Short economic and financial analyses

Measures of inflation sensitivity to monetary policy

Author: Luka Markovič

May 2025

BANKA SLOVENIJE
EVROSISTEM

Collection: Short economic and financial analyses

Title: Measures of inflation sensitivity to monetary policy

Author: Luka Markovič, Banka Slovenije, email address: luka.markovic@bsi.si

Issue: May 2025

Year: 2025

Place of publication: Ljubljana

Issued by:
Banka Slovenije
Slovenska 35, 1505 Ljubljana, Slovenija
www.bsi.si

Electronic edition:
https://www.bsi.si/en/publications/research-publications?q[type]=5

Kataložni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani

COBISS.SI-ID **237246467**
ISBN 978-961-7230-18-5 (PDF)

Table of contents

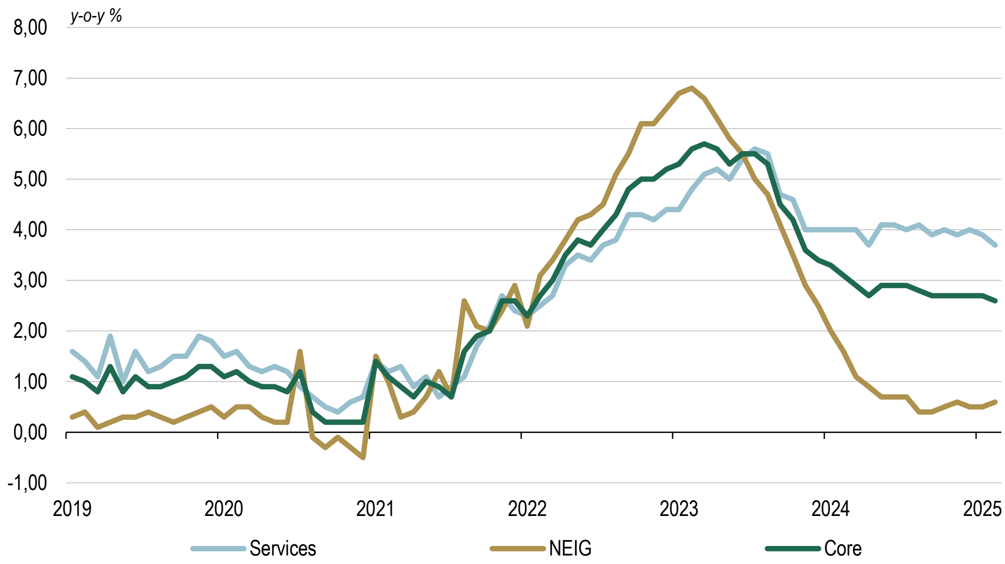
Abstract

This analysis examines the sensitivity of core inflation components to monetary policy shocks in the euro area. Using a granular inflation dataset, the analysis employs a local projection model to estimate impulse response functions for individual inflation components. The results reveal significant heterogeneity in inflation sensitivity, with some components experiencing a strong negative response to monetary tightening, while others exhibit negligible responses. By classifying inflation components into most sensitive and least sensitive categories, this study constructs new inflation measures to track their respective dynamics. The findings suggest that while monetary tightening substantially reduced the most sensitive inflation after the last hiking cycle, the least sensitive inflation demonstrated greater persistence. Furthermore, the findings suggest that external shocks, such as energy price fluctuations and supply chain disruptions, have played a crucial role in driving the divergent inflationary trends observed between the new inflation measures.

1 Introduction

Since the onset of the COVID-19 pandemic, inflation has become a central focus of economic discussions, reaching historically high levels in the euro area. By 2022, headline inflation surged past 10%, driven by a combination of external shocks, including global supply chain disruptions, soaring energy prices following the war in Ukraine, and expansionary monetary and fiscal policies. In response to high inflation, the European Central Bank (ECB) implemented substantial hiking cycles of interest rates, increasing policy rates by 400 bps from July 2022 until September 2023. While these measures contributed to a moderation in headline inflation, core inflation, which excludes energy and food prices to minimize short-term volatility, remained persistently elevated.

Figure 1: **Underlying inflation in the euro area**



Source: Eurostat.
Note: The figure depicts the year-on-year growth rates in percentages for core inflation, services inflation and non-energy industrial goods inflation.

