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Economic Letter

# Supply and Demand Determinants of Inflation in Ireland

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Vol. 2023, No. 4.

# Supply and Demand Determinants of Inflation in Ireland

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To what extent can the basics of supply and demand help to explain the high rates of inflation in Ireland since 2021? In this *Letter*, we analyse the data using a simple model-based approach and find that, on average, supply-side drivers explain around three fifths of inflation in the year to May 2023, while demand-side factors account for over one third of inflation. The decline in headline inflation since Q3 2022 has been mostly driven by an easing of supply-side inflationary pressures. The contribution of demand to core inflation appears to have faded over the last 12 months. Nevertheless, demand has become a more important driver of services inflation recently – consistent with signs of stronger domestic inflationary pressures.

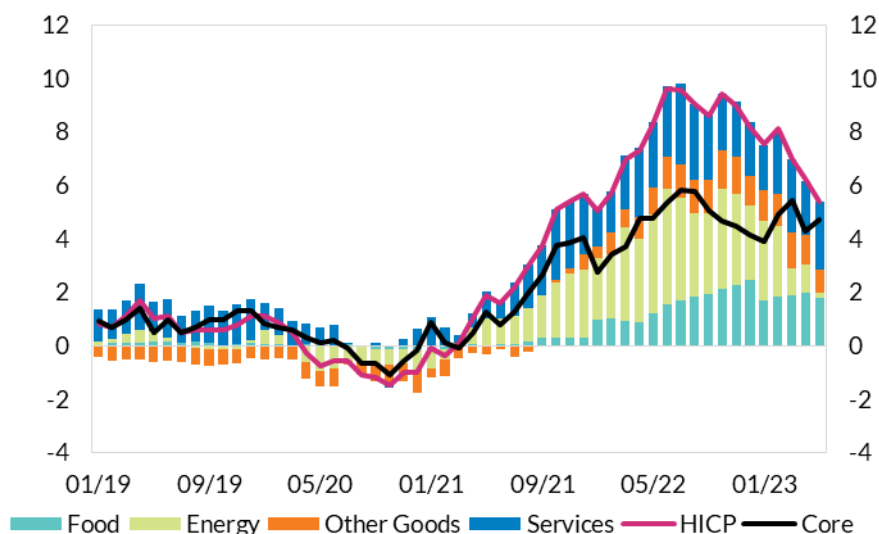
## 1. Introduction

Consumer price inflation in Ireland accelerated sharply from the second half of 2021 and into 2022. By June 2022, inflation as measured by the Harmonised Index of Consumer Prices (HICP) peaked at 9.6 per cent, a level of inflation not previously seen since the early 1980s. Both demand and supply factors played a role in the rise and subsequent fall in inflation since 2021. The reopening of economies and a surge in demand for services that had been restricted during the pandemic led to an increase in services inflation in 2021 and 2022, consistent with demand-driven price pressures, amid still constrained supply from pandemic restrictions. Russia's invasion of Ukraine in February 2022 led to enormous increases in energy prices, which had already been rising from late 2021, implying an important role for supply-side factors in driving the rise in overall inflation from the first quarter of 2022. The increase in energy prices eventually spilled over to prices of food and other goods and services during 2022 indicating that these supply-side effects were not confined to energy (Figure 1). Fiscal policy measures introduced by the Government also influenced inflation both directly – by reducing the price of some government-provided services – and indirectly by affecting household income and the level of demand for goods and services.

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<sup>1</sup> Irish Economic Analysis Division, Central Bank of Ireland. The views expressed in this paper are those of the authors only and do not necessarily reflect the views of the Central Bank of Ireland. We would like to thank colleagues in the Central Bank for comments on an earlier draft. We would like to thank Adam Shapiro (Federal Reserve Bank of San Francisco) for his guidance and support in applying his methodology to Ireland.

