Bank of England

ChaMP

Inflation composition and monetary stabilization

Staff Working Paper No. 1,208
September 2026

Michele Andreolli, Natalie Rickard, Paolo Surico and Chiara Vergeat

This paper contains research conducted within the network ‘Challenges for Monetary Policy Transmission in a Changing World Network’ (ChaMP). It consists of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the European System of Central Banks (ESCB).

ChaMP is co-ordinated by a team chaired by Philipp Hartmann (ECB), and consisting of Diana Bonfim (Banco de Portugal), Margherita Bottero (Banca d’Italia), Emmanuel Dhyne (Nationale Bank van België/Banque Nationale de Belgique) and Maria T Valderrama (Oesterreichische Nationalbank), who are supported by Melina Papoutsi and Gonzalo Paz-Pardo (both ECB), seven central bank advisers and eight academic consultants.

ChaMP seeks to revisit our knowledge of monetary transmission channels in the euro area in the context of unprecedented shocks, multiple ongoing structural changes and the extension of the monetary policy toolkit over the last decade and a half as well as the recent steep inflation wave and its reversal. More information is provided on its **website**.

Bank of England

Staff Working Paper No. 1,208

Inflation composition and monetary stabilization

Michele Andreolli,[1] Natalie Rickard,[2] Paolo Surico,[3] and Chiara Vergeat[4])

Abstract

Every inflation index is an aggregation rule. This paper asks when the aggregation that measures the cost of living is also the one that should guide monetary stabilization. A Consumer Price Index (CPI) measures purchasing power; a stabilization index should weight sectoral prices by what they reveal about states in which the policy rate has high marginal welfare value. In standard New-Keynesian models, the two indices coincide. We show that they diverge when the sectors generating price movements differ from the sectors through which interest rates move demand, income, and marginal costs. New euro-area data reveal such a mismatch. Discretionary sectors are the cyclical quantity margin and employ many hand-to-mouth workers, while necessity sectors account for much of inflation variation. After a contractionary monetary policy shock, discretionary consumption and employment adjust the most, but necessity prices respond more. We lay out a two-sector New-Keynesian model with non-homothetic demand and sectoral labour market heterogeneity that is consistent with these findings. Even with symmetric shocks and homogeneous nominal rigidities, optimal simple rules place nearly all weight on discretionary inflation, because reacting to necessity inflation uses the discretionary sector as the adjustment margin for price movements in sectors with little quantity traction. With stickier discretionary prices, as observed in the euro area, a discretionary inflation rule improves welfare further and closes about two thirds of the welfare gap between a CPI inflation rule and Ramsey policy. Under the empirical distribution of euro-area shocks, the gains come from lower sectoral inflation volatility rather than lower aggregate real volatility. Expenditure weights need not be stabilization weights.

Key words: Inflation composition, non-homothetic demand, labour market heterogeneity.

JEL classification: E52, E31, E32.

---

(1) Boston College and CEPR. Email: andreoll@bc.edu
(2) Bank of England. Email: natalie.rickard@bankofengland.co.uk
(3) London Business School and CEPR. Email: psurico@london.edu
(4) London Business School. Email: cvergeat@london.edu

The views expressed in this paper are those of the authors, and not necessarily those of the Bank of England or its committees. For very useful comments and suggestions, we are grateful to Carlo Altavilla, Agnes Benassy-Quere, Florin Bilbiie, Edouard Challe, Axel Ferriere, Jordi Gali, Peter Karadi, Andrea Galeotti, Philipp Hartmann, Christian Hoynck, Sara Holton, Rustam Jamilov, Xavier Jaravel, Andrea Papetti, Dhiren Patki, Federica Romei, Maria Valderrama, and Francesca Zucchi as well as participants at the ECB Forum on Central Banking 2025, EABCN/BoE Heterogeneous Agent Workshop, Boston College, SEA Conference, 24th Workshop on Macroeconomic Dynamics, Empirical Macro Group at AEA Conference, Fridays at the Boston Fed Workshop, 14th International Research Forum in Monetary Policy, BIS Conference on Heterogeneity and Inflation, BIS, BSE Summer Forum and SED.

The Bank's working paper series can be found at www.bankofengland.co.uk/working-paper/staff-working-papers

Bank of England, Threadneedle Street, London, EC2R 8AH
Email: enquiries@bankofengland.co.uk

ISSN 1749-9135 (on-line)

1 Introduction

An inflation index takes many prices and turns them into one statistic. The usual consumer price index aggregates prices using expenditure weights. This is the right aggregation for measuring purchasing power. Is it also the right aggregation for guiding monetary policy? This paper argues that, in general, it is not. We call the relevant policy objects *stabilization weights*: the weights on sectoral prices that reflect what those prices reveal about states in which the policy rate has high marginal welfare value. In the textbook New-Keynesian model, expenditure weights and stabilization weights coincide. They need not coincide when the sectors generating price movements differ from the sectors through which interest rates move demand, income, and marginal costs.

The distinction matters because monetary policy is not a price-by-price instrument. A central bank that raises the policy rate in response to inflation in one sector contracts not only that sector but also parts of the economy that are interest-sensitive. If those parts of the economy are also the sectors in which labour income accrues to households with limited ability to smooth consumption, the welfare cost of using them as the adjustment margin can be large. In that economy, an inflation component can receive a large expenditure weight and still be a poor signal for policy. Conversely, a component with a smaller expenditure weight can be central for stabilization if it is attached to the margin through which monetary policy moves quantities and current income.

This paper develops and quantifies this idea. We study a two-sector economy in which necessities (goods and services tied to basic needs) and discretionaries differ in demand cyclicality and labour force composition. Necessities absorb a large share of household expenditure and account for much of inflation variation. Discretionaries are more income-elastic and more interest-sensitive, so they are the main quantity margin of the business cycle and monetary transmission. Discretionary sectors also employ a larger share of hand-to-mouth workers. These features create a mismatch between the price signal in headline inflation and the real transmission margin of the interest rate instrument.

The mechanism is simple. Suppose that necessity prices rise. In an expenditure-weighted index, this movement receives substantial weight. An interest rate rule that reacts to headline inflation raises the policy rate. But if necessity demand is relatively insensitive to interest rates, the real contraction induced by the policy response falls mainly on discretionary consumption and employment. The central bank is then using discretionary demand and labour income as the adjustment margin for inflation in a sector where the policy rate has little impact on quantities. This may reduce real volatility, but it can worsen welfare by generating unnecessary movements in demand, earnings, relative prices, and sectoral marginal costs.

The relevant question is not only which prices move, but whether those prices are attached to the margin through which policy works.

We bring this mechanism to the data by constructing new Euro-area time series for necessity and discretionary consumption, inflation, and employment. The classification begins from consumption categories and is extended to production industries using input-output linkages, allowing us to measure prices, quantities, and labour market exposure on a common sectoral basis. Three facts motivate the model. First, real activity fluctuates primarily in discretionary sectors. Across recent Euro-area recessions, discretionary goods and services account for some 95% of the contraction in aggregate consumption and employment. Necessity consumption and necessity employment are much less cyclical. Second, price movements are concentrated elsewhere. Necessity sectors account for about 86% of inflation fluctuations. Thus, the sectors that move aggregate quantities are not the same sectors that dominate measured inflation. Third, discretionary sectors employ many more hand-to-mouth workers, with the difference being particularly pronounced at the bottom of the income distribution. The same sector that absorbs the cyclical quantity adjustment is therefore also the sector in which employment fluctuations are most likely to translate into current-income fluctuations for households with limited liquidity.

These facts are not a relabeling of existing decompositions. A large share of discretionary expenditure sits outside durable purchases, and within nondurables and services, discretionary items are more cyclical than necessity items. The distinction is also different from tradable versus non-tradable and from core versus non-core inflation. Core inflation removes volatile components; our classification separates components according to whether they are attached to the policy transmission margin.

We then ask whether the same separation appears after identified monetary policy shocks. Using high-frequency surprises around ECB policy announcements in a Bayesian VAR, we find that a contractionary monetary-policy shock reduces consumption and employment mainly in discretionary sectors. Necessity quantities adjust much less. Prices move in the opposite sectoral pattern: necessity prices respond more than discretionary prices. Monetary policy therefore has its strongest real effects in discretionary sectors, while a large part of the price response occurs in necessity sectors. This is the empirical counterpart of the signal-transmission mismatch.

To interpret the evidence and study policy, we build a two-sector New-Keynesian model with two household types. Preferences are non-homothetic, so discretionary spending is more income-elastic and more intertemporally substitutable than necessity spending. This makes discretionary demand the main cyclical margin for both Ricardian and hand-to-mouth households. Labor markets differ across sectors, with hand-to-mouth workers disproportionately employed in discretionary industries. This makes discretionary employment fluctuations especially important for current income and spending. Firms set prices subject to nominal rigidities, and monetary policy follows an interest-rate rule that can respond to different inflation indices.

The model is designed to isolate a new source of stabilization weights. Classic sectoral New-Keynesian models imply that policy should place more weight on inflation in sectors with stickier prices; others emphasize sector-specific shocks, durable goods, production networks, or reallocation frictions. Our mechanism operates even when shocks are symmetric and nominal rigidities are homogeneous. This is not because of a sectoral exogenous distortion. The reason is that monetary policy has an endogenous sectoral transmission margin, and the welfare cost of moving that margin depends on which households experience the associated changes in current income.

The welfare approximation makes this point transparent. Welfare losses depend on sectoral inflation volatility, aggregate real fluctuations, relative price movements, and the interaction between relative prices and real activity. Non-homothetic demand and labor-market heterogeneity raise the welfare cost of real aggregate fluctuations because the quantity margin of the cycle is concentrated in the sector where employment income accrues disproportionately to hand-to-mouth households. At the same time, welfare continues to depend directly on sectoral inflation volatility through price dispersion. The central bank therefore faces a trade-off between stabilizing pricing distortions and using real activity as an adjustment margin. The inflation index in the policy rule determines which sectoral price movements trigger that trade-off.

We quantify this trade-off using simple interest rate rules, as in Taylor (1993). The rules hold fixed the response coefficients and differ only in the inflation index entering the reaction function. A headline rule responds to expenditure-weighted CPI inflation. A discretionary inflation rule responds to inflation in discretionary goods and services. The welfare criterion is unchanged across rules. We therefore do not assume that discretionary inflation is the objective. We ask whether responding to discretionary inflation is a better way to stabilize the welfare-relevant allocation.

In the baseline model with symmetric cost-push shocks and homogeneous price rigidity, welfare improves as the rule places more weight on discretionary inflation. A discretionary-inflation rule reduces welfare losses relative to a headline-inflation rule even though discretionary goods have a smaller expenditure weight than necessities. Removing non-homothetic demand weakens the result. Removing sectoral labor-market heterogeneity, or removing hand-to-mouth households altogether, eliminates it. The result is therefore not driven by expenditure shares, sector-specific shocks, or sticky-sector logic. It comes from the interaction between the sectoral transmission of monetary policy and the sectoral incidence of current-income exposure.

The empirical calibration strengthens the result. Discretionary prices adjust less frequently than necessity prices in the Euro-area micro price data. Introducing this observed difference reinforces the new mechanism with the classic price dispersion motive for stabilizing inflation in the stickier sector. Under the calibrated economy, the discretionary inflation rule closes roughly two thirds of the welfare loss gap between the headline inflation rule and the Ramsey allocation.

Finally, we evaluate the same rules under the empirical distribution of Euro-area shocks. Using a sufficient-statistics approach that combines VAR-based dynamics with causal impulse responses, we construct counterfactual second moments under alternative policy rules. The discretionary inflation rule reduces welfare losses by 9.4% relative to the headline rule. The gain comes from lower sectoral inflation volatility rather than mechanically lowering aggregate consumption fluctuations. The rule performs better because it avoids using the most policy-sensitive sector to chase price movements originating in sectors where the policy rate has little quantity traction.

The main contribution of the paper is the principle of aggregation in stabilization policy. Expenditure weights are appropriate for measuring purchasing power. They are not generally the right weights for guiding an instrument that works through particular margins of demand, income, and marginal cost. In the textbook New-Keynesian model, these two aggregation problems collapse into one. Once sectoral prices are aggregated using expenditure weights, headline inflation is a sufficient statistic for stabilization policy: a central bank that stabilizes this index also stabilizes the measure of real activity that is relevant for welfare (Woodford, 2003, Galí, 2015). In an economy with heterogeneous sectoral transmission and heterogeneous income exposure, however, these two aggregation problems separate. Stabilization weights depend on the marginal value of the policy instrument in the monetary transmission, not only on budget shares.

This aggregation principle separates our contribution from Olivi et al. (2025). Their Marginal CPI is a price index: non-homothetic demand replaces average CPI weights with marginal spending shares, changing the New-Keynesian Phillips curve and the optimal response to asymmetric sectoral productivity shocks. Our stabilization index is an instrument index: sectoral prices receive weight when they signal states in which the policy rate has high marginal welfare value because it moves quantities, labour income, and marginal costs.

Their luxury component matters because households spend on it at the margin; our discretionary sector matters because policy transmits through it, with current-income effects concentrated among hand-to-mouth workers. In our model, non-homotheticity gives policy traction on discretionary quantities, while labour-market heterogeneity gives that traction welfare incidence: absent the latter, discretionary inflation is not a better policy signal. This is why our result holds with symmetric shocks and homogeneous nominal rigidities, weakens without non-homotheticity, and disappears without sectoral labor-market heterogeneity or hand-to-mouth households.

The same logic clarifies the relationship between our results and existing arguments for focusing on particular inflation components. Our case for discretionary inflation is not a case for core inflation: volatile components are not removed because they are noisy, and included components are not chosen because they forecast trend inflation. It is not only the standard argument for stabilizing inflation in sticky price sectors, though that force is present in the data. It is also distinct from the durable goods channel, because discretionary services and nondurables are central to the mechanism. The inflation component that is relevant for policy is the one attached to the sectoral margin through which monetary policy moves quantities and current income.

Our results also do not imply that central banks should replace headline inflation as their objective. Headline CPI inflation remains the natural measure of household purchasing power. The point is instead about implementation: the interest rate rule used to stabilize inflation and welfare-relevant activity may need to react to a different index from the one used to measure purchasing power. In the Euro-area data, that index is discretionary inflation. In Andreolli et al. (2024), we document similar necessity–discretionary heterogeneity for the United States, suggesting that the mechanism is not specific to the Euro area. That paper studies business-cycle amplification and fiscal policy; the present paper studies monetary policy design and the inflation index that should guide interest rate movements.

Related Literature. Our paper builds on important work on the macroeconomic implications of non-homothetic demand. Foundational contributions develop tractable frameworks with income-dependent preferences and show how they shape sectoral demand and structural transformation (Jaravel and Lashkari, 2024, Lashkari et al., 2021). Recent papers embed these preferences in heterogeneous-agent models of business-cycle dynamics, inequality, and fiscal transmission across sectors (Boehnert et al., 2025, Ferriere et al., 2025, Jaravel and Olivi, 2026). The closest monetary policy application is Olivi et al. (2025), whose Marginal CPI reweights sectors by marginal rather than average expenditure shares and changes the optimal response to asymmetric sectoral productivity shocks. We study a different policy object: stabilization weights for an interest rate rule. These weights reflect not only where households spend at the margin, but whether sectoral prices are attached to the margins through which policy moves quantities, current income, and marginal costs. Inflation composition therefore matters in our framework even when shocks and nominal rigidities are fully symmetric across sectors.

Our analysis connects to the literature on optimal monetary policy with sectoral heterogeneity. Classic results show that sectoral inflation matters when sectors differ in nominal rigidity or face sector-specific shocks (Aoki, 2001, Woodford, 2003, Benigno, 2004). Guerrieri et al. (2021) study asymmetric shocks that require sectoral reallocation: these shocks generate an endogenous cost-push trade-off, so no simple reweighted inflation index is generally an optimal target. Other recent work emphasizes production networks and sector-specific constraints in monetary transmission (Rubbo, 2023, Bianchi et al., 2024). Durable-goods New-Keynesian models provide a related benchmark: policy rules overweight durable inflation because durable purchases are highly interest-sensitive (Erceg and Levin, 2006, Barsky et al., 2007, 2016). We identify a different source of policy relevance. Even with symmetric shocks and homogeneous nominal rigidities, the inflation index in the interest rate rule can depart from headline CPI because stabilization weights depend on whether sectoral prices are attached to the margin through which policy moves quantities and current income. A sector should receive weight not simply because it is large, durable, central in production, sticky, or constrained, but because its prices reveal states in which the policy rate has high marginal welfare value.

Our question speaks to the debate on the appropriate inflation measure for monetary policy. Mankiw and Reis (2003) show that the weights in a stability price index depend on sectoral size, cyclical sensitivity, nominal rigidity, and sectoral shocks. We identify a new determinant: whether a sector's prices are attached to the margin through which monetary policy moves quantities and current income. This connects our analysis to empirical work using disaggregated prices to study inflation dynamics and monetary transmission (Boivin et al., 2009, Reis and Watson, 2010, Stock and Watson, 2016a). Unlike that literature, which focuses on price-setting, relative-price movements or trend/core inflation, we ask which inflation component should enter an interest rate policy rule when the price margin and the transmission margin differ.

The paper is also related to research on monetary transmission with heterogeneous agents (McKay and Wolf, 2022, Acharya et al., 2023, Bilbiie, 2025). We show that the sectoral allocation of hand-to-mouth workers is central for the design of monetary policy, as it determines how sectoral fluctuations translate into aggregate demand. Our mechanism relates to the income-based amplification channel emphasized by Patterson (2023) on U.S. data, but we show that its interaction with sectoral demand cyclicality has novel implications for monetary policy and stabilization weights. Finally, we contribute to the applied time-series literature on monetary transmission (Smets and Wouters, 2003, Christiano et al., 2005, Altavilla et al., 2019, Gertler and Karadi, 2015, Jarociński and Karadi, 2020). We add a new sectoral measurement, necessity vs discretionary, which allows us to show that the price margin in headline inflation and the quantity margin of monetary transmission do not coincide.

Roadmap. Section 2 presents the data and reduced-form correlations. Section 3 focuses on the effects of identified monetary policy shocks. Sections 4 and 5 present the model and derive the welfare criterion. Section 6 evaluates simple policy rules and compares them with the optimal policy. Section 7 extends the analysis beyond cost-push shocks. Section 8 concludes. Additional empirical results and derivations are collected in the Appendices.

2 Data and Measurement

This section constructs new Euro-area time series that decompose consumption, inflation, and employment into necessity and discretionary. We ask whether the sectors that absorb cyclical quantity adjustment also drive measured inflation, and which workers are exposed to those sectoral movements. Three facts emerge. First, consumption and employment fluctuate primarily in discretionary sectors, while inflation movements are concentrated in necessity sectors. Second, discretionary industries employ a disproportionately large share of hand-to-mouth workers. Third, these patterns are specific to the necessity–discretionary distinction and are not captured by standard classifications such as durables versus non-durables, tradables versus non-tradables, or core versus non-core inflation. Together, the facts identify a price–quantity disconnect and the sectoral incidence of income fluctuations: the quantity margin of the cycle is concentrated in sectors employing many hand-to-mouth workers, while inflation dynamics are concentrated elsewhere. The next sections extend this to identified monetary policy shocks and layout a model to explore the policy implications.

2.1 Data Construction

Our first step is to construct a dataset tracking necessity and discretionary economic activity across multiple macroeconomic dimensions in the Euro area. We begin from a classification of household consumption categories into necessity and discretionary goods and services. We then extend the classification to the production side using input–output linkages, which allows us to identify industries whose output is primarily necessity or discretionary in nature. This framework generates quarterly time series for consumption, prices, and employment, as well as supplementary series for financial market valuations, dividends, wages, compensation of employees, operating surplus, and gross value added. Full details are provided in Appendix A.

Consumption classification. We classify consumption categories following the UK Office for National Statistics (ONS), which assigns COICOP 4-digit categories into necessities, defined as expenditures tied to basic or legally required needs, and discretionaries, defined as optional or deferrable expenditures. We adapt this classification to Eurostat data at the COICOP 3-digit level by assigning each category to the majority classification of its 4-digit components. The resulting mapping closely aligns with Andreolli et al. (2024) and with the Engel-curve-based approach of Aguiar and Bils (2015). Details are in Appendix A.1.2.

Consumption and price series. We construct annual real consumption indices for necessity and discretionary goods using Eurostat National Accounts data on "Households Final Consumption by Purpose," following standard chain-linking procedures with 2015 as the reference year. Quarterly growth rates are obtained by interpolating the annual series using quarterly data from Italy (ISTAT) and Germany (DESTATIS) via the Chow and Lin (1971) method. The Chow–Lin interpolation preserves the annual Euro-area time-series patterns, with the Italian and German quarterly series used only to recover within-year dynamics.

Price indices are built from monthly HICP data at the COICOP 3-digit level, following standard aggregation and chain-linking methods. Appendix B.3.2 compares these series to core inflation. Core inflation contains a larger share of discretionary items than headline inflation, but also includes a substantial share of necessity goods. This distinction matters because the policy analysis below does not rely on excluding volatile items; it relies on separating the price components attached to different quantity margins. The final consumption and inflation series span 1997Q1–2024Q2 and 2003Q1–2024Q2, respectively. Construction details are provided in Appendix A.1.3.

Industry classification. To extend the classification to the production side, we map NACE Rev. 2 two-digit industries into necessity and discretionary sectors following Andreolli et al. (2024). Final industries are classified based on the nature of their output. Intermediate industries are assigned using the Leontief inverse of the Euro-area input–output table, which captures their direct and indirect contributions to final necessity and discretionary demand. This procedure yields 20 necessity industries, 37 discretionary industries, and 5 unclassified sectors under NACE Rev. 2, with a consistent mapping for earlier classifications. The full classification is reported in Table A.5, with details summarized in Appendix A.1.5.

Labor market. Quarterly sectoral employment series are constructed from the Eurostat Labour Force Survey, adjusting for classification changes over time. We focus on employment rates scaled by total Euro-area population, as described in Appendix A.1.6. To measure the sectoral distribution of current-income exposure, we use the ECB Household Finance and Consumption Survey (HFCS) to compute the share of hand-to-mouth workers employed in each sector, following the categorization proposed by Slacalek et al. (2020) and Kaplan et al. (2014). Appendix A.1.7 reports the distribution across income quintiles. These calculations rely on broader one-digit industry classifications and are therefore likely to understate the degree of sectoral heterogeneity in practice.

Frequency of price and wage adjustment. We measure the frequency of price changes using 135 million HICP price quotes at the COICOP 5-digit level for eleven Euro-area countries, following Gautier et al. (2024). Wage-adjustment frequencies are computed from the ECB Wage Tracker, which covers negotiated wages at the NACE Rev. 2 level for seven countries (Bates et al., 2025). These data allow us to distinguish the mechanism emphasized in the paper from the standard sectoral New-Keynesian motive for stabilizing inflation in sectors with stickier prices. Details are provided in Appendix A.1.8.

Supplementary data series. We construct additional series to complement the analysis. These include necessity and discretionary stock prices and dividends from firm-level Eikon data; sectoral sentiment from NLAnalytics earnings-calls; sectoral gross value added, compensation of employees, and operating surplus from national accounts; and sectoral wages from the ECB Wage Tracker. These variables allow us to assess whether the necessity–discretionary divide extends beyond consumption, prices, and employment to broader measures of real activity and firm performance: it does. All series are described in Appendix A.

2.2 Descriptive Evidence

This section documents three empirical facts about the necessity–discretionary divide in the Euro area. First, discretionary sectors account for most of the cyclical movements in quantities: consumption and employment fluctuate primarily in discretionary industries. Second, price movements are concentrated elsewhere: necessity inflation accounts for a disproportionate share of inflation fluctuations. Third, the sectors that move quantities employ a larger share of hand-to-mouth workers. These facts identify the empirical margins that will discipline the model: the sectors that absorb cyclical adjustment, the sectors that move measured inflation, and the workers whose income is exposed to the quantity margin.

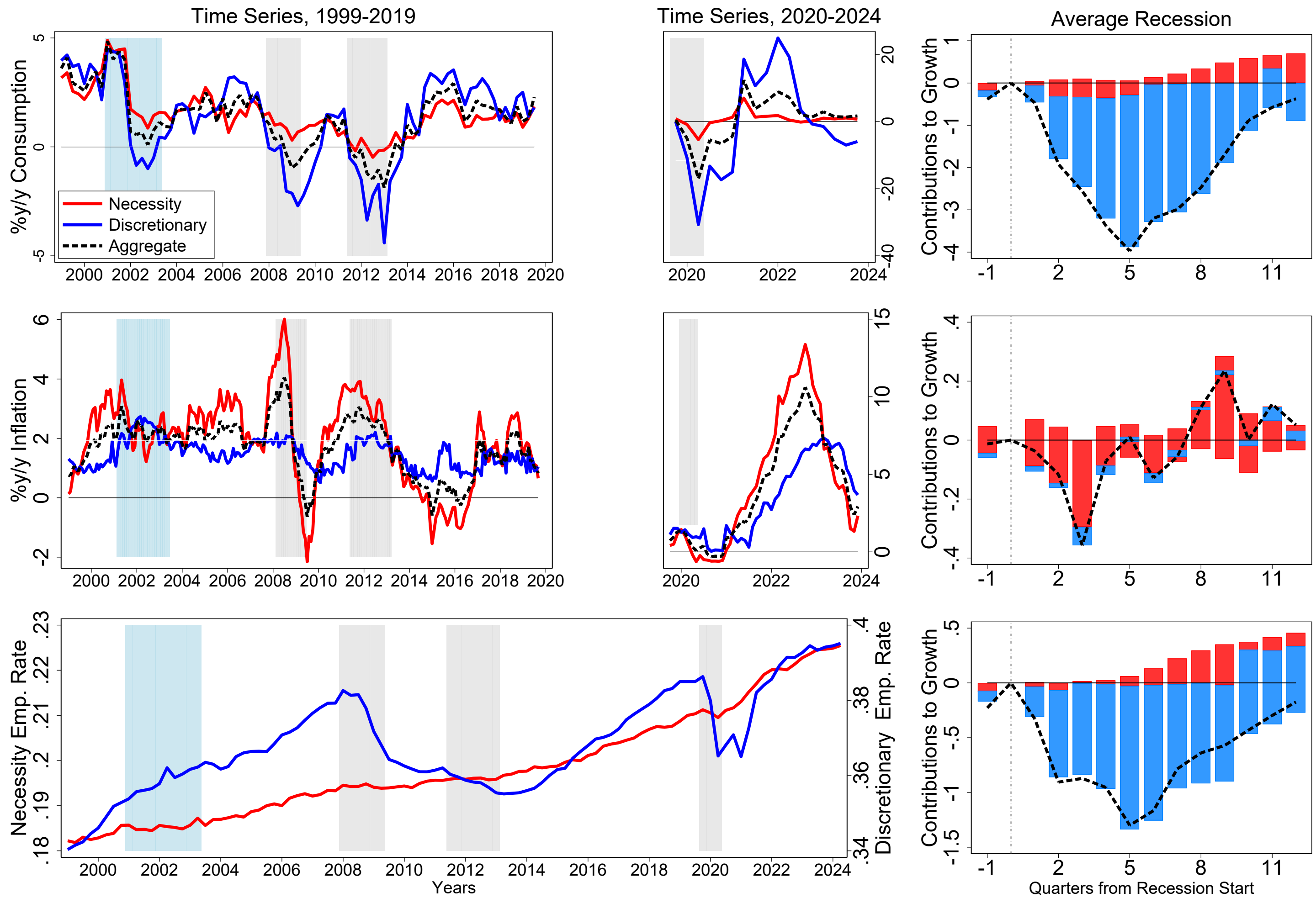
Necessity and Discretionary Sectors across Euro-Area Business Cycles. The first two columns of Figure 1 report time series for consumption, inflation, and employment, both in aggregate and disaggregated into necessity (reported as red lines and bars) and discretionary (represented in blue) components, using the measurement strategy described in the previous section. A clear asymmetry emerges. Discretionary consumption is substantially more cyclical, with sharper contractions during downturns and stronger recoveries afterward, while necessity consumption is comparatively stable. The same pattern appears in employment: employment in discretionary sectors fluctuates strongly over the cycle and closely tracks discretionary consumption, whereas employment in necessity sectors is much more stable. Price dynamics display the opposite pattern. Inflation in necessity sectors is more volatile than inflation in discretionary sectors and accounts for a larger share of movements in aggregate inflation. Thus, the sectors driving quantity adjustment differ from the sectors driving price movements. This price–quantity disconnect is the empirical starting point for the policy analysis below.

The third column of Figure 1 reports average responses of consumption, employment, and inflation during the three most recent Euro-area recessions, with blue and red bars denoting discretionary and necessity components, respectively. The contraction in aggregate consumption is almost entirely driven by discretionary spending, while necessity consumption remains broadly stable. The same pattern holds for aggregate employment, with most of the contraction coming from discretionary industries. By contrast, movements in inflation are primarily driven by necessity prices.

Quantitatively, discretionary sectors account for about 95% and 96% of the contraction in aggregate consumption and employment, respectively, across these episodes, but only 14% of inflation fluctuations. Details are provided in Appendix A.1.11. The same asymmetry extends beyond consumption and employment. Appendix B.1 shows that gross value added, compensation of employees, and operating surplus are all more cyclical in discretionary industries. Discretionary stock returns and dividends are also more correlated with GDP, consistent with financial markets assigning greater cyclical sensitivity to these sectors.[1] Finally, Appendix B.2 shows that discretionary quantities tend to lead aggregate economic activity, while necessity inflation helps predict aggregate price movements. These patterns reinforce the central empirical fact: discretionary sectors are the main quantity margin of the cycle, while necessity sectors are central for inflation dynamics.

[1] Negotiated wages show little sectoral difference, consistent with the wage-adjustment evidence of Table 1.

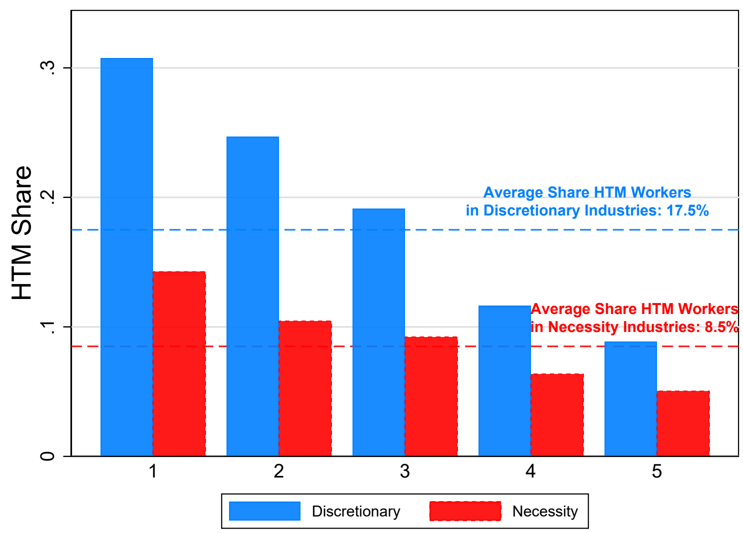
Figure 1: Consumption, Inflation and Employment — Time Series for Aggregate, Necessity and Discretionary Sectors



Notes: The first two columns present time series of consumption, inflation and employment rate both in aggregate and disaggregated into necessity and discretionary sectors, derived from Eurostat and National Accounts. The consumption series are reported as annual growth rates at the quarterly frequency, the inflation series are reported in annual changes at the monthly frequency, the employment rate series is quarterly. The shaded areas represent NBER (in light blue) and EABCN (in grey) recessions. The third column reports the quarterly unconditional responses of consumption, prices and employment rates-both in aggregate and disaggregated into necessity and discretionary components, as averages across the Global Financial Crisis, the Sovereign Debt Crisis, and the COVID-19 pandemic, where recession dates are defined according to the EACBN. Responses are calculated as differences (in logs for consumption) relative to the start of each recession and, for consumption, weighted by their respective consumption amounts.

Heterogeneity in Labor Force Composition. Figure 2 reports the share of hand-to-mouth (HTM) workers in necessity sectors (red bars) and discretionary sectors (blue bars) across income quintiles. Two patterns emerge. First, discretionary sectors employ a substantially larger share of HTM workers: on average 17.5%, compared with 8.5% in necessity sectors. Second, this gap is especially pronounced at the bottom of the income distribution, where around 31% of workers in discretionary sectors are HTM, compared with about 15% in necessity sectors. The difference narrows at higher income levels. This alignment matters because the sectors that absorb most cyclical employment fluctuations are also the sectors in which employment income is more likely to accrue to households with limited ability to smooth consumption. Fluctuations in discretionary employment may therefore have a larger effect on current spending than they would in an economy in which the same employment movements were borne by households with more liquid wealth. This fact will discipline the welfare criterion in Section 5 and the monetary transmission mechanism in Section 4.

