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ANATOMY OF INFLATION AND CONSUMPTION CHOICES IN ITALY AFTER THE PANDEMIC

by Donato Ceci*, Francesco Corsello*, Marco Fruzzetti* and Matteo Izzo**

Abstract

We study the drivers of the post-pandemic inflation episode in Italy and its implications for households' consumption baskets. Using granular monthly data on prices and quantities consumed, we disentangle supply from demand-driven inflationary pressures across expenditure categories. We show that the rise in inflation since 2021 was initially driven mainly by supply-side shocks, reflecting bottlenecks in global value chains and the exceptional increase in energy prices, while demand-side factors have gained importance since 2023. The inflationary shock affected consumption categories unevenly, with particularly large increases in the relative prices of essential items such as energy, food and housing-related expenditure. Since these goods are characterized by low price and income elasticities, households reduced their consumption only marginally and absorbed the shock by allocating a higher nominal share of expenditure to essential goods. As a result, the nominal weight of necessary items in the consumption basket increased persistently, while the adjustment of the basket in real terms and the reallocation towards discretionary components took place only gradually.

JEL Classification: E31, E32, E52.

Keywords: business cycle, inflation dynamics, elasticities.

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1. Introduction[1]

As economies emerged from the pandemic, inflation rose sharply in the main advanced economies, driven by production restrictions and bottlenecks in global value chains, the recovery in consumption and the exceptional increase in energy prices. This paper studies the drivers of inflation in Italy in the period after 2020, quantifying the relevance of demand-side factors relative to supply-side determinants, and describes the implications for households' consumption choices, interpreting them in light of the price and income elasticities of demand across different expenditure categories.

To identify the nature of the shocks that affected price dynamics, this paper uses the methodology proposed by Shapiro (2024), applied to monthly data on prices and quantities consumed by households, by expenditure category. In particular, supply (demand) shocks are classified as those that induce price and quantity movements in opposite (the same) directions. The results are consistent with the evidence documented by Gonçalves and Koester (2022) for the euro area and show that, in the first years after the pandemic (until the end of 2022), inflation was clearly dominated by supply shocks, while demand made an increasing contribution in the subsequent period. [2]

The rise in inflation affected sectors in a markedly heterogeneous way, leading to large changes in relative prices. Using an Almost Ideal Demand System (AIDS; Deaton and Muellbauer, 1980), this paper assesses the extent to which price shocks induced reallocations of consumption between necessary and discretionary expenditure categories, classified according to their price and income elasticities. Between 2020 and 2021, in a context of low inflation and pandemic-related restrictions, households reallocated expenditure towards essential goods, compressing discretionary components. From mid 2021, the relative prices of necessary goods increased sharply. Given the low price elasticity of demand for these goods, this resulted in a persistent increase in their nominal share in the consumption basket and a slow decline in their share in real terms. [3]

The analyses presented in this paper use consumption data collected through Istat's Household Budget Survey (HBS), which is also used in the estimation of national accounts consumption. We use the breakdown into 52 categories of the three-digit COICOP 2018 classification (Classification of Individual Consumption by Purpose, version 2) and examine the period from January 2014 to

[1] The paper benefited from comments by M. Riggi, F. Venditti, R. Zizza and G. Zevi.
[2] For a description of the methodology, see Appendix A.
[3] Several analyses have examined the role of sectoral heterogeneity in the propagation of shocks (see Andreolli et al., 2025, and Corsello and Neri, 2025). Using granular data for the euro area, Corsello and Neri (2025) show that energy price shocks are transmitted rapidly to a subset of goods characterized by frequent price adjustments (fast movers), while they induce more gradual and persistent effects in services characterized by greater rigidity (late movers).

December 2024. For each COICOP item, nominal expenditure is expressed in real terms using the corresponding subcomponent of the Harmonised Index of Consumer Prices as a deflator.