FIGURE 1: COMPONENTS OF HEADLINE INFLATION HICP



Source: Author's Calculations, Eurostat

To more precisely decipher the contributions of demand and supply factors, this *Economic Letter* uses a detailed breakdown of HICP inflation to estimate the supply and demand side drivers of inflation and to illustrate how the relative contributions of these drivers have changed over time. The supply and demand decomposition is based on [Shapiro \(2022\)](#) for the US and later applied to the euro area by [Gonçalves & Koester, \(2022\)](#). The increase in euro area core HICP inflation was initially mainly supply-driven, but the importance of demand factors has gradually increased over time up to the end of their analysis in July 2022. Decomposing inflation into demand and supply drivers can provide useful information on the possible persistence of inflation and can help signal whether evidence of second-round inflationary pressures may be emerging. Furthermore, since monetary policy is transmitted via the demand channel, understanding the supply and demand drivers of inflation is important.

Our main findings are as follows:

- In relation to the surge in inflation during 2022, supply side factors played a significant role with the relative contribution of demand also increasing up to the point when inflation peaked in Q3 2022.
- The decline in headline inflation since Q3 2022 has been mostly driven by an easing of supply-side inflationary pressures, while the contribution of demand has remained broadly unchanged. In the year to May 2023 compared to the previous 12-month period, on average around three-fifths of headline inflation relates to supply, with demand accounting for around one-third. A small proportion is driven by ambiguous factors, which cannot be labelled as supply or demand with a high degree of certainty.

- When we strip out more volatile elements, such as food and energy, we still find that around two-thirds of inflation in the last year has come from supply factors with just under a fifth coming from demand driven-factors as its contribution has faded over time (the remainder relates to the ‘ambiguous’ factor described above).
- In recent months, demand-side factors exert a somewhat larger influence on services inflation, consistent with stronger domestic inflationary pressures influencing core inflation – of which services accounts for just over two thirds of the inflation basket (the remainder is goods).

## 2. Methodology

Our methodology is based on [Shapiro \(2022\)](#). In a simple demand-supply framework, supply shifts move prices and quantities in opposite directions along a downward-sloping demand curve, while demand shifts move prices and quantities in the same direction along an upward-sloping supply curve. Put simply, prices and quantities rise as demand increases along the supply curve, while prices rise and quantities decline when supply declines along the demand curve, and vice versa.

We model inflation by estimating a rolling monthly VAR with 12 lags of prices and quantities of a variable – where variables here are a component of the inflation basket – and estimate the unexpected changes in prices and quantities.<sup>2</sup> ‘Unexpected changes’ are defined as the difference between the predicted value from the VAR and its realisation<sup>3</sup>. In line with the demand-supply framework outlined above, if the realised values for both price and quantity values are above their predictions, we take the difference or ‘innovation’ to be demand driven. If the innovations of price and quantity variables are of opposite signs, we take the unexpected change to be supply driven.<sup>4</sup> We label 20 per cent of the distribution to be ambiguous, or statistically indistinguishable from zero in line with the methodology in [Shapiro \(2022\)](#).<sup>5</sup> This ensures that we only label as demand or supply ‘unexpected changes’ in prices and quantities that are statistically different from zero.

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<sup>2</sup> We use 10 years of data in a rolling setting to get predicted values per period in order to define supply and demand labels each month. 10 years of data was chosen due to data availability and to ensure enough degrees of freedom existed to run our VARs reliably.

<sup>3</sup> See Appendix Equations (1) – (4). Our methodology attributes inflation to supply and demand in a given period. There is no causal interpretation

<sup>4</sup> We label supply and demand in a given month by the contemporaneous innovations of monthly price and quantity data, which tends to be volatile. Furthermore, prices may be sticky and slow to react to underlying price dynamics. To account for this fact, we define supply and demand in a given month as the sum of previous monthly contributions, which address some concerns regarding persistence and price stickiness.

<sup>5</sup> 20 per cent of the distribution of each COICOP variable is defined as ambiguous over the entire sample. As some variables have a higher weight in the HICP basket, it may lead to some periods having more ambiguity than others do. Variables can also be ambiguous in different points in time based on their own distribution. The ambiguous component helps to deal with some potential measurement error, by not assigning sufficiently strong observations as either supply or demand.