Figure 2: Hand-to-Mouth Workers in Necessity and Discretionary Industries



Notes: The figure shows the share of hand-to-mouth (HTM) workers across income quintiles of the Euro-area distribution employed in necessity and discretionary sectors. The calculations are based on data from the ECB-HFCS and follow the methodology of Slacalek et al. (2020) to identify HTM households.

Frequency of Price and Wage Adjustment. The evidence above concerns realized price movements. We next ask whether necessity and discretionary sectors also differ in nominal rigidity. Table 1 reports the average frequency of price changes for necessity and discretionary items, constructed from 135 million HICP price quotes (as in Gautier et al., 2024). Necessity prices are adjusted more frequently, with a monthly probability of 14.9%, compared with 10.1% in discretionary sectors. The difference persists when sales are excluded. By contrast, adjustment frequencies in negotiated wages are similar across sectors, at around 4.2%, and are substantially lower than price-adjustment frequencies. These facts are useful for two reasons.

First, they show that the necessity–discretionary divide is associated with differences in price rigidity, with discretionary prices being stickier. Second, they allow us to separate our mechanism from the classic sectoral New-Keynesian channel. In the baseline policy exercises below, we impose homogeneous price rigidity to isolate the role of demand composition and worker composition. We then reintroduce the empirical difference in price rigidity and show that it strengthens the case for a discretionary inflation rule.

Table 1: Nominal Rigidity across Discretionary and Necessity Sectors

	Prices		Wages	
Sector	All	Excl. sales	All	Excl. one-off
Euro area	12.3	7.9	4.2	3.8
Necessity	14.9	10.3	4.2	4.1
Discretionary	10.1	6.0	4.3	3.9

Note: Values are average frequency of price changes per month (%). Results are based on country-specific time periods and on products that are common to at least three of the four largest countries, as in Table 2 of Gautier et al. (2024).

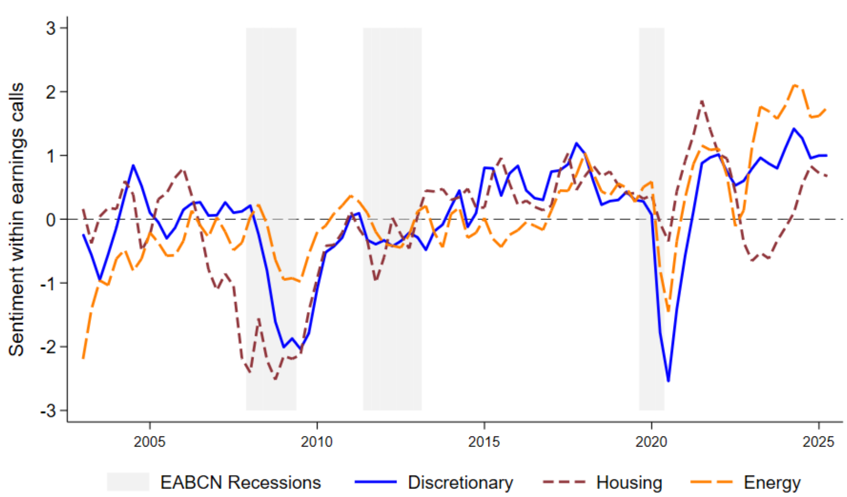
Alternative Consumption Classifications. The necessity–discretionary classification captures a dimension of heterogeneity that is distinct from conventional sectoral decompositions. While durable goods are largely discretionary, one-third of services and one-quarter of non-durables are also discretionary; with discretionary goods and services accounting in total for 42.7% of total consumption. Within each durability category, discretionary components are consistently more cyclical than necessity components. In particular, discretionary services display volatility comparable to that of durable goods (Figure B.5). Moreover, in Andreolli et al. (2024), we show that hand-to-mouth workers are disproportionally concentrated in non-durable rather than durable industries.

The classification is also distinct from the tradable–non-tradable split. Discretionary items account for roughly 60% of tradable expenditure, but also for around 30% of non-tradable expenditure. These patterns, detailed in Appendix B.3, show that the necessity–discretionary distinction isolates variation in cyclical demand and worker exposure that is not captured by standard expenditure categories. Finally, Appendix B.3.2 compares the classification to core inflation. Core measures combine both necessity and discretionary components, and the necessity components of core respond similarly to non-core prices after monetary policy shocks. The policy implications of focusing on discretionary inflation are therefore not the same as those of focusing on core inflation. The relevant distinction in our setting is not simply volatility or exclusion from core, but whether a price component is attached to the sector through which demand and current income adjust.

2.3 Discretionary Spending over the Cycle

Figure 3 provides complementary evidence using firm sentiment data. The blue line denotes discretionary sentiment, while the other lines refer to housing and energy. The indices are constructed from earnings call transcripts using NLAnalytics, following Hassan et al. (2019), as described in Appendix A.1.4. They provide a forward-looking measure of how firms perceive sectoral demand conditions, based on the language managers use when discussing risks, opportunities, and expected activity. This evidence does not rely on the consumption, price, or employment series used above, and thus provides an independent check on the cyclical role of discretionary sectors. Discretionary sentiment declines sharply and consistently during Euro-area recessions. By contrast, housing and energy sentiment deteriorate strongly only in particular episodes, such as the 2007–09 and 2020 downturns. Housing and energy are important recession narratives, but they are more episode-specific. Discretionary sentiment, instead, weakens across all three downturns, indicating a more systematic connection with the cycle. This pattern reinforces the central empirical finding of the section. Discretionary sectors are not merely one expenditure category among many; they are a recurrent margin along which aggregate demand adjusts. Combined with the evidence above, this implies that the sectors most informative about cyclical quantities are not the same sectors that dominate inflation movements. The model in Section 4 embeds this separation between the quantity margin and the price margin, and studies its policy implications.

Figure 3: Firm Sentiment on Discretionary, Housing, and Energy Sectors over the Cycle



Notes: Indices are constructed using NLAnalytics sentiment within earnings calls around keywords relating to discretionary spending, energy, and housing. Sentiment scores are aggregated across Euro-area firms' HQs using equal weights. Two-quarter moving average for each index to smooth seasonal reporting. Shaded areas denote EABCN recession dates. See Appendix A.1.4 for further details on NLAnalytics data processing.

3 The Dynamic Effects of Monetary Policy Shocks

Section 2 documents a price–quantity disconnect over the business cycle: discretionary sectors account for most fluctuations in consumption and employment, while necessity sectors account for a disproportionate share of inflation movements. This section asks whether the same disconnect characterizes the transmission of monetary policy. The goal is to identify the sectoral margin through which monetary policy operates. We first describe the empirical framework and identification strategy, and then present impulse-response evidence.

3.1 Empirical Framework and Identification

To estimate the impact of monetary policy on sectoral outcomes, we employ a set of quarterly BVARs following Jarociński and Karadi (2020). In our baseline, we adopt their *poor man's sign restrictions* identification. The shocks are constructed from high-frequency surprises in 3-month EONIA interest-rate swaps around ECB monetary policy announcements, restricted to events in which stock-price surprises move in the opposite direction.[2] The shocks are then aggregated to quarterly frequency.

We adopt Litterman priors, treating monetary policy shocks and central bank information shocks as internal instruments that are allowed to enter contemporaneously (Jarociński and Karadi, 2020). To limit dimensionality and keep the information set comparable across outcomes, we augment the baseline specification with one necessity or discretionary variable at a time. For each variable y_t, we estimate

$$\begin{pmatrix} m_t \\ y_t \end{pmatrix} = \sum_{p=1}^{P} \begin{pmatrix} 0 & 0 \\ B_{YM}^p & B_{YY}^p \end{pmatrix} \begin{pmatrix} m_{t-p} \\ y_{t-p} \end{pmatrix} + \begin{pmatrix} 0 \\ c_Y \end{pmatrix} + \begin{pmatrix} u_t^m \\ u_t^y \end{pmatrix}, \quad \begin{pmatrix} u_t^m \\ u_t^y \end{pmatrix} \sim \mathcal{N}(0, \Sigma). \tag{1}$$

Here y_t denotes the variable of interest, included separately in each specification, alongside a common set of controls: GDP (log), HICP (log), the 1-year yield, stock prices (log), the BBB-AA corporate bond spread, and the unemployment rate.[3] The vector m_t contains the identified monetary policy and information shocks. All BVARs are estimated at quarterly frequency with four lags. The baseline sample covers 1999Q1–2024Q2, while disaggregated price series start in 2003Q1. Appendix C reports additional results, including robustness to alternative identification strategies and sample restrictions.

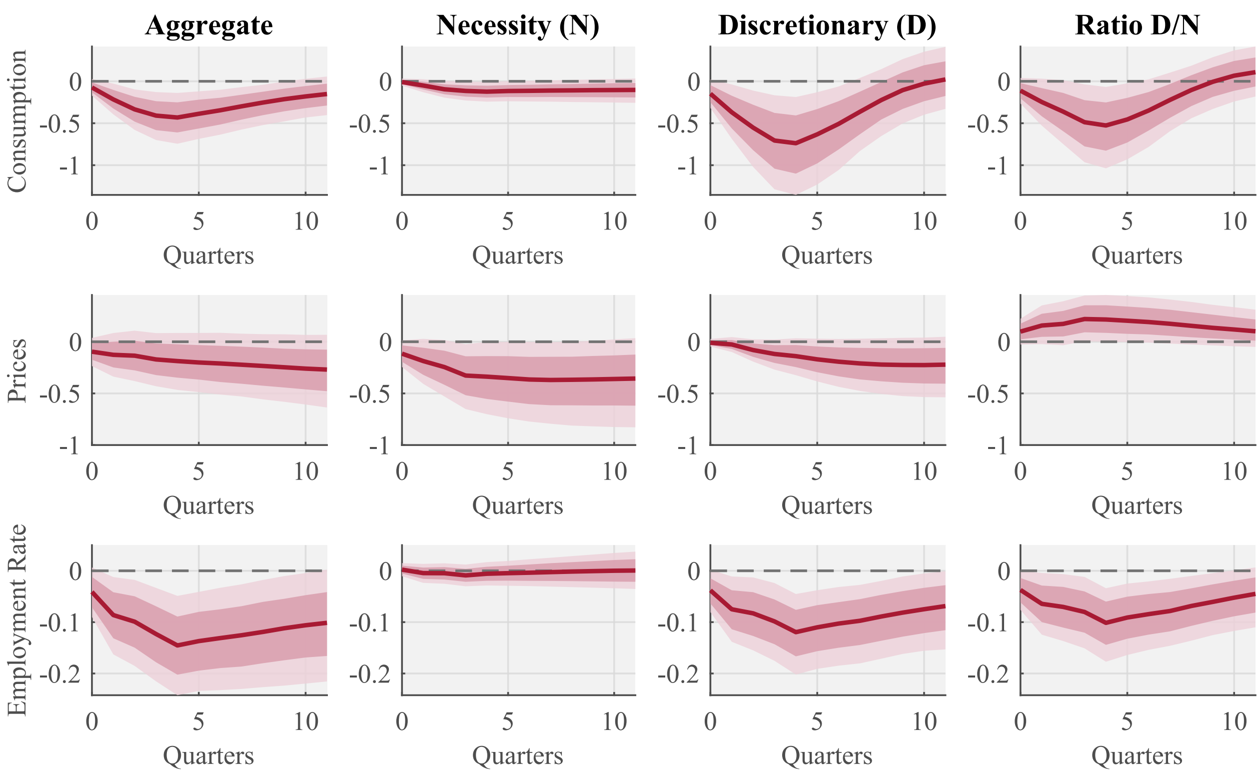
[2] Jarociński and Karadi (2020) distinguish monetary policy surprises from central bank information shocks by combining high-frequency identification with sign restrictions. The identifying assumption is that monetary policy shocks generate negative co-movements between interest rates and stock prices, while information shocks generate positive co-movements.

[3] The specification mirrors Jarociński and Karadi (2020), with the addition of the unemployment rate.

3.2 Sectoral Transmission of Monetary Policy

Figure 4 reports impulse responses of aggregate, necessity, and discretionary variables to a contractionary monetary policy shock. The median responses are shown as solid red lines, while shaded areas are 68% and 90% credible sets. The final column reports the response of the log ratio of discretionary to necessity outcomes, and so can be interpreted as a test of statistical difference.

Figure 4: Estimated IRFs to a contractionary monetary policy shock



Notes: IRFs in response to a one standard deviation monetary policy shock of consumption, HICP and employment rate. IRFs are from a BVAR on a quarterly sample 1999Q1–2024Q2 (2003Q1–2024Q2 for disaggregated prices). Median (line), percentiles 16–84 (darker band), percentiles 5–95 (lighter band). Quarters on the horizontal axes. Each IRF corresponds to a separate BVAR estimate with the respective variable added as an additional variable to the baseline controls: monetary policy shocks, central bank information shocks, 1-year yield, GDP (log), HICP (log), stock index (log), unemployment rate, and BBB-AA corporate bond spread. See the text for full specification details and the Appendix for IRFs of baseline controls.

A clear asymmetry emerges. The quantity effects of monetary policy are concentrated in discretionary sectors. Discretionary consumption accounts for most of the decline in aggregate consumption, reaching a peak contraction of around 80 basis points four quarters after the shock. By contrast, necessity consumption shows little response. This difference is economically large and statistically significant, as shown by the response of the discretionary-to-necessity consumption ratio.

Price responses display the opposite pattern. Necessity prices decline more strongly than discretionary prices, by roughly twice as much. Thus, the sectoral pattern of prices differs from the sectoral pattern of quantities: the part of the economy whose prices respond more strongly is not the part of the economy through which monetary policy primarily moves real activity. This distinction is important for the policy problem. It means that an inflation component can be informative about measured price movements without being the component most closely aligned with the real transmission margin of the interest-rate instrument used by the monetary authorities.

The same asymmetry appears on the production side. Employment in discretionary industries declines by around 0.1 percentage points, while employment in necessity sectors remains broadly unchanged. Monetary policy thus operates mainly through sectors that are more demand-sensitive and, as shown in Section 2, employ a larger share of hand-to-mouth workers. This concentration links monetary transmission to households whose consumption is especially sensitive to current income. Appendix C shows that wage responses are similar across sectors, implying that differences in labor income dynamics are driven primarily by employment.[4] We have verified that the same asymmetry extends to other macroeconomic variables, including stock returns, dividends, gross value added, and operating surplus (available upon request).

Taken together, the evidence identifies the sectoral transmission margin of monetary policy. Interest-rate shocks move quantities and employment primarily in discretionary sectors, while price responses are stronger in necessity sectors. The model in the next section is built to reproduce this asymmetry. The policy analysis then asks which inflation index should enter an interest-rate rule when the price signal in headline inflation and the real transmission margin of monetary policy are not the same.

4 A New-Keynesian Model of Demand Composition and Labor-Market Heterogeneity

This section lays out a sectoral New-Keynesian model that embeds the empirical patterns documented in Section 2 and rationalizes the impulse responses in Section 3. The model is designed to capture a simple but important asymmetry: the sectors that absorb most of the adjustment in quantities are not necessarily the sectors that dominate measured inflation. This asymmetry matters for monetary policy because the interest-rate instrument affects the economy mainly through the former, while a conventional Taylor rule gives substantial

[4] The ECB wage tracker starts in 2013, which limits the available variation.

weight to the latter.

The setup follows Andreolli et al. (2024). We introduce two features into an otherwise standard two-agent New-Keynesian model. First, preferences are non-homothetic, so discretionary spending is more income-elastic and more intertemporally substitutable than necessity spending. This makes discretionary goods the main margin of cyclical expenditure adjustment. Second, the labor force differs across sectors: discretionary industries employ a larger share of hand-to-mouth workers. This makes movements in discretionary employment especially relevant for current income and spending. Together, these features imply that sectoral inflation rates differ not only in their contribution to the aggregate price index, but also in the information they contain about the states in which monetary policy has high marginal welfare value. Section 5 derives the welfare criterion, and Section 6 studies how this altered trade-off maps into simple interest-rate rules.

Households. The economy is populated by two types of households: high-productivity Ricardian households, who have access to financial markets, and low-productivity hand-to-mouth households, who do not. All households $i = \{H, L\}$ have preferences over necessity consumption, discretionary consumption, and labor supply given by

$$U(C_{i,t}^N, C_{i,t}^D, N_{i,t}) = \frac{\left(C_{i,t}^N\right)^{1-\frac{1}{\gamma^N}}}{1-\frac{1}{\gamma^N}} + \varphi \frac{\left(C_{i,t}^D\right)^{1-\frac{1}{\gamma^D}}}{1-\frac{1}{\gamma^D}} - \xi \frac{N_{i,t}^{1+\chi}}{1+\chi}. \tag{2}$$

The key implication of this specification is that the intertemporal elasticity of substitution differs across goods. When $\gamma^D > \gamma^N$, discretionary goods are both more income-elastic and more intertemporally substitutable than necessities. Households therefore adjust discretionary consumption more strongly in response to interest-rate changes and income fluctuations. This property makes discretionary spending the main transmission margin for monetary policy: following a contractionary shock, both Ricardian and hand-to-mouth households reduce discretionary consumption more than necessity consumption. Thus, the cyclicality of discretionary spending is not driven only by liquidity constraints; Ricardian households also contribute to the reallocation of expenditure across sectors. To generate hump-shaped responses consistent with the evidence in Section 3, we assume that households update expectations infrequently as in Mankiw and Reis (2007). Ricardian households receive firm profits, as in Bilbiie (2008) and Debortoli and Galí (2024).

Firms. The economy consists of two sectors producing necessity and discretionary goods. Production differs across sectors in the composition of labor inputs:

$$Y_t^N = A^N (N_{L,t}^N)^{\alpha^N} (N_{H,t}^N)^{1-\alpha^N} \quad \text{and} \quad Y_t^D = A^D (N_{L,t}^D)^{\alpha^D} (N_{H,t}^D)^{1-\alpha^D}. \tag{3}$$

As in Figure 2, we set $\alpha^D > \alpha^N$: discretionary sectors employ a larger share of hand-to-mouth workers. This asymmetry links the sectoral transmission of monetary policy to household heterogeneity. Since discretionary demand is more cyclical, movements in discretionary employment translate into current-income fluctuations for households whose consumption is especially sensitive to current income.

Retailers in each sector set prices subject to Calvo frictions, generating sector-specific Phillips curves. Sectoral inflation is therefore a forward-looking object that depends on expected marginal costs and cost-push disturbances. This is important for the policy analysis below: stabilizing sectoral inflation is not mechanically equivalent to minimizing the unconditional volatility of sectoral quantities. Policy affects inflation through the way interest-rate-induced movements in demand, labor income, wages, and relative prices feed into sectoral pricing wedges.

The model can accommodate sectoral differences in price stickiness. In the main policy exercises, we first impose homogeneous price rigidity to isolate the role of demand composition and labor-market heterogeneity from the classic sticky-sector channel. We then reintroduce the empirically observed differences in price rigidity. For the cost-push experiments, the shock is symmetric across sectors, so any differential response across necessity and discretionary variables arises from the endogenous structure of demand and labor markets rather than from asymmetric disturbances.

Monetary policy and equilibrium. Monetary policy follows a simple interest-rate rule:

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)\left(\phi_\pi E_t \hat{\pi}_{t+1} + \phi_Y \hat{Y}_t\right) + \sigma_R \varepsilon_{R,t}, \tag{4}$$

where the inflation index entering the rule is

$$\hat{\pi}_{t+1} = \omega \hat{\pi}_{t+1}^D + (1-\omega)\hat{\pi}_{t+1}^N. \tag{5}$$

The parameter ω governs the weight placed on discretionary inflation in the inflation index to which the interest-rate rule responds. Setting $\omega = \bar{C}^D$ gives the headline inflation rule, since the index coincides with expenditure-weighted CPI inflation. Setting $\omega = 1$ gives the discretionary inflation rule, and setting $\omega = 0$ gives the necessity inflation rule. Varying ω changes the policy signal in the reaction function, not the welfare criterion. This distinction is central to the analysis: we ask which inflation index should guide interest-rate movements when the sectors that move prices differ from the sectors through which monetary policy moves quantities.

The model is closed with standard market-clearing conditions and fiscal instruments that ensure an efficient steady state.

Table 2: Model Parameters

Description	Parameter	Value
IES for necessities	γ^N	0.216
IES for discretionaries	γ^D	0.986
Low skilled share in necessities	α^N	0.126
Low skilled share in discretionaries	α^D	0.347
Price stickiness in necessities	θ^N	0.7217
Price stickiness in discretionaries	θ^D	0.8306
Time preference	β	0.99
Inverse of the macro Frisch elasticity	η	0.1
Dis-utility of working scaling parameter	ξ	1
Relative utility for discretionaries scaling parameter	φ	1
Elasticity of substitution across varieties	ε	2
Fraction of hand-to-mouth/low-skilled households	μ_L	0.2596
Attentive share of households	λ	0.1
Interest rate rule coefficient on targeted inflation	ϕ_π	1.25
Interest rate rule coefficient on output gap	ϕ_y	0.125
Interest rate rule coefficient on discretionary inflation in targeted inflation	ω	0.4055
Interest rate smoothing	ρ_R	0.8
Standard deviation of the monetary policy shock	σ_R	0.255
Persistence of the cost-push shock	ρ_X	0.9
Standard deviation of the cost-push shock	σ_X	0.05

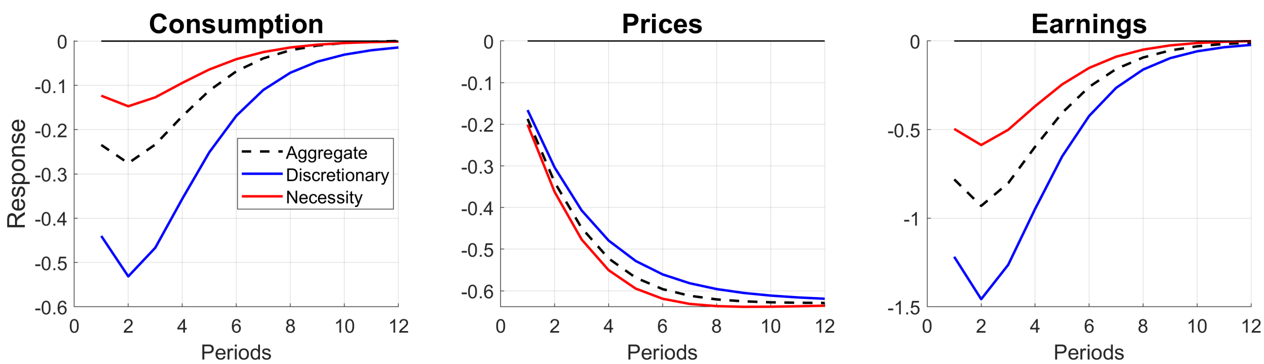
Notes: The baseline interest rate rule coefficient on discretionary inflation in targeted inflation (ω) is calibrated to hit the steady state share of discretionary good consumption in the overall economy ($\bar{C}^D$).

Calibration. We adopt a standard calibration for the baseline parameters. Preferences and nominal rigidities are chosen to be consistent with the Euro-area evidence, while the key heterogeneity parameters are disciplined by the facts in Section 2. In particular, we calibrate α^N and α^D to match the sectoral distribution of hand-to-mouth workers, and γ^N and γ^D to be consistent with differences in income elasticities of demand. The empirical price-stickiness parameters are calibrated using the evidence in Table 1. In the policy exercises below, we also consider a homogeneous-price-stickiness version of the model in order to isolate the new channel from the standard motive for stabilizing inflation in the more rigid sector. Full details are reported in Table 2.

Impulse response functions. Figure 5 shows the responses to a contractionary monetary policy shock. The model reproduces the empirical patterns of Section 3. Discretionary consumption falls more than necessity consumption, while necessity prices respond more than discretionary prices. Earnings decline mostly in discretionary sectors, where hand-to-mouth workers are concentrated.

These dynamics summarize the asymmetry central to the model. Monetary policy has its strongest quantity effects in discretionary sectors, but price movements are not concentrated in those same sectors. Discretionary sectors are therefore the main transmission margin for the interest-rate instrument, while necessity prices remain an important part of measured inflation. This separation between the policy transmission margin and the expenditure-weighted inflation index is what allows stabilization weights to differ from CPI weights. Appendix D reports the full set of equilibrium conditions and computational details.

Figure 5: Model IRFs to a contractionary monetary policy shock



Notes: This shows the IRFs to a contractionary policy shock. The panels report the % change in aggregate consumption, prices, and labor earnings, together with their discretionary and necessity counterparts.

5 The Welfare Trade-Off

The model in Section 4 provides a tractable environment to study how sectoral demand composition and labor-market heterogeneity shape the welfare criterion faced by the central bank. This section derives the welfare-based loss function and shows how the interaction between demand cyclicality and worker composition changes the trade-off between real activity and inflation. The key implication is not that policy should mechanically minimize aggregate output volatility. Rather, real fluctuations become welfare-relevant because the sectors that absorb cyclical adjustment are also the sectors in which income fluctuations are borne disproportionately by hand-to-mouth workers. This breaks the representative-agent mapping between stabilizing a single aggregate inflation index and stabilizing the welfare-relevant allocation.

We follow the standard approach in Woodford (2003) and Galí (2015) and take a second-order Taylor approximation of welfare. Welfare is defined using Pareto weights λ_H and λ_L:

$$\sum_{t=0}^{\infty} \beta^t \mathcal{W}_t = \sum_{t=0}^{\infty} \beta^t \left(\lambda_H \mathcal{U}_{H,t} + \lambda_L \mathcal{U}_{L,t} \right).$$

Relative to a representative-agent economy, this requires specifying how welfare weights are assigned across households. We assume that the steady state is efficient, with profits equal to zero because of an optimal subsidy as in Bilbiie (2025), and that Pareto weights scale with the marginal utility of necessity goods so as to match population shares. As in McKay and Wolf (2022) and Heathcote and Tsujiyama (2021), steady-state heterogeneity is therefore absorbed by fiscal policy, while monetary policy addresses cyclical fluctuations around the efficient steady state. First-order terms drop out, and welfare can be approximated by a quadratic loss function. Appendix E derives the following expression:

$$-2\sum_{t=0}^{\infty} \beta^t \frac{\mathcal{W}_t - \mathcal{W}}{C} \approx \sum_{t=0}^{\infty} \beta^t \left[a_{(\pi^N)^2} [\hat{\pi}_t^N]^2 + a_{(\pi^D)^2} [\hat{\pi}_t^D]^2 + a_{(C)^2} \hat{C}_t^2 + a_{(p^D)^2} (\hat{p}_t^D)^2 + a_{(C,p^D)} (\hat{p}_t^D \hat{C}_t) \right] + t.i.p. \tag{6}$$

The welfare criterion is made up of four components. Welfare losses increase with sectoral inflation variability, aggregate real fluctuations, relative-price variation, and the interaction between relative prices and aggregate real activity. The first two terms of the loss function are standard in New-Keynesian models, but the sectoral structure matters for both. Inflation enters through sector-specific price dispersion, while the real term reflects the welfare cost of fluctuations in the consumption/output gap. The relative-price terms capture inefficient movements in the composition of consumption and production across necessity and discretionary industries.

Equation (6) is useful because it separates the two margins that will discipline the policy rule analyses in Sections 6 and 7. First, the coefficients on sectoral inflation determine the welfare cost of price dispersion in each sector. Second, the coefficient on aggregate real activity determines how costly it is to use real demand as an adjustment margin. Comparing $a_{(\pi^N)^2}+a_{(\pi^D)^2}$ with $a_{(C)^2}$ therefore summarizes how heterogeneity changes the inflation–output trade-off. A higher value of $a_{(C)^2}$ does not imply that the optimal rule must always minimize the unconditional variance of output. It means that real adjustments are costly and that the central bank should be selective about which inflation signals justify moving the interest-rate instrument in response.

In representative-agent models with sectoral price rigidity, the classic result is that policy should place more weight on inflation in the sector with stickier prices (Aoki, 2001, Benigno, 2004). Our focus is different. We ask how demand cyclicality interacts with labor-market heterogeneity even when this classic channel is shut down. To isolate this mechanism, the baseline exercise in this section imposes homogeneous price stickiness across sectors. The average degree of price rigidity is chosen so that the overall inflation term in the welfare function is held fixed across the homogeneous- and heterogeneous-stickiness economies.[5] We then progressively remove the two sources of heterogeneity: non-homothetic demand and the sectoral concentration of hand-to-mouth workers, which we finally compare to the textbook representative-agent case.

Across model specifications, Figure 6 reports the weight on the consumption/output gap relative to the sum of the sectoral inflation weights,

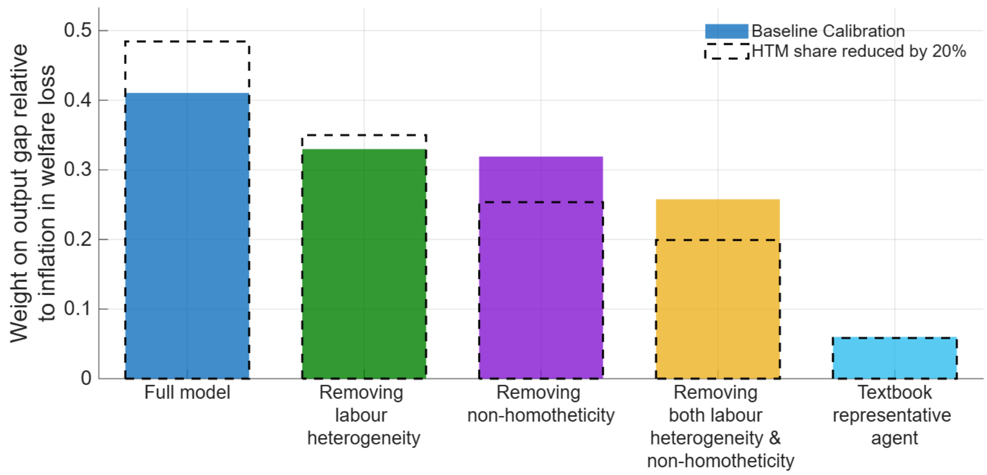
$$\frac{a_{(C)^2}}{a_{(\pi^N)^2} + a_{(\pi^D)^2}},$$

The blue bar corresponds to the full model with non-homothetic demand and labor-market heterogeneity. The green bar removes labor-market heterogeneity, the purple bar removes non-homotheticity, the yellow bar removes both features, and the light-blue bar reports the representative-agent benchmark.

The full model places substantially more weight on real fluctuations. In the representative-agent economy, the relative output-gap weight is 0.06, reproducing the standard result that aggregate inflation stabilization is close to sufficient. Introducing either non-homothetic demand or sectoral labor-market heterogeneity in isolation raises the weight, but the increase is limited. Combining the two features raises the relative weight to 0.41. The interaction is central: the welfare cost of real fluctuations is large only when the sectors in which spending is most cyclical are also the sectors in which employment income is most exposed to households with limited smoothing capacity. The intuition is that non-homothetic demand makes discretionary spending more responsive to both income and interest-rate movements, while labor-market heterogeneity makes fluctuations in discretionary employment income fall disproportionately on hand-to-mouth workers. When these two features are combined, fluc-

[5]We choose the average price stickiness such that $a_{(\pi^N)^2} + a_{(\pi^D)^2}$ is identical in the homogeneous- and heterogeneous-stickiness economies. Since $a_{(C)^2}$ does not depend on the degree of price stickiness, the inflation–output trade-off is unchanged across the two cases. Appendix E.1 provides the derivation. Section 6.2 shows that introducing greater price rigidity in discretionary sectors strengthens the main result.

Figure 6: Welfare loss function output gap relative weight



Notes: The chart shows the relative weight on the output gap versus inflation. This is the weight on the consumption variance in the welfare function, divided by the sum of the weights on necessity and discretionary inflation: $a_{(C)^2}/(a_{(\pi^N)^2} + a_{(\pi^D)^2})$. The colored bars report the baseline calibration. The dashed bars report an exercise in which the population share of hand-to-mouth households is reduced so that the steady-state aggregate share of hand-to-mouth households falls by 20%, while the sectoral asymmetry in labor-market composition is kept unchanged. The full model includes non-homothetic preferences, hand-to-mouth households, and labor heterogeneity, with low-income workers disproportionately employed in discretionary sectors. The other bars remove these features by setting the relevant parameters equal to their cross-sector averages.

tuations in discretionary demand move the current income of households whose consumption is most sensitive to current income. As a result of this, the welfare cost of real activity fluctuations depends on the sectoral incidence of income fluctuations, and this is why it rises sharply in the full model.