2. The drivers of inflation in Italy

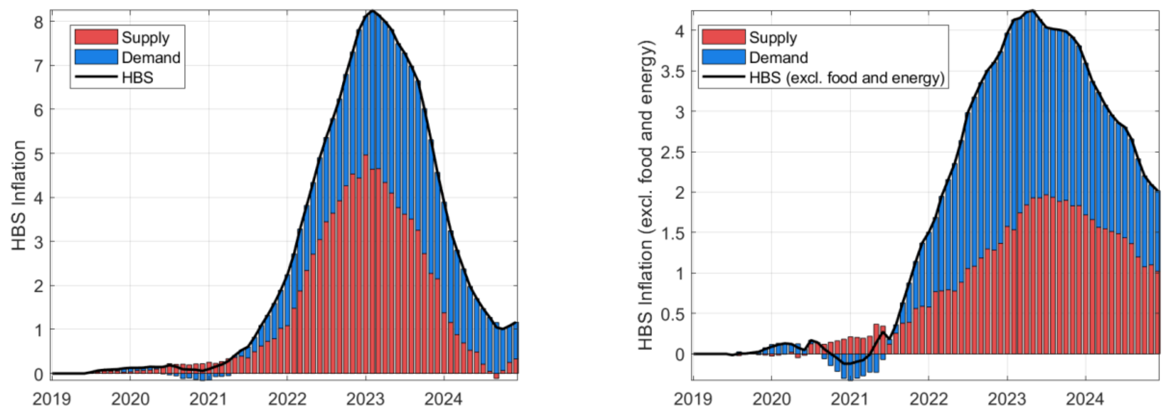
Figure 1 shows the contributions of demand and supply shocks to headline inflation (panel a) and core inflation (panel b), estimated using Shapiro's (2024) method. From spring 2021, the emergence of bottlenecks in supply chains and the rise in energy prices triggered a sharp increase in the supply-side contribution to inflation, which was subsequently amplified by the gradual recovery in demand. Following the outbreak of the Russia-Ukraine conflict and the record prices reached by gas and electricity, the supply component continued to grow markedly during 2022, peaking at the end of the year and accounting for almost two thirds of headline inflation. From the end of 2022, the consolidation of the post-pandemic recovery further boosted demand, with increasingly large effects, especially on the core components of inflation. In the most recent period, the decomposition of core inflation points to a balanced picture, with demand and supply factors contributing in roughly equal measure. [4]

Figure 2 distinguishes between goods and services. As regards headline inflation (Figure 2a), the contribution of supply shocks is particularly significant for goods, reflecting the direct effects (on energy products) and indirect effects (on food and non-energy industrial goods) of higher energy commodity and intermediate goods prices (Corsello et al., 2023). Demand played a more important role in the price dynamics of core components (Figure 2b), first for non-energy industrial goods and, later, for services as well. The delayed response of services inflation is related both to the slow adjustment of wages, which account for a large share of costs in this sector, and to the low frequency with which prices in the services sector are revised and incorporate shocks to intermediate input prices.

[4] This is aggregate inflation based on the weights of the HBS survey. In the calculation of the Harmonised Index of Consumer Prices (HICP), by contrast, Istat's weighting system, updated annually, is used. The product classification and price indices are the same as those used for the HICP. The comparison with the HICP shows that the two inflation dynamics are broadly very similar.

Fig. 1 Contributions of demand and supply to inflation

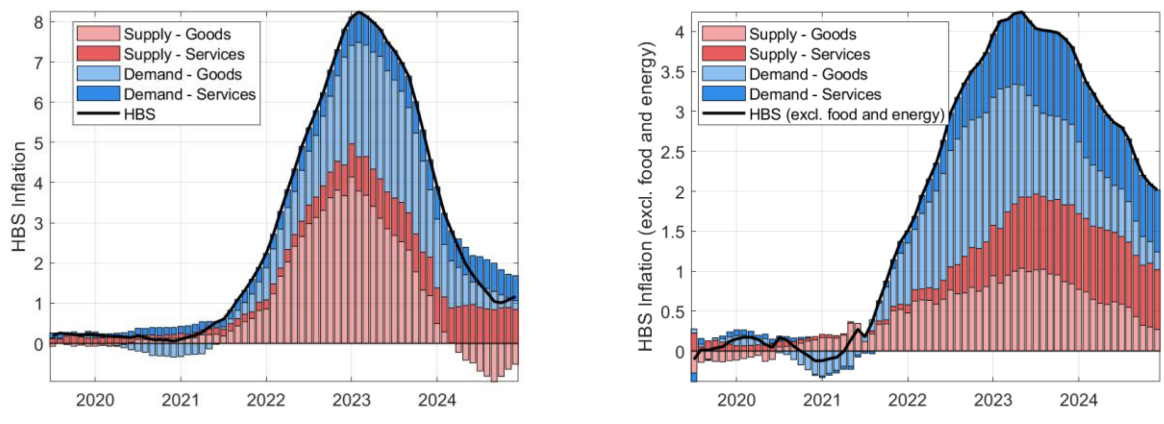
(a) Headline inflation (b) Core inflation



Source: authors' calculations based on Istat data.
Note: The black line represents the inflation series (12-month percentage change) calculated using the HBS basket weights, while the bars show the contributions of demand (blue) and supply (red). Core inflation is constructed excluding food, energy bills and petrol.

Fig. 2 Contribution of goods and services

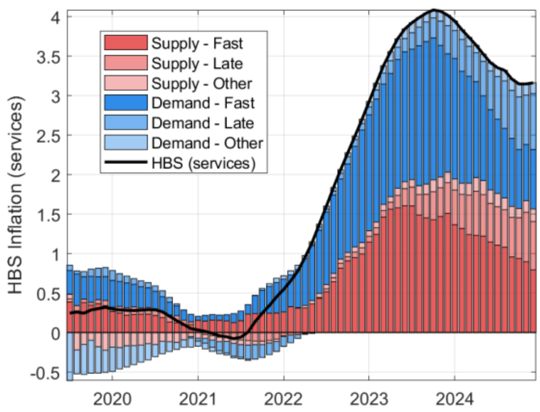
(a) Headline inflation (b) Core inflation



Source: authors' calculations based on Istat data.
Note: The black line represents the inflation series (over 12 months) calculated using the HBS basket weights, while the bars show the contributions of demand (blue) and supply (red). Core inflation is constructed excluding food, energy bills and petrol.