For the majority of the HICP subcomponents – around 60 per cent – direct quantity pairings are available. For example, the HICP inflation series for *clothing and footwear* is matched with the quantity series from the CSO Retail Sales Index on the volume of sales in *clothing, footwear and textiles*. Some quantity series are matched with more than one price series, if no suitable unique quantity index is readily available. This points to a caveat with the method used in this analysis that should be noted. The ability to correctly identify demand and supply contributions relies on the quality of the price-quantity pairings. Since exact pairings are not available for all HICP components, there is a degree of measurement error with this approach that should be considered in interpreting the results. The majority of our quantity data come from the CSO monthly retail and services indices, while our HICP data comes from Eurostat. Our analysis uses up to 57 sub-components of HICP (Appendix Table 1 contains a full list of the HICP subcomponents and matched quantity series used for this analysis).

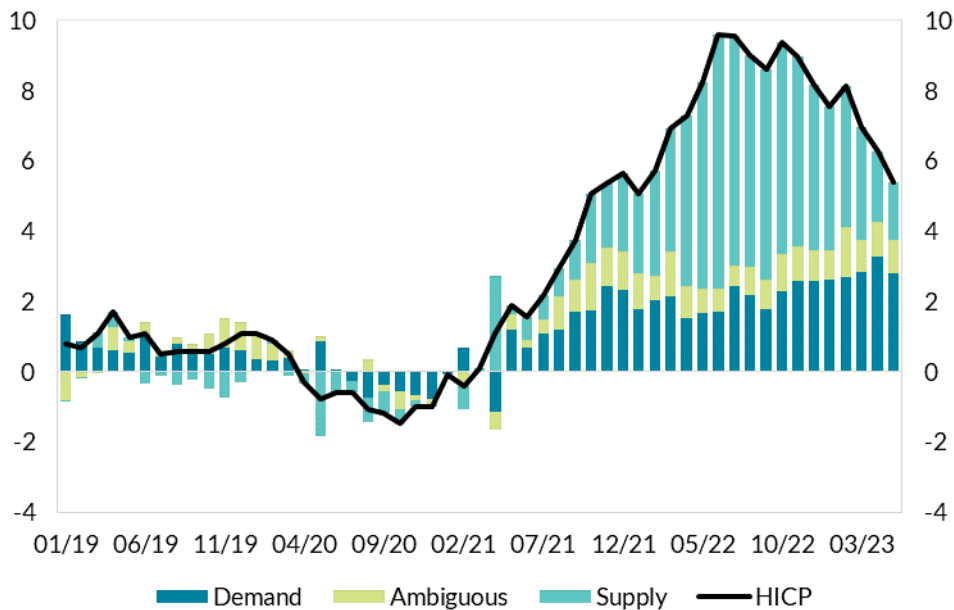
### 3. Decomposing Inflation into Supply and Demand Factors

#### 3.1 Headline Inflation

Figure 2 shows the decomposition of headline HICP inflation through to May 2023. At the onset of the pandemic, both weak demand and (excess) supply contributed to disinflation. After the re-opening of the economy during 2021, a resurgence in demand combined with supply chain restrictions affecting some sectors of the economy that had been closed during the pandemic led to a surge of inflation.<sup>6</sup> From the start of 2022 however, most of the increase in headline inflation came from the supply shock resulting from the Russian invasion of Ukraine and its impact on energy prices. As global commodity prices eased thereby reducing supply side pressures, the contribution of demand-side factors to headline inflation increased during the second half of 2022. From our estimation, this shows up in particular in increased demand for transport. Fiscal interventions – in addition to their direct effect of reducing the price of certain government-provided services – also appear to have added to demand-side inflation, in particular in the months after excise duty relief was introduced and households received rental credits. Looking at the more recent period, the decline in headline inflation since its peak in June 2022 up to May 2023 reflects an easing of price pressures predominantly from supply-side channels.

