermediate-goods firms sell their products to firms operating in a perfectly-competitive final-goods sector. The government pursues monetary and fiscal policy. The remainder of this section details the key blocks of the model, as well as how equilibrium obtains.

C.1 Household problem

We now assume that households experience disutility from labor hours, denoted as $\mathcal{N}_t(s)$:

$$\mathbb{E}_0\left\{\sum_{t=0}^{\infty}\beta^t\left[\frac{\left(C_{n,t}^{\theta}(s)D_t^{1-\theta}(s)\right)^{1-\sigma}}{1-\sigma}-\psi_N\frac{\mathcal{N}_t^{1+\varphi}(s)}{1+\varphi}\right]\right\}. \tag{7}$$

Concurrently, household s's budget constraint (deflated by the price of nondurables) is given by

$$\begin{aligned}C_{n,t}(s)+Q_tC_{d,t}(s)+B_{t+1}(s)=(1+r(B_t(s))_t)\,B_t(s)+w_{n,t}N_t(s)\exp\{e_t(s)\}\\+Div_t\overline{Div}(s)-\tau_t\bar{\tau}(s)-\tfrac{\alpha}{2}\left(\tfrac{C_{d,t}(s)}{D_t(s)}\right)^2D_t(s),\end{aligned} \tag{8}$$

where $w_{n,t}$ is the real wage rate,[31] and $e_t(s)$ is an idiosyncratic productivity shock with unit mean. Furthermore, households pay taxes, τ_t, and receive dividends from the ownership of firms, Div_t, according to the incidence rules $\bar{\tau}(s)$ and $\overline{Div}(s)$, which are set so that taxes and dividends are linear functions of individual productivity. Finally, the financial constraint in equation (3) applies.

C.2 Wage setting

We consider wage setting in the vein of Erceg et al. (2000), Erceg and Levin (2006) and Hagedorn et al. (2019). Specifically, each household provides differentiated labor services, which are transformed into aggregate effective labor, N_t, by perfectly competitive labor packers, using the technology

$$N_t=\left(\int_0^1\exp\{e_t(s)\}\left(\mathcal{N}_t(s)\right)^{\frac{\epsilon_w-1}{\epsilon_w}}ds\right)^{\frac{\epsilon_w}{\epsilon_w-1}}. \tag{9}$$

[31] Formally, this is indexed by "n", as we deflate the nominal wage by the price level of nondurables. However, it is important to recall that, as we assume perfect labor mobility, nominal wages are equalized across sectors.

A union sells labor services at the nominal wage W_t (equalized across production sectors) to the labor recruiter, who minimizes costs given the aggregate demand for labor, implying

$$\mathcal{N}_t(s) = \mathcal{N}\left(W_t(s); W_t, N_t\right) = \left(\frac{W_t(s)}{W_t}\right)^{-\epsilon_w} N_t \tag{10}$$

for the sth household, and where the equilibrium nominal wage amounts to

$$W_t = \left(\int_0^1 \exp\{e_t(s)\} W_t(s)^{1-\epsilon_w} ds\right)^{\frac{1}{1-\epsilon_w}}. \tag{11}$$

The union sets the nominal wage for one effective labor unit, $\hat{W}_t$, such that $\hat{W}_t = W_t$ subject to Rotemberg adjustment costs:

$$\mathcal{C}_w(\cdot) = \exp\left\{e_t(s)\right\} \frac{\xi_w}{2} \left(\frac{W_t(s)}{W_{t-1}(s)} - 1\right)^2 N_t, \tag{12}$$

assuming steady-state wage inflation $\Pi_w = 1$. The union's wage-setting problem maximizes

$$\begin{aligned} V_t^w\left(\hat{W}_{t-1}\right) \equiv \max_{\hat{W}_t} & \left(\int \frac{\exp\left\{e_t(s)\right\}(1-\tau_t)\hat{W}_t}{P_{n,t}} \mathcal{N}\left(\hat{W}_t; W_t, N_t\right) - \frac{v\left(\mathcal{N}\left(\hat{W}_t; W_t, N_t\right)\right)}{U'_{C_n}\left(C_{n,t}, D_t\right)}\right) ds \\ & - \int \exp\left\{e_t(s)\right\} \frac{\xi_w}{2}\left(\frac{\hat{W}_t}{\hat{W}_{t-1}} - 1\right)^2 N_t ds + \beta V_{t+1}^w\left(\hat{W}_t\right). \end{aligned} \tag{13}$$