Figure 3 shows the decomposition of services inflation only, distinguishing between fast movers and late movers according to the classification proposed by Corsello and Neri (2025). Until mid-2021, demand factors made an almost negligible contribution to inflation in the fast-moving components of services. Thereafter, the contribution of demand increased rapidly. This reflects the strong recovery in consumption in high-contact sectors, including travel and catering services. Alongside the intensification of demand-side pressures, the supply-side contribution also increased progressively, associated with the pass-through of higher energy prices. From 2023, however, inflation in fast-moving components began to ease, while the contribution of late-moving components to price dynamics increased and continued until the end of 2024.

Fig. 3 Services inflation



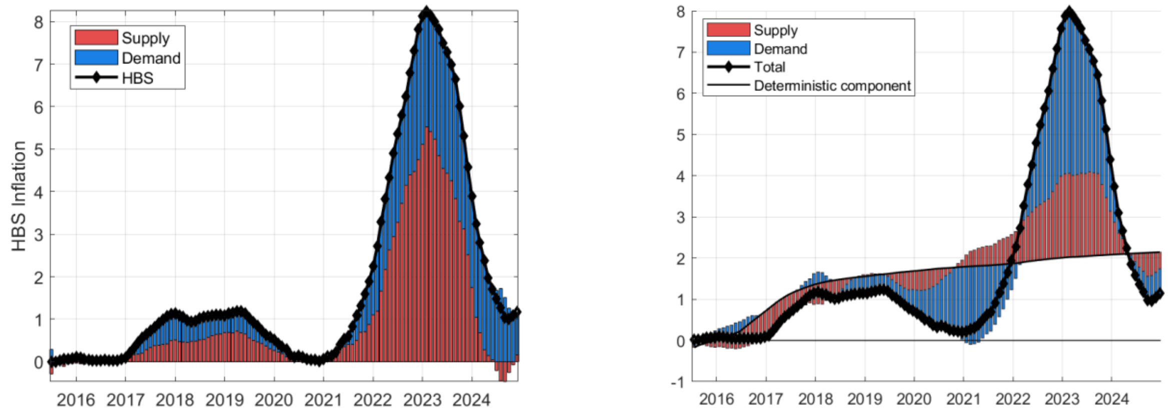
Source: authors' calculations based on Istat data.
Note: The black line represents the inflation series (over 12 months) calculated using the HBS basket weights, while the bars show the contributions of demand (blue) and supply (red). The panel refers to the services basket in the HBS survey.

The predominance of supply shocks in explaining inflation developments in the first years after the pandemic is consistent with the evidence provided by Gonçalves and Koester (2022) for the euro area, while it contrasts with the results of Giannone and Primiceri (2024), obtained using an aggregate approach. Figure 4 compares the evidence from the two methodologies. In particular, applying the Giannone and Primiceri (2024) method, the contribution of demand factors to inflation is significantly higher already from 2022. However, this narrative is difficult to reconcile with the imported nature of the energy shock that hit the Italian economy. The latter was in fact triggered by severe tensions in the gas and electricity markets related to the Russia-Ukraine conflict, which clearly characterize it, in its initial stages, as a supply shock. [5][6]

[5] The methodology proposed by Giannone and Primiceri (2024) is described in Appendix B, together with a discussion of the main differences from Shapiro's (2024) approach.
[6] The discrepancy regarding the nature of shocks is even more evident when focusing on households' expenditure on energy bills, a component that is not very sensitive to the business cycle (as it is essential spending). Figure B.1 in the Appendix compares the two methodologies for this specific consumption item. The fact that Giannone and Primiceri's methodology attributes the rise in energy tariffs mainly to demand shocks raises some doubts about its ability to correctly separate demand shocks from supply shocks.

Fig. 4 Decomposition of headline inflation

(a) Shapiro (2024) method (b) Giannone and Primiceri (2024) method



Source: authors' calculations based on Istat data.
Note: The black line with diamonds represents the inflation series (12-month percentage changes) calculated using the HBS basket weights, while the bars show the contributions of demand (blue) and supply (red). The deterministic component represents the long-run term of the VAR model. Panel (a) reports the estimate obtained using the full sample, unlike Figure 1.a where the estimate is based on a rolling window (see Appendix A).

3. The impact of the inflationary shock on the consumption basket

The analysis of inflation in Italy in the post-pandemic period has shown that price pressures were initially driven by supply shocks, followed by a progressive strengthening of demand pressures. This section studies how these shocks affected consumers' spending choices and, consequently, the consumption basket.

Economic theory identifies two channels through which shocks are transmitted to spending choices: demand shocks affect consumption expenditure mainly through an income effect; supply shocks, which typically materialize through exogenous changes in relative prices, mainly trigger a substitution effect.