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<sup>6</sup> The inflation rate in each month is the increase in the price level compared with the same month in the previous year. As a result, unusual factors in the base period (i.e. one year ago) affect the inflation rate in the current year. See [Box E](#) in QB1 2023 for a full explanation of base effects.

**FIGURE 2: DECOMPOSITION OF HICP INFLATION IN IRELAND**

Source: Author's Calculations, Eurostat

Note: Seasonally adjusted data used. Based on the approach developed by Adam Shapiro. Here HICP inflation is calculated as the sum of demand-driven, supply-driven and ambiguous components of inflation.

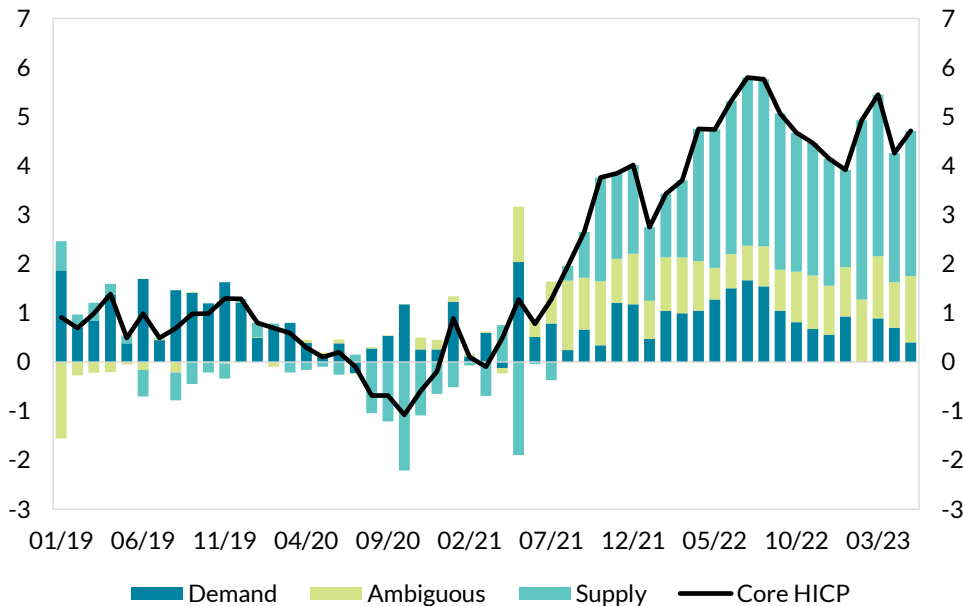
### 3.2 Core Inflation

Next, we strip out the more volatile elements of inflation (food and energy) and decompose the demand-supply components of core inflation (Figure 3). The results suggest slightly different relative roles for supply and demand factors than was the case for headline inflation. After the re-opening of the economy, base effects and supply chain pressures from the goods side of the economy, such as furniture and household equipment, resulted in most of the initial increase in inflation, with demand for restaurants and hotels, transport services and the provision of housing also playing a role during this period. From the start of 2022, however, most of the surge in core inflation came from indirect effects on other non-energy prices of the initial energy-related supply shock following the Russian invasion of Ukraine. Sectors such as restaurants and hotels added significantly to supply-side inflation during this period, whereas demand factors have been less pronounced.

Core inflation has remained elevated over the five months of 2023 and as shown in Figure 3, and continues to be driven more by supply channels than by demand. The overall contribution of demand-side factors to core inflation eased slightly in the period up to May 2023 reflecting a number of offsetting developments. The contribution of demand to goods inflation excluding energy and food items reduced, more than offsetting a somewhat increasing role for demand in services inflation up to May 2023. In terms of supply, there are a number of factors that explain the prominence of supply-side channels in driving core inflation at present. Firstly, in the past four months over two percentage points were added to core

inflation on the supply side due mostly to transport services and to a lesser extent recreation and communications.