The dashed bars provide a complementary check on this interpretation. In this exercise, the aggregate share of hand-to-mouth households in the economy is reduced by 20%, while the sectoral asymmetry in labor-market composition is held fixed. Lowering the average prevalence of hand-to-mouth households reduces the overall exposure of the economy to current-income fluctuations. However, the interaction mechanism remains operative: hand-to-mouth workers continue to be disproportionately employed in discretionary sectors, which are the most exposed to cyclical demand. The current-income exposure of hand-to-mouth households is therefore still concentrated in the part of the economy that moves more over the business cycle. The relative weight on the output gap remains high in this calibration, and the distance between the full model and the representative-agent benchmark widens. Intuitively, what matters for the welfare cost of fluctuations is not only the average share of hand-to-mouth households, but also how closely their income is tied to the sectors that absorb cyclical adjustment.

Several implications follow. First, our framework provides a microfoundation for assigning non-negligible welfare weight to real activity in policy analysis. Inflation stabilization remains important, but real fluctuations become costly because they are concentrated in sectors that employ households with high current-income exposure. Second, this result is independent of the policy rule and independent of the shock process; it follows from the welfare criterion and the structure of the economy. Third, it does not rely on reallocation frictions. In contrast to models such as Guerrieri et al. (2021), labor is perfectly mobile within skill groups, so the welfare effect comes from the interaction between demand cyclicality and the distribution of income across workers.

The broader implication is that the price index used to measure inflation need not be the price index that summarizes the stabilization problem. Headline inflation weights prices by expenditure shares. The welfare criterion instead depends on sectoral price dispersion, aggregate real activity, relative prices, and the incidence of real fluctuations across households. Once the sectors that move prices differ from the sectors through which demand and income adjust, expenditure weights cease to be sufficient for policy. In Section 6, we will explore how this altered welfare trade-off translates into the design of simple interest-rate rules.

6 Simple Rules and Optimal Policy

Section 5 shows that the interaction between demand composition and labor-market heterogeneity changes the welfare trade-off faced by the central bank. We now ask how this altered trade-off translates into implementable interest-rate rules. Across rules, the welfare criterion is held fixed. The rules differ only in the inflation index that enters the reaction function, not in the objective of the policymaker.

Specifically, we study simple interest-rate rules, as in (4), that hold fixed the response coefficients and vary the weight placed on discretionary and necessity inflation. This exercise isolates the role of inflation composition from the overall aggressiveness of monetary policy. We begin with a symmetric cost-push shock and homogeneous price rigidity across sectors. This benchmark shuts down two standard reasons for sectoral inflation rules: sector-specific shocks and differences in nominal rigidity. Any departure from the headline inflation rule therefore reflects the interaction between the sector through which monetary policy moves demand and the sectoral distribution of hand-to-mouth income exposure. We then introduce alternative welfare criteria, sectoral differences in price rigidity, and variation in the inflation coefficient. Finally, we compare the simple rules with the optimal policy under commitment. Section 7 evaluates the same rules under the full empirical distribution of Euro-area shocks.

6.1 Simple Interest Rate Rules

We evaluate alternative rules by varying the weight ω on discretionary inflation in the index $\hat{\pi}_{t+1}$ that enters the interest-rate rule:

$$\hat{\pi}_{t+1}(\omega) = \omega\hat{\pi}^D_{t+1} + (1-\omega)\hat{\pi}^N_{t+1}.$$

The case $\omega = \bar{C}^D$ corresponds to the headline inflation rule, $\omega = 0$ to a necessity inflation rule, and $\omega = 1$ to a discretionary inflation rule. Welfare is computed using the un-approximated loss function in (9).

Figure 7 summarizes the results. In the full model, welfare improves monotonically as the inflation index in the rule places more weight on discretionary inflation. The best rule in this class is the discretionary inflation rule, while the headline inflation rule lies strictly inside the feasible set and generates welfare losses that are about 6 percent higher. Since this exercise imposes symmetric cost-push shocks and homogeneous price rigidity, the result cannot be attributed to sector-specific disturbances or to the standard motive for stabilizing inflation in the stickier-price sector. Instead, the result reflects a mismatch between expenditure weights and stabilization weights.

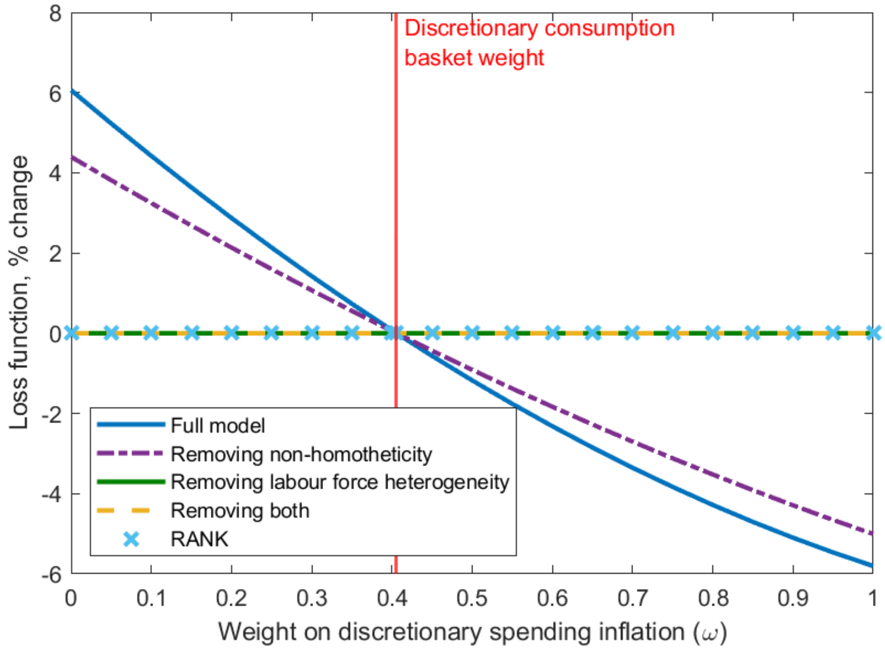
The intuition is easiest to see by rewriting the headline inflation index. Let $\omega^H = \bar{C}^D$ denote the expenditure weight on discretionary goods. Then

$$\hat{\pi}^H_{t+1} = \omega^H\hat{\pi}^D_{t+1} + (1-\omega^H)\hat{\pi}^N_{t+1} = \hat{\pi}^D_{t+1} + (1-\omega^H)\left(\hat{\pi}^N_{t+1} - \hat{\pi}^D_{t+1}\right). \tag{7}$$

Holding fixed the response coefficients in the interest-rate rule, the headline inflation rule is therefore equivalent to the discretionary inflation rule plus an additional response to relative necessity inflation. This additional response is costly in our environment because the policy instrument operates primarily through discretionary demand and employment, while necessity quantities are comparatively insensitive to interest rates. The headline inflation rule thus makes interest rates respond to price movements in a sector where the quantity margin is weak, and transmits that response through the sector where quantities and hand-to-mouth labor income are most sensitive.

The discretionary inflation rule instead aligns the policy signal with the monetary-transmission margin. It conditions interest-rate movements on inflationary pressure in the sector where policy has the greatest traction on spending, employment, and current income. This does not mean that the rule must minimize real volatility under every shock process. Rather, it means that the rule avoids using discretionary demand as the adjustment margin for necessity-price movements that are only weakly informative about the marginal welfare value of using the

Figure 7: Welfare loss for range of weights on discretionary inflation ω



Notes: The expression for the welfare loss function is specified in the text. Its value is calculated for different levels of the weight on discretionary inflation in the Taylor rule, ω, shown on the horizontal axis, and for different model scenarios, shown by the different lines. All changes are relative to the loss at the headline inflation weight, $\omega = \bar{C}^D$, in each respective model. RANK stands for representative-agent models, with and without non-homotheticity, which give the same results.

interest-rate instrument.

The restricted models clarify which ingredients generate this policy prescription. Removing non-homothetic demand dampens the gains from the discretionary inflation rule. Removing sectoral labor-market heterogeneity, or removing hand-to-mouth households altogether, eliminates them. In those economies, the sector through which demand adjusts is no longer disproportionately tied to households with high current-income exposure. As a result, sectoral inflation rates no longer differ in their value as policy signals, and the welfare ranking of inflation indices collapses.

This result differs from the logic of durable-goods New-Keynesian models. In those models, the case for overweighting durable inflation follows from the high interest sensitivity of long-lived goods (Erceg and Levin, 2006, Barsky et al., 2007, 2016). Here, the relevant component is broader than durables and is disciplined by the necessity-discretionary split in the data. Discretionary inflation is policy-relevant because it is attached to the sector in which monetary policy moves both intertemporal spending *and* the labor income of hand-to-mouth households. The policy index depends not only on expenditure shares, but also on the inflation component tied to the margin where policy most moves quantities and income.

6.2 Sensitivity

We next assess the robustness of the result along three dimensions: the welfare criterion used to evaluate the rules, sectoral heterogeneity in nominal rigidity, and the strength of the interest-rate response to inflation.

An aggregate mandate. We first consider an ad-hoc quadratic loss function that depends only on CPI inflation and aggregate output:

$$\text{Loss}_t = (\hat{\pi}_t^{CPI})^2 + \psi(\hat{Y}_t)^2. \tag{8}$$

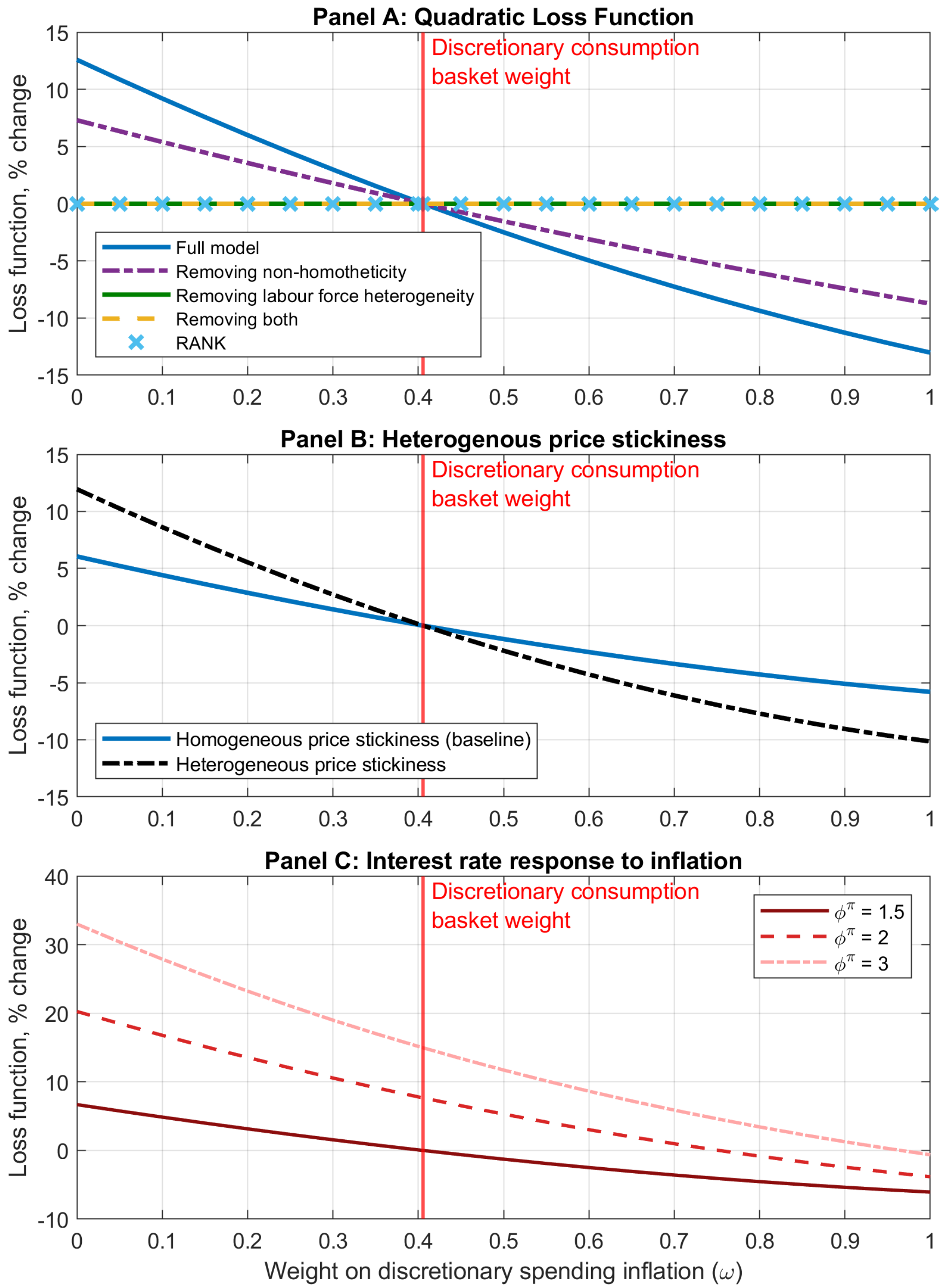
This specification abstracts from redistributive considerations, both in steady state and over the cycle, and corresponds more closely to a standard central bank's mandate. Panel A of Figure 8 shows that the main result is unchanged. Even when the monetary authorities care only about aggregate inflation and aggregate output, the discretionary inflation rule strictly dominates the headline inflation rule. The result therefore does not rely on the redistributive terms in the welfare criterion. It follows from the same signal-transmission mismatch: headline inflation gives weight to necessity-price movements, but the interest-rate response operates primarily through discretionary quantities and discretionary labor income.

Sectoral heterogeneity in price stickiness. The baseline exercise imposes homogeneous price rigidity to isolate the mechanism from the classic sectoral New-Keynesian channel. In the data, however, discretionary prices adjust less frequently than necessity prices, as shown in Table 1. We therefore repeat the exercise allowing for the sectoral price rigidities in the calibration.

Panel B of Figure 8 shows that sectoral heterogeneity in price rigidity strengthens the result. The discretionary inflation rule now combines two forces. The first is the mechanism emphasized in this paper: discretionary inflation is the price signal associated with the sector through which monetary policy moves demand and hand-to-mouth income. The second is the standard price-dispersion motive: when discretionary prices are stickier, stabilizing discretionary inflation is more valuable because price dispersion in that sector is more costly. The key point is that the first force is present even when the second is shut down.

More aggressive interest-rate responses to inflation. Finally, we compare the importance of the inflation index in the rule with the strength of the response to that index. Panel C of Figure 8 reports welfare losses for different values of ϕ_π in the simple rule (4). Two results emerge. First, the welfare gain from the discretionary inflation rule is robust across values

Figure 8: Robustness for welfare loss for range of weights on discretionary inflation ω



Notes: The expression for the welfare loss function is specified in the text. In each panel, we compute the loss function for different levels of the weight on discretionary inflation in the Taylor rule, ω, shown on the horizontal axis, and for different model scenarios, shown by the different lines. In Panel A, we evaluate the ad-hoc quadratic loss function $(\hat{\pi}_t^{CPI})^2 + \psi(\hat{Y}_t)^2$, with $\psi = 0.5$. RANK stands for representative-agent models, with and without non-homotheticity, which give the same results. In Panel B, we compare the model with homogeneous price stickiness to the model with sectoral heterogeneity in price stickiness. In Panel C, we normalize the loss at the headline inflation weight for the model with $\phi_\pi = 1.5$ and $\phi_y = 0$, and compare across models with different degrees of response to the inflation index in the rule.

of ϕ_π. Second, changing the inflation index can be quantitatively as important as changing the aggressiveness of the rule. A stronger response to the wrong index is not a substitute for responding to the right index. In fact, in the full model, increasing ϕ_π can worsen welfare. A more aggressive response to headline inflation makes the central bank react more forcefully to necessity-price movements and transmits those reactions through discretionary demand, where hand-to-mouth income exposure is high. This contrasts with the representative-agent benchmark, where stronger inflation responses improve welfare because the inflation index is a sufficient statistic for the relevant stabilization trade-off (Appendix Figure E.1). In our model, both the strength of the response and the composition of the inflation index matter.

6.3 Optimal Policy

Section 6.1 showed that, even when price stickiness is homogeneous across sectors, the discretionary inflation rule improves welfare relative to the headline inflation rule. Figure 7 illustrates this result: relative to a conventional Taylor rule in which the inflation index is headline CPI inflation, the welfare loss falls by about 6%. Section 6.2 then showed that the welfare gain rises to about 10.2% once we introduce the empirically observed greater rigidity of discretionary prices. In that richer environment, the policy-signal channel identified in this paper is reinforced by the traditional price-dispersion motive for stabilizing inflation in the stickier-price sector.

We now ask how close the discretionary inflation rule comes to the optimal policy implied by the full model under commitment. We solve the Ramsey problem using the same linearized private-sector equilibrium conditions and the same welfare criterion used to evaluate the simple rules. The policymaker chooses state-contingent paths for the policy instrument, taking the equilibrium constraints and initial conditions as given. This exercise provides a benchmark for the best implementable stabilization outcome in the model, against which the simple rules can be compared. The optimal policy delivers a welfare gain of about 15.7% relative to the headline inflation rule. The discretionary inflation rule therefore closes roughly two thirds of the gap between the conventional headline CPI inflation interest rate rule and the optimal policy.

The lesson from this section is that the inflation index entering the interest-rate rule is itself a first-order policy choice. In the standard representative-agent benchmark, headline inflation is a sufficient statistic for stabilization, so changing the inflation index in the rule has little independent role once the overall response to inflation is fixed. In our environment, this is no longer true. Because the sectors that absorb cyclical demand differ from the sectors that receive the largest expenditure weights in headline inflation, the rule that reacts to headline inflation places weight on price movements that are weakly connected to the main transmission margin of monetary policy. The discretionary inflation rule instead aligns the policy signal with the sector where interest rates have the greatest effect on spending, employment, and current income. The next section asks whether this policy prescription continues to hold when the economy is exposed not only to cost-push shocks, but to the full empirical distribution of Euro-area disturbances.

7 Policy Rules under the Empirical Distribution of Shocks

In Section 6, we used cost-push shocks as a laboratory to isolate the mechanism of the model. This section asks whether the policy ranking survives under the full empirical shock process. Throughout, we compare interest-rate rules that differ only in the inflation index entering the reaction function; the welfare criterion and the response coefficients are unchanged across rules. The exercise is useful for two reasons. First, it evaluates the rules under the empirical mixture of demand, supply, monetary, and sectoral disturbances, rather than under a single model-imposed shock. Second, it separates welfare from unconditional real volatility: the rule that delivers the lowest variance of aggregate consumption need not deliver the best stabilization trade-off.

We use the sufficient-statistics approach of McKay and Wolf (2023) and Caravello et al. (2025), which combines two objects: a reduced-form Wold representation of the Euro-area economy estimated from a VAR, and causal impulse responses that describe how the economy reacts to changes in the policy rule. We then construct counterfactual second moments under alternative interest-rate rules, holding fixed the empirical innovation covariance structure. This procedure does not require us to classify shocks as demand, supply, monetary, or sectoral, and thus provides a direct test of whether Section 6 prescription is robust to the actual shock mix in the data.[6]

The comparison should be interpreted through the lens of the decomposition that we have introduced in equation (7) of Section 6. Relative to the discretionary inflation rule, the headline inflation rule adds a response to relative necessity inflation. Under the empirical shock distribution, this additional interest rate response can affect the economy in two ways. On the one hand, it can reduce aggregate consumption volatility, because the policy rate responds to more of the observed inflation variation and transmits primarily through discretionary demand, the most interest-sensitive component of spending. On the other hand, this is not necessarily efficient stabilization. The additional policy movements are triggered by

[6] Details of the VAR specification and of the procedure in Caravello et al. (2025) are in Appendix F.

necessity-price fluctuations, while the real effects operate mainly through discretionary consumption, discretionary employment, and the income of hand-to-mouth workers employed in discretionary sectors. The welfare consequences therefore depend not only on the volatility of aggregate quantities, but also on the sectoral pricing wedges and inflation volatility generated by this feedback.

Table 3 reports the counterfactual moments. The discretionary inflation rule reduces welfare losses by 9.44% relative to the headline inflation interest rate rule.[7] Since the procedure is agnostic about the structural origin of the disturbances, this result shows that the case for the discretionary inflation rule is not specific to cost-push shocks. The composition of the welfare gain is informative. The discretionary inflation rule does not win by mechanically reducing real volatility. Aggregate consumption volatility increases slightly, from 1.63 to 1.68. The welfare gain instead comes from a large reduction in sectoral inflation volatility: the standard deviation of necessity inflation falls from 1.85 to 1.52, while the standard deviation of discretionary inflation falls from 1.33 to 0.89. Relative-price volatility is essentially unchanged. Hence the discretionary inflation rule trades a small increase in aggregate real volatility for a substantially larger reduction in the sectoral inflation distortions that enter the welfare criterion.

Table 3: Welfare under Alternative Inflation Measures in the Policy Rules

Inflation Index in Policy Rule	Welfare Loss	Standard Deviations			
		Consumption	Necessity Inflation	Discretionary Inflation	Relative Price
Headline CPI	5.59	1.63	1.85	1.33	1.50
Discretionary	5.06	1.68	1.52	0.89	1.48
Welfare Change (%)	-9.44				

Notes: The table reports welfare losses and standard deviations of their components under headline and discretionary inflation rules. All moments are computed as in McKay and Wolf (2023) and Caravello, McKay and Wolf (2025), applying counterfactual policy rules as described in the text. Inflation standard deviations are annualized. Welfare change reports the percentage change in welfare loss under the discretionary inflation rule relative to headline inflation rule; negative values indicate welfare gains.

This pattern sharpens the mechanism. The discretionary inflation rule is not the rule that always minimizes the volatility of the sector through which monetary policy acts. Rather, it is the rule that conditions policy on the inflation signal generated in that sector. By doing so, it avoids the extra feedback loop from necessity inflation to interest rates, from interest rates

[7]The interest rate rule that responds only to discretionary inflation accounts for about half of the welfare loss gap between a headline inflation interest rate rule and an implementable Ramsey policy that penalises also interest rate volatility in the spirit of Angeletos et al. (2026).

to discretionary demand and hand-to-mouth workers' income, and from those variables back to wages, relative prices, and sectoral marginal costs. The rule can thus reduce the volatility of both discretionary and necessity inflation even though necessity inflation is not directly included in the inflation index entering the rule. The reduction in necessity inflation volatility should not be interpreted as coming from a direct stabilization of necessity quantities. Necessity consumption and employment are relatively insensitive to interest rates. Instead, necessity inflation is a general-equilibrium object: it depends on expected future marginal costs, wages, and relative prices, all of which are affected by policy-induced movements in the discretionary sector. By removing the additional response to necessity-price movements, the discretionary inflation rule reduces policy-induced variation in these common pricing components: real activity can therefore be more volatile in the aggregate, while sectoral inflation becomes less volatile.

The empirical shock exercise thus reinforces the distinction between measurement weights and stabilization weights. Headline inflation weights prices by expenditure shares, which is appropriate for measuring the cost of living. The inflation index entering an interest-rate rule should instead reflect which price movements are informative about the marginal welfare value of using the policy instrument. In the Euro-area data, necessity prices receive a large weight in headline inflation but are attached to sectors whose quantities are relatively insensitive to monetary policy. Discretionary inflation receives a smaller expenditure weight, but it is associated with the sector where monetary policy has the greatest real traction and where employment fluctuations fall disproportionately on hand-to-mouth workers. This is why the discretionary inflation rule delivers a better welfare trade-off than the headline inflation rule under the empirical distribution of shocks.

8 Conclusions

A central simplification in New-Keynesian monetary theory is that the price index that measures inflation is also the price index that summarizes the stabilization problem. This paper studies when that equivalence breaks down. The key observation is that monetary policy is transmitted through specific sectors, workers, and spending margins. If those margins differ from the sectors that dominate measured inflation, then expenditure weights may not be the right weights for stabilization.

We study this issue through the necessity–discretionary divide in newly constructed Euro area data. The evidence reveals a sharp separation. Discretionary sectors account for most cyclical movements in consumption and employment, respond strongly to monetary policy, and employ a large share of hand-to-mouth workers. Necessity sectors account for much of inflation variation, but their quantities respond less over the cycle and to identified policy shocks. Thus, the sectors that move real activity and current income are not the same sectors that move headline inflation.

The model formalizes why this separation matters. Non-homothetic demand makes discretionary spending the main margin of intertemporal adjustment, while sectoral labor market heterogeneity makes movements in that margin especially relevant for welfare. The inflation component that should enter the interest rate rule is no longer determined by expenditure shares alone. It also depends on whether sectoral prices are attached to the margin through which policy moves quantities.

The normative analysis supports this logic. A policy rule that moves interest rates in response to discretionary inflation improves welfare relative to a headline inflation rule, even with symmetric shocks and homogeneous nominal rigidities. In our empirical calibration, the discretionary inflation rule closes a large share of the welfare-loss gap relative to the Ramsey policy. Under the full empirical distribution of Euro-area shocks, the discretionary inflation rule improves welfare by reducing sectoral inflation volatility and the pricing distortions generated when necessity price movements trigger policy responses that are transmitted through discretionary demand.

Our findings should not be read as an argument for abandoning headline inflation targeting. Headline inflation remains the natural object for measuring the cost of living and for communicating the policy objective. The distinction is instead between the objective and the instrument rule. A central bank that aims to stabilize headline inflation and welfare-relevant activity may need to condition its policy instrument on inflation components other than headline inflation itself.

The broader message is that the design of monetary policy begins with the price index. In conventional models routinely used by central banks, this choice is hidden because expenditure weights and stabilization weights coincide. Once the sectors that move prices differ from the sectors through which policy moves quantities and income, the choice becomes substantive. The relevant inflation measure is not necessarily the one that best summarizes purchasing power, but the one that best identifies when the policy rate should move.

References

Acharya, S., E. Challe, and K. Dogra (2023): "Optimal monetary policy according to HANK," *American Economic Review*, 113, 1741–1782.

Aguiar, M. and M. Bils (2015): "Has Consumption Inequality Mirrored Income Inequality?" *American Economic Review*, 105, 2725–56.

Albacete, N., P. Fessler, and A. Pekanov (2024): "The role of MPC heterogeneity for fiscal and monetary policy in the euro area," Tech. rep., Working Paper.

Allayioti, A., L. Górnicka, S. Holton, and C. M. Hernández (2024): "Monetary policy pass-through to consumer prices: Evidence from granular price data," .

Altavilla, C., L. Brugnolini, R. S. Gürkaynak, R. Motto, and G. Ragusa (2019): "Measuring euro area monetary policy," *Journal of Monetary Economics*, 108, 162–179.

Andreolli, M., N. Rickard, and P. Surico (2024): "Non-Essential Business Cycles," Tech. rep., CEPR Discussion Paper No. 19773.

Angeletos, G.-M., C. Lian, and C. K. Wolf (2026): "Fiscal Inaction as Monetary Support," Working Paper 34654, National Bureau of Economic Research.

Aoki, K. (2001): "Optimal monetary policy responses to relative-price changes," *Journal of monetary economics*, 48, 55–80.

Auclert, A., M. Rognlie, and L. Straub (2020): "Micro Jumps, Macro Humps: Monetary Policy and Business Cycles in an Estimated HANK Model," .

Barigozzi, M., C. Lissona, and L. Tonni (2024a): "Ea-md-qd: Large euro area and euro member countries datasets for macroeconomic research," .

——— (2024b): "Large datasets for the Euro Area and its member countries and the dynamic effects of the common monetary policy," *arXiv preprint arXiv:2410.05082*.

Barsky, R. B., C. E. Boehm, C. L. House, and M. S. Kimball (2016): "Monetary Policy and Durable Goods," Working Paper 2016-18, Federal Reserve Bank of Chicago.

Barsky, R. B., C. L. House, and M. S. Kimball (2007): "Sticky-Price Models and Durable Goods," *The American Economic Review*, 97, 984–998.

Bates, C., K. Bodnár, V. Botelho, and F. Rousseau (2025): "Real wage catch-up in the euro area," *Economic Bulletin Boxes*, 5.

Benigno, P. (2004): "Optimal monetary policy in a currency area," *Journal of international economics*, 63, 293–320.

Beraja, M. and C. K. Wolf (2021): "Demand composition and the strength of recoveries," Tech. rep., National Bureau of Economic Research.

Bianchi, J., A. McKay, and N. Mehrotra (2024): "How Should Monetary Policy Respond to Housing Inflation?" Working Paper 808, Federal Reserve Bank of Minneapolis.

Bilbiie, F. O. (2008): "Limited Asset Markets Participation, Monetary Policy and (Inverted) Aggregate Demand Logic," *Journal of economic theory*, 140, 162–196.

——— (2025): "Monetary policy and heterogeneity: An analytical framework," *Review of Economic Studies*, 92, 2398–2436.

Boehnert, L., S. de Ferra, K. Mitman, and F. Romei (2025): "High Non-Tradable Consumption, Inequality, and Weak Monetary Policy," *Working Paper*.

Boivin, J., M. P. Giannoni, and I. Mihov (2009): "Sticky Prices and Monetary Policy: Evidence from Disaggregated US Data," *American Economic Review*, 99, 350–384.

Caravello, T. E., A. McKay, and C. K. Wolf (2025): "Evaluating Monetary Policy Counterfactuals:(When) Do We Need Structural Models?" *National Bureau of Economic Research.*

Chow, G. C. and A.-l. Lin (1971): "Best linear unbiased interpolation, distribution, and extrapolation of time series by related series," *The review of Economics and Statistics*, 372–375.

Christiano, L. J., M. Eichenbaum, and C. L. Evans (2005): "Nominal rigidities and the dynamic effects of a shock to monetary policy," *Journal of political Economy*, 113, 1–45.

Christiano, L. J., M. Trabandt, and K. Walentin (2010): "DSGE models for monetary policy analysis," in *Handbook of monetary economics*, Elsevier, vol. 3, 285–367.

Coibion, O. and Y. Gorodnichenko (2012): "What can survey forecasts tell us about information rigidities?" *Journal of political economy*, 120, 116–159.

Comin, D., J. Quintana, T. Schmitz, and A. Trigari (2025): "Revisiting productivity dynamics in Europe: A new measure of utilization-adjusted TFP growth," *Journal of the European Economic Association*, 23, 1598–1633.

Debortoli, D. and J. Galí (2024): "Idiosyncratic income risk and aggregate fluctuations," *American Economic Journal: Macroeconomics*, 16, 279–310.

Drescher, K., P. Fessler, and P. Lindner (2020): "Helicopter money in Europe: New evidence on the marginal propensity to consume across European households," *Economics Letters*, 195, 109416.

Erceg, C. J. and A. T. Levin (2006): "Optimal Monetary Policy with Durable Consumption Goods," *Journal of Monetary Economics*, 53, 1341–1359.

Ferriere, A., P. Grübener, and D. Sachs (2025): "Optimal Redistribution: Rising Inequality vs. Rising Living Standards," *Working Paper.*

Forni, M. and L. Gambetti (2014): "Sufficient information in structural VARs," *Journal of Monetary Economics*, 66, 124–136.

Galí, J. (2015): *Monetary policy, inflation, and the business cycle: an introduction to the new Keynesian framework and its applications*, Princeton University Press.

Gautier, E., C. Conflitti, R. P. Faber, B. Fabo, L. Fadejeva, V. Jouvanceau, J.-O. Menz, T. Messner, P. Petroulas, P. Roldan-Blanco, et al. (2024): "New facts on consumer price rigidity in the euro area," *American Economic Journal: Macroeconomics*, 16, 386–431.

Gertler, M. and P. Karadi (2015): "Monetary Policy Surprises, Credit Costs, and Economic Activity," *American Economic Journal: Macroeconomics*, 7, 44–76.

Guerrieri, V., G. Lorenzoni, L. Straub, and I. Werning (2021): "Monetary policy in times of structural reallocation," *University of Chicago, Becker Friedman Institute for Economics Working Paper.*

Hamilton, J. D. (2018): "Why you should never use the Hodrick-Prescott filter," *Review of Economics and Statistics*, 100, 831–843.

Hassan, T. A., S. Hollander, L. van Lent, and A. Tahoun (2019): "Firm-Level Political Risk: Measurement and Effects," *Quarterly Journal of Economics*, 134, 2135–2202.

Heathcote, J. and H. Tsujiyama (2021): "Optimal income taxation: Mirrlees meets Ramsey," *Journal of Political Economy*, 129, 3141–3184.