Using the AIDS model (Deaton and Muellbauer, 1980), it is possible to estimate the price and expenditure elasticities of the different consumption categories. The former measures the percentage change in the quantity demanded of a good following a 1% increase in its price; the latter measures the percentage change in the quantity demanded following a 1% change in real income. In the absence of income data, income is proxied by real expenditure, a valid approximation under the assumption of non-satiation. Details on the estimation of the model and the related econometric specifications are provided in Appendix C.

Table 1. Elasticity estimates from the AIDS model

	Price elasticity	Expenditure elasticity
Food	-0.20	0.67
Clothing	-1.19	1.73
Housing, rents, maintenance	-1.89	0.50
Fuel, electricity, gas	-0.90	0.88
Transport and communication	-2.66	1.59
Other goods	-0.36	1.40
Other services	-5.48	1.80

Note: As regards price elasticities, $|\varepsilon| > 1$ indicates elastic demand, while $|\varepsilon| < 1$ indicates inelastic demand. For expenditure elasticity, $\varepsilon > 1$ denotes luxury or superior goods, while $\varepsilon < 1$ denotes necessary goods. Elasticities are estimated over the period 2014M1-2019M12.

The elasticities reported in Table 1 make it possible to distinguish between discretionary and necessary goods and services on the basis of expenditure elasticity. The former are characterized by an income elasticity greater than one: following a decline in real income, the quantity demanded falls more than proportionally. By contrast, necessary goods are characterized by an income elasticity below one. Food and energy goods and housing-related consumption are classified as necessary goods because they display expenditure elasticities below unity: their demand increases less than proportionally when income rises. For food and energy, price elasticity is also below 1. This indicates relatively rigid demand and limited scope for substitution. By contrast, categories with expenditure elasticities above unity (such as clothing, transport, other goods and services) can be interpreted as discretionary expenditure classes, whose consumption is therefore more sensitive to changes in income. Spending on discretionary items is generally also more price elastic, reflecting greater substitutability. In particular, spending on other services, which includes recreational services, displays a particularly high price elasticity, in line with empirical evidence showing that this expenditure is the first to be compressed when prices increase.

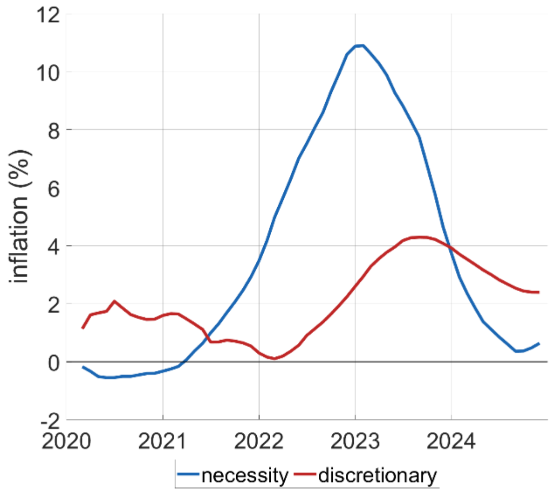
These distinctions are useful for interpreting the evolution of households' choices in the high-inflation environment observed since 2021. As shown in Figure 5, panel (a), the inflationary shock affected the necessary components of the basket much more strongly, especially through the sharp increase in energy prices and, indirectly, in food prices. This led to a significant increase in the relative prices of essential goods compared with discretionary components. Figure 5, panel (b), shows the dynamics of the shares of necessary and discretionary expenditure items in the consumption basket (in real and nominal terms), expressed as deviations from the 2014-2019 average. This decomposition allows us to identify two phases. Between 2020 and 2021, in a phase of low inflation, pandemic-related restrictions and the contraction in real disposable income mainly generated an income effect: households compressed discretionary components and increased the share of spending on necessary goods. In this period, real and nominal expenditure shares show similar dynamics, given low inflation and the substantial stability of relative prices.

From mid-2021, a different regime began, characterized first by supply shocks that led to a significant increase in the relative prices of necessary goods, and then by the reopening of the economy after the most acute phase of the pandemic. Owing to the low price elasticity of demand for necessary goods, the substitution effect operated only to a limited extent: in nominal terms, the share of necessary goods in the basket remained persistently above its long-term trend. Between 2021 and 2022, the increase in the nominal share of essential goods was accompanied by a limited and only gradual decline in the real share, which from 2023 stood slightly below the 2014-2019 average. [7]

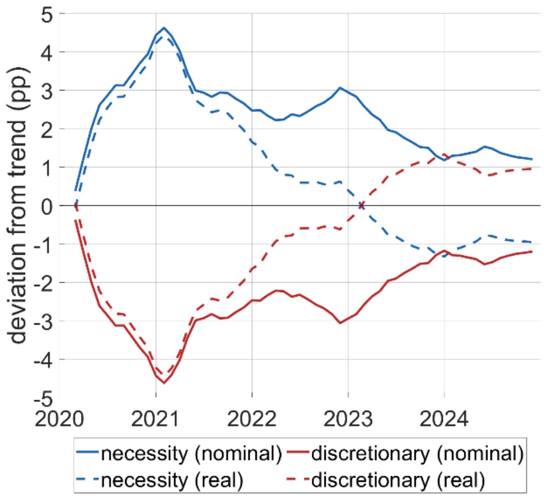
[7] On the different responsiveness of discretionary and necessary consumption items to shocks, see Corsello, Foschi, Fruzzetti and Riggi (2026).