**FIGURE 3: DECOMPOSITION OF CORE HICP INFLATION IN IRELAND**



Source: Author's Calculations, Eurostat

Secondly, it is important to note the impact of a mechanical aspect of the calculation of our metric. We define each annual supply, demand, and ambiguous component as the sum of the previous 12 months of monthly contributions of that component. From 2022 onwards, the sum of supply side effects relating to the Russian war outweighed demand effects. As these effects drop out of the calculation of annual inflation, one would expect demand to play a more pronounced role in future months.

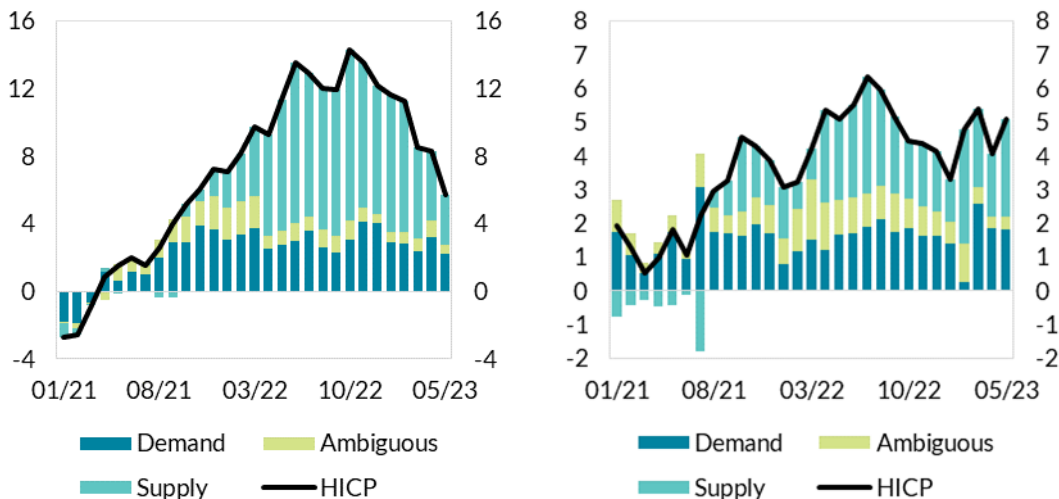
### 3.3 Decomposition of Goods and Services Inflation

Figure 4 shows the demand-supply decomposition for goods (left panel) and services (right panel) inflation. Up to the end of 2021, demand outweighed supply as the main driver of goods inflation, with strong demand in sectors such as telecommunications, clothing, transport fuels, and some health products fuelling inflation. From the onset of the war in early-2022, supply-side factors took hold, with food, furnishings, and energy pushing up goods inflation. The introduction of minimum alcohol pricing also added to the increase in price levels via base effects over the period. The estimates indicate that the effect of demand on goods inflation is broadly unchanged since mid-2022. While the impact of supply factors on goods inflation has reduced in 2023 compared to 2022, the majority of goods inflation continues to be driven by supply-side effects up to May 2023.

In many respects, the narrative around the decomposition of services inflation is similar to that for goods. Services inflation in Ireland typically reflects more domestically-driven inflation ([Bermingham et al, 2012](#); [Gerlach et al, 2015](#); [Byrne and Zakipour-Saber, 2020](#); [Faubert, 2021](#); & [Byrne, McLaughlin and O'Brien, 2022](#)). Therefore, one might expect to observe stronger evidence of possible second round effects via the services channel. Demand explains most of the initial rise in services inflation, with restaurants and hotels, housing, and transport services all playing a role. Supply factors began to dominate services inflation after Russia’s invasion of Ukraine however. As with goods, supply dynamics remain the most prominent factors in explaining services inflation in the year to date, explaining over half of all services inflation in 2023.

At the same time, it is notable that the contribution of demand-side drivers to overall services inflation has picked up somewhat in recent months, with restaurants/ hotels and housing having a prominent role. This is consistent with a rise in domestic inflationary pressures. As the initial energy shock has faded, services inflation appears to be arising as a result of second-round effects from increased demand in recent months, as well as a persistent contribution from the supply side. This could indicate pass through of higher wages to domestic inflation in the services sector, giving rise to demand driven inflation; as well as cost-push factors such as firms maintaining or increasing their mark-ups, resulting in supply side inflation.