An illustration of inflation heterogeneity is also notable in the differing responses of core inflation components, particularly between non-energy industrial goods (NEIG) and services. As shown in Figure 1, core inflation rose sharply after 2021, increasing from approximately 1% to nearly 6% by March 2023. However, the trajectories of its underlying components varied significantly. NEIG inflation surged earlier, peaking in February 2023 before undergoing a notable decline. In contrast, services inflation peaked later, in July 2023, and has since remained persistently high, stabilizing at around 4% without dropping below 3.7%. This divergence underscores that inflationary pressures are not uniform across price categories, raising critical questions about the transmission of monetary policy and the extent of heterogeneity among inflation components. Such heterogeneous outcomes have reignited the debate on how inflation components respond to monetary policy and why some price categories exhibit greater sensitivity to policy changes than others.

To better understand these dynamics, this study examines the sensitivity of individual inflation components to monetary policy shocks. Using a granular dataset, we estimate impulse response functions to classify inflation components into two distinct groups:

those that are highly sensitive to monetary policy and those that exhibit limited sensitivity. By constructing measures for these groups, we analyse their respective trends and the factors behind the difference in their dynamics.

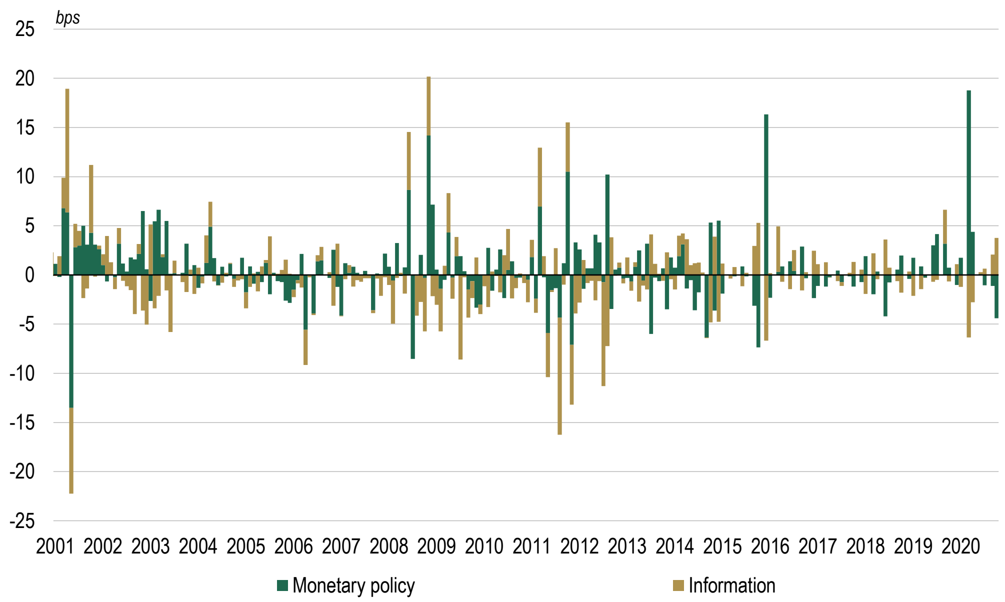
2 Inflation sensitivity to monetary policy

In this section, the sensitivity of inflation components to monetary policy shocks is estimated. Given the focus on monetary policy responsiveness, the analysis is restricted to core inflation, which excludes energy and food from headline inflation. This approach eliminates the more volatile inflation components that are heavily influenced by external factors, allowing the study to concentrate on components that are more closely linked to business cycles and monetary policy dynamics.

2.1 Data

To examine the heterogeneity in the sensitivity of inflation components in the euro area, this analysis utilizes the most granular data available for the given time period. Specifically, Eurostat's level 4 classification is employed, which divides headline inflation into 117 categories and core inflation into 72 categories, the latter being the primary focus of this study. The data from this classification has been consistently available for all components since 2001. Prior to estimation, all components are seasonally adjusted.

Figure 2: **Monetary policy shocks**



Sources: Jarocinski and Karadi (2022), own calculations.
Note: The figure illustrates the monetary policy and central bank information shocks from 2001 to 2020. The shocks are measured in bps.