Fig. 5 Inflation and the evolution of the consumption basket

(a) inflation of necessary and discretionary goods



(b) composition of the expenditure basket relative to the long-term trend



Source: authors' calculations based on Istat data.
Note: Panel (a) reports inflation for necessary goods (blue line) and discretionary goods (red line) using HBS weights. Panel (b) reports, from 2020 onwards and relative to the long-term basket (calculated as the 2014-2019 average), the evolution of the expenditure shares of necessary goods (blue line) and discretionary goods (red line) in the HBS consumption basket, both in nominal terms (solid lines) and in real terms (dashed lines). Values above (below) zero indicate that the weight of these goods and services has increased (decreased) relative to the long-term basket composition.

4. Conclusions

This paper shows that the post-pandemic inflation episode in Italy was initially driven by supply shocks, to which a progressive strengthening of demand pressures was subsequently added. The granular analysis of the different consumption components highlights large differences between goods and services and marked heterogeneity in the timing and intensity of the transmission of inflationary shocks to the various consumption categories.

After the profound changes induced by the pandemic, which had initially shifted demand towards necessary goods, the subsequent recomposition of the basket towards discretionary components took place only gradually, even though supply shocks had affected the prices of necessary goods to an exceptional extent. Indeed, given the low price elasticity of demand for the latter, households reduced their consumption only marginally, thereby absorbing the increase in prices through a higher share of income devoted to purchasing these goods.

Possible future developments of the research include the analysis of the redistributive effects of the inflationary episode, also for the purpose of evaluating economic policies. In particular, it would be useful to investigate the impact of inflationary shocks and the resulting changes in consumption choices on the distribution of income and on households' welfare, taking into account the different weight of the various categories of goods in the baskets of households with different spending capacities (Corsello and Riggi, 2026).

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Appendix

A. Shapiro's (2024) methodology

The analytical approach is based on the assumption, drawn from the macroeconomic literature, of an upward-sloping supply curve and a downward-sloping demand curve for each sector:i

$$\text{supply curve:} \quad q_i = \sigma^i p_i + \alpha^i,$$

$$\text{demand curve:} \quad p_i = -\delta^i q_i + \beta^i,$$

where q_i denotes quantity (or, in this paper, real consumption), p_i denotes the price level, σ^i is the slope of the supply curve, $-\delta^i$ is the slope of the demand curve, while α^i and β^i are the two intercepts. A shift in the intercept is defined as a "supply shock" for the supply curve and as a "demand shock" for the demand curve. It follows that shocks to the supply and demand curves for each sector can be represented as:

$$\text{supply shock:} \quad \varepsilon_{i,t}^s = \left(q_{i,t} - \sigma^i p_{i,t}\right) - \left(q_{i,t-1} - \sigma^i p_{i,t-1}\right),$$

$$\text{demand shock:} \quad \varepsilon_{i,t}^d = \left(\delta^i q_{i,t} + p_{i,t}\right) - \left(\delta^i q_{i,t-1} + p_{i,t-1}\right),$$

where $\varepsilon_{i,t}^s = \Delta\, \alpha^i$ and $\varepsilon_{i,t}^d = \Delta\, \beta^i$. This system of equations can be estimated using a structural VAR of the following form

$$A^i z_{i,t} = \sum_{j=1}^{N} A_j^i z_{i,t-j} + \varepsilon_{i,t},$$

where $z_{i,t} = \begin{bmatrix} q_{i,t} \\ p_{i,t} \end{bmatrix} A^i = \begin{bmatrix} 1 & -\sigma^i \\ \delta^i & 1 \end{bmatrix}$, It follows that $\varepsilon_{i,t} = \begin{bmatrix} \varepsilon_{i,t}^s \\ \varepsilon_{i,t}^d \end{bmatrix}$ denote the structural demand and supply shocks in period t. Specifically, the shocks $\varepsilon_{i,t}$ represent unexpected shifts in the demand and supply curves in period t, where the surprise is defined as new information relative to that available up to period t. To identify structural shocks, we estimate a reduced-form VAR with prices and quantities (z_i) and the resulting reduced-form residuals, $\nu_{i,t}^p$ and $\nu_{i,t}^q$:

$$z_{i,t} = [A^i]^{-1} \sum_{j=1}^{N} A_j^i z_{i,t-j} + \nu_{i,t},$$

where $\nu_i = \begin{bmatrix} \nu_i^q \\ \nu_i^p \end{bmatrix}$. Structural shocks can then be identified through a transformation of the reduced-form residuals:

$$\varepsilon_{i,t} = A^i \nu_{i,t}.$$

As shown in Kohler and Jump (2022), restrictions on the slopes of the supply and demand curves imply restrictions on the signs of structural shocks $\varepsilon_{i,t}$ and, consequently, on the reduced-form residuals $\nu_{i,t}$. In particular, $\varepsilon_{i,t} = A^i \nu_{i,t}$ implies that the signs of reduced-form residuals reveal information about the signs of structural shocks:

$$\text{Positive demand shock:} \quad \nu_{i,t}^p > 0, \nu_{i,t}^q > 0 \rightarrow \varepsilon_{i,t}^d > 0,$$

$$\text{Negative demand shock:} \quad \nu_{i,t}^p < 0, \nu_{i,t}^q < 0 \rightarrow \varepsilon_{i,t}^d < 0,$$

$$\text{Positive supply shock:} \quad \nu_{i,t}^p < 0, \nu_{i,t}^q > 0 \rightarrow \varepsilon_{i,t}^s > 0,$$

$$\text{Negative supply shock:} \quad \nu_{i,t}^p > 0, \nu_{i,t}^q < 0 \rightarrow \varepsilon_{i,t}^s < 0.$$

The presence of a positive (negative) reduced-form residual obtained from the price regression and a negative (positive) reduced-form residual obtained from the quantity time-series regressions implies that a negative (positive) supply shock occurred at time t.

In the paper, the following price and quantity regressions are estimated for each of the 52 consumption categories over rolling four-year windows (corresponding to 48 monthly observations):

$$q_{i,t} = \sum_{j=1}^{6} \gamma_j^{qp} p_{i,t-j} + \sum_{j=1}^{6} \gamma_j^{qq} q_{i,t-j} + c + \nu_{i,t}^q,$$

$$p_{i,t} = \sum_{j=1}^{6} \gamma_j^{pp} p_{i,t-j} + \sum_{j=1}^{6} \gamma_j^{pq} q_{i,t-j} + c + \nu_{i,t}^p,$$

where $q_{i,t}$ and $p_{i,t}$ are, respectively, the logarithm of the quantity and price index of category i at time t, while c is a constant. The regressions include 6 lags of prices and quantities as controls: the results are robust to alternative specifications (both in the number of lags included and when using logarithmic differences, i.e. $\Delta q_{i,t}$ and $\Delta p_{i,t}$, instead of $q_{i,t}$ and $p_{i,t}$). The result of these regressions therefore generates two series of residuals from July 2018. The reduced-form residuals, $\nu_{i,t}^{q}$ and $\nu_{i,t}^{p}$, collected for the last month t of each window, are used to classify shocks at time according to the following scheme:

$$\mathbb{1}_{i\in dom(+),t} = \begin{cases} 1 & \text{if } \nu_{i,t}^{p} > 0, \nu_{i,t}^{q} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{1}_{i\in dom(-),t} = \begin{cases} 1 & \text{if } \nu_{i,t}^{p} < 0, \nu_{i,t}^{q} < 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{1}_{i\in off(+),t} = \begin{cases} 1 & \text{if } \nu_{i,t}^{p} < 0, \nu_{i,t}^{q} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{1}_{i\in off(-),t} = \begin{cases} 1 & \text{if } \nu_{i,t}^{p} > 0, \nu_{i,t}^{q} < 0 \\ 0 & \text{otherwise} \end{cases}$$

It follows that the share of expenditure subject to the shock (s) in month t is:

$$\eta_{s,t} = \sum_{i} \mathbb{1}_{i\in s,t}\omega_{i,t},$$

where $s \in \{dom(+), dom(-), off(+), off(-)\}$ and $\omega_{i,t}$ is the expenditure weight of category i in the consumption basket. It therefore represents a continuous measure of the incidence of demand and supply shocks $\eta_{s,t}$ on consumption at time t.

Similarly, the share of inflation arising from a demand or supply shock can be constructed. In particular, by aggregating positive and negative shocks as follows

$$\mathbb{1}_{i\in off,t} = \begin{cases} 1 & \text{if } \nu_{i,t}^{p} > 0, \nu_{i,t}^{q} < 0 \text{ o } \nu_{i,t}^{p} < 0, \nu_{i,t}^{q} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{1}_{i\in dom,t} = \begin{cases} 1 & \text{if } \nu_{i,t}^{p} > 0, \nu_{i,t}^{q} > 0 \text{ o } \nu_{i,t}^{p} < 0, \nu_{i,t}^{q} < 0 \\ 0 & \text{otherwise} \end{cases},$$

it is possible to decompose inflation in the HBS basket into two distinct components: supply-driven inflation and demand-driven inflation:

$$\pi_{t,t-1} = \underbrace{\sum_{i} \mathbb{1}_{i\in off,t}\omega_{i,t-1}\pi_{i,t,t-1}}_{\text{supply } (\pi_{t,t-1}^{off})} + \underbrace{\sum_{i} \mathbb{1}_{i\in dom,t}\omega_{i,t-1}\pi_{i,t,t-1}}_{\text{demand } (\pi_{t,t-1}^{dom})}.$$

This identification assumes the presence of only one type of shock (demand or supply) for each expenditure category and at each point in time.t

Moreover, to facilitate the interpretation of the results, the figures show the twelve-term moving average of the demand and supply components of inflation.