**FIGURE 4A: DECOMPOSITION OF GOODS INFLATION**      **FIGURE 4B: DECOMPOSITION OF SERVICES INFLATION**



Source: Author’s Calculations, Eurostat



## 4. Conclusion

Both supply and demand factors are responsible for the current inflationary environment. In the past year, on average around three fifths of inflation has been a result of supply factors, with demand-driven inflation accounting for around a third of inflation. When we look only at core inflation, over three fifths of inflation in the last year is attributed to supply factors with just under a fifth coming from demand driven factors. The relatively smaller role for demand in core inflation in recent months is entirely a result of the declining role for demand in goods inflation excluding food and energy products. Services inflation, in contrast, has seen a somewhat increasing role for demand factors in recent months.

Overall, our analysis shows that the recent surge in inflation has mainly come from the supply channel, and it continues to have a pronounced effect on inflation into early 2023. While energy-related price increases played a key role in the initial rise in supply-driven inflation in 2022, domestic factors have become a more important driver of inflation over time. Demand-side factors continue to exert an important influence on goods and services inflation. From a policy making perspective, the key take-away is that for inflation to fall further, it will require an easing of *both* supply and demand pressures, with the latter increasingly important for services in recent months.

## Appendix

TABLE 1: PRICE- QUANTITY PAIRINGS

Price (HICP) Indices	Price (HICP) Sub-indices	Price (HICP) Sub-Sub-indices	Quantity Indices	HICP Weight 2023 %	
Housing, water, electricity, gas and other fuels			Daft.ie	<b>15.714</b>	
	Electricity, gas and other fuels		Automotive fuel	6.655	
	Actual rentals for housing		Daft.ie	8.326	
	Maintenance and repair of the dwelling			Daft.ie	0.416
		Materials for the maintenance and repair of the dwelling		Daft.ie	0.295
		Services for the maintenance and repair of the dwelling		Daft.ie	0.121
	Water supply and miscellaneous services relating to the dwelling			Daft.ie	0.317
		Water supply		All retail businesses	0.00
		Refuse collection		Total Services	0.157
		Other services relating to the dwelling n.e.c.		Daft.ie	0.16
Furnishings, household equipment and routine household maintenance			Retail sale of furniture and lighting	<b>5.796</b>	
	Domestic services and household services		Total Services	0.863	

Price (HICP) Indices	Price (HICP) Sub-indices	Price (HICP) Sub-Sub-indices	Quantity Indices	HICP Weight 2023 %
Transport			Transportation and storage	<b>13.274</b>
	Fuels and lubricants for personal transport equipment		Automotive fuel	3.849
	Purchase of vehicles		Motor vehicles in retail	5.087
	Spare parts and accessories for personal transport equipment		Trade and repair of motor vehicles	0.431
	Maintenance and repair of personal transport equipment		Trade and repair of motor vehicles	1.137
	Transport services		Transportation and storage	2.127
	Other services in respect of personal transport equipment		Transportation and storage	0.644
Communications			Information and Communication	<b>3.441</b>
	Telephone and telefax equipment		All retail businesses	0.279
	Postal services		Transportation and storage	0.151
Education			Employment series	<b>1.615</b>
Restaurants and hotels			Accommodation and food service activities	<b>16.808</b>
Food and non-alcoholic beverages			Retail sale of food	<b>11.152</b>