This problem yields a wage Phillips curve (see Hagedorn et al. (2019)):

$$(1-\epsilon_w) w_{n,t} + \epsilon_w \frac{U'_{\mathcal{N}}(N_t)}{U'_{C_n}(C_{n,t}, D_t)} - \xi_w (\Pi_{w,t} - 1) \Pi_{w,t} + \beta \xi_w (\Pi_{w,t+1} - 1) \Pi_{w,t+1} \frac{N_{t+1}}{N_t} = 0, \tag{14}$$

where the aggregation assumptions are as in Hagedorn et al. (2019), so that one obtains the representative agent outcome when heterogeneity is turned off.

C.3 Production

Each of the two sectors—durables and nondurables—features a two-layer production structure. final-goods producers operate under monopolistic competition and face price-setting frictions à la Rotemberg (1982). Their production technology combines intermediate goods, which are produced by intermediate-goods producers using a linear technology that relies solely on labor as an input.

Final-goods producers In each sector $j = \{n, d\}$ a representative final-goods producer aggregates a continuum of intermediate goods indexed by $i \in [0,1]$, $y_{j,t}(i)$ (with price $p_{j,t}(i)$), in accordance with the CES technology

$$Y_{j,t} = \left(\int_0^1 y_{j,t}(i)^{\frac{\epsilon_j - 1}{\epsilon_j}} di \right)^{\frac{\epsilon_j}{\epsilon_j - 1}}, \tag{15}$$

where ϵ_j is the elasticity of substitution across goods of type j. Given $Y_{j,t}$, profit maximization for the jth final-goods producer implies a demand for intermediate good i in the same sector:

$$y_{j,t}(i) = y\left(p_{j,t}(i); P_{j,t}, Y_{j,t}\right) = \left(\frac{p_{j,t}(i)}{P_{j,t}} \right)^{-\epsilon} Y_{j,t}, \tag{16}$$

where $P_{j,t}$ denotes the equilibrium price of the final good:

$$P_{j,t} = \left(\int_0^1 p_{j,t}(i)^{1-\epsilon_j} di \right)^{\frac{1}{1-\epsilon_j}}. \tag{17}$$

Intermediate-goods producers Intermediate-goods producers in either sector employ a linear production technology:

$$Y_{j,t}(i) = A_j N_{j,t}(i), \tag{18}$$

where A_j represents total factor productivity (TFP), assumed to be common to all firms in sector j. Sectoral TFPs are used to attain a steady-state relative price of durables $Q = 1$.

Price setting Final-goods producers' price-setting decisions are subject to Rotemberg adjustment costs $\mathcal{C}_j(\cdot) = \frac{\xi_j}{2}\left(\frac{p_{j,t}(i)}{p_{j,t-1}(i)} - 1\right)^2 Y_{j,t}$ (with $\xi_j > 0$) as in, e.g., Hagedorn et al. (2019). Each firm's value function in real terms reads as

$$\begin{aligned} V_{j,t}\left(p_{j,t-1}(i)\right) \equiv & \max_{p_{j,t}(i)} \frac{p_{j,t}(i)}{P_{j,t}} y\left(p_{j,t}(i); P_{j,t}, Y_{j,t}\right) - w_{j,t} N_{j,t} \\ & - \frac{\xi_j}{2}\left(\frac{p_{j,t}(i)}{p_{j,t-1}(i)} - 1\right)^2 Y_{j,t} + \beta V_{j,t+1}\left(p_{j,t}(i)\right). \end{aligned} \tag{19}$$

This problem yields the usual New Keynesian Phillips curve(s):

$$(1 - \epsilon_j) + \epsilon_j w_{j,t}/A_j - \xi_j \left(\Pi_{j,t} - 1\right) \Pi_{j,t} + \beta \xi_j \left(\Pi_{j,t+1} - 1\right) \Pi_{j,t+1} \frac{Y_{j,t+1}}{Y_{j,t}} = 0, \tag{20}$$

where $\Pi_{j,t}$ denotes the sectoral gross rate of inflation.