To determine which inflation components are sensitive to monetary policy, it is essential to use a measure of monetary policy shocks, as estimating the effects of monetary policy using policy rate series would result in biased estimates due to endogeneity. The existing literature already provides exogenously identified monetary policy shocks for the euro area, such as those presented by Altavilla et al. (2019) and Jarocinski and Karadi (2020). Such shocks are identified using the intraday asset price changes following monetary policy announcements, based on the assumption that, during these short windows, no other factors influence financial markets besides monetary policy. As this analysis aims to capture the effects of monetary policy, including those of unconventional measures, the shocks for the euro area identified by Jarociński and Karadi (2022) are employed. Their approach distinguishes between monetary policy and information shocks. This distinction is necessary due to their contrasting effects on financial markets. Monetary policy shocks, defined by unexpected shifts in the central bank's policy stance, such as sudden interest rate hikes, lead to a tightening of financial conditions, reflected in higher borrowing costs and declining stock prices, as future corporate earnings become discounted more heavily. By contrast, information shocks stem from unanticipated positive disclosures or communication by the central bank regarding economic fundamentals, such as stronger growth outlook, resulting in simultaneous increases in both interest rates and equity prices as markets revise upward their expectations about the economy. Therefore, the shocks used in this analysis are pure monetary policy shocks, as illustrated in Figure 2.

In addition to monetary policy shocks and inflation data, we include additional series, i.e. an indicator of economic activity, industrial production and the Euribor rate. Furthermore, we extend the analysis by considering shocks to additional relevant variables, such as the Global Supply Chain Pressure Index (GSCI) from the New York Fed, the Producer Price Index (PPI) and the World Bank Commodity Index for energy. All data used in this analysis are collected on a monthly basis.

2.2 Estimation methodology

The methodology in this analysis draws on the approach outlined by Arnaut and Bengali (2024), who performed a similar analysis for US inflation components. To estimate the sensitivity of inflation components to monetary policy shocks, we use the local projection model popularized by Jorda (2005). Specifically, we use the inflation component as the dependent variable in long difference and the identified monetary policy shock as the intervention, with industrial production, core inflation and Euribor as control variables. In the model, we compare the projections with the intervention of monetary policy to those without, examining how monetary policy affects the cumulative inflation of certain HICP components over time. Inflation components, core inflation and industrial production are transformed to log levels, whereas Euribor remains untransformed. The model specification covering the period from 2001 to 2019 is presented as follows:

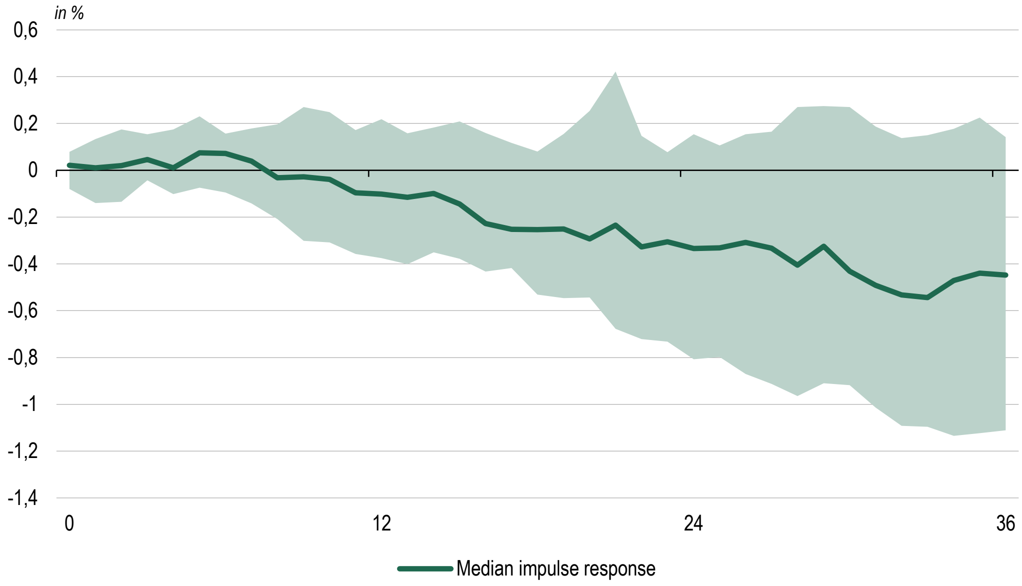
$$y_{i,t+h} - y_{i,t-1} = \alpha_{i,h} + \beta_{i,h} MP_t + \gamma_h (y_{t-1} - y_{t-2}) + \sum_{j=1}^{M} \delta_{i,h,j} X_{i,t-j} + u_{i,t+h}, \quad (1)$$

where $y_{i,t+h} - y_{i,t}$ denotes the cumulative change in the *inflation component i* over horizon *h*. The key coefficient of interest, $\beta_{i,h}$, captures the response of *inflation components* to the *monetary policy shock* MP_t. The model also includes lagged changes in the dependent variable $(y_{t-1} - y_{t-2})$, to account for persistence in inflation dynamics. We include the control variables in $X_{i,t-j}$, which is a vector of *core inflation*, *industrial production* and the *Euriobor rate*, which help isolate the effects of *monetary policy shocks*. The control variables enter the model with three lags. $u_{i,t+h}$ denotes the error term in the model.