Price (HICP) Indices	Price (HICP) Sub-indices	Price (HICP) Sub-Sub-indices	Quantity Indices	HICP Weight 2023 %
Recreation and culture			Total Services	<b>7.324</b>
	Recreational and cultural services		Accommodation and food service activities	3.616
	Package holidays		Accommodation and food service activities	1.21
	Audio-visual, photographic and information processing equipment		All retail businesses	0.156
	Major durables for outdoor recreation		All retail businesses	0.019
	Musical instruments and major durables for indoor recreation		All retail businesses	0.016
	Other recreational items and equipment, gardens and pets		All retail businesses	1.378
	Newspapers, books and stationery		All retail businesses	0.929
	Repair of audio-visual, photographic and information processing equipment		Information and communication	0.003
Alcoholic beverages, tobacco and narcotics			Retail sale of food, beverages and tobacco in specialised store	<b>5.759</b>

Price (HICP) Indices	Price (HICP) Sub-indices	Price (HICP) Sub-Sub-indices	Quantity Indices	HICP Weight 2023 %
Health			Retail sale of pharmaceutical, medical and cosmetic articles	<b>6.117</b>
	Out-patient services		Total Services	2.034
	Hospital services		Total Services	3.036
	Pharmaceutical products		Retail sale of pharmaceutical, medical and cosmetic articles	0.856
	Pregnancy tests and mechanical contraceptive devices		Retail sale of pharmaceutical, medical and cosmetic articles	0.005
	Other medical products n.e.c.		Retail sale of pharmaceutical, medical and cosmetic articles	0.019
	Corrective eye-glasses and contact lenses		Retail sale of pharmaceutical, medical and cosmetic articles	0.107
	Hearing aids		Retail sale of pharmaceutical, medical and cosmetic articles	0.041
	Other therapeutic appliances and equipment		Retail sale of pharmaceutical, medical and cosmetic articles	0.019

Price (HICP) Indices	Price (HICP) Sub-indices	Price (HICP) Sub-Sub-indices	Quantity Indices	HICP Weight 2023 %
Miscellaneous goods and services			All retail businesses	<b>7.677</b>
	Electric appliances for personal care		All retail businesses	0.049
	Non-electrical appliances		All retail businesses	0.197
	Jewellery, clocks and watches		All retail businesses	0.496
	Travel goods		All retail businesses	0.249
	Hairdressing salons and personal grooming establishments		Total Services	1.072
	Social protection		Total Services	1.096
	Insurance		Total Services	0.867
	Financial services n.e.c.		Information and communication	0.495
	Other services n.e.c.		Services (68, 92, 93, 95, 96)	0.647
Clothing and footwear			Retail sale of textiles, clothing and footwear	<b>5.323</b>
	Clothing		Retail sale of textiles, clothing and footwear	4.313
		Cleaning, repair and hire of clothing	Total Services	0.099

VAR EQUATIONS<sup>7</sup>

$$P_{i,t} = a_0 + a_{11}P_{i,t} + a_{21}Q_{i,t} + \varepsilon_{i,t}^p \quad (1)$$

$$Q_{i,t} = a_1 + a_{12}P_{i,t} + a_{22}Q_{i,t} + \varepsilon_{i,t}^q \quad (2)$$

- $P_{i,t}$  represents the monthly inflation rate for variable  $i$  in time  $t$
- $Q_{i,t}$  represents the monthly rate of change in the quantity index for variable  $i$  in time  $t$
- $\varepsilon_{i,t}^p$  represents the innovation of the price index of category  $i$  in month  $t$
- $\varepsilon_{i,t}^q$  represents the innovation of the price index of category  $i$  in month  $t$

$$\mathbb{1}_{i \in \text{demand}} \begin{cases} \varepsilon_{i,t}^p < 0 \cap \varepsilon_{i,t}^q < 0 \cup \varepsilon_{i,t}^p > 0 \cap \varepsilon_{i,t}^q > 0 \\ 0 \text{ otherwise} \end{cases} \quad (3)$$

$$\mathbb{1}_{i \in \text{supply}} \begin{cases} \varepsilon_{i,t}^p < 0 \cap \varepsilon_{i,t}^q > 0 \cup \varepsilon_{i,t}^p > 0 \cap \varepsilon_{i,t}^q < 0 \\ 0 \text{ otherwise} \end{cases} \quad (4)$$

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<sup>7</sup> See [Shapiro 2022](#) for full derivations.