Jaravel, X. and D. Lashkari (2024): "Measuring Growth in Consumer Welfare with Income-Dependent Preferences: Nonparametric Methods and Estimates for the United States," *Quarterly Journal of Economics*, 139, 477–532.

Jaravel, X. and A. Olivi (2026): "Prices, Non-Homothetocity and Optimal Taxation," *mimeo.*

Jarociński, M. and P. Karadi (2020): "Deconstructing Monetary Policy Surprises—The Role of Information Shocks," *American Economic Journal: Macroeconomics*, 12, 1–43.

Jarociński, M. and B. Maćkowiak (2017): "Granger causal priority and choice of variables in vector autoregressions," *Review of Economics and Statistics*, 99, 319–329.

Kaplan, G., G. L. Violante, and J. Weidner (2014): "The Wealthy Hand-to-Mouth," *Brookings Papers on Economic Activity*, 45, 77–153.

Lashkari, D., D. Comin, and M. Mestieri (2021): "Structural Change with Long-Run Income and Price Effects," *Econometrica*, 89, 311–374.

Mankiw, N. G. and R. Reis (2003): "What Measure of Inflation Should a Central Bank Target?" *Journal of the European Economic Association*, 1, 1058–1086.

——— (2007): "Sticky information in general equilibrium," *Journal of the European Economic Association*, 5, 603–613.

McKay, A. and C. Wolf (2022): "Optimal policy rules in hank," *Manuscript, January*, 121–144.

McKay, A. and C. K. Wolf (2023): "What can time-series regressions tell us about policy counterfactuals?" *Econometrica*, 91, 1695–1725.

Olivi, A., V. Sterk, and D. Xhani (2025): "Optimal Monetary Policy in a Cost-of-Living Crisis," Tech. rep., UCL and Tilburg University.

Patterson, C. (2023): "The Matching Multiplier and the Amplification of Recessions," *American Economic Review*, 113, 982–1012.

Reis, R. and M. W. Watson (2010): "Relative Goods' Prices, Pure Inflation, and the Phillips Correlation," *American Economic Journal: Macroeconomics*, 2, 128–157.

Rubbo, E. (2023): "Networks, Phillips Curves, and Monetary Policy," *Econometrica*, 91, 1417–1455.

Slacalek, J., O. Tristani, and G. L. Violante (2020): "Household balance sheet channels of monetary policy: A back of the envelope calculation for the euro area," *Journal of Economic Dynamics and Control*, 115, 103879.

Smets, F. and R. Wouters (2003): "An estimated dynamic stochastic general equilibrium model of the euro area," *Journal of the European economic association*, 1, 1123–1175.

——— (2007): "Shocks and frictions in US business cycles: A Bayesian DSGE approach," *American economic review*, 97, 586–606.

Stock, J. H. and M. W. Watson (2016a): "Core Inflation and Trend Inflation," *The Review of Economics and Statistics*, 98, 770–784.

——— (2016b): "Dynamic factor models, factor-augmented vector autoregressions, and structural vector autoregressions in macroeconomics," in *Handbook of macroeconomics*, Elsevier, vol. 2, 415–525.

Taylor, J. B. (1993): "Discretion versus policy rules in practice," *Carnegie-Rochester Conference Series on Public Policy*, 39, 195–214.

Temursho, U. and M. Weitzel (2024): "Consumer demand in EU member states," *Publications Office of the European Union.*

Woodford, M. (2003): "Interest and prices: Foundations of a theory of monetary policy," .

Appendix

"Inflation Composition and Monetary Stabilization"

by Michele Andreolli (Boston College), Natalie Rickard (Bank of England), Paolo Surico (LBS) and Chiara Vergeat (LBS)

This appendix provides supplementary material for the main paper. It is organised as follows.

Appendix A: Measurement. This appendix describes the construction of all data series used in the paper, including the necessity–discretionary classification of consumption categories (following the UK ONS COICOP framework, adapted to Eurostat data), Euro-area consumption and price indices, the industry classification via input-output analysis, employment series and hand-to-mouth worker shares from the LFS and ECB HFCS, frequencies of price and wage adjustment, stock price and dividend indices, and national accounts series. It also details durables/non-durables/services and tradables/non-tradables splits, confirming that the necessity–discretionary asymmetry is not captured by these standard decompositions.

Appendix B: Further Descriptive Evidence. This appendix presents additional time-series evidence for wages, national accounts aggregates, stock returns, and dividends, and documents the leading indicator properties of necessity and discretionary variables. It also examines the relationship between our classification and core/non-core inflation—showing that the stronger response of necessity prices to monetary policy shocks persists after excluding food and energy—and alternative consumption categorisations.

Appendix C: Monetary Policy IRFs — Robustness. This appendix reports robustness checks for the impulse response evidence in Section 3. The main findings are robust to alternative shock identification: sign restrictions yield the same sectoral asymmetry as the baseline poor man's approach. They are also robust to sample period: restricting estimation to the pre-COVID period (1999Q1–2019Q4) produces quantitatively similar impulse responses.

Appendix D: Model Derivations. This appendix provides the full derivation of the theoretical model, including the household and firm optimisation problems, equilibrium conditions, the log-linearised system, and details of the steady-state calibration.

Appendix E: Optimal Monetary Policy — Details. This appendix derives the welfare loss function and presents additional policy results. The main finding is robust to alternative loss functions, to allowing necessity prices to be more flexible, and to varying ϕ_π in the Taylor rule. It also evaluates alternative rules under the full empirical distribution of Euro-area shocks using the McKay and Wolf (2023) sufficient statistics framework, confirming the welfare ranking is not driven by the assumed shock process.

A Measurement

This section provides full technical details of the data construction. Section A.1.2 describes the necessity–discretionary classification of COICOP categories, adapted from the ONS 4-digit framework to Eurostat 3-digit data; Section A.1.3 uses this to construct annual, quarterly, and monthly Euro-area consumption and price series. Section A.1.4 describes the NLAnalytics sentiment data used in the leading-indicator analysis. Section A.1.5 extends the classification to the supply side via input-output analysis; Sections A.1.6 and A.1.7 then construct employment series from the Eurostat LFS and hand-to-mouth worker shares from the ECB HFCS. Section A.1.8 documents frequencies of price and wage adjustment. Sections A.1.9 and A.1.10 describe the construction of stock price, dividend, and national accounts series. Section A.1.11 details the recession decomposition methodology. Finally, Section A.2 constructs durables/non-durables/services and tradables/non-tradables splits, confirming the necessity–discretionary asymmetry is not captured by these standard decompositions.

A.1 Data Construction

A.1.1 Necessity and discretionary spending in national statistics

We classify consumption categories into necessity and discretionary goods following the UK Office for National Statistics (ONS), which aligns with Andreolli et al. (2024) and Aguiar and Bils (2015). The ONS classifies COICOP 4-digit categories, defining necessity expenditure as: "Goods or services which are purchased because they meet a basic need (food, shelter, healthcare), are required to maintain current living arrangements (car maintenance, school fees), or are a legal obligation (compulsory insurance, Stamp Duty)", and discretionary expenditure as: "Goods or services which could be considered 'optional' purchases, for example, takeaway meals, alcohol and holidays." Table A.1 gives the full classification.

Table A.1: Classification of Necessity and Discretionary Consumption Categories

COICOP 4-digits
Necessity Bread, breakfast cereals and other cereal products excluding cakes and biscuits; beef, veal, pork, lamb, goat, poultry and other meats; fish and other seafood; milk, cheese and eggs; oils and fats; fruit; vegetables; jams, honey and spreads (excluding chocolate, confectionery and ice-cream); food additives and condiments and other food n.e.c.; coffee, tea and cocoa; rent; new dwelling purchase by owner-occupiers; maintenance and repair of the dwelling; water and sewerage; electricity, gas and other household fuels; property rates and charges; repair of household appliances; cleaning and maintenance products and other non-durable household products; pharmaceutical products; therapeutic appliances and equipment; medical and hospital services; dental services; hospital services; spare parts and accessories for motor vehicles; automotive fuel; maintenance and repair of motor vehicles; other services in respect of motor vehicles; rail fares excluding Eurotunnel fares; road transport including removals; postal services; telecommunication equipment and services; pets, related products, pet food, veterinary and other services for pets; preschool, primary and secondary education excluding tertiary education; canteens; personal care products; childcare; insurance; deposit and loan facilities direct charges and other financial services; other services.
Discretionary Cakes and biscuits; chocolate, confectionery, ice cream and other dairy products; waters, soft drinks and juices; spirits; wine; beer; tobacco; garments for men, women, infants and children; footwear for men, women, infants and children; accessories; cleaning, repair and hire of clothing and footwear; furniture; carpets and other floor coverings; household textiles; major household appliances; small electric household appliances; glassware, tableware and household utensils; tools and equipment for house and garden; other household services; motor vehicles; Eurotunnel fares; air fares; sea fares; audio, visual and computing equipment; audio, visual and computing media and services; major durables for in/outdoor recreation; games, toys and hobbies; equipment for sports, camping and open-air recreation; gardens, plants and flowers; sports participation; other recreational, sporting and cultural services; books, newspapers, magazines and stationery; international holiday travel and accommodation; cultural services; tertiary education; restaurant meals; takeaway and fast foods; domestic holiday travel and accommodation; hairdressing and personal grooming services; jewellery, clocks and watches; other personal effects.

Notes: The table reports the classification of COICOP 4-digit consumption categories into necessity and discretionary consumption goods from the ONS.

A.1.2 Classification of necessity and discretionary consumption categories

We classify consumption categories into necessity and discretionary goods based on the classification developed by the UK Office for National Statistics (ONS). While the ONS defines this classification at the COICOP 4-digit level, we can easily adapt it to Eurostat data, available at the 3-digit level, by assigning each 3-digit category according to the majority classification of its 4-digit components.

For example, Food (CP011) is classified as necessity because the majority of its 4-digit components—bread, meat, fish, dairy, oils, fruit, and vegetables—are necessity goods, even though it also includes sugar and sweet products, which are classified as discretionary goods in the ONS classification at the COICOP 4-digits level.

Some categories require additional judgment. Transport Services (CP073) contains both necessity items (rail and road transport) and discretionary items (air and water transport). We resolve such cases using UK Consumer Trends expenditure data at the 4-digit level: since necessity transport consistently accounts for less than half of total Transport Services expenditure, CP073 is classified as discretionary. Table A.2 presents the full 3-digit classification. Two categories—CP10 and CP122_127—are available only at the 2-digit level in the early part of the sample; both are treated as aggregate discretionary categories until 3-digit data become available.

Table A.2: Classification of COICOP 3-digit Categories

COICOP 3-digits
Necessity Food; actual rentals for housing; imputed rentals for housing; maintenance and repair of the dwelling; water supply and miscellaneous services relating to the dwelling; electricity, gas and other fuels; medical products, appliances and equipment; out-patient services; hospital services; operation of personal transport equipment; postal services; telephone and telefax equipment; telephone and telefax services; pre-primary and primary education; secondary education; post-secondary non-tertiary education; personal care; social protection; insurance; financial services n.e.c.; other services n.e.c.
Discretionary Non-alcoholic beverages; alcoholic beverages; tobacco; narcotics; clothing; footwear; furniture and furnishings; carpets and other floor coverings; household textiles; household appliances; glassware, tableware and household utensils; tools and equipment for house and garden; goods and services for routine household maintenance; purchase of vehicles; transport services; audio-visual, photographic and information processing equipment; other major durables for recreation and culture; other recreational items and equipment; gardens and pets; recreational and cultural services; newspapers, books and stationery; package holidays; tertiary education; education not definable by level; catering services; accommodation services; prostitution; personal effects n.e.c.

Notes: The table reports the classification of COICOP 3-digit consumption categories into necessity and discretionary consumption goods, built from the ONS classification of COICOP 4-digit consumption categories.

A.1.3 Construction of Consumption and Prices Series

With our classification of consumption categories into necessity and discretionary goods, we construct time series for both necessity and discretionary consumption and prices for the Euro Area. Specifically, we build annual chain-linked volume indices of necessity and discretionary consumption following the ONS-Eurostat methodology. To obtain quarterly year-on-year growth rates for the Euro Area, we interpolate the annual series using corresponding quarterly series derived from Italian and German data, which are available at a quarterly frequency. The corresponding annual dynamics from the Italian and German data are similar to aggregate euro-area dynamics, while the aggregate series are also similar, so we see view this as likely a reasonable approximation of the absent euro-area quarterly data.

For prices, we construct necessity and discretionary price indices following the methodology Eurostat uses for compiling the Harmonised Index of Consumer Prices (HICP), detailed in the "Handbook of prices and volumes in national accounts".

Annual Consumption Series We collect annual series of household consumption expenditures at current prices (CP) and at previous year prices (PYP) for various 3-digit consumption categories from the Eurostat table "Final consumption expenditure of households by consumption purpose (COICOP 3-digit)" (table **nama_10_co3_p3**). Using these data, we construct chain-linked indices of necessity and discretionary consumption by aggregating CP and PYP values across necessity and discretionary categories and applying a chain-linking procedure with 2015 as the reference year. More specifically, we first construct:

$$CP_{N,y} = \sum_{i \in N} cp_{i,y}, \qquad PYP_{N,y} = \sum_{i \in N} pyp_{i,y}$$

with analogous expressions for discretionary goods. We then set the chain-linked volume in 2015 equal to the current price volume in that year, and recursively compute the chain-linked-volumes for all other years using:

$$CVM_{\{N,y\}} = CVM_{\{N,y+1\}} \times \frac{CP_{\{N,y\}}}{PYP_{\{N,y+1\}}}$$

The same procedure is applied to discretionary consumption. Finally, we compute annual growth rates of the constructed chain-linked volumes.

Interpolated Quarterly Consumption Series To obtain quarterly growth rates of necessity and discretionary consumption for the Euro Area, we interpolate their respective annual growth rates using data from Italy and Germany, for which quarterly figures are available. Specifically, we first construct quarterly series of necessity and discretionary consumption by aggregating data from these two countries. We then compute quarterly growth rates for necessity and discretionary consumption for the Euro Area by interpolating their respective annual growth rates using the quarterly growth rates derived from the Italian and German data. The quarterly data are sourced from the National Statistical Offices: data for Italy are obtained from ISTAT ("Spesa per consumi finali delle famiglie per voce di spesa (Coicop 2018 3 cifre) e durata"), and data for Germany are from the national accounts, which are available in DESTATIS.

Quarterly data are available at the COICOP 2-digit level, which is less granular than the 3-digit classification used in our annual series. We classify each COICOP 2-digit category based on the share of necessity and discretionary consumption within each category in the annual series for Italy and Germany, using average shares over the sample period 1995–2022. We classify as necessity the 2-digits consumption categories with an average share of necessity consumption greater or equal 50%, according to our classification of COICOP 3 digits categories, detailed above. Table A.3 details the final classification of COICOP 2 digits categories into necessity and discretionary.

Table A.3: Classification of COICOP 2-digit Categories

COICOP 2-digits
Necessity CP01 Food and non-alcoholic beverages; CP04 Housing, water, electricity, gas and other fuels; CP06 Health; CP07 Transport; CP08 Information and communication; CP12 Insurance, financial services, miscellaneous goods and services.
Discretionary CP02 Alcoholic beverages, tobacco and narcotics; CP03 Clothing and footwear; CP05 Furnishings, household equipment and maintenance; CP09 Recreation, sport and culture; CP10 Education; CP11 Restaurants and accommodation services.

Notes: The table reports the classification of COICOP 2-digit consumption categories into necessity and discretionary consumption goods, built from our classification of COICOP 3-digit categories and expenditure shares in necessity and discretionary goods computed using Eurostat annual consumption data.

Some adjustments are made for consistency. ISTAT reports under the COICOP 2018 classification; we aggregate "Insurance and Financial Services" and "Personal Care, Social Protection and Misc. Goods and Services" into CP12 to align with the COICOP 1999 structure used in the annual series. For DESTATIS, CP09 and CP10 are available only as a combined aggregate; we disaggregate them using average shares from the ISTAT data. CP08 is treated entirely as a necessity.

ISTAT and DESTATIS provide data on nominal consumption expenditures at current prices (CP). To derive real expenditures (KP) for each COICOP category, we combine these nominal series with price data from Eurostat. Using this information, we compute expenditure at previous quarter prices (PQP) for each consumption category i as:

$$pqp_{\{i,t\}} = kp_{\{i,t\}} \times \frac{cp_{\{i,t-1\}}}{kp_{\{i,t-1\}}}$$

With both current price and previous quarter price expenditures available for each category, we construct quarterly chain-linked volume indices for necessity and discretionary consumption, applying the same methodology used for the annual series. We then compute year-on-year growth rates at the quarterly frequency by comparing each quarter with the same quarter in the previous year.

To obtain quarterly growth rates for the Euro Area, we interpolate the annual growth rates of necessity and discretionary consumption using the Chow-Lin interpolation method, under the assumption of a linear relationship between each annual growth rate and the average of the corresponding quarterly growth rates.

Monthly Price Series We collect price indices at the 3-digit COICOP level from the Eurostat table "HICP- monthly data (Index)" (**prc_hicp_midx**), considering indices normalized to 100 in the base year 2015. Corresponding item weights, used to aggregate price indices across consumption categories, are obtained from the Eurostat table "HICP-item weights" (**prc_hicp_inw**). To construct aggregate price indices, we first un-chain the individual category-level indices by dividing each monthly index by its value in December of the previous year. Specifically, we compute:

$$I_{\{m,i,y,\text{unchained}\}} = \frac{I_{\{m,i,y,\text{chained}\}}}{I_{\{Dec,i,y-1,\text{chained}\}}}$$

Next, we construct the unchained index of necessity prices as follows:

$$I_{\{N,m,y,\text{unchained}\}} = \sum_{i \in N} w_{i,m,y} I_{\{m,i,y,\text{unchained}\}}$$

where $w_{i,m,y}$ denotes the HICP weights of each consumption category i, normalised within the basket of necessity goods. The unchained index of discretionary prices is constructed in the same way. Finally, we obtain the chain-linked price indices by multiplying each monthly unchained index by its value in December of the previous year, after initializing the chain-linked index to equal the unchained index in the first year of the sample (2002). For necessities this is:

$$I_{\{N,m,y,\text{chained}\}} = \frac{I_{\{N,m,y,\text{unchained}\}}}{100} \times I_{\{N,Dec,y-1,\text{chained}\}}$$

and analogously for discretionary goods. Finally, the two price indices are de-seasonalized.

A.1.4 NLAnalytics

NLAnalytics applies natural language processing (NLP) to the full text of publicly available earnings call transcripts, following the methodology of Hassan et al. (2019). For each call, it identifies sentences that contain a predefined set of search terms associated with a given topic, and classifies each matching sentence as positive, negative, risk-related, or merely exposing the topic. We use data covering the period from January 2002 to December 2025. We restrict the sample to firms whose headquarters are located in one of the twenty euro-area member states: Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.

For each topic and each earnings call, we obtain four raw counts: the number of positive sentences (P), negative sentences (N), risk-related sentences, and total sentences (S). Firm-level counts are aggregated to the quarterly level by summing across all calls within the quarter. The topic-specific sentiment index is then defined as:

$$\text{Sentiment}_t = \frac{\sum_i P_{i,t} - \sum_i N_{i,t}}{\sum_i S_{i,t}}$$

where the sums run over all firm-quarter observations in the euro-area sample.

To smooth out within-year reporting seasonality arising from staggered reporting dates across jurisdictions, we apply a two-quarter backward-looking moving average to each index. All indices are subsequently standardised—demeaned and scaled by their standard deviation—before plotting. The sample displayed in Figure 3 starts in 2003Q1. Recession shading is based on EABCN recession dates. To measure sentiment for each topic, each topic index is constructed from a keyword query submitted to NLAnalytics. Table A.4 reports the exact query used for the three topic series plotted in Figure 3. The discretionary query covers spending categories that map to our discretionary consumption classification. The housing query focuses on the residential real estate and mortgage market. The energy query covers fossil fuels, electricity and utilities, and the renewable-energy transition.

A.1.5 Classification of Industries

To extend the necessity-discretionary framework beyond consumption and prices to the supply side, we classify industries according to the nature of the goods and services they produce. We follow the methodology developed in Andreolli et al. (2024) for the US, adapting it here to the Euro Area context. Eurostat provides data on employment at the NACE 2-digit level, which we adopt as our definition of industry. Accordingly, we classify each NACE 2-digit industry as either necessity or discretionary.

The classification proceeds in two steps. First, we distinguish between industries that produce final goods and those that produce intermediate goods. Final goods industries are manually classified as necessity or discretionary based on the nature of their output. Intermediate goods industries are classified using input-output analysis: we compute the Leontief inverse from the input-output table and assess each intermediate industry's contribution to the production of final necessity and discretionary goods.

Final Industries We classify industries as final or intermediate using the Eurostat symmetric input-output table at basic prices (**naio_10_cp1750**). For each industry, we compute the share of total output sold directly to households; industries selling more than one-third to households are classified as final, the remainder as intermediate.

Final industries are then manually classified as necessity or discretionary following the COICOP 3-digit classification. Retail trade (G47) spans both categories and is split into necessity and discretionary sub-industries using expenditure shares. Of the resulting 62 NACE Rev. 2 2-digit industries, 10 are necessity, 19 are discretionary, and 33 remain as intermediate, to be classified through the input-output tables.

Intermediate Industries We classify intermediate industries by their contribution to final necessity and discretionary output, following Andreolli et al. (2024). The input-output table

Table A.4: NLAnalytics Keyword Queries

Topic	Query used in NLAnalytics
Discretionary	(“restaurant prices” OR “restaurant sales” OR restaurants OR cafes OR cafés OR dining OR “dining out” OR foodservice OR “food away from home” OR catering OR canteens) OR (“alcohol prices” OR alcohol OR spirits OR liquor OR wine OR beer OR breweries OR distilleries OR tobacco OR cigarettes OR cigars OR vaping OR nicotine OR cannabis OR narcotics) OR (“clothing prices” OR “apparel prices” OR clothing OR apparel OR garments OR fashion OR footwear OR shoes OR sneakers OR boots OR tailoring OR “clothing repair”) OR (“furniture sales” OR furniture OR furnishings OR carpets OR flooring OR rugs OR bedding OR curtains) OR (“consumer appliances” OR appliances OR “white goods” OR refrigerator OR washing machine OR dishwasher OR microwave OR cookware OR utensils OR hardware OR tools OR “household durables”) OR (“vehicle sales” OR automobiles OR cars OR motorcycles OR bicycles OR bikes) OR (“air travel” OR airlines OR flights OR airfare OR aviation) OR (“water transport” OR ferries OR cruises OR cruise lines) OR (“transport services” OR mobility services OR ride-hailing OR rideshare) OR (“consumer electronics” OR electronics OR televisions OR TVs OR cameras OR photography OR optical equipment OR computers OR laptops OR tablets OR gaming consoles OR “device repair”) OR (“recreational equipment” OR sports equipment OR camping OR outdoor equipment OR musical instruments OR toys OR games OR hobbies OR gardening OR plants OR flowers) OR (“recreation services” OR entertainment OR leisure OR gyms OR fitness OR sporting services OR cultural services OR concerts OR theaters OR museums OR gambling OR casinos OR lotteries) OR (“books” OR publishing OR newspapers OR magazines OR periodicals OR stationery OR office supplies) OR (“package holidays” OR tourism OR travel packages OR leisure travel) OR (“tertiary education” OR university OR college OR higher education OR private education) OR (“hotel prices” OR hotels OR accommodation OR lodging OR hospitality) OR (“personal grooming” OR hairdressing OR salons OR barbers OR beauty services OR cosmetics) OR (jewellery OR jewelry OR watches OR clocks OR accessories OR personal effects)
Housing	housing OR residential OR single-family OR houses OR multifamily OR “new construction” OR “home prices” OR mortgage
Energy	(energy OR “energy markets” OR “energy prices” OR “energy costs” OR “energy demand” OR “energy supply”) OR (oil OR “crude oil” OR Brent OR WTI OR “oil prices” OR “oil market” OR “oil production” OR “oil supply” OR OPEC OR “OPEC+” OR shale OR “shale oil”) OR (“natural gas” OR gas OR “natural gas prices” OR “gas prices” OR “gas supply” OR LNG OR “liquefied natural gas”) OR (fuel OR fuels OR gasoline OR petrol OR diesel OR “jet fuel” OR “fuel prices” OR “fuel costs” OR refining OR refineries) OR (electricity OR power OR “power prices” OR “electricity prices” OR utilities OR generation OR grid OR transmission) OR (renewables OR renewable OR solar OR wind OR “clean energy” OR “energy transition”)

Notes: The table reports the exact Boolean queries submitted to NLAnalytics to generate the three topic-specific sentiment series in Figure 3. All queries cover the period 2002–2025.

. Note quotes are used in case phrases contain reserved syntax; multi-word terms without quotes are still treated as a phrase.

is first modified to account for the G47 split: using expenditure shares on goods sold through retail channels under our COICOP classification, we find that 43% of retail trade maps to necessity goods, and partition the input-output matrix accordingly. This assumes that input industries do not differentially serve necessity versus discretionary retail—a reasonable approximation.

Using the Leontief inverse, we compute each intermediate industry's sales share flowing to necessity versus discretionary final goods. An industry is classified as necessity if its necessity sales exceed its discretionary sales and together account for at least one-third of total sales. Of the 62 NACE Rev. 2 2-digit industries, 20 are classified as necessity, 37 as discretionary, and 5 as unclassified. Table A.5 gives the full classification.

Before 2008, Eurostat used the NACE Rev. 1 classification, for which input-output tables are not available. We address this by manually matching NACE Rev. 1 2-digit industries to their NACE Rev. 2 counterparts and assigning the corresponding necessity or discretionary classification. While statistical offices advise caution in such matches, the requirement here is modest: we need only ensure the necessity/discretionary classification is consistent over time, not that each matched industry is identical. In practice, we do not observe a structural break in the distinction between sectors as a result. Of 62 NACE Rev. 1 2-digit industries, 22 are classified as necessity, 29 as discretionary, and 11 as unclassified. Table A6 gives the full classification.

A.1.6 Employment

We construct quarterly employment series for necessity and discretionary sectors using the Eurostat Labour Force Survey (LFS). We use **lfsq_egana2d** (NACE Rev. 1, 1998–2008) and **lfsq_egan22d** (NACE Rev. 2, 2008 onwards) at the 2-digit industry level.

Retail trade (G52/G47) is split into necessity and discretionary components using the same 43% necessity expenditure share as in the input-output classification. Total necessity employment is then the sum across necessity industries, including the appropriate retail share, and analogously for discretionary. This is an approximation, but would only bias our results towards greater similarity towards the sectors.

To avoid a discontinuity at the 2008 classification change, we rescale the pre-2008 series using the ratio of NACE Rev. 2 to NACE Rev. 1 employment in the respective sectors in 2008 (2007 where 2008 Rev. 2 data are unavailable). Between 2003 and 2005, EA20 data are annual only, and no data are available before 2003; we extend the quarterly series back to 1999 using year-over-year growth rates from a subset of countries with continuous quarterly coverage (Austria, Belgium, Greece, Spain, Finland, Italy, Portugal, Slovenia, and Slovakia).

We also construct employment rate series for necessity and discretionary sectors by dividing the respective employment totals by the total Euro Area population, obtained from Eurostat (**lfsq_pganws**). Finally, the resulting employment rate series are seasonally adjusted.

Table A.5: Classification of Industries into Necessity and Discretionary

NACE Rev. 2 - 2-digit Industries
Necessity
A01: Crop and animal production, hunting and related service activities; A03: Fishing and aquaculture; B: Mining and quarrying; C10–12: Manufacture of food products, beverages and tobacco products; C17: Manufacture of paper and paper products; C20: Manufacture of chemicals and chemical products; C21: Manufacture of basic pharmaceutical products and pharmaceutical preparations; C26: Manufacture of computer, electronic and optical products; D: Electricity, gas, steam and air conditioning supply; E36: Water collection, treatment and supply; G46: Wholesale trade, except of motor vehicles and motorcycles; G47E: Retail trade, except of motor vehicles and motorcycles; J61: Telecommunications; J62_63: Computer programming, consultancy, and information service activities; K65: Insurance, reinsurance and pension funding, except compulsory social security; K66: Activities auxiliary to financial services and insurance activities; M73: Advertising and market research; N77: Rental and leasing activities; Q86: Human health activities; Q87_88: Residential care activities and social work activities without accommodation.
Discretionary
A02: Forestry and logging; C13–15: Manufacture of textiles, wearing apparel, leather and related products; C16: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; C18: Printing and reproduction of recorded media; C22: Manufacture of rubber and plastic products; C23: Manufacture of other non-metallic mineral products; C24: Manufacture of basic metals; C25: Manufacture of fabricated metal products, except machinery and equipment; C27: Manufacture of electrical equipment; C28: Manufacture of machinery and equipment n.e.c.; C29: Manufacture of motor vehicles, trailers and semi-trailers; C31_32: Manufacture of furniture; other manufacturing; C33: Repair and installation of machinery and equipment; E37–39: Sewerage, waste management, remediation activities; F: Construction; G45: Wholesale and retail trade and repair of motor vehicles and motorcycles; G47N: Retail trade, except of motor vehicles and motorcycles; H49: Land transport and transport via pipelines; H50: Water transport; H51: Air transport; H52: Warehousing and support activities for transportation; H53: Postal and courier activities; I: Accommodation and food service activities; J58: Publishing activities; K64: Financial service activities, except insurance and pension funding; L68B: Real estate activities excluding imputed rents; M69_70: Legal and accounting activities; activities of head offices; management consultancy activities; M71: Architectural and engineering activities; technical testing and analysis; M74_75: Other professional, scientific and technical activities; veterinary activities; N78: Employment activities; N79: Travel agency, tour operator reservation service and related activities; N80–82: Security and investigation, service and landscape, office administrative and support activities; P: Education; R90–92: Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities; R93: Sports activities and amusement and recreation activities; S95: Repair of computers and personal and household goods; S96: Other personal service activities.
Unclassified
C19: Manufacture of coke and refined petroleum products; C30: Manufacture of other transport equipment; J59_60: Motion picture, video, television programme production; programming and broadcasting activities; M72: Scientific research and development; S94: Activities of membership organizations.

Notes: The table reports the classification of NACE Rev. 2 2-digit industries into those producing necessity goods, discretionary goods, and unclassified industries. The classification is obtained by first distinguishing between final and intermediate industries. Final industries are manually classified, while intermediate industries are classified into necessity and discretionary based on input-output tables. Data are from Eurostat.

Table A.6: Classification of Industries into Necessity and Discretionary

NACE Rev. 1 - 2-digit Industries

Necessity

A01: Agriculture, hunting and related service activities; B05: Fishing, fish farming and related service activities; CA10: Mining of coal and lignite; extraction of peat; CA11: Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying; CA12: Mining of uranium and thorium ores; CB13: Mining of metal ores; CB14: Other mining and quarrying; DA15: Manufacture of food products and beverages; DA16: Manufacture of tobacco products; DE21: Manufacture of pulp, paper and paper products; DG24: Manufacture of chemicals and chemical products; DL30: Manufacture of office machinery and computers; E40: Electricity, gas, steam and hot water supply; E41: Collection, purification and distribution of water; G51: Wholesale trade and commission trade, except of motor vehicles and motorcycles; G52E: Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods; I64: Post and telecommunications; J66: Insurance and pension funding, except compulsory social security; J67: Activities auxiliary to financial intermediation; K71: Renting of machinery and equipment without operator and of personal and household goods; K72: Computer and related activities; N85: Health and social work.

Discretionary

A02: Forestry, logging and related service activities; DB17: Manufacture of textiles; DB18: Manufacture of wearing apparel, dressing, dyeing of fur; DC19: Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear; DD20: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; DE22: Publishing, printing and reproduction of recorded media; DH25: Manufacture of rubber and plastic products; DI26: Manufacture of other non-metallic mineral products; DJ27: Manufacture of basic metals; DJ28: Manufacture of fabricated metal products, except machinery and equipment; DK29: Manufacture of machinery and equipment n.e.c.; DL31: Manufacture of electrical machinery and apparatus n.e.c.; DM34: Manufacture of motor vehicles, trailers and semi-trailers; DN36: Manufacture of furniture; manufacturing n.e.c.; DN37: Recycling; F45: Construction; G50: Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel; G52N: Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods; H55: Hotels and restaurants; I60: Land transport; transport via pipelines; I61: Water transport; I62: Air transport; I63: Supporting and auxiliary transport activities; activities of travel agencies; J65: Financial intermediation, except insurance and pension funding; K70: Real estate activities; M80: Education; O90: Sewage and refuse disposal, sanitation and similar activities; O92: Recreational, cultural and sporting activities; O93: Other service activities.