2.3 Empirical results

In this subsection, the results of estimating the local projection model are presented. Figure 3 illustrates the range of impulse response functions for the HICP components, obtained by estimating the equation above. The solid line denotes the median response of the core inflation components. The shaded area represents the interquartile range, with the lower and upper bounds corresponding to the 25th and 75th percentiles, respectively, rather than significance intervals. From the figure, it can be observed that the median response of inflation components to a tightening shock of 25 bps is negative, falling by about 0.4% after three years. The shaded area reveals significant heterogeneity in the impulse responses of the inflation components to monetary policy shocks. While some components exhibit a decline of approximately 1% following a tightening shock after three years, others show little to no response. This variability underscores the need for further disaggregation, which is explored in the next step of the analysis.

Figure 3: **Responses of inflation components to MP shock**



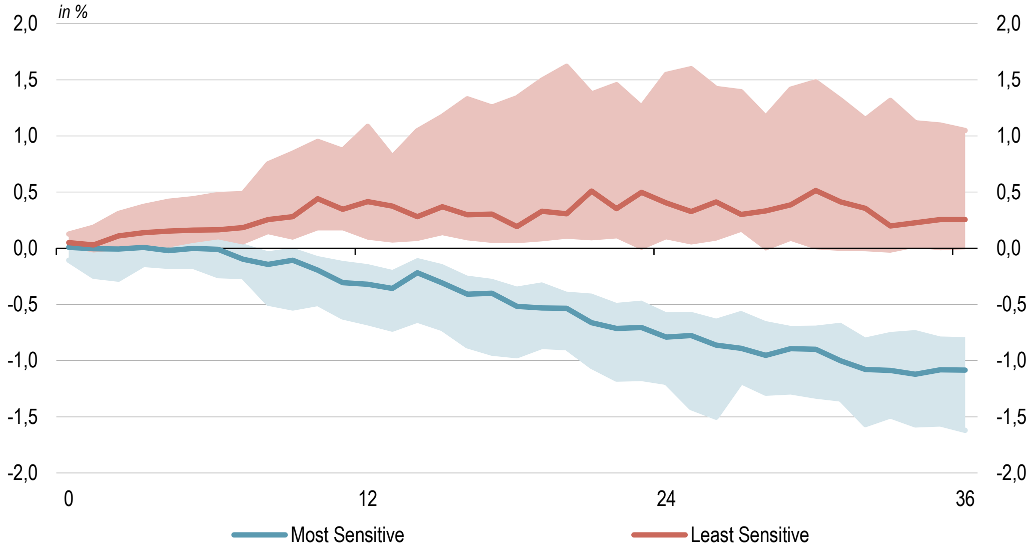
Source: Own calculations.
Notes: The figure illustrates the impulse response function of all inflation components over a three-year period. The green line represents the median response of these components to a monetary policy shock of 25 bps. The shaded green area indicates the range between the 25th and 75th percentiles of the impulse response functions. The Y-axis is expressed in percentages, showing the cumulative change in the inflation components after a certain number of months in response to the monetary policy shocks. The X-axis denotes the number of months.

To identify the inflation components most and least sensitive to monetary policy, we extracted the largest cumulative decline in response to a monetary policy shock for each HICP component and ranked them accordingly. The top and bottom 40th percentiles of components were selected and adjusted for their weight in the HICP basket to form two distinct groups: the most and least sensitive inflation components.

The components falling within the middle 20th percentile range, also weighted accordingly, were excluded from further analysis to ensure a clearer distinction between the two groups. Nonetheless, this group, which comprises 11 components, was analysed separately to assess its responsiveness to monetary policy shocks. The median impulse response reaches approximately –0.3% after three years, placing it between the identified most and least sensitive groups. Moreover, the majority of components exhibit statistically insignificant impulse responses, further justifying their exclusion from the main analysis.