The model features two sectoral price-setting conditions. Even with two Phillips curves, taking nondurables as the numeraire ties the durable sector's real marginal cost to the relative price, creating a general equilibrium feedback that prevents cumulative sectoral inflation differentials from drifting. Sectoral inflation can diverge temporarily after shocks, but the relative price is mean-reverting, so the economy returns to steady-state inflation (which is assumed to be symmetric). This is consistent with standard formulations of two-sector economies with asymmetric degrees of sectoral price rigidity (see, e.g., Barsky et al., 2007; Monacelli, 2009; Petrella et al., 2019).

Total real dividends (deflated by $P_{n,t}$) are

$$Div_t = \sum_j Div_{j,t} = Y_{n,t} - w_{n,t} N_{n,t} + Q_t \left(Y_{d,t} - w_{d,t} N_{d,t} \right). \tag{21}$$

C.4 Government

The government comprises two branches: a monetary policy authority and a fiscal policy maker.

Monetary policy The monetary authority adjusts the nominal interest rate, i_t, in response to aggregate inflation and output deviations from steady state, following a Taylor rule with interest-rate inertia:

$$1 + i_t = (1 + i_{t-1})^{\rho_i} \left(\tilde{\Pi}_t^{\phi_\pi} \left(Y_t / Y \right)^{\phi_y} \left(1 + r_t^* \right) \right)^{1-\rho_i}, \tag{22}$$

where $\rho_i \in [0, 1]$, and r_t^* captures the non-systematic component of monetary policy. Aggregate inflation is defined as $\tilde{\Pi}_t \equiv \Pi_{n,t}^{1-\gamma} \Pi_{d,t}^{\gamma}$ where γ equals the share of durable spending over total expenditure (in steady state, i.e. $\gamma = C_d/(C_n + C_d)$).

Fiscal policy The fiscal authority issues one-period nominal bonds, B_t^g, and adjusts the level of lump-sum taxes, τ_t, as in Auclert et al. (2020):

$$\begin{aligned} (1 + r_t) B_{t-1}^g &= \tau_t + B_t^g, \\ \tau_t &= \tau + \phi_\tau \left(B_{t-1}^g - B^g \right), \end{aligned} \tag{23}$$

where τ and B^g denote steady-state taxes and government bonds, respectively, while ϕ_τ determines how fast deficits are closed. Note that such formulation does not affect the steady state. Outside the steady state, we determine taxes in each period conditional on the government budget constraint holding; see F for further details.

C.5 Equilibrium

Market clearing Bonds market clearing obtains as

$$B_t = \int_0^1 B_t(s)ds = B_t^g. \tag{24}$$

Aggregate labor hours are given by

$$N_t = \sum_j \int_0^1 N_{j,t}(i)di = \sum_j Y_{j,t}/A_j, \tag{25}$$

and are assumed to be distributed uniformly among household types, i.e. $N_t(s) = N_t$ for all $s \in (0,1)$. The sectoral resource constraints are

$$Y_{d,t} = C_{d,t}, \tag{26}$$

and

$$Y_{n,t} = C_{n,t} + \chi_t + \kappa \int \max(-B_t(s), 0)ds, \tag{27}$$

where the last two terms of (27) respectively capture the costs of adjusting the stock of durables and that of borrowing, respectively. It follows from equations (26) and (27) that the market for aggregate goods clears in accordance with

$$Y_t = Q_t Y_{d,t} + Y_{n,t} = Q_t C_{d,t} + C_{n,t} + \chi_t + \kappa \int \max(-B_t(s), 0)ds. \tag{28}$$

Equilibrium definition An equilibrium in this economy is defined as paths for individual household decisions, $\{C_{n,t}(s), D_t(s), B_t(s)\}_{t\geqslant 0}$, inflation rates and relative prices, $\{\Pi_{n,t}, \Pi_{d,t}, Q_t\}_{t\geqslant 0}$, real wages, $\{w_{n,t}, w_{d,t}\}_{t\geqslant 0}$, sectoral output and employment, $\{Y_{n,t}, Y_{d,t}, N_{n,t}, N_{d,t}\}_{t\geqslant 0}$, dividends, $\{Div_t\}_{t\geqslant 0}$, interest rates, $\{i_t, r_t\}_{t\geqslant 0}$, government bond supply and taxes, $\{B_t^g, \tau_t\}_{t\geqslant 0}$, such that:

1. Households maximize their objective functions, given the $\{Q_t, r_t, w_{n,t}, N_t, Div_t, \tau_t,\}_{t\geqslant 0}$ sequences;

2. Firms in each sector maximize their profits, taking as given the $\{w_{n,t}, w_{d,t}, Q_t\}_{t\geqslant 0}$ sequences;

3. Given the $\{C_{n,t}, D_t\}_{t\geqslant 0}$ sequences, the real-wage sequences, $\{w_{n,t}\}_{t\geqslant 0}$ and $\{w_{d,t}\}_{t\geqslant 0}$, are consistent with the wage Phillips curve, (14), conditional on perfect sectoral mobility, as captured by $Q_t w_{d,t} = w_{n,t}$;

4. The government budget constraint, (23), is satisfied;

5. Bonds, labor, nondurable and durable goods markets clear;

6. Distributions fulfill consistency requirements.

Computational details Household policy functions are obtained by using the endogenous grid method algorithm (EGM) of Auclert et al. (2021); see D for details. To solve for the steady state, we use a multi-dimensional root finder to guess on β, N_d and target: *i*) bonds market clearing; *ii*) durable goods market clearing. Given bonds and durable goods market clearing, the nondurable goods market clears by Walras's law; see E for further details. To obtain impulse responses, we formulate our model in sequence space; see F.

D Endogenous grid method

D.1 Model setup

Households face the following optimization problem:

$$
\begin{aligned}
V_t\left(z_t, B_t, D_t\right) &= \max_{C_{n,t}, D_{t+1}, B_{t+1}} u\left(C_{n,t}, D_t\right) + \beta \mathbb{E}_t V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right) \\
\text{s.t. } C_{n,t} + B_{t+1} + Q_t\left(D_{t+1} - (1-\delta) D_t\right) &= z_t + \left(1 + r_t\right) B_t - \Psi\left(D_{t+1}, D_t\right) \\
B_t \geqslant \underline{B}, &\quad D_t \geqslant 0,
\end{aligned}
\tag{29}
$$

where z_t denotes idiosyncratic income, B_t is wealth, D_t denotes the stock of durables and Q_t is the price of durables relative to that of nondurables. In the general equilibrium setting, $z_t = \exp\{e_t\}\left[w_{n,t} N_t - \tau_t + Div_t\right]$. The rest, except for utility and the cost function $\Psi(\cdot)$ is standard. Note that we do not take care of sticky expectations explicitly in this algorithm, as it is possible to simply apply an appropriate matrix operation to the household Jacobians as shown in Auclert et al. (2020). The utility and the adjustment cost functions are

$$
\begin{gathered}
u(C_{n,t}, D_t) = \frac{\psi(C_{n,t}, D_t)^{1-\sigma}}{1-\sigma} \quad \text{and} \quad \psi(C_{n,t}, D_t) = C_{n,t}^{\theta} D_t^{1-\theta}, \\
\Psi\left(D_{t+1}, D_t\right) = \frac{\alpha}{2}\left(\frac{D_{t+1} - (1-\delta) D_t}{D_t}\right)^2 D_t.
\end{gathered}
\tag{30}
$$

D.2 First-order and envelope conditions

Re-write the Bellman equation by substituting out consumption using the budget constraint

$$
\begin{aligned}
V_t\left(z_t, B_t, D_t\right) = \max_{B_{t+1}, D_{t+1}} \quad & u\left(z_t+\left(1+r_t\right) B_t-Q_t\left(D_{t+1}-(1-\delta) D_t\right)-\Psi\left(D_{t+1}, D_t\right)-B_{t+1}, D_t\right) \\
& +\mu_t D_{t+1}+\lambda_t\left(B_{t+1}-\underline{B}\right)+\beta \mathbb{E} V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right),
\end{aligned}
\tag{31}
$$

where μ_t and λ_t are the multipliers for the non-negativity constraint on durables and the unsecured credit-borrowing constraint, respectively.