Unclassified

DF23: Manufacture of coke, refined petroleum products and nuclear fuel; DL32: Manufacture of radio, television and communication equipment and apparatus; DL33: Manufacture of medical, precision and optical instruments, watches and clocks; DM35: Manufacture of other transport equipment; K73: Research and development; K74: Other business activities; O91: Activities of membership organizations n.e.c.; P95: Activities of households as employers of domestic staff; P96: Undifferentiated goods-producing activities of private households for own use; P97: Undifferentiated services-producing activities of private households for own use; Q99: Extra-territorial organizations and bodies.

Notes: The table reports the classification of NACE Rev. 1 2-digit industries into those producing necessity goods, discretionary goods, and unclassified industries. The classification is obtained by manually matching NACE Rev. 2 2-digit industries with corresponding NACE Rev. 1 2-digit industries, and then applying our classification of necessity, discretionary, and unclassified industries.

A.1.7 Share of Hand-to-Mouth Workers in Necessity and Discretionary Industries

We use wave 2[1] of the ECB Household Finance and Consumption Survey (HFCS) to compute the share of hand-to-mouth (HTM) workers in necessity and discretionary sectors across the Euro Area income distribution, following closely the procedure from Slacalek et al. (2020). A household is classified as hand-to-mouth if its net liquid wealth is non-negative but less than or equal to its biweekly income, or if its net liquid wealth is negative and less than or equal to biweekly income minus an assumed credit limit equal to one month of income. Formally, a household is considered as hand-to-mouth if:

- Net Liquid Wealth ≥ 0 AND Net Liquid Wealth $\leq$ biweekly income OR
- Net Liquid Wealth < 0 AND Net Liquid Wealth $\leq$ biweekly income - credit limit.

In the HFCS, the variables above are defined as follows:

- Net Liquid Wealth: Liquid Assets - Liquid Liabilities, where:
    1. Liquid Assets = sight and saving accounts (deposits), directly held mutual funds, bonds and stocks = da2101 + da2102 + da2103 + da2105,
    2. Liquid Liabilities = overdraft debt and credit card debt = dl1210 + dl1220.
- Income: di2000,
- Credit Limit is assumed to be one month of income.

The HFCS reports industry at the NACE 1-digit level. We assign each household to one NACE 1 industry, based on the industry of employment of the highest earner in the household in terms of labor income. We then assign each household to necessity and discretionary industries proportionally to the aggregate shares of employment in necessity and discretionary industries as classified at the NACE 2 level, within each broader NACE 1 industry, computed using our aggregate employment data. This mapping likely understates sectoral heterogeneity relative to what 2-digit detail would yield. We then compute HTM shares in necessity and discretionary sectors overall and by Euro-Area income quintiles.

A.1.8 Frequency of price and wage adjustments

To provide a fuller picture of any possible heterogeneity between discretionary and necessity sectors, we rely on the data underlying the detailed analyses in Gautier et al. (2024) for prices and in Bates et al. (2025) for negotiated wages to compute the frequency of nominal adjustment in the goods and labour market. The frequency of price changes in discretionary and necessity sectors is calculated using granular consumer price data from a sample of 135

[1] The HFCS uses multiple imputation to address item non-response, providing 5 implicates per wave. We append all five and use the ECB-provided per-implicate survey weights, which are scaled by 1/5 relative to the standard household weight to preserve population representativeness when implicates are pooled.

million price quotes underlying the Harmonized Index of Consumer Prices (HICP) at the COICOP-5 (five digit) product level for eleven Euro-area countries.

The frequency of wage changes in discretionary and necessity industries is computed using the ECB wage tracker, which in turn relies on granular wage data at the NACE Rev.2 sectoral level for 7 Euro-area countries provided by the Deutsche Bundesbank, the Banque de France, the Banco de Espana and the Spanish Ministry of Labour and Social Economy, the Banca dâItalia and the Italian National Institute of Statistics (ISTAT), the Oesterreichische Nationalbank and Statistics Austria, the Dutch employers association AWVN and Statistics Netherlands, Eurostat and Haver Analytics. [2]

A.1.9 Stock Prices and Dividends

To analyse equity market dynamics across necessity and discretionary sectors, we construct stock price and total dividends indices using firm-level data from Eikon, following a methodology broadly aligned with that used to construct the EURO STOXX 600 Index, which is detailed in the STOXX Calculation Guide. For each date in our sample, we extract from Eikon the list of EURO STOXX 600 constituents, along with each firm's cum-dividend and ex-dividend opening and closing prices (in Euro), the number of free-float market shares, and the NACE industry classification. In addition, for all dates involving changes in index composition-either due to official index reviews or other updates to membership-we record the identities and industry classifications of entering and exiting firms. We then classify each of these dates as involving a rebalancing of necessity stocks, discretionary stocks, or both.

With these data at hand, we construct pseudo stock price indices for necessity and discretionary industries. For necessity stocks, we compute the free-float market capitalization as:

$$M_t^N = \sum_{\{i \in S_{n,t}\}} p_{i,t} \times ff_{i,t}$$

where $p_{i,t}$ are ex-dividend close prices, $ff_{i,t}$ is the number of free float shares and $S_{n,t}$ is the set of stocks i in the EUROSTOXX600 at time t that belong to the necessity category. We follow the same procedure for discretionary stocks.

To compute the index, we construct a divisor that rescales for changes in index composition (entry or exit of firms), preventing artificial jumps. Unlike the official EURO STOXX 600 methodology, we do not adjust for corporate actions (dividends, stock splits, or mergers), focusing solely on composition changes. This does not affect our analysis of stock price dynamics, and the resulting aggregate index correlates 96.7% with the EURO STOXX 600, confirming the approach does not introduce significant distortions.

The divisor for the necessity stock price series at each time period is computed as:

$$D_{t+1}^N = D_t^N \times \frac{M_{t+1}^N}{M_t^N}$$

when the index is rebalanced, and equals the previous period's value otherwise. Here M_{t+1}^N uses opening prices and M_t^N uses closing prices; rebalancing occurs only on dates

[2]Detailed information can be found online on the ECB wage tracker data portal.

involving changes in the composition of necessity firms. The necessity stock price index is then $I_t^N = M_t^N / D_t^N$, and the same procedure applies to the discretionary series.

We also construct three dividend series-aggregate, necessity, and discretionary-for the Euro Area. Consistent with the approach outlined above, we construct these dividend series based on the full set of EUROSTOXX 600 constituents, distinguishing between firms belonging to necessity and discretionary industries. Specifically, we aggregate the cash dividends distributed quarterly by each group of firms. To derive quarterly dividends, we evenly distribute the cumulative annual dividends paid by each firm across all quarters within each fiscal year. This methodology effectively smooths dividend distributions, mitigating distortions caused by seasonal dividend payments—since firms typically concentrate their distributions in a single quarter—thereby enhancing our ability to isolate business-cycle-related fluctuations. All dividend values are expressed in real terms, deflated using the Harmonised Index of Consumer Prices (HICP).

A.1.10 National Accounts Data

We construct novel series of Gross Value Added (GVA), Compensation of Employees, Wages and Salaries, and Operating Surplus for necessity and discretionary sectors from Eurostat national accounts. Annual data are available at the NACE Rev. 2 level through 2022, classified using the same industry mapping as for employment. We aggregate from EA20 country-level figures, excluding any industry-country pairs that are redacted in the source data (a negligible share of the aggregate). Quarterly data are available only at the 1-digit level; we compute average necessity shares within each 1-digit industry from the annual series and apply these to construct a quarterly indicator series. We then use the Chow-Lin procedure to interpolate the annual series using this quarterly indicator, constructing index levels from 1995Q4 using year-on-year quarterly growth rates.

All series are constructed in nominal terms and deflated using the Euro-area HICP. This applies to GVA as well, which Eurostat provides in chained volume terms; using the nominal value ensures the resulting real series are consistent with other national accounts variables. An implication is that relative changes between necessity and discretionary sectors are identical regardless of the deflator used.

A.1.11 Calculations behind the recession plots, and recession plots for price indices and stock prices.

This section provides the detailed methodology underlying the third column in Figure 1 in the main text. The black dashed line shows the change in the aggregate variable of interest relative to the start of the recession. Recession dates are taken from the Euro Area Business Cycle Network (EACBN). For the consumption series, changes are calculated as log differences; for employment and inflation, they are calculated as simple differences. For consumption, each point on the black dashed line is computed as $log(c_{t+h}) - log(c_t)$, where t is the quarter marking the start of the recession. For employment, each point is calculated as $er_{t+h} - er_t$, analogously for inflation.

The red and blue bars show necessity and discretionary contributions: each sector's change (relative to the recession start) multiplied by its weight in the aggregate series. For the employment rate, which equals the sum of necessity and discretionary components, the bars directly show each sector's change.

A.2 Measurement of alternative consumption categorisations

Durables, Non-Durables, Services and six ways split We construct consumption and price series for Durable (including Semi-Durable), Non-Durable, and Services goods, following the ONS classification at the COICOP 4-digit level adapted to the Eurostat 3-digit level using majority-vote assignment. Where a 3-digit category spans multiple durability types, we assign it to the majority type; where subcategories are mixed (e.g. clothing categories 03.1–03.2, household appliances 05.3), repair and hire services are grouped with the main product. For ambiguous categories (cleaning materials and services, 05.6), we use detailed UK expenditure data to determine the majority classification. Annual and quarterly series are constructed using the same chain-linking and Chow-Lin interpolation methodology as for the necessity/discretionary classification.

We also combine the durability and necessity/discretionary classifications into a six-way split. At the COICOP 2-digit level used for quarterly interpolation, no category maps to necessity durables, yielding five categories in practice: necessity non-durables, necessity services, discretionary durables, discretionary non-durables, and discretionary services. Table A.7 gives the full classification.

Tradables and non-Tradables and four ways split Table B.2 in the main text reports expenditure shares across four categories: tradable and non-tradable necessity goods, and tradable and non-tradable discretionary goods. These combine our necessity/discretionary classification with the tradable/non-tradable classification of 3-digit COICOP items from **?**. The resulting mapping is given in Table A.8.

Table A.7: Classification of COICOP 3-digit Categories into Six-Way Split

	Durables & Semi-Durables	**Non-Durables**	**Services**
Necessity	Telephone and telefax equipment.	Medical products, appliances and equipment; food; operation of personal transport equipment; electricity, gas and other fuels.	Post-secondary non-tertiary education; other services n.e.c.; out-patient services; imputed rentals for housing; hospital services; water supply and miscellaneous services relating to the dwelling; personal care; telephone and telefax services; financial services n.e.c.; maintenance and repair of the dwelling; insurance; secondary education; postal services; social protection; actual rentals for housing; pre-primary and primary education.
Discretionary	Other recreational items and equipment; gardens and pets; clothing; other major durables for recreation and culture; footwear; glassware, tableware and household utensils; audio-visual, photographic and information processing equipment; purchase of vehicles; personal effects n.e.c.; household appliances; household textiles; furniture and furnishings; carpets and other floor coverings; tools and equipment for house and garden.	Alcoholic beverages; non-alcoholic beverages; tobacco; narcotics; newspapers, books and stationery; goods and services for routine household maintenance.	Tertiary education; transport services; education not definable by level; catering services; recreational and cultural services; prostitution; other services n.e.c.; package holidays; education; accommodation services.

Notes: The table reports the classification of COICOP 3-digit consumption categories into necessity durables, necessity non-durables, necessity services, discretionary durables, discretionary non-durables, and discretionary services.

Table A.8: Classification of COICOP 3-digit Categories into Four-Way Split

	Tradables	**Non-Tradables**
Necessity	Telephone and telefax equipment; medical products, appliances and equipment; food; electricity, gas and other fuels.	Water supply and miscellaneous services relating to the dwelling; financial services n.e.c.; social protection; hospital services; maintenance and repair of the dwelling; out-patient services; postal services; insurance; actual rentals for housing; imputed rentals for housing; telephone and telefax services; personal care; operation of personal transport equipment.
Discretionary	Purchase of vehicles; tobacco; goods and services for routine household maintenance; audio-visual, photographic and information processing equipment; clothing; household appliances; glassware, tableware and household utensils; newspapers, books and stationery; tools and equipment for house and garden; other major durables for recreation and culture; furniture and furnishings; carpets and other floor coverings; other recreational items and equipment; gardens and pets; narcotics; alcoholic beverages; footwear; non-alcoholic beverages; household textiles; package holidays.	Recreational and cultural services; education; accommodation services; catering services; transport services; personal effects n.e.c.; prostitution; other services n.e.c.

Notes: The table reports the classification of COICOP 3-digit consumption categories into necessity tradables, necessity non-tradables, discretionary tradables, and discretionary non-tradables.

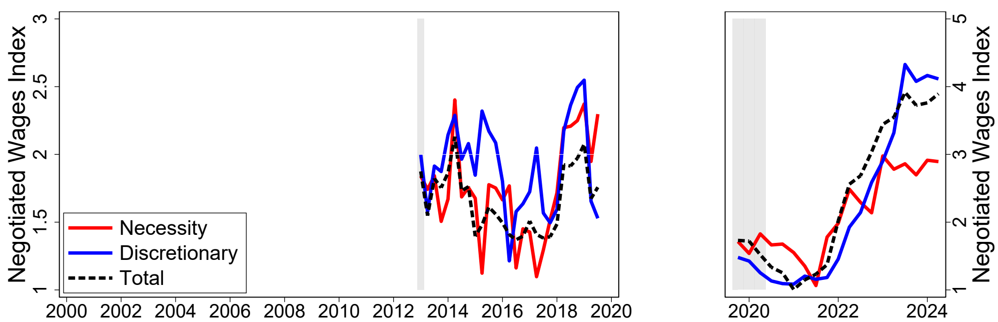
B Further descriptive evidence

This appendix is organised as follows. Section B.1 presents additional time-series evidence on wages, national accounts aggregates, and stock returns and dividends. Section B.2 documents the leading indicator properties of necessity and discretionary variables using the Granger Causal Priority test of Jarociński and Maćkowiak (2017). Section B.3 shows that the necessity/discretionary asymmetry in quantities and prices is distinct from the durables/non-durables/services and tradables/non-tradables splits. Section B.3.2 confirms that the stronger response of necessity prices to monetary policy shocks persists after excluding food and energy.

B.1 Additional Time Series Evidence

Figure B.1 shows negotiated wage growth in aggregate and by sector. Necessity and discretionary wages display no clear cyclical differences, consistent with the finding in Section 2 of similar wage stickiness across sectors.

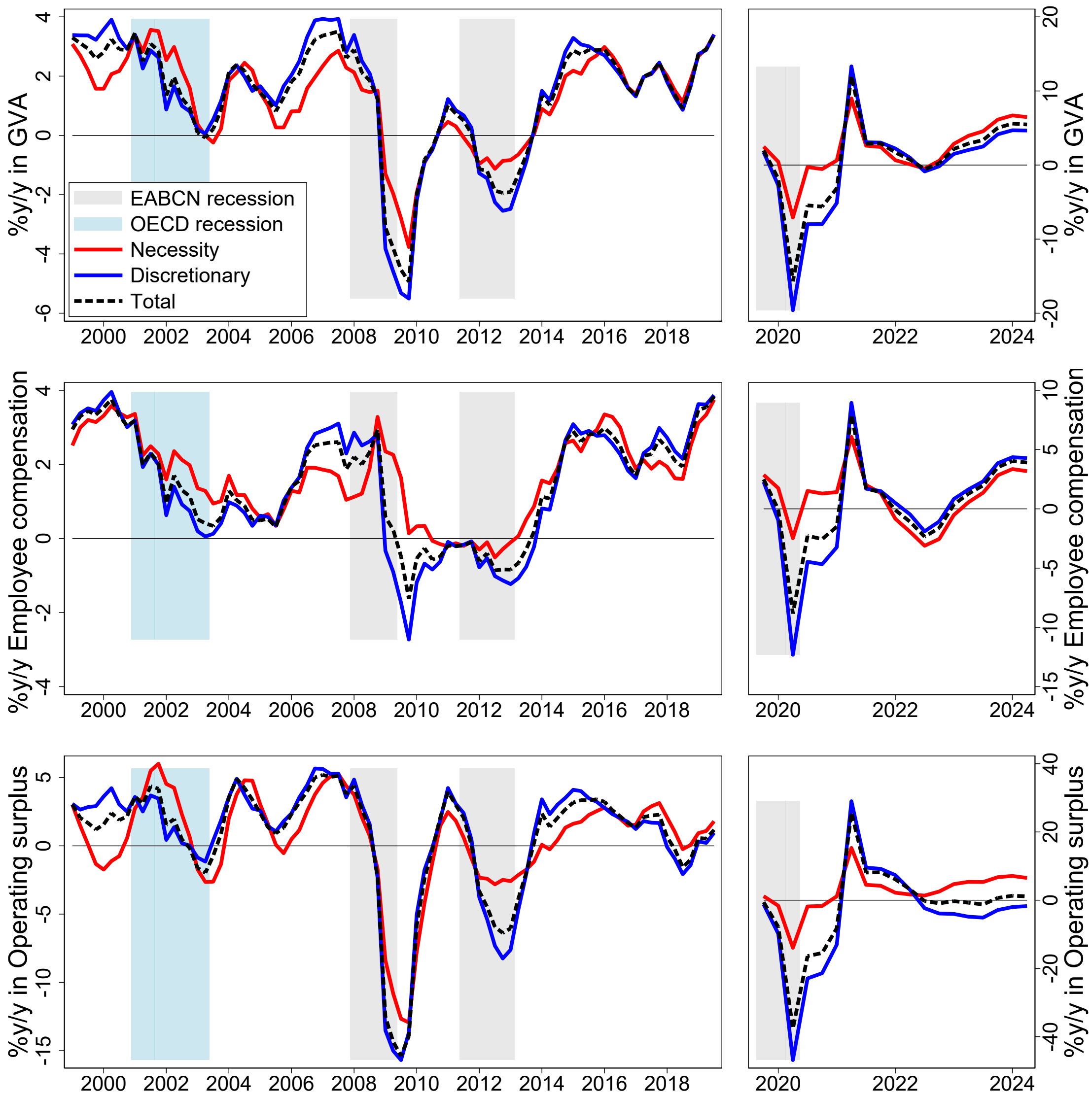
Figure B.1: Negotiated Wages Index



Notes: The table presents negotiated wages, both in aggregate and disaggregated into necessity and discretionary goods and industries. Data derived from the ECB wage tracker.

Figure B.2 shows year-on-year growth rates of gross value added, compensation of employees, and operating surplus, in aggregate and by sector. Aggregate operating surplus is flat in real terms following the 2022 inflation episode, but this masks a substantial increase in necessity sector profits alongside a decline in discretionary sector profits—a pattern consistent with diverging mark-up trends across sectors during periods of high inflation.

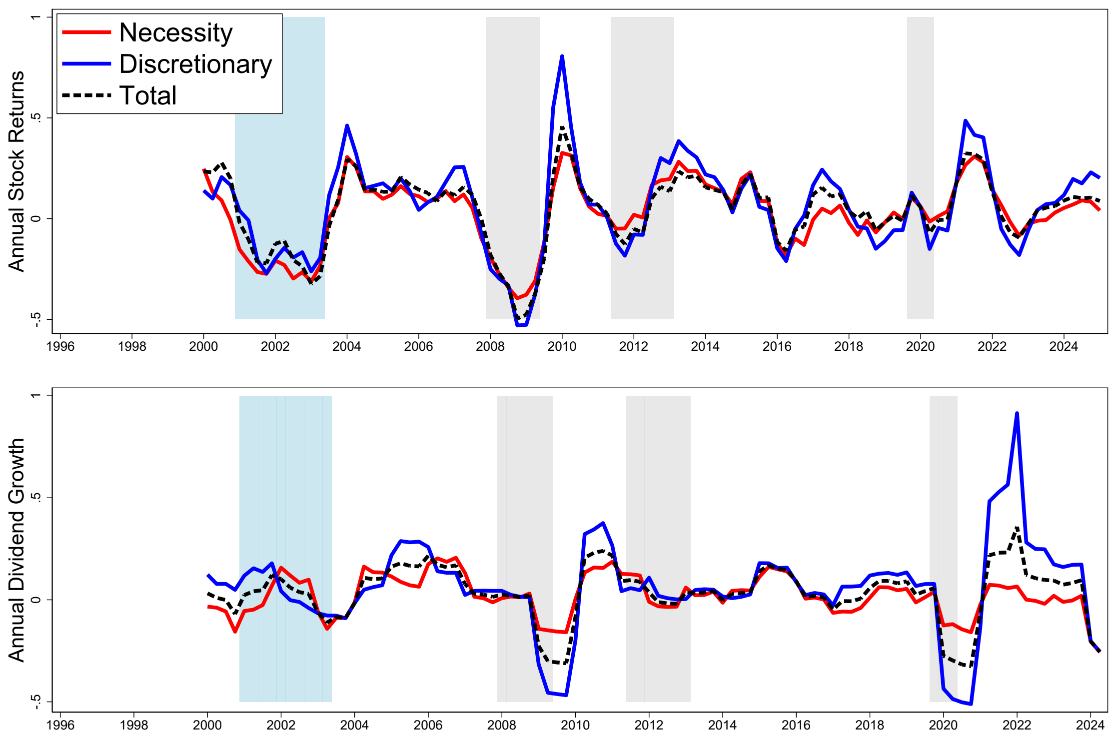
Figure B.2: National Accounts



Notes: GVA, Operating Surplus and Employee compensation, both in aggregate and disaggregated into necessity and discretionary industries, using data from Eurostat quarterly and annual National Accounts. All series are real and indexed to 100 in 2015. See Data Appendix for data construction details.

Figure B.3 shows annual stock returns (top) and dividend growth (bottom) for necessity and discretionary sectors from 1999 to 2024. Consistent with the patterns in consumption and employment, discretionary returns are notably more pro-cyclical than necessity returns, likely reflecting investor expectations of differential business-cycle sensitivity. Discretionary dividends are also more pro-cyclical, suggesting firms in that sector pass through the cyclicality of revenues to shareholders.

Figure B.3: Annual Stock Returns & Dividends Growth Rates in Necessity and Discretionary Industries



Notes: The table reports the annual stock returns and the aggregate dividends for the aggregate market, as well as for necessity and discretionary sectors. The indices are constructed following a methodology similar to the one of the EUROSTOXX600. See the Data Appendix for details on the construction of the indices.

B.2 Leading Indicator Analysis

We test the predictive power of necessity and discretionary variables for the business cycle using the Granger Causal Priority (GCP) approach of Jarociński and Maćkowiak (2017). The test assesses whether a variable is causally prior to a set of outcome variables—here GDP and HICP. We follow their methodology closely, using a BVAR with 4 lags and the same priors, estimated on a quarterly sample from 1999 to 2019. Where necessity or discretionary series are shorter than the full sample, we extend them back using the aggregate series.

Table B.1 reports GCP test results for a selection of variables. Each entry is the probability that the variable is not causally prior to the outcome variables; a value close to 1 indicates no leading indicator property. Odd-numbered columns use aggregate variables; even-numbered columns replace aggregates with their necessity and discretionary counterparts to identify which sector drives the leading properties of the aggregate. Both necessity and discretionary consumption and stock indices are highly predictive for GDP and HICP. However, there is substantial heterogeneity in the predictive power of prices, employment, and dividends: discretionary employment and dividends are highly predictive, while necessity employment and dividends are not. Conversely, necessity price inflation is more relevant for the business cycle than discretionary inflation.

Table B.1: Leading indicator properties of necessity and discretionary variables

	Predicting:	**GDP and HICP**		**GDP**		**HICP**	
		Agg	**Nec/Disc**	**Agg**	**Nec/Disc**	**Agg**	**Nec/Disc**
Cons	*Agg*	0.0001		0.0000		0.0000	
	Nec		0.0027		0.0019		0.0012
	Disc		0.0000		0.0000		0.0000
Emp rate	*Agg*	0.0072		0.0126		0.0094	
	Nec		1.0000		0.9991		0.9990
	Disc		0.0341		0.0265		0.0182
Prices	*Agg*			0.0001			
	Nec		0.0000		0.0073		0.0072
	Disc		0.9993		0.9999		0.9982
GDP	*Agg*					0.0002	
GVA	*Nec*		0.0000		0.0002		0.0006
GVA	*Disc*		0.0000		0.0000		0.0001
Stock mkt	*Agg*	0.0529		0.0585		0.0591	
	Nec		0.0032		0.0032		0.0018
	Disc		0.0003		0.0009		0.0000
Dividends	*Agg*	0.1168		0.1044		0.1120	
	Nec		0.9868		0.9956		0.9903
	Disc		0.0427		0.0312		0.0249
Unemp Rate		0.0002	0.0001	0.0000	0.0002	0.0000	0.0000
Ind conf		0.0018	0.0000	0.0002	0.0000	0.0004	0.0001
Oil price		0.0717	0.0087	0.0746	0.0079	0.0815	0.0131
US GDP		0.0151	0.0063	0.0143	0.0042	0.0170	0.0059
EURUSD		1.0000	0.9998	0.9998	0.9997	0.9997	1.0000

Notes: GCP of Jarocinski and Makowiak; probability that the variable are not causally prior to GDP, HICP or both. Each column is a separate model, quarterly data 1999-2019. Only selected aggregate variables included in table from estimation.

B.3 Descriptive Statistics of alternative consumption categorizations

Table B.2 shows that the necessity/discretionary split is distinct from both the durables/non-durables/services and tradables/non-tradables classifications. Nearly all durable spending is discretionary, but around 33.4% of services and 25.1% of non-durables are also discretionary; altogether, discretionary goods account for 42.7% of the Euro-area basket. For tradables, discretionary consumption accounts for approximately 61% of tradable expenditure but only 29% of non-tradable expenditure.

Table B.2: Composition of expenditure by category - shares (%)

Panel (a): Non-durables, services, and durables & semi-durables

	Goods and services			Share of total
Sectors	Non-durables	Services	Durables	(%)
Euro area	32.7	48.8	18.5	100.0
Necessity	24.5	32.5	0.3	57.3
Discretionary	8.2	16.3	18.2	42.7

Panel (b): Tradables and non-tradables

	Goods and services		Share of total
Sectors	Tradable	Non-tradables	(%)
Euro area	44.2	55.8	100.0
Necessity	17.7	39.6	57.3
Discretionary	26.5	16.2	42.7

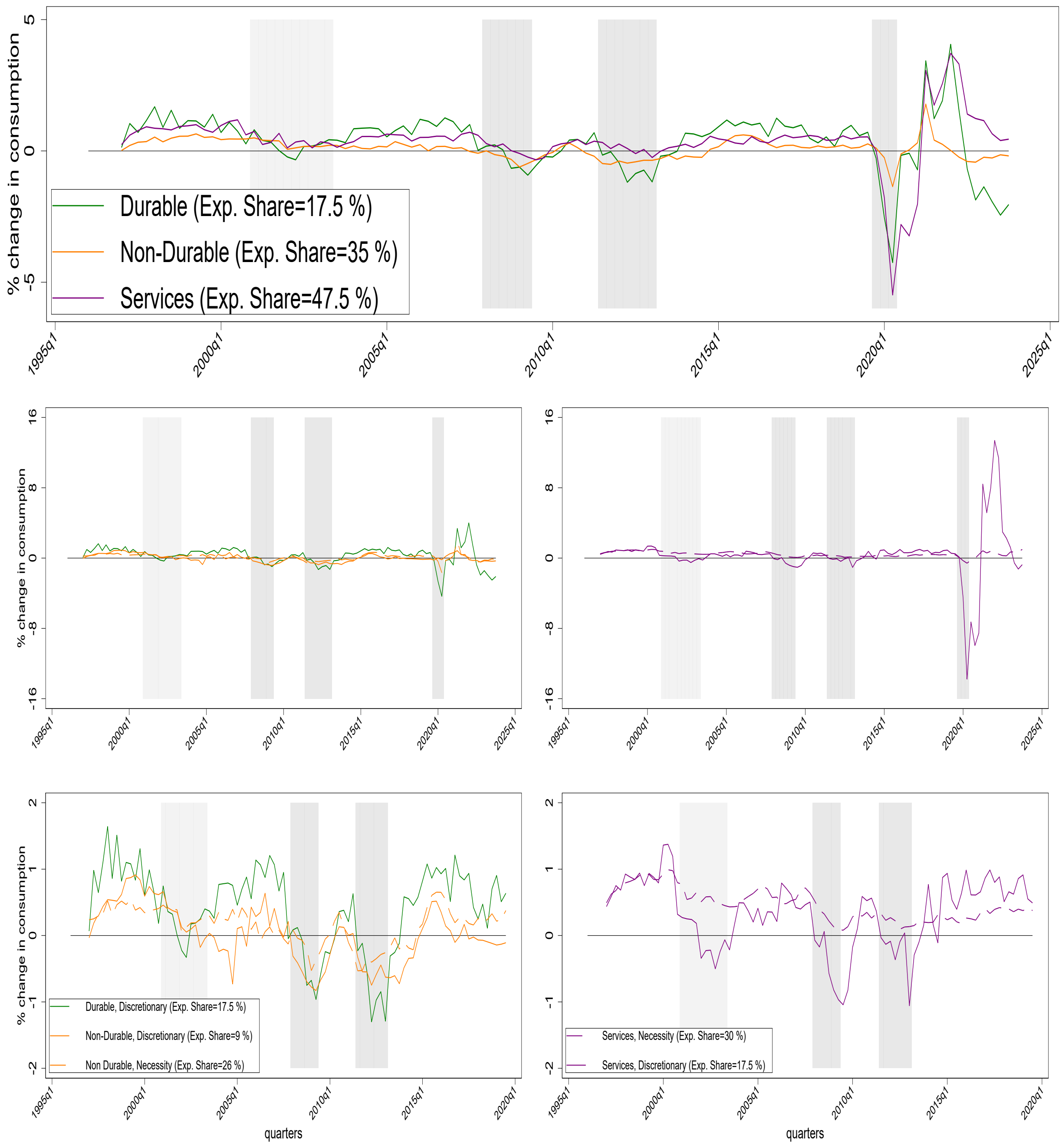
Note: Values are average expenditure shares in the Euro Area. Panel (a) disaggregates into durables (including semi-durables), non-durables, and services, and then into necessity and discretionary categories within each group. Panel (b) disaggregates into tradables and non-tradables, and then into necessity and discretionary categories within each group. Derived from Eurostat Household Budget Survey.

B.3.1 Non-durables, services and durables

Figure B.4 plots annual consumption growth rates for durables, non-durables, and services, split by necessity/discretionary, for the full sample and the pre-COVID period. Discretionary services display volatility comparable to discretionary durables, while necessity goods consistently exhibit low volatility across all categories.

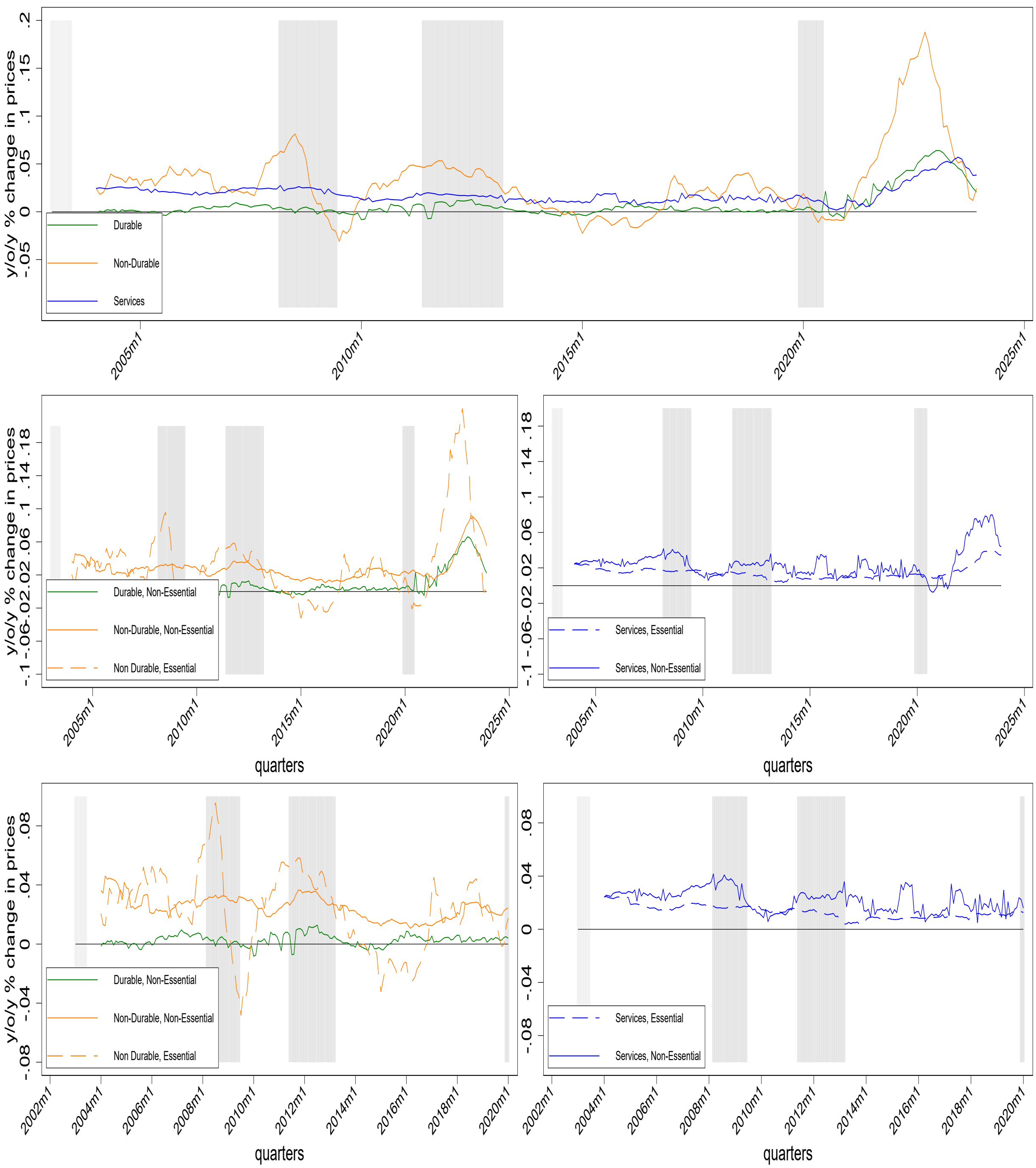
Figure B.5 presents the analogous price series. Necessity non-durable prices are the most volatile, consistent with the inclusion of food and energy in that category.