The impulse response functions of the most and least sensitive inflation groups are presented in Figure 4, with the shaded areas representing the interquartile ranges and the solid lines denoting the median impulse response function for each group of inflation components. One group consists of the components most sensitive to monetary policy, denoted by blue, and the other group consists of the least sensitive components, denoted by red. From the figure, it can be seen that the median impulse responses are substantially different compared to those in Figure 3, as there is now a clear distinction between the two groups. Over a three-year horizon, the median impulse response of the most sensitive components shows approximately a 1% decline in response to a tightening monetary policy shock. On the other hand, the median of the least sensitive components does not negatively respond to monetary policy, showing a 0.25% increase in response to the monetary policy shock. This highlights a clear heterogeneity in inflation components' responsiveness to monetary policy.

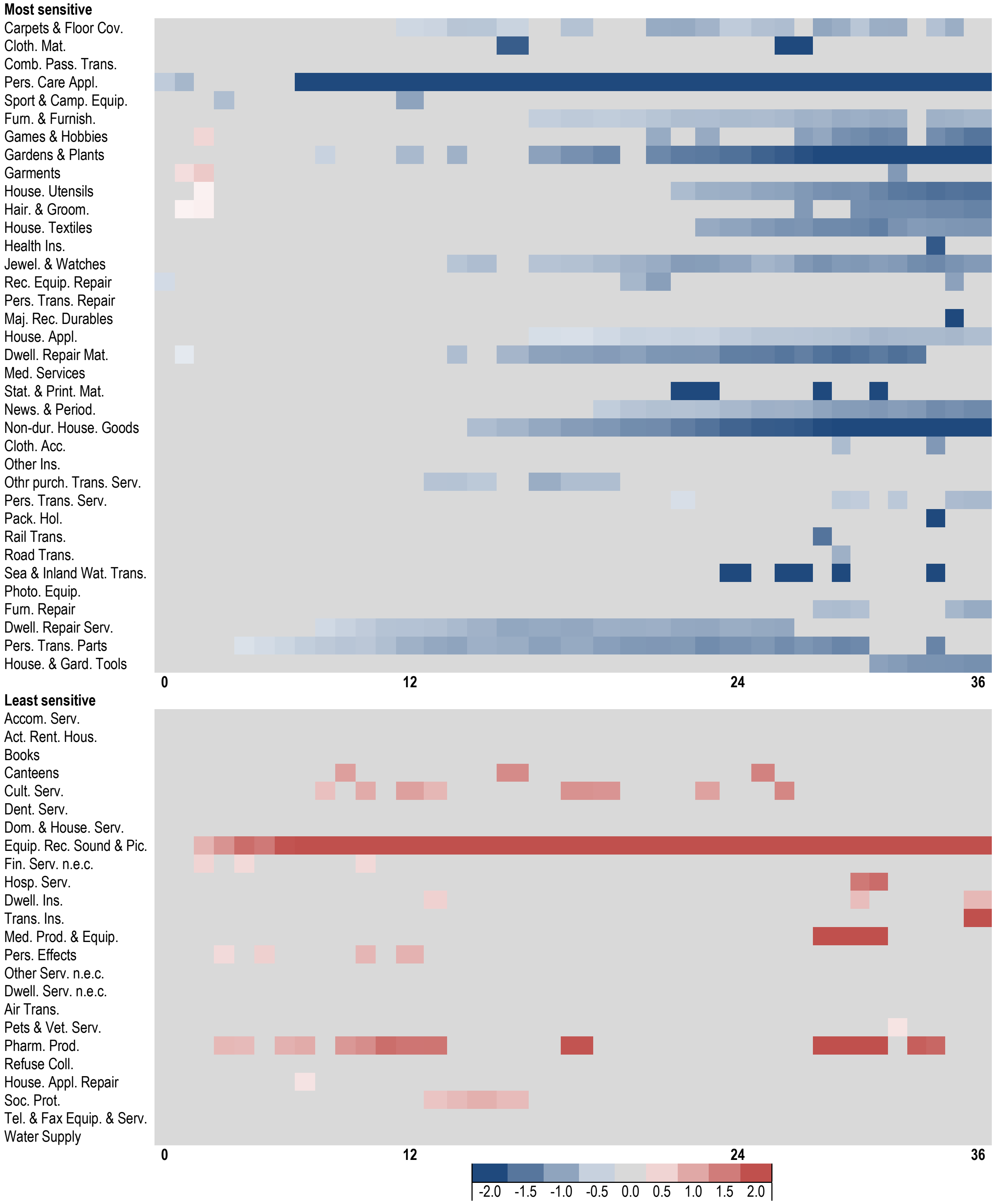
Figure 4: **Responses of most and least sensitive inflation components to MP shock**