B. Giannone and Primiceri's (2024) methodology

The analysis is based on a structural vector autoregression (SVAR) model designed to distinguish between demand and supply shocks and their effects on inflation and real activity.

The reduced-form VAR model is specified as follows:

$$Y_t = A(L)Y_{t-1} + u_t$$

where Y_t is a vector that includes inflation and real activity, $A(L)$ is a lag polynomial and u_t is a vector of reduced-form residuals.

The structural representation is given by:

$$B\,Y_t = C(L)Y_{t-1} + \varepsilon_t$$

where $\varepsilon_t$are structural shocks with $E[\varepsilon_t\ \varepsilon_t{}'] = I$, and $u_t = B^{-1}{}^{\varepsilon}_{t}$.

Identification is based on sign restrictions. Demand shocks are assumed to increase both consumption and prices, and the opposite holds for supply shocks. Formally:

$$\text{demand shock: },\Delta y_t > 0\Delta\pi_t > 0$$

$$\text{supply shock: },\Delta y_t < 0\Delta\pi_t > 0$$

Unexpected changes in prices and quantities can therefore be determined by a combination of demand and supply shocks hitting the economy at the same time.t.

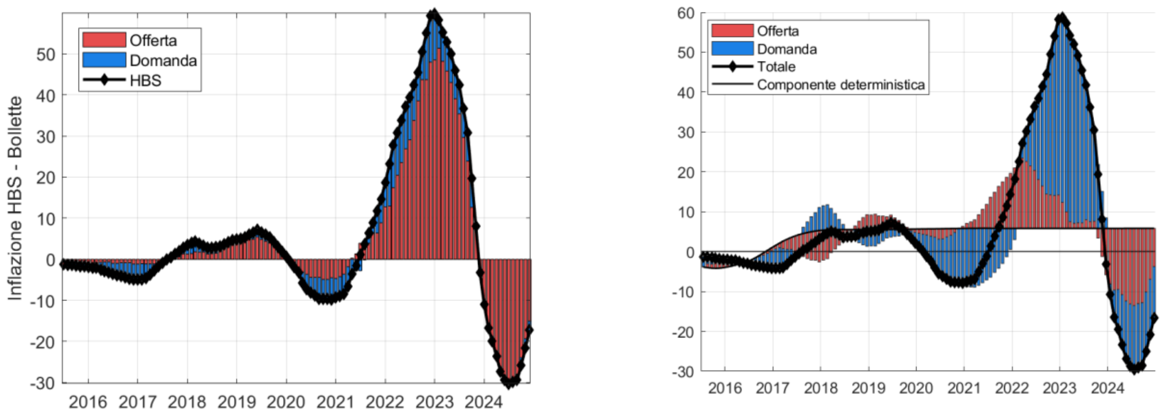
In estimation, to address the dimensionality problem arising from the limited length of the sample, Bayesian inference methods are used. In the estimation equation, the deterministic trend in inflation and its cyclical components are also separated; only the latter are subject to demand and supply shocks.

The identification strategy adopted by Giannone and Primiceri (2024) differs from that proposed by Shapiro (2024) along two main dimensions. First, the two approaches differ in the data used: Giannone and Primiceri use aggregate series, while Shapiro relies on sectoral data on consumption expenditure. Second, the interpretative criterion differs. The SVAR model identifies shocks starting from the theoretical structure of the model and also allows for dynamic analysis through impulse response functions and forecast error variance decomposition. The focus is therefore on the macroeconomic propagation mechanisms of shocks. By contrast, Shapiro's methodology adopts a reduced-form approach: the classification of shocks is derived from the joint observation of changes in prices and quantities at the sectoral level, without requiring the estimation of a structural multivariate model.

Figure B.1 compares the results of the two methodologies applied to energy bills inflation. As for headline inflation (see Figure 4), the Giannone and Primiceri (2024) model assigns a clearly predominant role to demand factors. This evidence, however, appears implausible. Household demand for gas and electricity tends to be relatively insensitive to the business cycle, as these are essential expenditures. Moreover, the increase in energy bills recorded between 2022 and 2023 was largely determined by the rise in the price of imported energy.
These results therefore reinforce the conclusions obtained using Shapiro's methodology and highlight the importance of using granular information to identify inflationary shocks, especially in the presence of extraordinary events that deviate from historical regularities.

Fig. B.1 Decomposition of energy bills inflation

(a) Shapiro (2024) method (b) Giannone and Primiceri (2024) method



Source: authors' calculations based on Istat data.
Note: The black line with diamonds represents the inflation series calculated using the HBS basket weights, while the bars show the contributions of demand (blue) and supply (red). The deterministic component represents the long-run term of the VAR model.