Figure B.4: Durable, non-Durable and Services Consumption - Aggregate & Necessity/Discretionary Split



Notes: The top panel shows the evolution over time of durable, non durable and services consumption in the EA from 1997Q1 to 2024Q2, the middle panel rapresents the evolution over time of the same series, split into necessity and discretionary, and the bottom panel shows the same series, zooming in the pre-Covid period.

Figure B.5: Durable, non-Durable and Services Prices - Aggregate & Necessity/Discretionary Split



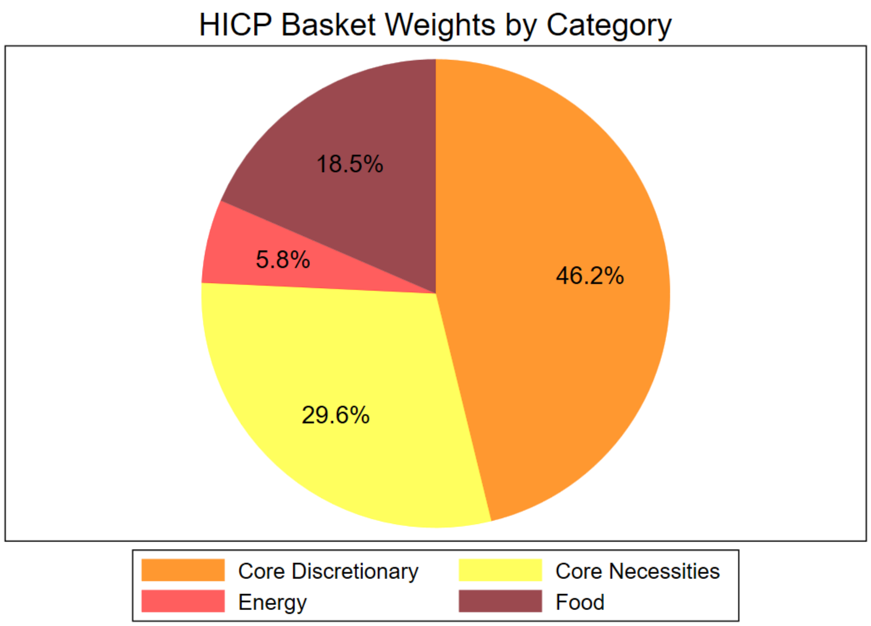
Notes: The top panel shows the evolution over time of durable, non durable and services prices in the EA from 2003Q1 to 2024Q2, the middle panel rapresents the evolution over time of the same series, split into necessity and discretionary, and the bottom panel shows the same series, zooming in the pre-Covid period.

B.3.2 Core & non-core Prices

Necessity prices respond more strongly to monetary policy shocks, but necessity goods include energy and food—volatile components often driven by supply shocks that monetary policy cannot easily address in the short term. Here we ask whether the stronger necessity price response survives after excluding food and energy, and compare core necessity prices to core discretionary prices.

Figure B.6 shows average HICP basket weights for energy (CP045), food (CP011/CP012), core necessity, and core discretionary goods over 1996–2023. Core necessity items account for approximately 54% of the necessity category, which together represents 53.9% of the total HICP basket.

Figure B.6: HICP Basket Weights of Energy, Food, Core Necessities and Core Discretionaries

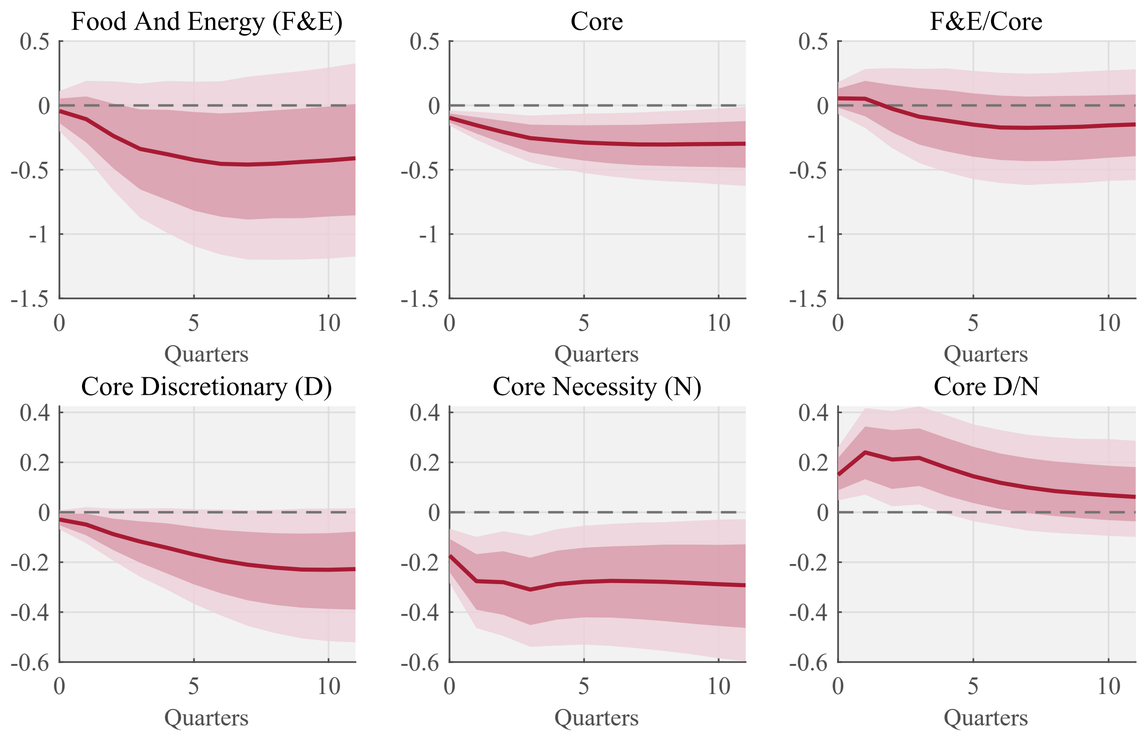


*Notes:*The figure displays the HICP weights of energy, food, core necessity and core discretionary consumption goods. Energy corresponds to the COICOP 3 digits code CP045, food corresponds to the COICOP 3 digits codes CP011 CP012. The rest of the COICOP codes are split into core-necessity and core-discretionary based on our classification of COICOP 3 digits categories into necessity and discretionary. HICP weights are displayed as averages across years over the sample period from 1996 to 2023.

Figures B.7 and B.8 report IRFs for food and energy prices, overall core prices, and core necessity and discretionary prices using our baseline BVAR, estimated on the full sample (1999Q1–2024Q2) and the pre-COVID sample (1999Q1–2019Q4). In both samples, core necessity prices respond significantly, with magnitude similar to food and energy; the greater responsiveness of necessity prices relative to discretionary prices persists after excluding food and energy.

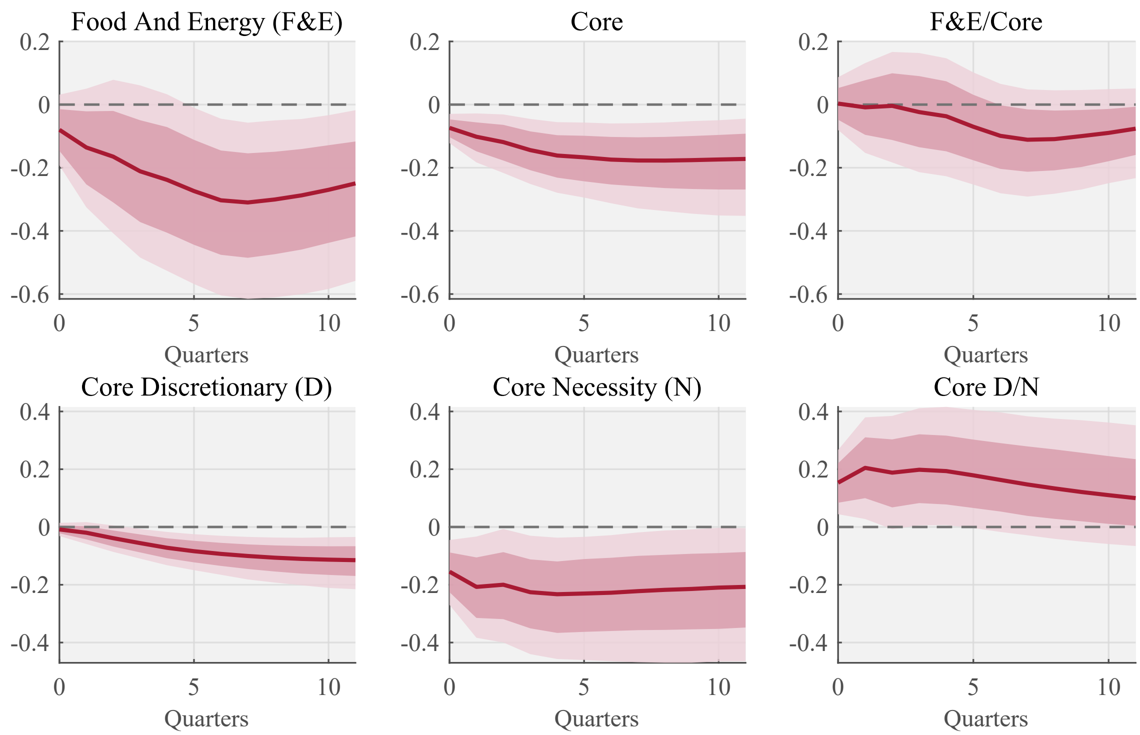
Our findings contrast with Allayioti et al. (2024), who find that discretionary item prices respond more strongly to monetary policy shocks. The difference reflects methodology: we aggregate necessity and discretionary goods into two HICP-like series with basket weights, then estimate impulse responses of these aggregates. Their approach instead estimates item-specific BVARs for each of 72 HICP items and classifies items by the sensitivity of their price responses—a conceptually different exercise focused on price sensitivity rather than consumption cyclicality—and finds that the most responsive items tend to be discretionary.

Figure B.7: Impulse response functions - Prices, full sample.



Notes: The figure displays the IRFs to identified monetary policy shocks of Food and Energy (log) Prices, Core (log) Prices, the (log) difference between food and energy and core prices, (log) core necessity and(log) core discretionary, and the log difference between core discretionary and core necessity prices. Energy corresponds to the COICOP 3 digits code CP045, food corresponds to the COICOP 3 digits codes CP011 CP012. The rest of the COICOP codes are split into core-necessity and core-discretionary based on our classification of COICOP 3 digits categories into necessity and discretionary. Price indices for the various sub-categories are constructed following the methodology used to construct necessity and discretionary prices indices, outlined in the Data section of the appendix. The IRFs are estimated using the *poor man* identification on the whole sample period (1999Q1, 2024Q2).

Figure B.8: Impulse response functions - Prices, pre-Covid sample.



Notes: The figure displays the IRFs to identified monetary policy shocks of Food and Energy (log) Prices, Core (log) Prices, the (log) difference between food and energy and core prices, (log) core necessity and(log) core discretionary, and the log difference between core discretionary and core necessity prices. Energy corresponds to the COICOP 3 digits code CP045, food corresponds to the COICOP 3 digits codes CP011 CP012. The rest of the COICOP codes are split into core-necessity and core-discretionary based on our classification of COICOP 3 digits categories into necessity and discretionary. Price indices for the various sub-categories are constructed following the methodology used to construct necessity and discretionary prices indices, outlined in the Data section of the appendix. The IRFs are estimated using the *poor man* identification on the pre-Covid sample period (1999Q1, 2019Q4).

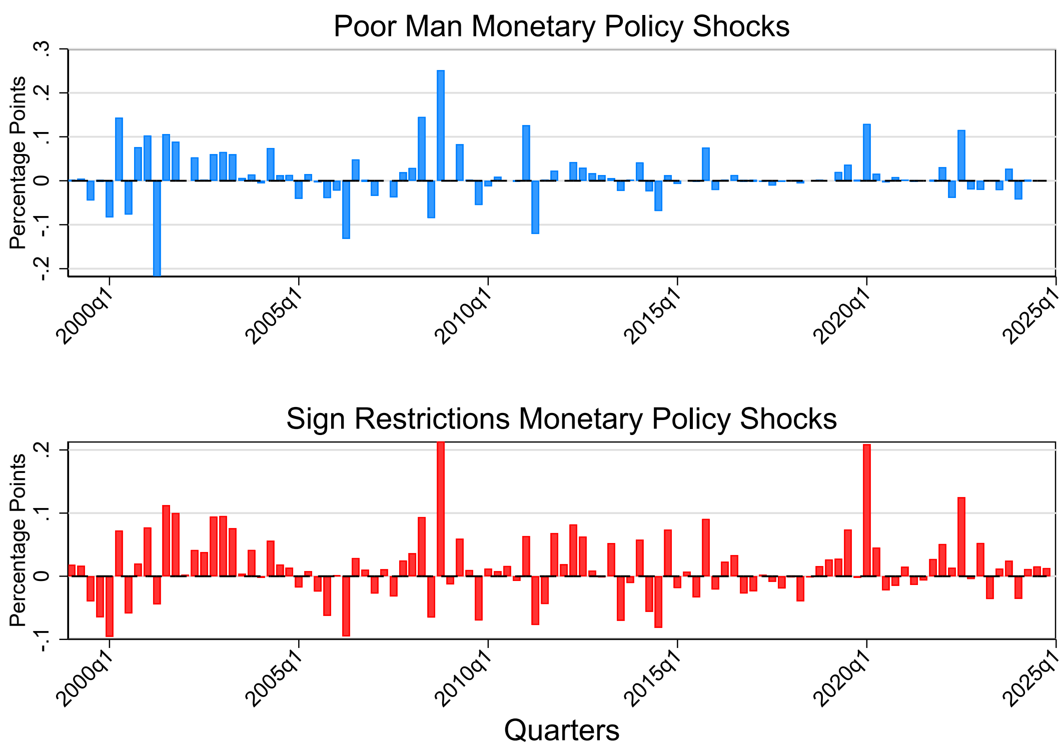
C Monetary Policy IRFs: Robustness

This appendix documents the monetary policy shocks used in the paper and presents robustness checks for the impulse response evidence in Section 3. Section C.1 plots the poor man's and sign restriction shocks from Jarociński and Karadi (2020). Section C.2 describes the sign restriction identification approach. Section C.3 reports the control variable IRFs across all BVAR specifications and shows that the main results are robust to alternative shock identification (Figure C.3) and to restricting the sample to the pre-COVID period (Figure C.4).

C.1 Monetary Policy Shocks

Figure C.1 plots the quarterly poor man's and sign restriction monetary policy shocks used in the baseline specification and robustness tests. Both series are constructed by cumulating the corresponding monthly shocks from Jarociński and Karadi (2020) within each quarter.

Figure C.1: Sign Restriction and Poor Man Monetary Policy Shocks from Jarociński and Karadi (2020).



C.2 Sign Restriction Identification

The sign restriction identification follows the same logic as the poor man's approach: monetary policy shocks are associated with a negative co-movement, and central bank information shocks with a positive co-movement, in high-frequency surprises in OIS rates and stock prices around ECB announcements. The two shocks are orthogonal and, unlike the poor man's case, may occur simultaneously within the same month. They are identified via a block-Cholesky structure with the two announcement shocks in the first block, followed by sign restrictions on contemporaneous responses. As this approach delivers set identification, posterior draws are computed under a uniform prior on rotations following Rubio-Ramirez, Waggoner, and Zha (2010). Quarterly shocks are obtained by cumulating the monthly shocks from Jarociński and Karadi (2020) within each quarter.

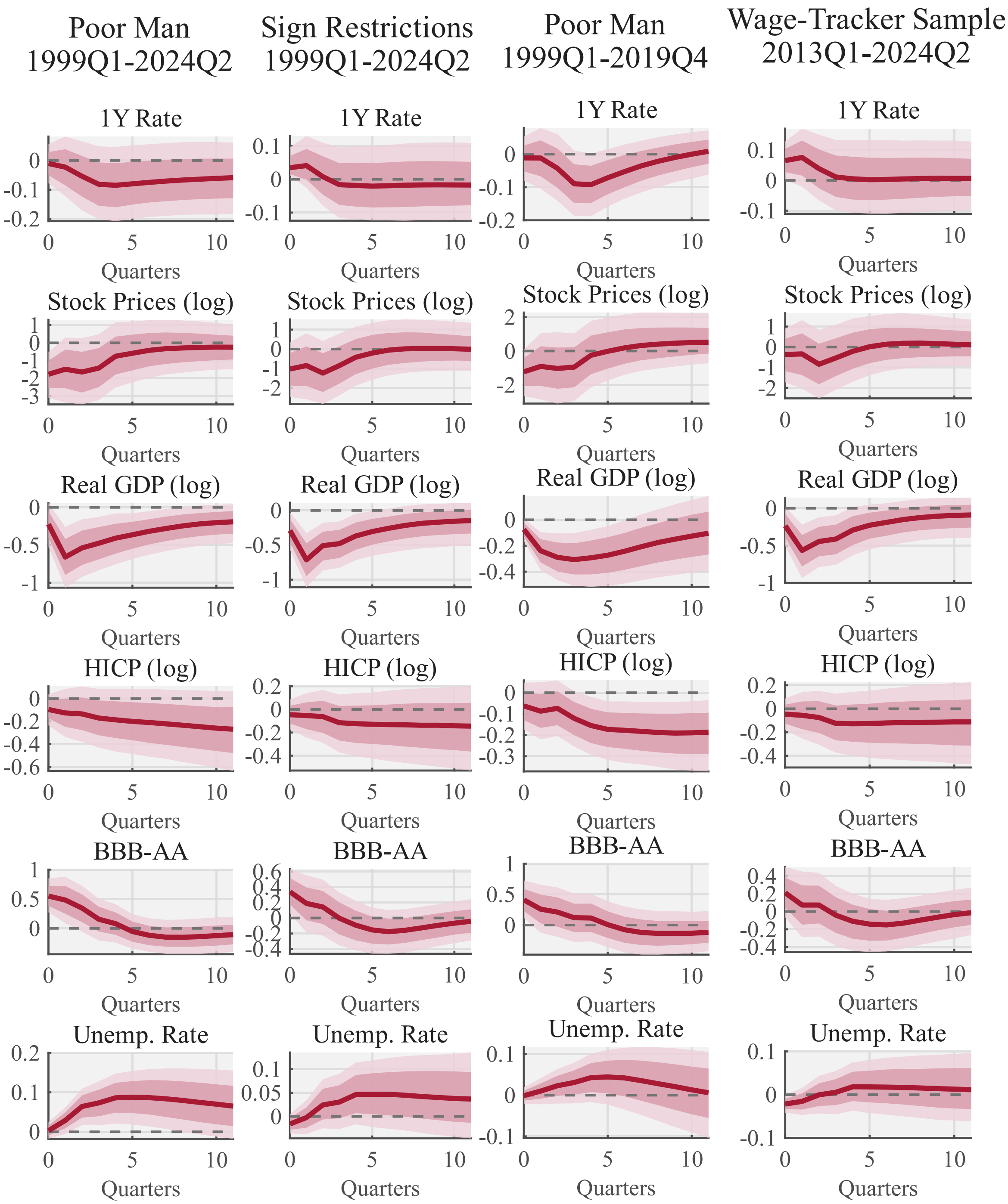
C.3 Baseline and Alternative Specification IRFs

Following Jarociński and Karadi (2020), all specifications include the 1-year Bund yield, BBB-AA corporate bond spread, log real GDP, log stock price index, and log HICP as baseline controls; we also add the unemployment rate. Figure C.2 shows the control variable IRFs across four specifications: (1) poor man's identification, full sample (1999Q1–2024Q2); (2) sign restriction identification, full sample; (3) poor man's identification, pre-COVID sample (1999Q1–2019Q4); (4) poor man's identification, wage-tracker sample (2013Q1–2024Q2).

The results are broadly consistent with Jarociński and Karadi (2020): following a monetary tightening, stock prices, GDP, and inflation decline while the BBB-AA spread and unemployment rise. The 1-year Bund yield rises only under sign restrictions, reflecting the additional restriction that the impact response is at least one basis point; our poor man's estimates are consistent with their findings.

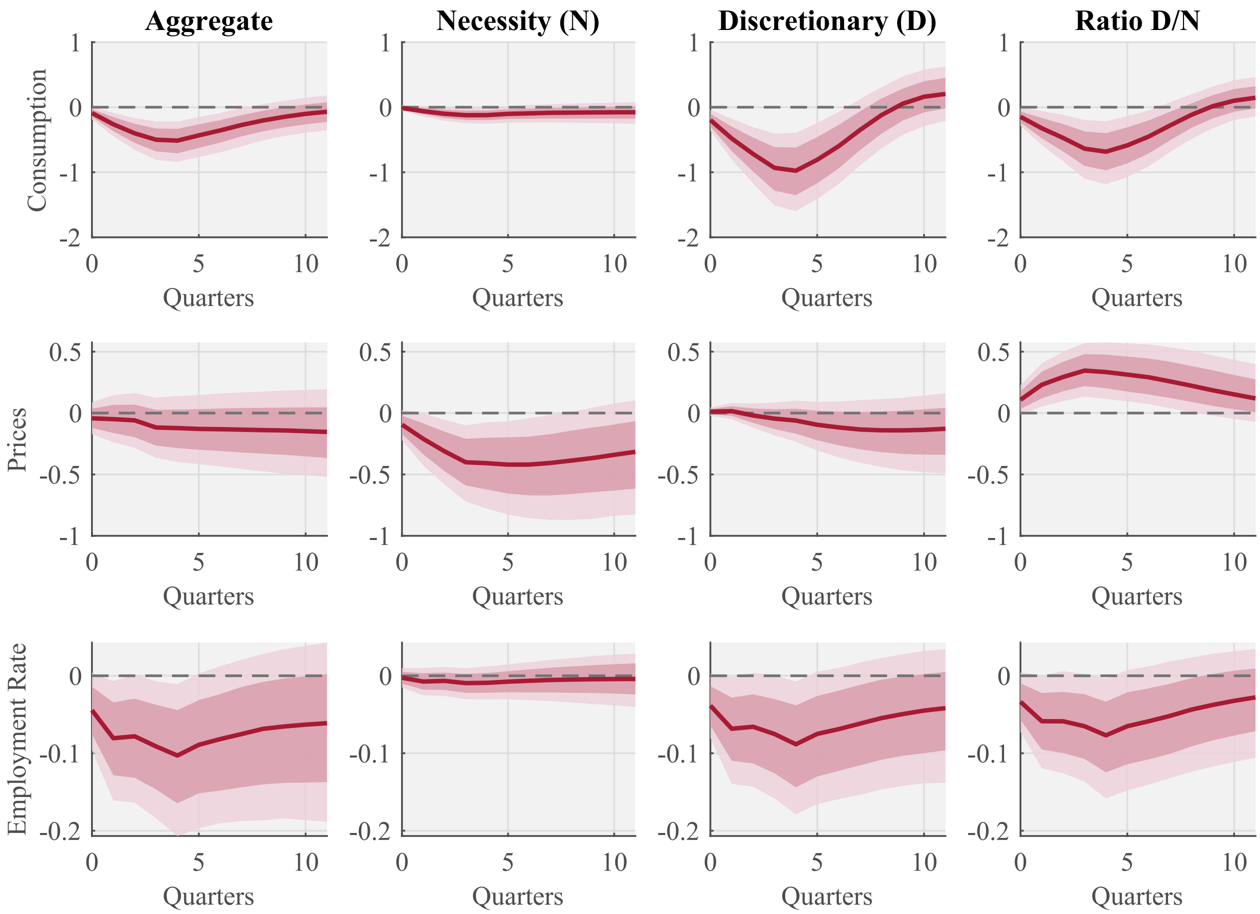
Figure C.3 reports the IRFs for our primary variables of interest, derived from estimating the BVAR model using sign restrictions. These results are consistent with the findings reported in the main text, where identification is achieved via the "poor man's" approach. Figure C.4 presents the IRFs obtained from our baseline specification, specifically estimated on the pre-COVID sample. The patterns observed remain consistent with the results derived from the full-sample analysis.

Figure C.2: Baseline irfs



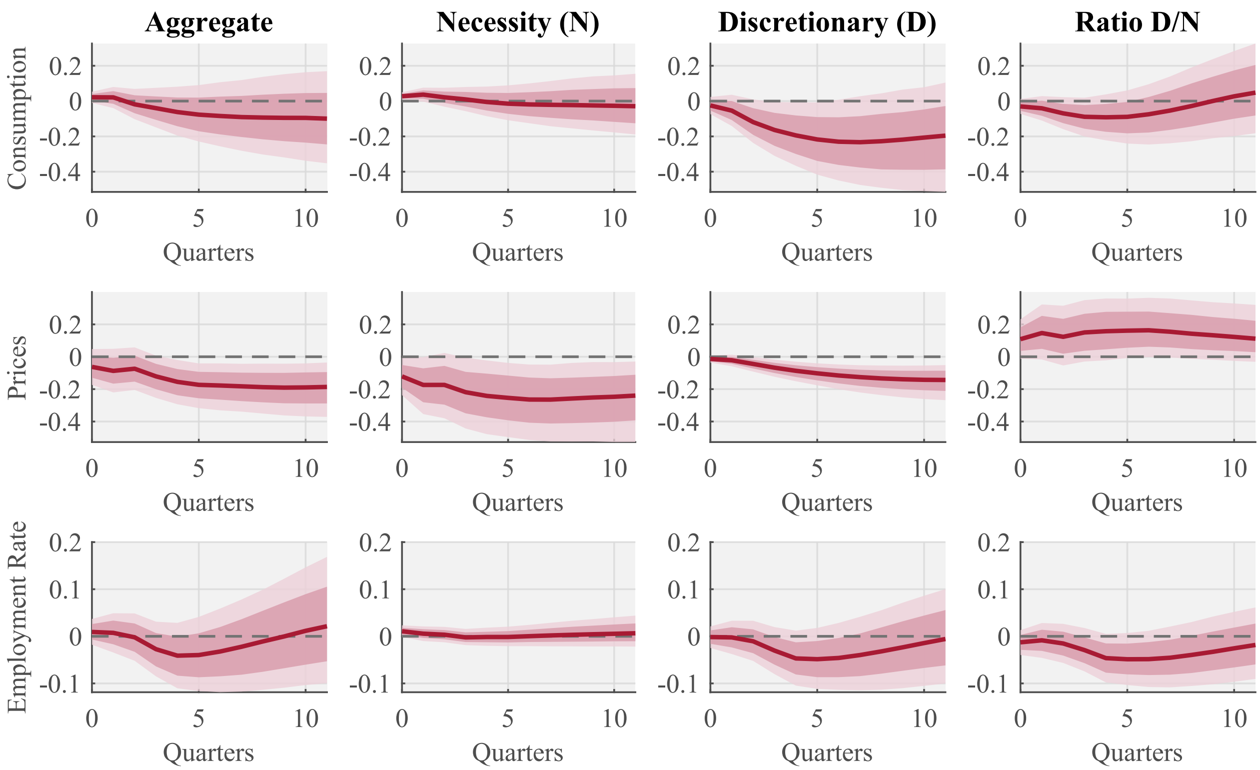
Notes: Impulse response functions of control variables across different specification. Column 1 shows the IRFs from our baseline specification, estimated on the full sample from 1999Q1 to 2024Q2, using the poor man's identification of monetary policy shocks. Column 2 displays the IRFs from the sign restriction specification estimated on the same full sample. Column 3 reports the IRFs obtained using the poor man's identification, but with the sample restricted to the pre-COVID period, from 1999Q1 to 2019Q4. Column 4 presents the IRFs estimated using the same identification method, but on sample from 2013Q1 to 2024Q2, in which the wage tracker series is available.

Figure C.3: Consumption, Prices, Employment Rate - Sign Restriction Identification



Notes: IRFs in response to a one standard deviation monetary policy shock, estimated using a BVAR on a quarterly sample 1999-2024q2 with the alternative sign restriction identification from Jarocinski and Karadi (2020). Median (line), percentiles 16â84 (darker band), percentiles 5â95 (lighter band). Quarters on the horizontal axes. Each IRF corresponds to a separate BVAR estimate with the respective variable added as an additional variable to the baseline controls (monetary policy shocks, 1y yield, GDP, HICP, stock index, unemployment, corporate bond spread). See text for full specification details and Appendix for IRFs of baseline controls.

Figure C.4: Consumption, Prices, Employment Rate - Pre-Covid Sample



Notes: IRFs in response to a one standard deviation monetary policy shock of consumption, HICP and employment rate. IRFs are from a BVAR on a quarterly sample 1999-2019q4. Median (line), percentiles 16-84 (darker band), percentiles 5-95 (lighter band). Quarters on the horizontal axes. Each IRF corresponds to a separate BVAR estimate with the respective variable added as an additional variable to the baseline controls (monetary policy shocks, 1y yield, GDP, HICP, stock index, unemployment, corporate bond spread). See text for full specification details and Appendix for IRFs of baseline controls.

D Model Derivations

This appendix explains the derivations of the theoretical model. We follow closely Andreolli et al. (2024). The key difference is the presence of a symmetric cost-push shock to study optimal policy and heterogeneous price stickiness in the two sectors to match Euro Area micro data. The notation is different, in this paper, discretionaries/luxuries/non-essentials are defined with a superscript D, in Andreolli et al. (2024) with N. Necessities/essentials are defined with a N in this paper, and with an E in Andreolli et al. (2024).

D.1 Households

We first solve the problem of the Ricardian agent, and then the Hand-to-Mouth one. The key role of inattention is to allow for a hump shape in the response in consumption, as in the empirical IRFs, while at the same time keeping the relative IES across different goods.