Source: Own calculations.
Notes: The figure illustrates the impulse response functions of the most and least sensitive inflation components over a three-year period. The blue line represents the median response of the most sensitive components to a monetary policy shock of 25 bps, while the red line represents the median response of the least sensitive components. The shaded areas indicate the range between the 25th and 75th percentiles of the impulse response functions for each group. The Y-axis is expressed in percentages, showing the cumulative change in the inflation components after a certain number of months in response to the monetary policy shocks. The X-axis denotes the number of months.

The heterogeneous effects of monetary policy on inflation components are further illustrated in Figure 5, which presents coefficient values and their significance, where insignificant coefficients are represented by grey cells. The figure confirms that the first group is negatively affected by a tightening monetary policy shock, while highlighting that among the most sensitive components, the majority exhibit statistically significant responses approximately one year after the shock. Some examples of highly responsive components include major durables for indoor and outdoor recreation, electrical appliances for personal care, and passenger transport by sea and inland waterway. Furthermore, it can be observed that the most sensitive group comprises a larger number of components compared to the least sensitive group. This is because highly responsive components tend to have a lower weight in the HICP index relative to less sensitive ones.

Figure 5: **Coefficient values of inflation components to monetary shocks**



Source: Own calculations.
Notes: The figure displays coefficient values using a heatmap. Grey cells denote insignificant coefficients. Coefficients denote the cumulative percentage change since the shock.

Coefficients for the least sensitive components in Figure 5 highlight those that show minimal responsiveness to monetary policy shocks. Some components' coefficients show a temporary positive response within the first year but soon become insignificant. The least responsive components include *other services in respect of personal transport equipment, major household appliances, whether electric or not*, and *maintenance and repair of personal transport equipment*. The only component that appears to be significantly and positively related to monetary policy shocks is *equipment for the reception, recording and reproduction of sound and picture.*

3 Measure of most and least sensitive inflation

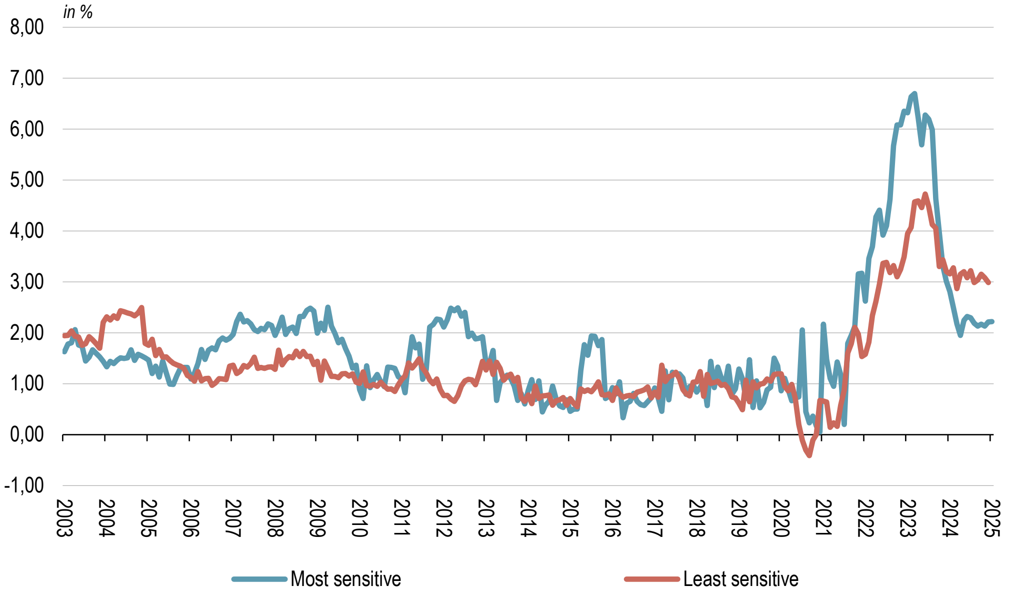
Once the groups are identified, new HICP measures for the most and least sensitive inflation components are constructed. This is achieved by weighting the indices of individual components within each group according to the annually updated weights provided by Eurostat.