C. Deaton et al. (1980) methodology

The Almost Ideal Demand System (AIDS), proposed by Deaton and Muellbauer (1980), is a system of demand equations derived from a class of preferences known as PIGLOG (Price-Independent Generalized Logarithmic). The system has several useful properties for the analysis: it provides a first-order approximation to any demand system derived from optimizing behaviour by agents; it exactly satisfies the axioms of consumer choice; it aggregates perfectly across consumers without requiring parallel linear Engel curves; it is simple to estimate (making nonlinear estimation less relevant); and it allows homogeneity and symmetry restrictions to be tested through linear restrictions on the parameters.

The AIDS model specifies the expenditure share allocated to a good or category i (w_i) as a function of the logarithm of total real expenditure and the logarithms of the prices of all the goods considered. The functional form is derived from an expenditure function representing aggregate preferences. The estimating equation for each category i at time t is the following:

$$w_{i,t} = \alpha_i + \sum_{j=1}^{N-1} \gamma_{ij} lnp_{j,t} + \beta_i ln\frac{x_t}{P_t} + \varepsilon_{i,t}$$

where:

$w_{i,t}$ is the expenditure share of category i in total consumption expenditure at time$t$

$p_{j,t}$ is the price of category j at time t

x_t is total nominal consumption expenditure at time t

P_t is an aggregate consumer price index, approximated by the Stone price index, defined as

$$lnP_t = \sum_{k=1}^{N} w_{k,t} ln\ p_{k,t}$$

α_i is the category-specific intercept, which captures the effect of unobserved factors that are constant over time

γ_{ij} are the parameters measuring the response of the expenditure share of good i to a percentage change in the price of good j

β_i is the parameter measuring the response of the expenditure share of good i to a percentage change in real expenditure

A key advantage of the AIDS model is that it allows the theoretical restrictions derived from utility maximization to be imposed and tested. In the estimation process, the following constraints are imposed to reduce the number of parameters to be estimated and obtain more robust estimates:

Adding-up: the sum of expenditure shares is equal to 1. This implies: $\sum_{i=1}^{N} \alpha_i = 1$, $\sum_{i=1}^{N} \beta_i = 0$, and for every j: $\sum_{i=1}^{N} \gamma_{ij} = 0$

Homogeneity: the demand function must be homogeneous of degree zero in prices and expenditure. This requires: for every i: $\sum_{j=1}^{N} \gamma_{ij} = 0$

Slutsky symmetry: deriving from the symmetry of the Hicksian substitution matrix: $\gamma_{ij} = \gamma_{ji}$ for every $i \neq j$

From the estimated parameters of the Linear Additive AIDS model, the key elasticities for the economic analysis can be derived:

Expenditure (income/expenditure) elasticity of demand: $e_{i,x} = 1 + \frac{\beta_i}{w_i}$ this measures the percentage change in the quantity demanded of the good i in response to a 1% change in total real expenditure (income, under the assumption of non-satiation). A value greater than 1 identifies a luxury good, while a value below 1 identifies a necessary good

Own-price elasticity of demand: $e_{i,i} = -1 + \frac{\gamma_{ii}}{w_i} - \beta_i$ this measures the percentage change in the quantity demanded of the good i in response to a 1% change in its price, holding total nominal expenditure constant

Cross-price elasticity of demand: $e_{i,j} = \frac{\gamma_{ij}}{w_i} - \beta_i \frac{w_j}{w_i}$ this measures the effect on the quantity demanded of the good i of a 1% change in the price of good j

The LA/AIDS model is estimated separately over two time intervals: the pre-COVID period (January 2014 – December 2019) and the full sample (January 2014 – December 2024). The direct comparison of the coefficients β_i and the elasticities derived from the two samples allows us to identify possible changes in consumption behaviour. Changes in expenditure elasticity indicate a shift of the good along the "necessity-luxury" spectrum; changes in price elasticity indicate a change in households' ability or willingness to substitute.

The estimated changes in elasticities are interpreted in light of the nature of the shocks identified in the previous sections (demand vs supply). A reduction in expenditure and price elasticities for essential goods (food and energy) is consistent with the presence of persistent supply shocks, which strengthen their character as rigid goods that are difficult to compress in households' budgets. By contrast, an increase in expenditure elasticity for discretionary goods (clothing and recreational services) is interpreted as an adjustment of demand to a new consumption equilibrium.

The system of equations is estimated using the Seemingly Unrelated Regression (SUR) method, which accounts for the contemporaneous correlation of the error terms $\varepsilon_{i,t}$ across the different equations, thereby increasing the efficiency of the estimators.

The estimates are robust to different ways of treating the lockdown period in the analysis: including all of 2020, excluding only March, or excluding the entire year. They also remain robust when a time dummy for the lockdown is included in the full sample. Moreover, price elasticities remain robust to those reported in Table 1, while expenditure elasticities do not change significantly.