Ricardian agents problem. The nominal budget constraint of the unconstrained family of agents is:

$$P_t^N C_{H,t}^N + P_t^D C_{H,t}^D + B_{H,t} \leq W_{H,t} N_{H,t} + \Pi_{H,t} + T_{H,t} + R_{t-1} B_{H,t-1}$$

They consume necessity and discretionary goods at prices P_t^N and P_t^D respectively, they can invest in nominal bonds $B_{H,t}$ that earn risk free nominal rate R_t, the wage they earn is $W_{H,t}$, they also receive transfers $T_{H,t}$ and profits $\Pi_{H,t}$. We can rewrite the budget constraint defining wealth in terms of the necessity price $a_{H,t}$:

$$\begin{aligned}
a_{H,t} &= b_{H,t-1} \frac{R_{t-1}}{\pi_t^N} + w_{H,t} N_{H,t} + \Pi_{H,t}^r + t_{H,t} \\
a_{H,t+m+1} &= \prod_{k=0}^{m} \tilde{R}_{t+k+1} a_{H,t} - \sum_{j=0}^{m} \prod_{k=j}^{m} \tilde{R}_{t+k+1} (C_{H,t+j}^N + p_{t+j}^D C_{H,t+j}^D) \\
&\quad + \sum_{j=0}^{m} \prod_{k=j+1}^{m} \tilde{R}_{t+k+1} (w_{t+j+1} N_{H,t+j+1} + \Pi_{H,t+j+1}^r + t_{H,t+j+1})
\end{aligned}$$

Where $\pi_{t+1}^N \equiv \frac{P_{t+1}^N}{P_t^N}$ is the inflation of necessity goods, and similarly for discretionary goods, $\tilde{R}_{t+1} \equiv R_t/\pi_{t+1}^N$ is real ex-post rate in terms of the necessity price inflation. All lower case variables are the corresponding uppercase variable in terms of the necessity price: $p_t^D \equiv \frac{P_t^D}{P_t^N}$, $w_{H,t} \equiv \frac{W_{H,t}}{P_t^N}$, $t_{H,t} \equiv \frac{T_{H,t}}{P_t^N}$, and $b_{H,t} \equiv \frac{B_{H,t}}{P_t^N}$. We define $\Pi_{H,t}^r \equiv \frac{\Pi_{H,t}}{P_t^N}$ as real profits to avoid confusion with inflation.

Households update their expectations only sporadically. Specifically, they update with probability λ. Somebody who updates today has probabilities λ of updating tomorrow, $\lambda(1-\lambda)$ of updating in 2 periods, $\lambda(1-\lambda)^j$ in $j+1$ periods, and so on. When they update, the problem is as in year zero, making the problem recursive. As they realise that they might not be able to update, households make plans for future choices in the current period. They choose consumption of a variety, say necessities, for today: $C_{i,t,0}^N$ and for the future if they don't update $C^N_{i,t+j,j}$ for j periods ahead, and similarly for discretionary consumption and savings, subject to the family budget contraint. As households delegate the labour choice to unions, we can ignore the disutility of labour in the household problem.

$$V(a_{H,t}) = \max_{\{C^N_{H,t+m,m}, C^D_{H,t+m,m}\}_{m=0}^{\infty}} \left(\sum_{m=0}^{\infty} \beta^m (1-\lambda)^m \left(\frac{\left(C^N_{H,t+m,m}\right)^{1-\frac{1}{\gamma^N}}}{1-\frac{1}{\gamma^N}} + \varphi \frac{\left(C^D_{H,t+m,m}\right)^{1-\frac{1}{\gamma^D}}}{1-\frac{1}{\gamma^D}} \right) \right.$$
$$\left. + \beta\lambda \sum_{m=0}^{\infty} \beta^m (1-\lambda)^m \mathbb{E}_t V(a_{H,t+m+1}) \right)$$
$$s.t.\ a_{H,t+m+1} = \prod_{k=0}^{m} \tilde{R}_{t+k+1} a_{H,t} - \sum_{j=0}^{m} \prod_{k=j}^{m} \tilde{R}_{t+k+1} (C^N_{H,t+j} + p^D_{t+j} C^D_{H,t+j})$$

The household makes plans for when they cannot update (first terms) and for when they can update (second terms). By taking the same steps as Mankiw and Reis (2007) and Andreolli et al. (2024) we can arrive to the equations that summarise the problems of the Ricardian agents: four equilibrium conditions, a budget constraint (which drops out due to Walras Law), two aggregation equations, and an equation summarising the average marginal utility. The equilibrium conditions consist of: an Euler equation for the attentive consumer in terms of the essential good, an intra-temporal condition linking consumption of necessity goods to discretionary goods for an attentive consumer, and two conditions, one for necessity goods and one for discretionary goods, linking the consumption plans for consumers who do not update to the expectation of what an attentive consumer would do.

$$(C^N_{H,t,0})^{-\frac{1}{\gamma^N}} = \beta \mathbb{E}_t \left((C^N_{H,t+1,0})^{-\frac{1}{\gamma^N}} \frac{R_t}{\pi^N_{t+1}} \right) \qquad \varphi (C^D_{H,t,0})^{-\frac{1}{\gamma^D}} = p^D_t (C^N_{H,t,0})^{-\frac{1}{\gamma^N}}$$
$$(C^N_{H,t+j,j})^{-\frac{1}{\gamma^N}} = \mathbb{E}_t \left((C^N_{H,t+j,0})^{-\frac{1}{\gamma^N}} \right) \qquad (C^D_{H,t+j,j})^{-\frac{1}{\gamma^D}} = \mathbb{E}_t \left((C^D_{H,t+j,0})^{-\frac{1}{\gamma^D}} \right)$$

Consumption aggregation across attentive and non-attentive consumers, as a function of the expected actions of attentive consumers:

$$C^N_{H,t} = \lambda \sum_{j=0}^{\infty} (1-\lambda)^j \left[\mathbb{E}_{t-j} \left((C^N_{H,t,0})^{-\frac{1}{\gamma^N}} \right) \right]^{-\gamma^N}$$
$$C^D_{H,t} = \lambda \sum_{j=0}^{\infty} (1-\lambda)^j \left[\mathbb{E}_{t-j} \left((C^D_{H,t,0})^{-\frac{1}{\gamma^D}} \right) \right]^{-\gamma^D}$$

We can define the average marginal utility of consumption aggregated across attentive and inattentive agents, to use as an objective function for the union:

$$\zeta_{H,t} = (C^N_{H,t})^{-\frac{1}{\gamma^N}} \frac{C^N_{H,t}}{C^N_{H,t} + C^D_{H,t} p^D_t} + (C^D_{H,t})^{-\frac{1}{\gamma^D}} \frac{\varphi}{p^D_t} \frac{C^D_{H,t} p^D_t}{C^N_{H,t} + C^D_{H,t} p^D_t}$$

Hand-to-mouth agents problem. Constrained agents face the same problem, with the same information friction, but do not have access to bond markets. They make plans for consumption choices in the future, as they can also be inattentive, but do not have saving choices to smooth out inconsistent plans as the Ricardian agents. Therefore, we posit a risk sharing agreement across hand-to-mouth households, to ensure that each household follows ex-post their consumption plans and the overall hand-to-mouth agents budget constraint is satisfied. First, we show the budget constraint in terms of wealth:

$$C_{L,t}^N + p_t^D C_{L,t}^D \leq a_{L,t} = w_{L,t} N_{L,t} + \Pi_{L,t}^r + t_{L,t}$$

Their maximisation problem, for the periods in which they cannot update:

$$\begin{aligned}V(a_{L,t}) = \max_{\{C_{L,t+m,m}^N, C_{L,t+m,m}^D\}_{m=0}^{\infty}} \sum_{m=0}^{\infty} \beta^m (1-\lambda)^m \Bigg(\frac{\left(C_{L,t+m,m}^N\right)^{1-\frac{1}{\gamma^N}}}{1-\frac{1}{\gamma^N}} + \varphi \frac{\left(C_{L,t+m,m}^D\right)^{1-\frac{1}{\gamma^D}}}{1-\frac{1}{\gamma^D}} \\ + \eta_{t+m} \mathbb{E}_t \left(a_{L,t+m} - C_{L,t+m,m}^N - C_{L,t+m,m}^D p_{t+m}^D\right) \Bigg)\end{aligned}$$

To find the solution, take the FOC for the two goods and equate the marginal utilities to arrive to the three equilibrium conditions as for the Ricardian agents, minus the Euler equation:

$$\varphi (C_{L,t,0}^N)^{-\frac{1}{\gamma^N}} = (C_{L,t,0}^D)^{-\frac{1}{\gamma^D}} \frac{1}{p_t^D}$$

$$(C_{L,t+j,j}^N)^{-\frac{1}{\gamma^N}} = \mathbb{E}_t (C_{L,t+j,0}^N)^{-\frac{1}{\gamma^N}} \qquad (C_{L,t+j,j}^D)^{-\frac{1}{\gamma^D}} = \mathbb{E}_t (C_{L,t+j,0}^D)^{-\frac{1}{\gamma^D}}$$

We can still aggregate goods consumption across attentive and non-attentive consumers. By assuming risk sharing across consumers, agents can follow through with their plans ex-post. Moreover, we can still define the average marginal utility of consumption.

$$C_{L,t}^N = \lambda \sum_{j=0}^{\infty} (1-\lambda)^j \left[\mathbb{E}_{t-j} \left((C_{L,t,0}^N)^{-\frac{1}{\gamma^N}} \right) \right]^{-\gamma^N}$$

$$C_{L,t}^D = \lambda \sum_{j=0}^{\infty} (1-\lambda)^j \left[\mathbb{E}_{t-j} \left((C_{L,t,0}^D)^{-\frac{1}{\gamma^D}} \right) \right]^{-\gamma^D}$$

$$\zeta_{L,t} = (C_{L,t}^N)^{-\frac{1}{\gamma^N}} \frac{C_{L,t}^N}{C_{L,t}^N + C_{L,t}^D p_t^D} + (C_{L,t}^D)^{-\frac{1}{\gamma^D}} \frac{\varphi}{p_t^D} \frac{C_{L,t}^D p_t^D}{C_{L,t}^N + C_{L,t}^D p_t^D}$$

D.2 Unions

Unions operate under perfect competition and are fully responsive. There are two unions, each representing a different type of consumer: Ricardian and Hand-to-Mouth. Following Mankiw and Reis (2007), we separate consumption and labor supply decisions by introducing unions. Since each union represents the entire household, it uses the average marginal utility of consumption when determining labor supply. This framework leads to two standard intra-temporal equilibrium conditions: $\xi \frac{N_{L,t}^{\chi}}{\zeta_{L,t}} = w_{L,t}$ and $\xi \frac{N_{H,t}^{\chi}}{\zeta_{H,t}} = w_{H,t}$

D.3 Firms

Final good producers. The final good producers combine different retail varieties of the necessity and discretionary goods according to a CES aggregator. $Y_t^i = \left(\int_0^1 (y_{k,t}^i)^{\frac{\varepsilon^i - 1}{\varepsilon^i}} dk \right)^{\frac{\varepsilon^i}{\varepsilon^i - 1}}$ for $i = \{N, D\}$. This leads to a standard demand that the final good producers have for different varieties of a given good category: $y_{k,t}^i = Y_t^i \left(\frac{P_{k,t}^i}{P_t^i} \right)^{-\varepsilon^i}$ for $i = \{N, D\}$.

Calvo retailers. There two sets of retailers, one set for necessity goods and the second for discretionary goods. The problem is symmetric across sectors. In a given sector i, retailers face a possibly heterogenous Calvo friction to change prices, where the probability of not being able to reset prices is equal to θ^i in each period. This is a first difference from Andreolli et al. (2024). Retailers buy a wholesale good and use it to produce the retail variety $y_{k,t}^i$. The second difference from Andreolli et al. (2024) is that the price they pay is subject to a stochastic disturbance that creates a cost-push shock: $P_t^{i,w} X_t$. X_t has an AR(1) structure once log-linearised: $\ln(X_t) = \rho_X \ln(X_{t-1}) + \sigma_X \varepsilon_{X,t}$. Importantly, the same X_t hits both the necessity and the discretionary sectors. This allows us to study how a symmetric shock is propagated asymmetrical in the economy, due to interaction of demand, production, and household heterogeneities. The real marginal cost $\mathcal{S}_t^i X_t = \frac{P_t^{i,w} X_t}{P_t^i}$ is the wholesale price relative to its retail average value, scaled with the stochastic disturbance. They receive a subsidy τ^i for each unit of good they produce and pay lump sum taxes T_t^i; these taxes allow to have zero profit in steady state but do not affect the profit allocation off-steady state. We use the SDF of Ricardian households, but notice that as we take a first order Taylor approximation to solve the model, the choice of whose SDF we take drops out. This leads to a standard non-linear three equations New-Keynesian Phillips Curve.

$$
\begin{aligned}
K_t^{i,f} &= \left(C_{H,t}^i\right)^{-\frac{1}{\gamma^i}} Y_t^i \mathcal{S}_t^i X_t \frac{\varepsilon^i}{\varepsilon^i - 1}(1 - \tau^i) + \theta^i \beta \mathbb{E}_t (\pi_{t+1}^i)^{\varepsilon^i} K_{t+1}^{i,f} \\
F_t^{i,f} &= \left(C_{H,t}^i\right)^{-\frac{1}{\gamma^i}} Y_t^i + \theta^i \beta \mathbb{E}_t (\pi_{t+1}^i)^{\varepsilon^i - 1} F_{t+1}^{i,f} \\
\frac{K_t^{i,f}}{F_t^{i,f}} &= \left(\frac{1 - \theta^i (\pi_t^i)^{\varepsilon^i - 1}}{1 - \theta^i} \right)^{\frac{1}{1 - \varepsilon^i}}
\end{aligned}
$$

Wholesalers. Wholesalers produce one type of good, necessity or discretionary, are perfectly competitive and they combine high-skill labour $N_{H,t}^i$ and low-skill labour $N_{L,t}^i$ with a Cobb-Douglas production function:

$$
Y_t^N = A^N (N_{L,t}^N)^{\alpha^N} (N_{H,t}^N)^{1-\alpha^N} \qquad Y_t^D = A^D (N_{L,t}^D)^{\alpha^D} (N_{H,t}^D)^{1-\alpha^D}
$$

They sell these goods at nominal price $P_t^{i,w}$ to retailers. They pay nominal wage $W_{H,t}$ for each unit of high-skilled household labour and nominal $W_{L,t}$ for each unit of low-skilled household labour. The low-skilled share in production is α^i. As discussed in the main text, we have that $\alpha^N < \alpha^D$: there are relatively more low-skilled workers in discretionary goods production than in necessity goods production. The solution to the problem of the necessity and the discretionary wholesalers are:

$$\mathcal{S}_t^N \alpha^N \frac{Y_t^N}{N_{L,t}^N} = w_{L,t},\ \mathcal{S}_t^N (1-\alpha^N) \frac{Y_t^N}{N_{H,t}^N} = w_{H,t}, \quad \mathcal{S}_t^D \alpha^D \frac{Y_t^D}{N_{L,t}^D} = \frac{w_{L,t}}{p_t^D},\ \mathcal{S}_t^D (1-\alpha^D) \frac{Y_t^D}{N_{H,t}^D} = \frac{w_{H,t}}{p_t^D}$$

D.4 Market clearing

We close the model with two goods market clearing condition, for necessity and discretionary goods, two labour market clearing conditions, for high and low skilled labour, and bond marker clearing condition by which bonds are in zero net supply. In this economy the population is divided in the two types of households with total mass equal to one: $1 = \mu_H + \mu_L$. The market clearing conditions for the two goods markets:

$$Y_t^N = C_t^N = \sum_{i=\{H,L\}} \mu_i C_{i,t}^N \qquad\qquad Y_t^D = C_t^D = \sum_{i=\{H,L\}} \mu_i C_{i,t}^D$$

The labour market clearing conditions for the two types of labour:

$$N_{H,t}^N + N_{H,t}^D = \mu_H N_{H,t} \qquad\qquad N_{L,t}^N + N_{L,t}^D = \mu_L N_{L,t}$$

The bonds market clearing specifies that bonds are in zero net supply: $\mu_H B_{H,t} = 0$. We compute real GDP with production in the two sectors weighted by prices in steady state, with P^N being normalised to one: $Y_t = Y_t^N + p^D Y_t^D$. Variables without time subscripts denote steady state values. We define CPI inflation by averaging the inflation rate in the two sectors with the steady state economy wide consumption shares:

$$\pi_t^{CPI} = \frac{C^N}{C^N + p^D C^D} \pi_t^N + \frac{p^D C^D}{C^N + p^D C^D} \pi_t^D \equiv (1 - \bar{C}^D) \pi_t^N + \bar{C}^D \pi_t^D$$

D.5 Government

The government consists of a central bank that sets interest rates according to a Taylor rule:

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho_R} \left(\left(\mathbb{E}_t(\pi_{t+1}^{target})\right)^{\phi_\pi} \left(\frac{Y_t}{Y}\right)^{\phi_Y} \right)^{1-\rho_R} \exp(\sigma_R \varepsilon_{R,t})$$

Where target inflation is:

$$\pi_t^{target} = \omega \pi_t^D + (1-\omega) \pi_t^N$$

As discussed in the main text, the central bank achieves the standard aggregate/CPI targeting by setting $\omega = \bar{C}^D$, where $\bar{C}^D \equiv \frac{p^D C^D}{C^N + p^D C^D}$.

The only role of fiscal policy in the baseline model is to ensure that Calvo retailers profits are zero in steady state. The government sets a lump sum tax on each Calvo retailer such that it pays in a non-distortive way for the subsidy to the same retailer. With this tax, retailers profits are zero in steady state.

$$T_t^N = \tau^N P_t^N \mathcal{S}_t^N X_t Y_t^N \qquad\qquad T_t^D = \tau^D P_t^D \mathcal{S}_t^D X_t Y_t^D$$

With $\tau^N = 1/\varepsilon^N$ and $\tau^D = 1/\varepsilon^D$. Taxes to households are zero and there is no government spending. Therefore, the government runs a balanced budget. We specify a profit allocation rule off steady state, where we give profits to Ricardian households in our baseline model in the spirit of Bilbiie (2008) or Debortoli and Galí (2024):

$$\Pi_{k,t} = \phi_{\Pi,k}^N \Pi_t^N + \phi_{\Pi,k}^D \Pi_t^D \quad k = \{H, L\}$$

D.6 Steady state computation and calibration

We denote the steady-state value of a variable simply by dropping the time subscript. We solve for a zero-inflation steady state ($\pi^N = \pi^D = 1$). We set the transfers to the Calvo retailers at $\tau^N = 1/\varepsilon^N$ and $\tau^D = 1/\varepsilon^D$ to ensure no steady state markups ($\mathcal{S}^N = \mathcal{S}^D = 1$) and zero steady state profits. We normalise the steady state price level for the necessity good at 1 ($P^N = 1$) and solve for the steady state relative price p^D numerically.

We take a standard calibration for the parameters that characterize the standard block of the model. η is consistent with the evidence of Christiano et al. (2010) and μ_L with the evidence of the average MPC in the Euro-area by Slacalek et al. (2020), Drescher et al. (2020), and Albacete et al. (2024). Smets and Wouters (2007) is the source of the persistence of the cost push shock ρ_X and of the monetary policy rule ρ_R. We use a value of λ of 0.1, which sits between the structural estimation from Beraja and Wolf (2021) and Auclert et al. (2020) and the empirical estimates of Coibion and Gorodnichenko (2012). β is standard, ξ, σ_R, and σ_X are scaling parameters. γ^N and γ^D are borrowed from Andreolli et al. (2024), who estimate them on U.S. data, these parameters yield an aggregate intertemporal elasticity of substitution of 0.528, which is consistent with the estimates by Smets and Wouters (2003) for the Euro Area, and a income elasticity of demand for discretionaries of 1.863 and for necessities of 0.411, which are consistent with Engle curve estimates for the European Union by Temursho and Weitzel (2024). The Calvo parameters θ^N and θ^D are calibrated with the evidence for prices that we report in Table 1 to be the quarterly counterparts of the frequency of price changes per month.

Parameters α^N and α^D are chosen to match (i) the fraction, over the total population, of hand-to-mouth households working in the necessity sector ($N_L^N/(\mu_L N_L + \mu_H N_H)$) and the discretionary sector ($N_L^D/(\mu_L N_L + \mu_H N_H)$), ans (ii) the share of necessity consumption for low-skilled ($\bar{C}_L^N = C_L^N/(C_L^N + p^D C_L^D)$) and high-skilled ($\bar{C}_H^N = C_H^N/(C_H^N + p^D C_H^D)$) households.

To calibrate the share of hand-to-mouth households across sectors, we use data from the ECB Household Finance and Consumption Survey (HFCS). The resulting values match those shown in Figure 2: 0.175 in the discretionary sector and 0.085 in the necessity sector. For the share of necessity consumption among low-skilled (0.585) and high-skilled (0.667) households, we rely on Eurostat Household Budget Survey data. In this dataset, we classify low-skilled households as those in the bottom two quintiles of the income distribution, and the necessity/discretionary classification follows our consumption categorization.

The steady state moments we obtain are close to their empirical counterparts: $\bar{C}_L^N =$

0.576, $\bar{C}_H^N = 0.662$, $N_L^N/(\mu_L N_L + \mu_H N_H) = 0.090$, and $N_L^D/(\mu_L N_L + \mu_H N_H) = 0.169$. This close alignment is achieved despite using only two parameters, α^N and α^D, to match them.

D.7 Log-linear equilibrium

We solve the log-linearised model. Steps are standard, we log-linearise each variable, except for profits, which we linearise as they are zero in steady state. Log-linearised and linearised variables are hatted.

Equilibrium. The competitive equilibrium consists of 28 endogenous allocations $\{\hat{C}_t$, $\hat{C}_t^N$, $\hat{C}_t^D$, $\hat{C}_{H,t}^N$, $\hat{C}_{H,t}^D$, $\hat{C}_{L,t}^N$, $\hat{C}_{L,t}^D$, $\hat{C}_{H,t,0}^N$, $\hat{C}_{H,t,0}^D$, $\hat{C}_{L,t,0}^N$, $\hat{C}_{L,t,0}^D$, $\hat{N}_{H,t}$, $\hat{N}_{L,t}$, $\hat{N}_{H,t}^N$, $\hat{N}_{H,t}^D$, $\hat{N}_{L,t}^N$, $\hat{N}_{L,t}^D$, $\hat{\zeta}_{H,t}$, $\hat{\zeta}_{L,t}$, $\hat{\Pi}_{L,t}^r$, $\hat{\Pi}_t^{r,N}$, $\hat{\Pi}_t^{r,E}$, $\hat{Y}_t$, $\hat{Y}_t^N$, $\hat{Y}_t^D$, $\hat{X}_t$, $\hat{Earn}_t^N$ $\hat{Earn}_t^D\}$, 10 prices $\{\hat{w}_{H,t}$, $\hat{w}_{L,t}$, $\hat{\pi}_t^N$, $\hat{\pi}_t^D$, $\hat{p}_t^D$, $\hat{\pi}_t^{CPI}$, $\hat{\pi}_t^{target}$, $\hat{R}_t$, $\hat{\mathcal{S}}_t^N$, $\hat{\mathcal{S}}_t^D\}$, and 2 exogenous processes $\{\varepsilon_{X,t}$, $\varepsilon_{R,t}\}$; such that households, final good producers, retailers, and wholesalers optimise, the central bank follows a Taylor rule, the treasury follows the tax rule, profits are disbursed according to the profit rule, and markets clear. The equilibrium is characterised by the following static equations:

$$
\begin{aligned}
-\frac{1}{\gamma^N}\hat{C}_{H,t,0}^N + \frac{1}{\gamma^D}\hat{C}_{H,t,0}^D &= -\hat{p}_t^D \\
-\frac{1}{\gamma^N}\hat{C}_{L,t,0}^N + \frac{1}{\gamma^D}\hat{C}_{L,t,0}^D &= -\hat{p}_t^D \\
C_L^N\hat{C}_{L,t}^N + p^D C_L^D(\hat{p}_t^D + \hat{C}_{L,t}^D) &= w_L N_L(\hat{w}_{L,t} + \hat{N}_{L,t}) + \frac{\hat{\Pi}_{L,t}^r}{\mu_L} \\
\hat{\zeta}_{H,t} &= -\frac{1}{\gamma^N}\hat{C}_{H,t}^N(1-\bar{C}_H^D) - \left(\frac{1}{\gamma^D}\hat{C}_{H,t}^D + \hat{p}_t^D\right)\bar{C}_H^D \\
\hat{\zeta}_{L,t} &= -\frac{1}{\gamma^N}\hat{C}_{L,t}^N(1-\bar{C}_L^D) - \left(\frac{1}{\gamma^D}\hat{C}_{L,t}^D + \hat{p}_t^D\right)\bar{C}_L^D \\
\chi\hat{N}_{H,t} - \hat{\zeta}_{H,t} &= \hat{w}_{H,t} \\
\chi\hat{N}_{L,t} - \hat{\zeta}_{L,t} &= \hat{w}_{L,t} \\
\hat{Y}_t^D &= \alpha^D\hat{N}_{L,t}^D + (1-\alpha^D)\hat{N}_{H,t}^D \\
\hat{\mathcal{S}}_t^D + \hat{Y}_t^D - \hat{N}_{H,t}^D &= \hat{w}_{H,t} - \hat{p}_t^D \\
\hat{\mathcal{S}}_t^D + \hat{Y}_t^D - \hat{N}_{L,t}^D &= \hat{w}_{L,t} - \hat{p}_t^D \\
\hat{Y}_t^N &= \alpha^N\hat{N}_{L,t}^N + (1-\alpha^N)\hat{N}_{H,t}^N \\
\hat{\mathcal{S}}_t^N + \hat{Y}_t^N - \hat{N}_{H,t}^N &= \hat{w}_{H,t} \\
\hat{\mathcal{S}}_t^N + \hat{Y}_t^N - \hat{N}_{L,t}^N &= \hat{w}_{L,t} \\
N_H^N\hat{N}_{H,t}^N + N_H^D\hat{N}_{H,t}^D &= \mu_H N_H\hat{N}_{H,t} \\
N_L^N\hat{N}_{L,t}^N + N_L^D\hat{N}_{L,t}^D &= \mu_L N_L\hat{N}_{L,t} \\
\hat{\Pi}_{L,t}^r &= \phi_{\Pi,L}^N\hat{\Pi}_t^{r,N} + \phi_{\Pi,L}^D\hat{\Pi}_t^{r,D} \\
\hat{\Pi}_t^{r,N} &= -Y^N(\hat{\mathcal{S}}_t^N + \hat{X}_t)
\end{aligned}
$$

$$
\begin{aligned}
\hat{\Pi}_t^{r,D} &= -Y^D p^D(\hat{\mathcal{S}}_t^D + \hat{X}_t) \\
C^N\hat{C}_t^N &= \mu_H C_H^N \hat{C}_{H,t}^N + \mu_L C_L^N \hat{C}_{L,t}^N \\
C^D\hat{C}_t^D &= \mu_H C_H^D \hat{C}_{H,t}^D + \mu_L C_L^D \hat{C}_{L,t}^D \\
\hat{Y}_t^N &= \hat{C}_t^N \\
\hat{Y}_t^D &= \hat{C}_t^D \\
\hat{Y}_t &= \hat{C}_t \\
Y\hat{Y}_t &= Y^N\hat{Y}_t^N + p^D Y^D \hat{Y}_t^D \\
\hat{\pi}_t^{CPI} &= (1-\bar{C}^D)\hat{\pi}_t^N + \bar{C}^D\hat{\pi}_t^D \\
\hat{\pi}_t^{target} &= (1-\omega)\hat{\pi}_t^N + \omega\hat{\pi}_t^D \\
\hat{Earn}_t^N &= \frac{w_H N_H^N}{w_H N_H^N + w_L N_L^N}(\hat{w}_{H,t} + \hat{N}_{H,t}^N) + \frac{w_L N_L^N}{w_H N_H^N + w_L N_L^N}(\hat{w}_{L,t} + \hat{N}_{L,t}^N) \\
\hat{Earn}_t^D &= \frac{w_H N_H^D}{w_H N_H^D + w_L N_L^D}(\hat{w}_{H,t} + \hat{N}_{H,t}^D) + \frac{w_L N_L^D}{w_H N_H^D + w_L N_L^D}(\hat{w}_{L,t} + \hat{N}_{L,t}^D)
\end{aligned}
$$

The following dynamic equations:

$$
\begin{aligned}
\frac{1}{\gamma^N}\mathbb{E}_t\left(\hat{C}_{H,t+1,0}^N\right) &= \frac{1}{\gamma^N}\hat{C}_{H,t,0}^N - \ \mathbb{E}_t(\hat{\pi}_{t+1}^N) + \hat{R}_t \\
\hat{C}_{H,t}^N &= \lambda\sum_{j=0}^{\infty}(1-\lambda)^j\mathbb{E}_{t-j}\left(\hat{C}_{H,t,0}^N\right) \\
\hat{C}_{H,t}^D &= \lambda\sum_{j=0}^{\infty}(1-\lambda)^j\mathbb{E}_{t-j}\left(\hat{C}_{H,t,0}^D\right) \\
\hat{C}_{L,t}^N &= \lambda\sum_{j=0}^{\infty}(1-\lambda)^j\mathbb{E}_{t-j}\left(\hat{C}_{L,t,0}^N\right) \\
\hat{C}_{L,t}^D &= \lambda\sum_{j=0}^{\infty}(1-\lambda)^j\mathbb{E}_{t-j}\left(\hat{C}_{L,t,0}^D\right) \\
\hat{\pi}_t^D &= \beta\mathbb{E}_t(\hat{\pi}_{t+1}^D) + \kappa^D(\hat{\mathcal{S}}_t^D + \hat{X}_t) \\
\hat{\pi}_t^N &= \beta\mathbb{E}_t(\hat{\pi}_{t+1}^N) + \kappa^N(\hat{\mathcal{S}}_t^N + \hat{X}_t) \\
\hat{\pi}_t^D &= \hat{\pi}_t^N + \hat{p}_t^D - \hat{p}_{t-1}^D \\
\hat{R}_t &= \rho_R\hat{R}_{t-1} + (1-\rho_R)(\phi_\pi E(\hat{\pi}_{t+1}^{\text{target}}) + \phi_Y\hat{Y}_t) + \sigma_R\varepsilon_{R,t} \\
\hat{X}_t &= \rho_X\hat{X}_{t-1} + \sigma_X\varepsilon_{X,t}
\end{aligned}
$$

Where, as standard, we defiled κ^i to be the slope of the linearised Phillips Curve for a given sector: $\kappa^i = \frac{(1-\theta^i)(1-\theta^i\beta)}{\theta^i}$.

E Optimal Monetary Policy Details

This section outlines the derivations of optimal policy and welfare comparisons, and additional results on optimal policy exercises described in Section 4.

E.1 Analytical derivation

This section outlines how we derive the welfare loss function shown in Section 5. We are going to do a second order Taylor expansion on the welfare function following Galí (2015). We focus on the case of a symmetric cost-push shock and no monetary policy shock. We have two complications compared to the literature: sector heterogeneity with different wages by household, so that we cannot use a unique economy-wide wage to simplify derivations, and non-homotheticity. We follow the optimal taxation literature, similarly to McKay and Wolf (2022) in assuming that the steady state level of income inequality is efficient, equivalently, we assume that the central bank mandate is about cyclical fluctuations and that steady state heterogeneity is the domain of fiscal policy. We achieve this by imposing a specific Pareto weight in the Welfare function.

Price dispersion. First, we follow the same steps as Galí (2015) and Woodford (2003) to rewrite the supply side of the economy to have highlight the variance of prices. For sector $i = \{N, D\}$:

$$\int_0^1 y^i_{k,t} dk = \int_0^1 \left(\frac{P^i_{k,t}}{P^i_t}\right)^{-\varepsilon^i} Y^i_t dk = Y^i_t \nu^{Pi}_t = C^i_t \nu^{Pi}_t = A^i_t (N^i_{L,t})^{\alpha^i} (N^i_{H,t})^{1-\alpha^i}$$

We focus on the price dispersion variable ν^{Pi}_t. We follow the same steps of Woodford (2003), define $\hat{p}^i_{k,t} \equiv \log(P^i_{k,t}) - \log(P^i_t)$, take a second order Taylor approximation of $(P^i_{k,t}/P^i_t)^{-\varepsilon^i}$ to arrive at the following approximation:

$$\nu^{Pi}_t \equiv \int_0^1 \left(\frac{P^i_{k,t}}{P^i_t}\right)^{-\varepsilon^i} dk \approx 1 + \frac{\varepsilon^i}{2} Var_k(\log(P^i_{k,t})) = 1 + \frac{\varepsilon^i}{2}\Delta^i_t$$

Where the expectation (and variance) operators are taken with respect to product varieties k: $\mathbb{E}_k(\hat{p}^i_{k,t}) \equiv \int_0^1 \hat{p}^i_{k,t} dk$. With same steps as Woodford (2003), we first arrive to a dynamic mapping from price dispersion to inflation:

$$\Delta^i_t \approx \theta^i \Delta^i_{t-1} + \frac{\theta^i}{(1-\theta^i)}[\pi^i_t]^2$$

Let's iterate this expression from time -1 and take the infinite discounted sum we can arrive to a formula that depends only on the initial price dispersion and inflation in a given sector squared:

$$\Delta^i_t = (\theta^i)^{t+1}\Delta^i_{-1} + \frac{\theta^i}{(1-\theta^i)} \sum_{s=0}^{t} (\theta^i)^{t-s} [\pi^i_s]^2$$

$$\sum_{t=0}^{\infty}\beta^t\Delta_t^i = \frac{\theta^i}{1-\theta^i\beta}\Delta_{-1}^i + \frac{\theta^i}{(1-\theta^i)(1-\theta^i\beta)}\sum_{t=0}^{\infty}\beta^t[\pi_t^i]^2$$

This will go into the welfare function thought the supply side of the economy: $\hat{Y}_t^i = \hat{A}_t^i + \alpha^i(\hat{N}_{L,t}^i) + (1-\alpha^i)(\hat{N}_{H,t}^i) - \frac{\varepsilon^i}{2}\Delta_t^i$.