Figure 6 shows the two aggregate measures on a year-on-year basis from 2002 to 2025. In the figure, it is clear that the measure of the most sensitive inflation is more volatile, with periods of notable divergence between the two measures. Prior to the tightening cycle following the COVID-19 pandemic, significant divergences occurred in the periods 2005–2008, 2011–2013 and during a sharp rise in 2015. During the post-pandemic inflationary surge, the most sensitive inflation measure increased rapidly, beginning in mid-2021 and peaking at 6.7% in March 2023. The least sensitive measure also rose, albeit with a lag and to a lower peak of 4.7% in July 2023.

Following the start of the substantial hiking cycle in the euro area which started in mid 2022, where policy rates increased from -0.5% to a peak of 4%, both inflation measures began to decline. However, the most sensitive inflation measure was the first to respond, while the least sensitive inflation exhibited a lagged reaction. While the most sensitive inflation quickly dropped to levels close to the target, the least sensitive inflation only returned to levels observed in August 2022 and remains persistently above the target at approximately 3%. This suggests that the persistence of least sensitive inflation has been a key factor behind the above-target core inflation rates observed in late 2024. It is important to note that these components still fall within core inflation, as energy and food components are excluded.

However, sensitivity to monetary policy alone may not fully explain why the most sensitive inflation is more volatile and why it increased significantly more than the least sensitive inflation after 2020. One possible explanation is that the loose monetary policy stance led to a substantial rise in the most sensitive components. However, this explanation appears limited, as monetary policy had been accommodative since 2015, with negative interest rates and the introduction of the Asset Purchase Programme (APP). An alternative explanation is that the most sensitive components are also more reactive to exogenous shocks, such as energy price fluctuations, global supply chain disruptions and commodity price shocks. This hypothesis is further explored in the next section.

Figure 6: **Measures of most and least sensitive inflation**



Source: Own calculations.
Note: The figure displays the computed measures of the most and least sensitive inflation components, weighted according to their share in HICP core inflation. These measures are expressed as year-on-year percentage growth.

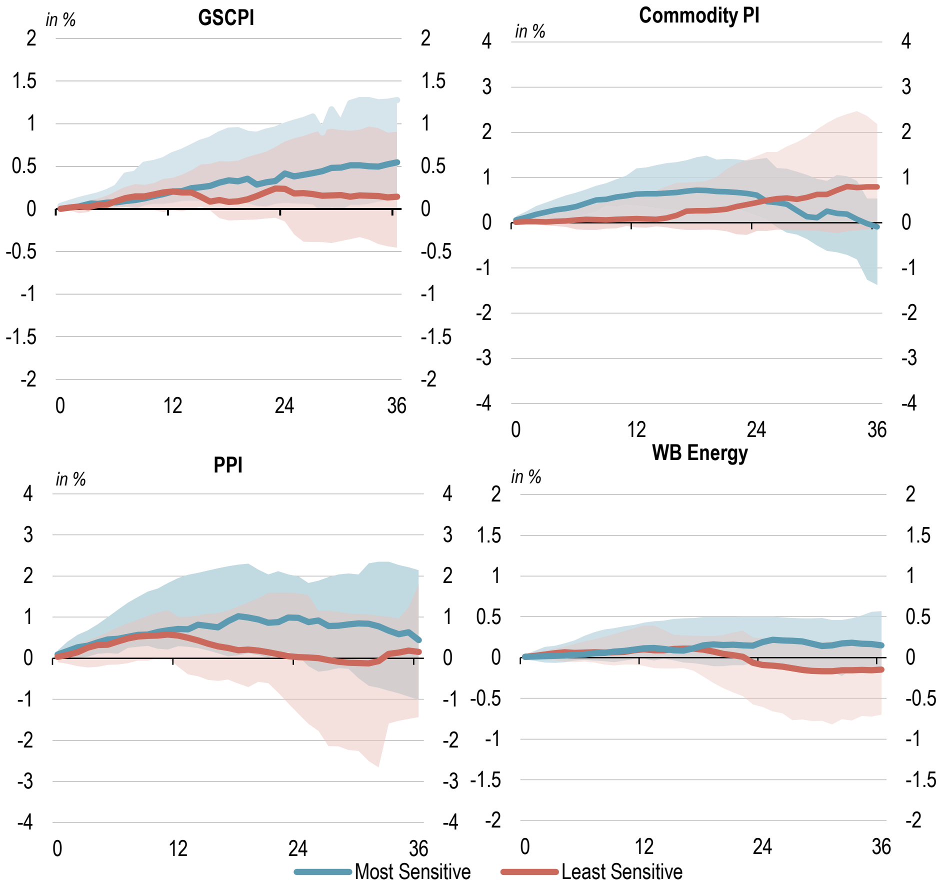
4 Inflation sensitivity to exogenous shocks