The first-order conditions with respect to D_{t+1} and B_{t+1} yield

$$
\begin{aligned}
\partial_{C_{n,t}} u(C_{n,t}, D_t)\left(Q_t+\partial_{D_{t+1}} \Psi\left(D_{t+1}, D_t\right)\right) &= \mu_t+\partial_{D_{t+1}} \beta \mathbb{E} V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right), \\
\partial_{C_{n,t}} u(C_{n,t}, D_t) &= \lambda_t+\partial_{B_{t+1}} \beta \mathbb{E} V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right).
\end{aligned}
\tag{32}
$$

The envelope conditions are

$$
\begin{aligned}
& \partial_{B_t} V_t\left(z_t, B_t, D_t\right)=\left(1+r_t\right) \partial_{C_{n,t}} u(C_{n,t}, D_t), \\
& \partial_{D_t} V_t\left(z_t, B_t, D_t\right)=\partial_{D_t} u(C_{n,t}, D_t)+\partial_{C_{n,t}} u(C_{n,t}, D_t)\left[Q(1-\delta)-\partial_{D_t} \Psi\left(D_{t+1}, D_t\right)\right].
\end{aligned}
\tag{33}
$$

For later use, it is convenient to define the post-decision value function as

$$
W_t\left(z_t, B_{t+1}, D_{t+1}\right) \equiv \beta \mathbb{E}_t V_{t+1}\left(z_t, B_{t+1}, D_{t+1}\right).
\tag{34}
$$

D.3 Main equations of the algorithm

First, we combine the two equations in (32) to obtain

$$
\frac{\mu_t+\partial_{D_{t+1}} \beta \mathbb{E} V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right)}{\lambda_t+\partial_{B_{t+1}} \beta \mathbb{E} V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right)}=Q_t+\alpha\left(\frac{D_{t+1}}{D_t}-(1-\delta)\right).
\tag{35}
$$

From the F.O.C. wrt. B_{t+1} in equation (32) we can pin down nondurable consumption:

$$
\begin{aligned}
\frac{\partial u(C_{n,t}, D_t)}{\partial C_{n,t}} &= \lambda_t+\partial_{B_{t+1}} \beta \mathbb{E} V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right) \\
\Rightarrow C_{n,t} &= \left[\frac{1}{\theta}\left(\lambda_t+\partial_{B_{t+1}} \beta \mathbb{E} V_{t+1}\left(z_{t+1}, B_{t+1}, D_{t+1}\right)\right) D_t^{(\theta-1)(1-\sigma)}\right]^{\frac{1}{\theta(1-\sigma)-1}}.
\end{aligned}
\tag{36}
$$

D.4 Algorithm

The algorithm is based on the two-asset algorithm described in Auclert et al. (2021). For a generic variable x_t, denote today's grid by x and tomorrow's grid by $x^{'}$. Thus, according to the EGM algorithm:

1. When seeking for steady-state policies, initialize the guess on $\partial_B V\left(z, B, D\right), \partial_D V\left(z, B, D\right)$.

Otherwise, start backward induction by starting from steady-state $\partial_B V(z, B, D), \partial_D V(z, B, D)$ (used when calculating household Jacobians).

2. Let the productivity-shock transmission matrix be notated by Π. The value functions have a common $z' \to z$ so the post-decision functions are:

$$\begin{aligned} W_B(z, B', D') &= \beta \Pi V_B(z', B', D'), \\ W_D(z, B', D') &= \beta \Pi V_D(z', B', D'). \end{aligned} \tag{37}$$

3. Find $D'(z, B', D)$ for the *unconstrained* case using equation (35):

$$\frac{W_D(z, B', D')}{W_B(z, B', D')} = Q + \alpha \left(\frac{D'}{D} - (1 - \delta) \right). \tag{38}$$

4. Use $D'(z, B', D)$ to map $W_B(z, B', D')$ into $W_B(z, B', D)$ by interpolation. Then compute nondurable consumption by using equation (36):

$$C_n(z, B', D) = \left(W_B\left(z, B', D\right) D^{\theta - 1} \cdot D^{(1-\theta)\sigma} \right)^{\frac{1}{\theta(1-\sigma)-1}}. \tag{39}$$

5. Now it is possible to find total assets by inserting $D'(z, B', D)$ and $C_n(z, B', D)$ into the budget constraint:

$$B\left(z, B', D\right) = \frac{C_n(z, B', D) + Q\left(D'(z, B', D) - (1-\delta) D\right) + B' + \Psi\left(D'(z, B', D), D\right) - z}{1 + r}. \tag{40}$$

6. Invert $B(z, B', D)$ to obtain $B'(z, B, D)$ by interpolation. Use the same interpolation weights to obtain $D'(z, B, D)$.