Loss function. We next derive the loss function. Welfare is defined given some Pareto weights: λ_H and λ_L

$$\sum_{t=0}^{\infty}\beta^t\mathcal{W}_t = \sum_{t=0}^{\infty}\beta^t(\lambda_H\mathcal{U}_{H,t} + \lambda_L\mathcal{U}_{L,t})$$

We take a second order Taylor approximation and use the steady state relationship between the marginal utility of necessity consumption and the marginal utility of discretionary consumption and of leisure:

$$\begin{aligned}
\mathcal{W}_t - \mathcal{W} \approx \lambda_H U_{C_H^N}\Bigg[& C_H^N\left(\hat{C}_{H,t}^N + \frac{1}{2}\left(1-\frac{1}{\gamma^N}\right)(\hat{C}_{H,t}^N)^2\right) + p^D C_H^D\left(\hat{C}_{H,t}^D + \frac{1}{2}\left(1-\frac{1}{\gamma^D}\right)(\hat{C}_{H,t}^D)^2\right) + \\
& - w_H N_H\left(\hat{N}_{H,t} + \frac{1}{2}(1+\chi)(\hat{N}_{H,t})^2\right)\Bigg] \\
& + \lambda_L U_{C_L^N}\Bigg[C_L^N\left(\hat{C}_{L,t}^N + \frac{1}{2}\left(1-\frac{1}{\gamma^N}\right)(\hat{C}_{L,t}^N)^2\right) + p^D C_L^D\left(\hat{C}_{L,t}^D + \frac{1}{2}\left(1-\frac{1}{\gamma^D}\right)(\hat{C}_{L,t}^D)^2\right) + \\
& - w_L N_L\left(\hat{N}_{L,t} + \frac{1}{2}(1+\chi)(\hat{N}_{L,t})^2\right)\Bigg]
\end{aligned}$$

Here we use the assumption that the steady state is efficient, that we will use to drop the first order terms. We need two assumptions, first we assume that the Pareto weights are such that their multiplication with the marginal utility on essential goods equals the population shares. In addition, we also assume that profits are zero in steady state thanks the optimal subsidy, similarly to representative agent New Keynesian models.

$$\begin{aligned}
\mathcal{W}_t - \mathcal{W} \approx \mu_H\Bigg[& C_H^N\left(\hat{C}_{H,t}^N + \frac{1}{2}\left(1-\frac{1}{\gamma^N}\right)(\hat{C}_{H,t}^N)^2\right) + p^D C_H^D\left(\hat{C}_{H,t}^D + \frac{1}{2}\left(1-\frac{1}{\gamma^D}\right)(\hat{C}_{H,t}^D)^2\right) + \\
& - w_H N_H\left(\hat{N}_{H,t} + \frac{1}{2}(1+\chi)(\hat{N}_{H,t})^2\right)\Bigg] \\
& + \mu_L\Bigg[C_L^N\left(\hat{C}_{L,t}^N + \frac{1}{2}\left(1-\frac{1}{\gamma^N}\right)(\hat{C}_{L,t}^N)^2\right) + p^D C_L^D\left(\hat{C}_{L,t}^D + \frac{1}{2}\left(1-\frac{1}{\gamma^D}\right)(\hat{C}_{L,t}^D)^2\right) + \\
& - w_L N_L\left(\hat{N}_{L,t} + \frac{1}{2}(1+\chi)(\hat{N}_{L,t})^2\right)\Bigg]
\end{aligned}$$

Next, we use a second order approximation of goods and labours market clearing conditions and the production function approximation with price dispersion we just derived and drop term of higher order than squared and terms independent of policy (e.g. stochastic technology).

$$
\begin{aligned}
-2\frac{\mathcal{W}_t-\mathcal{W}}{C} \approx\ & (1-\bar{C}^D)\varepsilon^N\Delta_t^N + \bar{C}^D\varepsilon^D\Delta_t^D - (1-\bar{C}^D)(\hat{C}_t^N)^2 - \bar{C}^D(\hat{C}_t^D)^2 \\
& + \tilde{C}_H^N(1-\bar{C}^D)\frac{1}{\gamma^N}(\hat{C}_{H,t}^N)^2 + \tilde{C}_H^D\bar{C}^D\frac{1}{\gamma^D}(\hat{C}_{H,t}^D)^2 + (1-\alpha^{avg})\chi(\hat{N}_{H,t})^2 + \\
& + (1-\tilde{C}_H^N)(1-\bar{C}^D)\frac{1}{\gamma^N}(\hat{C}_{L,t}^N)^2 + (1-\tilde{C}_H^D)\bar{C}^D\frac{1}{\gamma^D}(\hat{C}_{L,t}^D)^2 + \alpha^{avg}\chi(\hat{N}_{L,t})^2 \\
& + (1-\bar{C}^D)\left((1-\alpha^N)(\hat{N}_{H,t}^N)^2 + \alpha^N(\hat{N}_{L,t}^N)^2\right) + \bar{C}^D\left((1-\alpha^D)(\hat{N}_{H,t}^D)^2 + \alpha^D(\hat{N}_{L,t}^D)^2\right) + t.i.p.
\end{aligned}
$$

Where: $\bar{C}^D \equiv \frac{p^D C^D}{C} = \frac{p^D C^D}{p^D C^D + C^N}$ is the economy wide share of discretionaries, $\bar{C}_H^D \equiv \frac{p^D C_H^D}{C_H} = \frac{p^D C_H^D}{p^D C_H^D + C_H^N}$ is the share of discretionaries in Ricardian consumption, $\tilde{C}_H^D \equiv \frac{\mu_H C_H^D}{C^D} = \frac{\mu_H C_H^D}{\mu_H C_H^D + \mu_L C_L^D}$ is the share that Ricardian have in the consumption of discretionaries over the total consumption of discretionaries, $\tilde{C}_H^N \equiv \frac{\mu_H C_H^N}{C^N} = \frac{\mu_H C_H^N}{\mu_H C_H^N + \mu_L C_L^N}$ is the share that Ricardian have in the consumption of necessities over the total consumption of necessities, and $\alpha^{avg} = \frac{\mu_L w_L N_L}{C}$ is the economic size of the Hand-to-Mouth in terms of what fraction of total earning they have. We take an infinite sum:

$$
\begin{aligned}
-2\sum_{t=0}^{\infty}\beta^t\frac{\mathcal{W}_t-\mathcal{W}}{C} \approx \sum_{t=0}^{\infty}\beta^t\Bigg[& (1-\bar{C}^D)\varepsilon^N\frac{\theta^N}{(1-\theta^N)(1-\theta^N\beta)}[\hat{\pi}_t^N]^2 + \bar{C}^D\varepsilon^D\frac{\theta^D}{(1-\theta^D)(1-\theta^D\beta)}[\hat{\pi}_t^D]^2 \\
& - (1-\bar{C}^D)(\hat{C}_t^N)^2 - \bar{C}^D(\hat{C}_t^D)^2 \qquad (9)\\
& + \tilde{C}_H^N(1-\bar{C}^D)\frac{1}{\gamma^N}(\hat{C}_{H,t}^N)^2 + \tilde{C}_H^D\bar{C}^D\frac{1}{\gamma^D}(\hat{C}_{H,t}^D)^2 + (1-\alpha^{avg})\chi(\hat{N}_{H,t})^2 + \\
& + (1-\tilde{C}_H^N)(1-\bar{C}^D)\frac{1}{\gamma^N}(\hat{C}_{L,t}^N)^2 + (1-\tilde{C}_H^D)\bar{C}^D\frac{1}{\gamma^D}(\hat{C}_{L,t}^D)^2 + \alpha^{avg}\chi(\hat{N}_{L,t})^2 \\
& + (1-\bar{C}^D)\left((1-\alpha^N)(\hat{N}_{H,t}^N)^2 + \alpha^N(\hat{N}_{L,t}^N)^2\right) + \bar{C}^D\left((1-\alpha^D)(\hat{N}_{H,t}^D)^2 + \alpha^D(\hat{N}_{L,t}^D)^2\right)\Bigg] + t.i.p.
\end{aligned}
$$

This is the loss function that we evaluate in the computational exercises by computing theoretical moments. We can see that in the loss function:

- The inflation rates squared in both sectors only depends on the steady state consumption shares of the two goods, on the elasticity of substitution across varieties, and on price stickiness. These do not depend on non-homotheticity or the share of Hand-to-Mouth. This means that the weights on inflation in the loss function do not vary when we simplify the models in Figure 6.

- The following consumption and labour supply terms depend on parameters and steady state values in an intuitive way. It is more costly, *ceteris paribus*, to face variations in necessities given that the consumption specific terms are multiplied by the inverse of the gamma parameters. The parameter that multiply these terms do not depend on the New Keynesian Phillips Curve terms, but are affected by non-homotheticity or the share of Hand-to-Mouth.

(9) is the welfare function we use to run our welfare comparison exercises in Sections 6, and 6.2. However, to gather more intuition and to be comparable with the existing literature, we express the consumption and labour supply variables as functions of the output gap/consumption $\hat{C}_t$ and the relative price $\hat{p}_t^D$. This mapping is exact in a model without inattention and it can be found by solving the static equations of the model, listed in Section D.7, for $\hat{C}_t$ and $\hat{p}_t^D$. This shows that the only thing that matter for these convolution is the private sector structure of the economy and not policy choices or the dynamic equations. In the model with inattention this mapping is not exact, so we simulate the model for 10000 periods and then run regression of simulated $\hat{C}_t$ and $\hat{p}_t^D$ as RHS variables and the consumption and labor supply choices as LHS variables. E.g. we express $\hat{C}_H^D = a_C^{C_H^D}\hat{C}_t + a_p^{C_H^D}\hat{p}_t^D$. The R squared for each of these regressions is almost close to one, with the lowest one being 0.9975, indicating that this approximation error is very small. This allows us to rewrite the loss function in the standard way:

$$-2\sum_{t=0}^{\infty}\beta^t\frac{\mathcal{W}_t-\mathcal{W}}{C}\approx\sum_{t=0}^{\infty}\beta^t\left[a_{(\pi^N)^2}[\hat{\pi}_t^N]^2+a_{(\pi^D)^2}[\hat{\pi}_t^D]^2+a_{(C)^2}\hat{C}_t^2+a_{(p^D)^2}(\hat{p}_t^D)^2+a_{(C,p^D)}(\hat{p}_t^D\hat{C}_t)\right]+t.i.p.$$

In our baseline exercise, we shut off price stickiness heterogeneity in order to focus on how demand cyclicality interacts with labor markets and household heterogeneity. We do so by picking an average value of θ^{avg} such that the loss function is unaltered across price stickiness heterogeneity and homogeneity. That is, we set $a_{(\pi^N)^2}+a_{(\pi^D)^2}$ to be the same across the two price stickiness regimes[3], or equivalently, we pick θ^{avg} to solve the following equation:

$$((1-\bar{C}^D)\varepsilon^N+\bar{C}^D\varepsilon^D)\frac{\theta^{avg}}{(1-\theta^{avg})(1-\theta^{avg}\beta)}=(1-\bar{C}^D)\varepsilon^N\frac{\theta^N}{(1-\theta^N)(1-\theta^N\beta)}+\bar{C}^D\varepsilon^D\frac{\theta^D}{(1-\theta^D)(1-\theta^D\beta)}$$

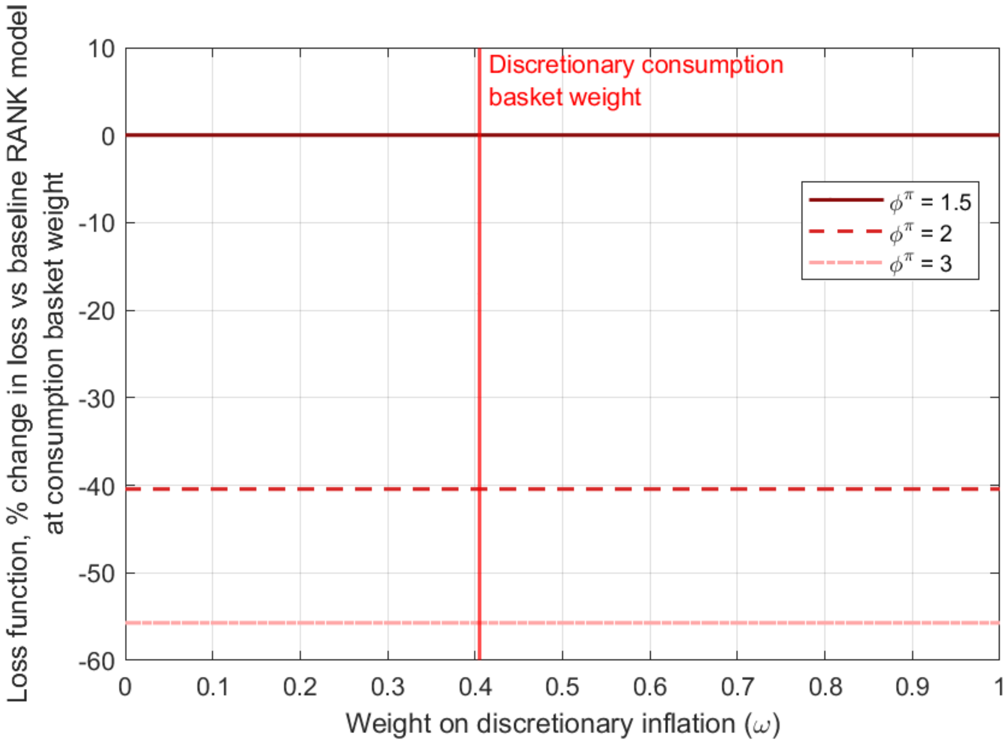
Finally, when we progressively make our model simpler, in Section 6, we do this by taking the following steps. When we remove non-homotheticity, we set $\gamma^N=\gamma^D=IES$, equal to average IES in the economy. When we remove sectoral heterogeneity, we set $\alpha^N=\alpha^D=\alpha^{avg}$, so that the Hand-to-Mouth keep the same economic size as in the main model, but achieve this by working equally in both sectors. When we remove Hand-to-Mouth overall, we do this by setting $\alpha^N=\alpha^D=0$ and $\mu_L=0$, so that they are not present in the model.

E.2 Additional Results

To complement the findings of panel C of 8 of the main text, Figure E.1 shows the welfare loss comparison over different Taylor rule coefficients of the simplified, representative agent version of the model. In this version of the model, the three key features of the model are switched off; non-homothetic preferences are removed by setting the IES of both consumption types equal to the average IES, and we remove the presence of Hand-to-Mouth agents, a representative agent supplies all the labour to all sectors. Figure E.1 replicates a common

[3]Notice, from equation (9), how $a_{(C)^2}$, $a_{(p^D)^2}$, and $a_{(C,p^D)}$ are unaffected by the price stickiness parameters.

Figure E.1: Welfare loss for range of weights on discretionary inflation ω in RANK



Notes: The expression for the welfare loss function is specified in text. Its value is calculated for different levels of the weight in the Taylor rule on discretionary inflation (ω, across the x axis) and for different parameters on inflation in the Taylor rule (ϕ_π, different lines). All changes are relative to the baseline inflation weight $\phi_\pi = 1.5$ at the necessity consumption basket weight (red vertical line). The corresponding weight on the output gap ϕ_Y is set to zero for expositional clarity. This figure shows the results of the representative agent model RANK.

result in the optimal monetary policy literature (see, e.g. Galí, 2015) that it is welfare improving for a central bank to more aggressively target inflation. Relative to the baseline $\phi_\pi = 1.5$ increasing the degree of inflation targeting to $\phi_\pi = 2$ and $\phi_\pi = 3$ decreases the welfare loss. This contrasts to our full model, where more aggressive inflation targeting is no longer welfare improving, because it comes at the cost of greater output gap variability, which is more costly in welfare terms in our model.

F Counterfactual Policy Rules and Second Moments

This appendix describes the methodology used to evaluate the welfare implications of alternative monetary policy rules under the empirical distribution of shocks. We show that targeting discretionary spending inflation improves welfare compared to targeting CPI inflation not only under symmetric cost-push shocks, but also under the actual shocks that hit the Euro Area economy. To answer this question, we build on the counterfactual policy framework of McKay and Wolf (2023) and the hybrid implementation of Caravello et al. (2025). The central idea is to use impulse responses to monetary policy shocks, both contemporaneous and news shocks, to construct the sequence of synthetic policy shocks that would make the economy satisfy an alternative policy rule. Applying this mapping to one identified structural disturbance gives the impulse-response counterfactuals studied in the main text. Applying the same mapping to each innovation in the Wold representation of the data allows us to compute counterfactual unconditional second moments. These moments can then be mapped into the welfare criterion we derived.

F.1 A General Counterfactual Policy Framework

We recast our linearized economy in sequence space to apply the methodologies of McKay and Wolf (2023) and Caravello et al. (2025). Let x denote the stacked path of observable endogenous variables that enter the welfare function, discretionary inflation, necessity inflation, consumption, and the relative price of discretionary over necessities, let z denote the stacked path of the policy instrument, the policy rate, and let w denote the stacked path of all other endogenous variables. The non-policy block of the economy is

$$H_w w + H_x x + H_z z + H_\varepsilon \varepsilon = 0, \tag{10}$$

where ε collects non-policy structural shocks. The baseline policy rule is

$$A_x x + A_z z + \nu = 0, \tag{11}$$

where ν denotes policy shocks. The vector ν contains both contemporaneous monetary policy shocks and anticipated monetary policy shocks at different horizons. This distinction is important because changing a policy rule generally affects expectations about future policy, so the counterfactual mapping requires the response of the economy not only to current policy innovations but also to policy news shocks.

Assume that, under the baseline rule, equilibrium exists and is unique. Since the economy is linear, equilibrium allocations can be written as

$$\begin{pmatrix} w \\ x \\ z \end{pmatrix} = \Theta_A \begin{pmatrix} \varepsilon \\ \nu \end{pmatrix}, \tag{12}$$

where Θ_A collects impulse responses under the baseline policy rule. In particular,

$$x_A(\varepsilon, \nu) = \Theta_{x,\varepsilon,A}\varepsilon + \Theta_{x,\nu,A}\nu, \tag{13}$$

$$z_A(\varepsilon, \nu) = \Theta_{z,\varepsilon,A}\varepsilon + \Theta_{z,\nu,A}\nu. \tag{14}$$

When policy shocks are set to zero, we write

$$x_A(\varepsilon) \equiv \Theta_{x,\varepsilon,A}\varepsilon, \qquad z_A(\varepsilon) \equiv \Theta_{z,\varepsilon,A}\varepsilon. \tag{15}$$

These objects describe the response of observables and policy instruments to a given non-policy disturbance under the baseline rule.

Now consider an alternative policy rule

$$\widetilde{A}_x x + \widetilde{A}_z z = 0. \tag{16}$$

The counterfactual exercise holds fixed the non-policy block in (10) and changes only the policy rule. The key result in McKay and Wolf (2023) is that the allocation under the alternative rule can be represented using impulse responses estimated or computed under the baseline rule. For a given shock sequence ε, define the synthetic policy-shock sequence $\widetilde{\nu}$ as the sequence that makes the baseline economy satisfy the counterfactual rule. Then

$$x_{\widetilde{A}}(\varepsilon) = x_A(\varepsilon) + \Theta_{x,\nu,A}\widetilde{\nu}, \tag{17}$$

$$z_{\widetilde{A}}(\varepsilon) = z_A(\varepsilon) + \Theta_{z,\nu,A}\widetilde{\nu}, \tag{18}$$

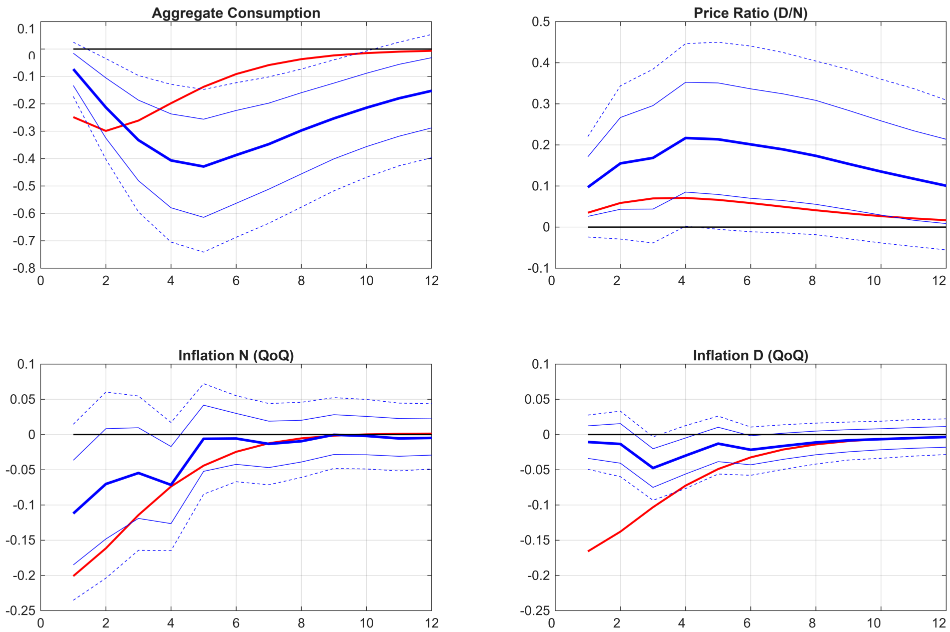
where $\widetilde{\nu}$ solves

$$\widetilde{A}_x \left[x_A(\varepsilon) + \Theta_{x,\nu,A}\widetilde{\nu}\right] + \widetilde{A}_z \left[z_A(\varepsilon) + \Theta_{z,\nu,A}\widetilde{\nu}\right] = 0. \tag{19}$$

Thus the alternative policy rule is implemented by adding to the baseline economy a sequence of monetary policy shocks that exactly enforces (16). The construction does not require solving a new structural model for each policy rule. It requires the impulse responses of the economy to monetary policy shocks under the baseline rule, including the responses to anticipated policy shocks.

In McKay and Wolf (2023), these policy-shock impulse responses can in principle be obtained directly from identified time-series variation. In the hybrid approach of Caravello et al. (2025), a structural model is used to extrapolate the required responses to policy news shocks after matching the model to a subset of empirically identified policy-shock responses. We follow the latter logic: the structural model is used to provide the policy-shock impulse responses needed to implement the counterfactual rule, while the empirical VAR described below provides the distribution of shocks to which the rule is applied. The strength of the approach is that we do not need to specify in the model which structural non-policy shocks hit the economy, a potential source of misspecification with full-information estimation methods. Figure F.1 shows that the model and empirical IRFs to a contractionary monetary policy shock for the variables that enter the welfare loss function. The model's responses are a sufficiently close match that we view the combination of model with the empirical VAR as reasonable, as the model captures sufficiently close policy-shock transmission as the VAR.

Figure F.1: Model and Empirical IRFs to a contractionary monetary policy shock



Notes: The figure displays impulse responses of of aggregate consumption, inflation in necessity goods, inflation in discretionary goods and the relative price index to a contractionary monetary policy shock estimated from the model (in red) and with the BVAR specification and identification (in blue) detailed in Section 3. The empirical IRFs are displayed with 65% and 90% confidence intervals.

F.2 From a Specific Shock to the Empirical Distribution of Shocks

The main text studies alternative policy rules in response to a symmetric cost-push shock. This exercise is useful because it isolates the mechanism through which the policy rule affects welfare-relevant allocations. However, the welfare criterion depends on unconditional second moments. Those second moments are determined not only by the propagation of a particular cost-push disturbance, but also by the full set of disturbances that hit the economy and by their empirical relative importance.

The question addressed in this appendix is therefore whether the policy ranking obtained under the symmetric cost-push shock also holds under the empirical distribution of shocks. Rather than identify every structural disturbance separately, we use the Wold representation of the data. Let

$$y_t = \begin{pmatrix} x_t \\ z_t \\ v_t \end{pmatrix} \tag{20}$$

collect the variables that enter the loss function x_t and the policy instrument z_t, and the additional macro variables that ensure invertibility v_t. Under the baseline policy rule, suppose that y_t admits a structural vector moving-average representation

$$y_t = \sum_{\ell=0}^{\infty} \Theta_\ell \varepsilon_{t-\ell} = \Theta(L)\varepsilon_t, \tag{21}$$

where ε_t denotes the vector of structural shocks. The object of interest is the second-moment structure that would prevail if the same economy were instead governed by the counterfactual policy rule. If $\widetilde{\Theta}_\ell$ denotes the impulse response of y_t to structural shocks under the counterfactual rule, then

$$y_t = \sum_{\ell=0}^{\infty} \widetilde{\Theta}_\ell \varepsilon_{t-\ell} = \widetilde{\Theta}(L)\varepsilon_t, \tag{22}$$

with autocovariances

$$\Gamma_y^{\widetilde{A}}(h) = \sum_{m=0}^{\infty} \widetilde{\Theta}_m \widetilde{\Theta}'_{m+h}. \tag{23}$$

The difficulty is that the shocks in (21) are not all separately identified.

The invertibility result in McKay and Wolf (2023) resolves this problem for second moments. Let u_t denote the Wold innovations from an estimated reduced-form VAR for y_t, and let ε_t^* be a unit-variance orthogonalization of those innovations. For example,

$$\varepsilon_t^* = \operatorname{chol}\left(\operatorname{Var}(u_t)\right)^{-1} u_t, \qquad \operatorname{Var}(\varepsilon_t^*) = I. \tag{24}$$

The observed data can then be represented as

$$y_t = \sum_{\ell=0}^{\infty} \Psi_\ell \varepsilon_{t-\ell}^* = \Psi(L)\varepsilon_t^*. \tag{25}$$

If the baseline structural representation is invertible, then the Wold innovations are an orthogonal rotation of the structural shocks:

$$\varepsilon_t^* = P\varepsilon_t, \qquad \Psi(L) = \Theta(L)P', \tag{26}$$

for some orthogonal matrix P satisfying $P'P = I$.

The same counterfactual mapping can be applied to the Wold impulse responses. Let $\widetilde{\Psi}_\ell$ denote the counterfactual impulse responses obtained by applying (18)–(19) to each orthogonalized Wold innovation. Since $\widetilde{\Psi}(L) = \widetilde{\Theta}(L)P'$, the second moments computed from the counterfactual Wold representation are

$$\sum_{m=0}^{\infty} \widetilde{\Psi}_m \widetilde{\Psi}'_{m+h} = \sum_{m=0}^{\infty} \widetilde{\Theta}_m P'P\widetilde{\Theta}'_{m+h} \tag{27}$$

$$= \sum_{m=0}^{\infty} \widetilde{\Theta}_m \widetilde{\Theta}'_{m+h} = \Gamma_y^{\widetilde{A}}(h). \tag{28}$$

This means that the identification matrix P that maps Wold innovations to structural shocks cancels when computing second moments. This is the key reason the procedure can evaluate welfare under the empirical distribution of shocks without separately identifying each shock as demand, supply, financial, or policy. Invertibility means that this matrix exists.

F.3 Constructing Counterfactual Second Moments

The implementation has three conceptual steps. First, we estimate a reduced-form VAR for the vector y_t and recover its Wold representation under the observed policy rule. This delivers impulse responses

$$\{x_A(\varepsilon_i^*), z_A(\varepsilon_i^*)\}_{i=1}^{n_y}, \tag{29}$$

where ε_i^* is the ith orthogonalized Wold innovation and n_y is the dimension of y_t.

Second, for each Wold innovation ε_i^*, we compute the sequence of synthetic policy shocks $\widetilde{\nu}_i$ that enforces the counterfactual rule. That sequence solves

$$\widetilde{A}_x \left[x_A(\varepsilon_i^*) + \Theta_{x,\nu,A}\widetilde{\nu}_i\right] + \widetilde{A}_z \left[z_A(\varepsilon_i^*) + \Theta_{z,\nu,A}\widetilde{\nu}_i\right] = 0. \tag{30}$$

The corresponding counterfactual responses are

$$x_{\widetilde{A}}(\varepsilon_i^*) = x_A(\varepsilon_i^*) + \Theta_{x,\nu,A}\widetilde{\nu}_i, \tag{31}$$
$$z_{\widetilde{A}}(\varepsilon_i^*) = z_A(\varepsilon_i^*) + \Theta_{z,\nu,A}\widetilde{\nu}_i. \tag{32}$$

Third, we stack the counterfactual responses across all Wold innovations to obtain the counterfactual vector moving-average representation

$$y_t = \sum_{\ell=0}^{\infty} \widetilde{\Psi}_\ell \varepsilon_{t-\ell}^*. \tag{33}$$

Which leads to the counterfactual variance-covariance matrix:

$$\Gamma_y^{\widetilde{A}} = \sum_{m=0}^{\infty} \widetilde{\Psi}_m \widetilde{\Psi}_m'. \tag{34}$$

These objects summarize how the alternative policy rule changes the volatility and comovement of the variables in y_t when the economy is exposed to the same empirical distribution of shocks as in the data. We evaluate welfare with the relevant elements form $\Gamma_y^{\widetilde{A}}$ using the welfare loss function (6).

We perform this analysis under two Taylor rules described in (4) and (5): either when we target CPI inflation ($\omega = \bar{C}^D$) or when we targer discretionary spending inflation ($\omega = 1$). The results of this exercise are shown in Table 3.

F.4 Operationalising the Wold VAR

We estimate a nine-variable reduced-form VAR in the following Cholesky ordering: the short-term interest rate, consumption, necessity-sector inflation, discretionary-sector inflation, the relative price of discretionary to necessity goods, the unemployment rate, investment, utilisation-adjusted TFP, and the labour share. The specification is constructed in the spirit of Caravello et al. (2025), adapted to the Euro Area context and augmented with our sector-specific price and quantity series. Non-stationary series (consumption, investment, utilization-adjusted TFP, the labour share, and relative prices) are transformed to stationarity using the approach of Hamilton (2018); the unemployment rate, sector-specific inflation rates, and the short-term interest rate are not filtered. The VAR is estimated over the pre-COVID sample 2003Q1-2019Q4 with two lags, a constant, and a linear time trend. In terms of variables construction, aggregate consumption, necessity inflation, discretionary inflation, and the relative price index are constructed using our methodology as detailed in the data appendix, with the relative price index defined as the log difference between the discretionary and necessity price indices. The unemployment rate is from Eurostat. Per capita investment is constructed as real gross capital formation divided by total Euro Area population. Utilisation-adjusted TFP is from Comin et al. (2025). The labour share is defined as compensation of employees over gross value added, from national accounts statistics. The EONIA is the relevant policy rate in our considered sample period.

To verify that the nine-variable system spans the relevant macroeconomic information set, we follow the approach of Forni and Gambetti (2014), in addition to the approach implemented by Caravello et al. (2025). We extract eight principal-component factors from the Barigozzi et al. (2024b,a) Euro Area quarterly dataset (118 series), following the factor estimation procedure of Stock and Watson (2016b), processing the data for stationarity as in Barigozzi et al. (2024a)'s standard procedure. The first factor accounts for 28.4% of total variance; together, the eight factors explain 67.1%. For each VAR equation, we regress the OLS residuals on two lags of incrementally included factors and test the joint null that the factor lags carry no predictive content for the residuals. See Table F.1 for results, plus the one-and four-quarter ahead R^2 with and without factors. We fail to reject this null across all variables, suggesting that the VAR is informationally sufficient.

Table F.1: Informational sufficiency: Gambetti–Forni test

	1-quarter ahead R^2		4-quarter ahead R^2		
	w/o f	w/ f	w/o f	w/ f	GF p-value
Short rate	0.977	0.980	0.909	0.923	0.093
Consumption	0.988	0.991	0.969	0.979	0.904
Inflation (N)	0.434	0.542	0.353	0.539	0.976
Inflation (D)	0.572	0.671	0.421	0.541	0.822
Rel. prices	0.858	0.872	0.624	0.742	0.870

Notes: Columns 2–5 report in-sample forecasting R^2 at one- and four-quarter horizons, with and without the inclusion of 8 factors (f). The GF p-value is the p-value of the the null that 2 lags of all 8 factors carry no predictive content for the VAR residuals. Sample: 2003Q1–2019Q4.