To test whether the most sensitive inflation is more sensitive to exogenous shocks, we apply the same model as before but change the source of intervention. Instead of using monetary policy shocks, we analyse the effects of shocks of the following variables: the Global Supply Chain Pressure Index (GSCPI), the Commodity Price Index (Commodity PI), the Producer Price Index (PPI), and the World Bank Energy Price Index (WB Energy).

Figure 7 presents the median impulse response functions for each group in response to the external shocks. The allocation of inflation components follows the classification based on monetary policy sensitivity, with the most sensitive components identified accordingly. The figure shows that, in all cases, a one-standard-deviation increase in an external shock leads to a rise in both inflation groups. However, the most sensitive inflation exhibits a stronger response compared to the least sensitive.

This suggests that the rise in most sensitive inflation components may be partially driven by external shocks. These shocks became particularly substantial after the end of COVID-19 lockdowns, when growing demand and supply side constraints, such as supply chain bottlenecks (proxied by the Global Supply Chain Pressure Index), exerted upward pressure on prices. Additionally, energy prices surged, especially following the outbreak of the war in Ukraine, as reflected in the World Bank Energy Price Index. Other commodity prices also increased, which may have disproportionately affected the most sensitive components. This could explain the sharp and rapid rise in most sensitive inflation observed in 2022.

Figure 7: **Responses of most and least sensitive inflation components to external shocks**



Source: Own calculations.
Notes: The figure illustrates the impulse response functions of the most and least sensitive inflation components over a three-year period. The blue line represents the median response of the most sensitive components to a one standard deviation of the external shocks, namely GSCPI, Commodity Price Index, PPI and World Bank Energy respectively. The red line represents the median response of the least sensitive components. The shaded areas indicate the range between the 25th and 75th percentiles of the impulse response functions for each group. The Y-axis is expressed in percentages, showing the cumulative change in the inflation components after a certain number of months in response to the monetary policy shocks. The X-axis denotes the number of months.

5 Conclusions

This study analyses the heterogeneity in inflation sensitivity to monetary policy shocks in the euro area by employing a granular dataset and a local projection model to estimate impulse response functions. The findings reveal that core inflation components exhibit significant variation in their responsiveness to monetary tightening. Some components experience a substantial negative reaction to monetary policy shocks, while others show minimal or insignificant response. To better capture these dynamics, the study classifies inflation components into two distinct categories: the most sensitive and the least sensitive to monetary policy. The empirical results indicate that the most sensitive inflation components responded strongly to the monetary policy tightening cycle that began in mid-2022, with their inflation rates declining rapidly. In contrast, the least sensitive inflation components exhibited a more persistent trajectory.

In addition to the effects of monetary policy, the study examines the role of external shocks in driving the heightened volatility and substantial post-pandemic surge of the most policy-sensitive inflation measure. The results suggest that exogenous shocks, such as energy price fluctuations and global supply chain disruptions, significantly affects the most sensitive components, while the effects on the least sensitive components are less pronounced. That might suggest that the more substantial rise in the most sensitive inflation compared to the least sensitive in 2022 may have been partially driven by higher sensitivity also to the exogenous shocks.

6 References

1. Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R., & Ragusa, G. (2019). Measuring Euro Area Monetary Policy. *Journal of Monetary Economics*, 108, 162–179.
2. Arnaut, Z., & Bengali, L. (2024). How Quickly Do Prices Respond to Monetary Policy? FRBSF Economic Letter, 2024, 10.
3. Jarociński, M., & Karadi, P. (April 2020). Deconstructing Monetary Policy Surprises – The Role of Information Shocks. *American Economic Journal: Macroeconomics*, 12, 1–43.
4. Jordà, Ò. (March 2005). Estimation and Inference of Impulse Responses by Local Projections. *American Economic Review*, 95, 161–182.
5. Motto, R., & Özen, K. (2022). Market-stabilization QE. Available at SSRN 4035082.