7. Find $D'(z, \underline{B}, D)$ for the *constrained* case using equation (35). For scaling, define $\kappa \equiv \lambda / W_B(z, \underline{B}, D')$. Then equation (35) becomes

$$\frac{1}{1+\kappa} \frac{W_D(z, \underline{B}, D')}{W_B(z, \underline{B}, D')} = Q + \alpha \left(\frac{D'}{D} - (1 - \delta) \right). \tag{41}$$

8. Use equation (41) to solve for $D'(z, \kappa, D)$, that is over a grid of κ values. Then compute consumption as

$$C_n(z, \kappa, D) = \left((1+\kappa) W_B(z, \kappa, D) D^{\theta-1} \cdot D^{(1-\theta)\sigma} \right)^{\frac{1}{\theta(1-\sigma)-1}}. \tag{42}$$

9. Using $D'(e,\kappa,D)$, $C_n(e,\kappa,D)$ and the budget constraint obtain

$$B(z,\kappa,D) = \frac{C_n(z,\kappa,D) + Q\left(D'(z,\kappa,D) - (1-\delta)\,D\right) + \underline{B} + \Psi\left(D'(z,\kappa,D),D\right) - z}{1+r}. \tag{43}$$

10. Invert $B(z,\kappa,D)$ by interpolation to obtain $\kappa(z,B,D)$. The same interpolation weights can be used to map $D'(z,\kappa,D)$ into $D'(z,B,D)$. By definition, $B'(z,B,D) = \underline{B}$.

11. Combine the constrained and the unconstrained solutions of $B'(z,B,D)$ and $D'(z,B,D)$. Then compute consumption from the budget constraint:

$$C_n(z,B,D) = z + (1+r)\,B - Q\left(D'(z,B,D) - (1-\delta)\,D\right) - \Psi\left(D',D\right) - B'(z,B,D). \tag{44}$$

12. Update $\partial_B V\,(z,B,D)$ and $\partial_D V\,(z,B,D)$ using the envelope conditions from equation (33):

$$\begin{aligned} \partial_B V\,(z,B,D) &= (1+r)\,\partial_{C_n} u(C_n,D), \\ \partial_D V\,(z,B,D) &= \partial_D u(C_n,D) - \partial_{C_n} u(C_n,D)\left[Q(1-\delta) + \partial_D \Psi\left(D',D\right)\right]. \end{aligned} \tag{45}$$

13. For the steady-state solutions: Return to step 2 and follow the same steps until the change in $\partial_B V\,(z,B,D)$ and $\partial_D V\,(z,B,D)$ between iterations is ≈ 0. Otherwise, solve paths by backward iteration (used to obtain household Jacobians given some shock to a given household input variable).

Finally, to obtain aggregates we need to simulate the distribution of households. We use the histogram method as developed in Young (2010). In the steady state, we simulate forward until the change in the distribution between consecutive iterations is ≈ 0 (see E). Outside the steady state, one can simply simulate forward given a path length (used to obtain Jacobians).

E Stationary steady state

Given guesses for β, N_d, we can solve for equilibrium quantities as follows:

1. We set $P_n = 1$ as the numeraire, so that $\Pi_n = 1$;

2. We get that $\Pi_d = 1$, as $\Pi_d = \Pi_n$ in the steady state;

3. We normalize $Q = 1$;

4. Given a calibration target for N_d (which is set to 1/6), we pin down $A_d = Y_d/N_d$;[32]

[32] $N_d = 0.5$ is a reasonable choice—given that $A_d N_d = Y_d = C_d$—as C_d makes up a empirically plausible share of total consumption; cf. the calibration target for $C_n/(C_n + C_d)$.

5. We obtain $w_d = A_d \cdot \frac{\epsilon_d - 1}{\epsilon_d}$ from the durable-goods sector Phillips curve;
6. The latter then yields real wage in the nondurable-goods sector as $w_n = Q \cdot w_d$, as the nominal wage is equalized across sectors;
7. From the nondurable-goods sector Phillips curve we can pin down $A_n = w_n \cdot \frac{\epsilon_n}{\epsilon_n - 1}$;
8. We set $Y_n = 1 - Q \cdot Y_d$, such that total output, $Y = 1$;
9. We then obtain employment in the nondurable-goods sector as $N_n = Y_n / A_n$;
10. We get dividends from equation (21), $Div(Y_n, Y_d, Q, w_n, w_d)$;
11. Taxes are pinned down by $\tau = r \cdot B^g$.

As we pin down all variables from aggregate relationships, it is possible to solve the household problem to obtain C_n, C_d, B, and check root-finding target residuals. After root-finding, we set ψ_N given w_n, C_n, C_d and parameters, such that the wage Phillips curve, equation (14), holds in the steady state.

F Sequence space formulation for the impulse responses

In sequence space, the model can be summarized by the equation system

$$H\left(N_{n,t}, N_{d,t}, \Pi_{n,t}, Q_t, w_{n,t}, u_t^r\right) = \begin{pmatrix} \text{Wage Phillips curve} \\ \text{Phillips curve durables} \\ \text{Phillips curve nondurables} \\ \text{Bonds market clearing} \\ \text{Durable goods market clearing} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \tag{46}$$

Using caligraphic variables $\mathcal{B}$,$\mathcal{C}_n$,$\mathcal{C}_d$,$\mathcal{D}$ to denote the aggregated household solution variables counterparts, the system reads as

$$H\left(N_{n,t}, N_{d,t}, \Pi_{n,t}, Q_t, w_{n,t}, u_t^r\right) =$$
$$\begin{pmatrix} (1-\epsilon_w)\, w_{n,t} + \epsilon_w \frac{U'_N(N_t)}{U'_{C_n}(\mathcal{C}_{n,t}, \mathcal{D}_t)} - \xi_w \left(\Pi_{w,t} - 1\right) \Pi_{w,t} + \beta \xi_w \left(\Pi_{w,t+1} - 1\right) \Pi_{w,t+1} \frac{N_{t+1}}{N_t} \\ (1-\epsilon_d) + \epsilon_d w_{d,t}/A_n - \xi_d \left(\Pi_{d,t} - 1\right) \Pi_{d,t} + \beta \xi_d \left(\Pi_{d,t+1} - 1\right) \Pi_{d,t+1} \frac{Y_{d,t+1}}{Y_{d,t}} \\ (1-\epsilon_n) + \epsilon_n w_{n,t}/A_d - \xi_n \left(\Pi_{n,t} - 1\right) \Pi_{n,t} + \beta \xi_n \left(\Pi_{n,t+1} - 1\right) \Pi_{n,t+1} \frac{Y_{n,t+1}}{Y_{n,t}} \\ \mathcal{B}_t - B_t^g \\ Y_{d,t} - \mathcal{C}_{d,t} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \tag{47}$$

where we have

$$\Pi_{d,t} = \frac{Q_t}{Q_{t-1}} \Pi_{n,t} \tag{48}$$

$$\Pi_{w,t} = \frac{w_{n,t}}{w_{n,t-1}} \cdot \Pi_{n,t} \tag{49}$$

$$Y_{n,t} = A_n N_{n,t} \tag{50}$$

$$Y_{d,t} = A_d N_{d,t} \tag{51}$$

$$N_t = N_{n,t} + N_{d,t} \tag{52}$$

$$w_{d,t} = Q_t^{-1} w_{n,t} \tag{53}$$

$$Div_t = Y_{n,t} - w_{n.t} N_{n,t} + Q_t \left[Y_{d,t} - w_{d,t} N_{d,t} \right] \tag{54}$$

$$\tilde{\Pi}_t = \Pi_{n,t}^{1-\gamma} \Pi_{d,t}^{\gamma} \tag{55}$$

$$1 + i_t = (1 + i_{t-1})^{\rho_i} \left(\tilde{\Pi}_t^{\phi_{\tilde{\pi}}} \left(Y_t / Y \right)^{\phi_y} (1 + r_t^*) \right)^{1-\rho_i}, \tag{56}$$

$$(1 + r_t) B_{t-1}^g = \tau_t + B_t^g \tag{57}$$

$$\tau_t = \tau + \phi_\tau \left(B_{t-1}^g - B^g \right) \tag{58}$$

and where the nondurable goods market clears by Walras' law.

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