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Inflation shock momentum for the euro area

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Table of contents

Abstract

This paper constructs the inflation shock momentum index (ISMI) for the euro area following Lansing and Shapiro (2026) and assesses its informativeness regarding future inflation. The index is shown to closely track inflation dynamics, with negative shock momentum dominating much of the past decade and positive momentum becoming widespread during the post-pandemic inflation surge. Furthermore, persistent inflationary pressures predominantly stem from core components, particularly services. A lead–lag correlation analysis shows that the ISMI is positively correlated with, and leads, both headline and core inflation, while increases in the index are shown to be associated with cumulative increases in the price level over a two-year horizon. Moreover, an out-of-sample (OOS) forecasting exercise shows that augmenting conventional models with the ISMI improves short-term forecasting performance, reducing the RMSFE by up to 20%. Taken together, the evidence suggests that the ISMI constitutes a useful addition to the euro area's inflation monitoring toolkit.

1 Introduction

The flexibility afforded to the ECB by the medium-term orientation of its price stability objective has become increasingly important in an uncertain geopolitical environment, where inflationary pressures are often driven by supply-side shocks. In such circumstances, temporary deviations of inflation from the target may be looked through by policymakers to avoid premature action, given that an immediate response could prove counterproductive by imposing unnecessary costs in terms of economic activity and employment. However, while the notion of temporary deviations is conceptually straightforward, distinguishing them from persistent inflation dynamics in real time remains a challenge, as evidenced by the post-pandemic inflation surge.

To aid in the understanding of the ongoing inflation process, this paper constructs the ISMI for the euro area following Lansing and Shapiro (2026) and assesses its informativeness regarding future inflation through a lead–lag correlation analysis, local projections and an OOS forecasting exercise.

The results show that shock momentum in the euro area has been predominantly unidirectional, with core components, particularly services, accounting for a large share of persistent inflationary pressures. Furthermore, the ISMI exhibits a leading relationship with both headline and core inflation, while increases in the index are associated with statistically significant cumulative increases in the price level over a two-year horizon. An OOS forecasting exercise shows that augmenting conventional models with the ISMI improves short-term forecasting performance, reducing the RMSFE by up to 20%. Considering the evidence, this paper contributes to the literature on indicators of underlying inflation dynamics in the euro area (e.g. Bańbura and Bobeica, 2020; Fröhling, O'Brien and Schaefer, 2022).

The remainder of the paper is structured as follows. Section 2 discusses the intuition, methodology and data used for the construction of the ISMI, analyzes its evolution and establishes its validity. Section 3 assesses its leading properties with a set of complementary exercises. Section 4 concludes.

2 Construction and drivers of the ISMI

2.1 Methodology and data

We develop a diffusion-style index measuring inflation shock momentum for the euro area following Lansing and Shapiro (2026). More specifically, the measure reflects identified recent sustained deviations from the data-generating process of inflation and provides a timely measure of persistent inflationary pressures driving the consumption basket. To motivate its construction, it is useful to first consider a conventional way of measuring persistence. Suppose monthly inflation π_t can be characterized by an AR(1) process:

$$\pi_t = \mu + \rho\pi_{t-1} + \varepsilon_t \qquad (1)$$

$$\varepsilon_t = \alpha\varepsilon_{t-1} + \epsilon_t \qquad (2)$$

where $\rho\pi_{t-1}$ represents the inflation inertia and ε_t represents a disturbance to inflation in month t. To the extent that $\alpha > 0$, the disturbances can be thought of as self-reinforcing, and hence α would actually be a measure of shock persistence or rather inflation shock momentum. However, as Lansing and Shapiro (2026) point out, estimates of this parameter would be questionable in practice, due to non-linearity. Furthermore, its informativeness would be lacking, since it does not convey the direction in which shocks are sustained and the estimation sample would contain many stale observations.

Taking this into account, the authors opt for a different approach, which also exploits information from the cross-sectional distribution of price changes by utilizing category-level data.[1] The framework still revolves around an AR(1) model:[2]

$$\pi_{i,t} = \alpha + \rho_i \pi_{i,t-1} + \varepsilon_{i,t} \tag{3}$$

which is estimated using 10-year rolling-window regressions for each available HICP item i, with residuals retained in each iteration. To classify whether item i is driven by positive or negative shock momentum, a non-parametric filter with two indicator functions is used:

$$M_{i,t}^{+} = \prod_{k=0}^{K} 1(\hat{\varepsilon}_{i,t-k} > 0) \tag{4}$$

$$M_{i,t}^{-} = \prod_{k=0}^{K} 1(\hat{\varepsilon}_{i,t-k} < 0) \tag{5}$$

where $k = 3$ in the baseline specification,[3] meaning that the last three residuals in each rolling window are used as inputs and $M_{i,t}^{+}$ ($M_{i,t}^{-}$) is equal to 1 if all are positive (negative) and zero otherwise. The indicator values are then weighted by the corresponding weights ω of item i in a consumption basket and summed to yield the share driven by either persistent positive or negative shock momentum:

$$S_t^{+} = \sum_{i=1}^{N} \omega_{i,t} M_{i,t}^{+} \tag{6}$$

$$S_t^{-} = \sum_{i=1}^{N} \omega_{i,t} M_{i,t}^{-} \tag{7}$$

The ISMI is then a diffusion-style index defined as the net share of items in the consumption basket that are experiencing the two types of shock momentum:

$$ISMI_t = S_t^{+} - S_t^{-} \tag{8}$$

Hence a positive (negative) value of the ISMI indicates that shock momentum is predominantly positive (negative), while an increase in the ISMI could result from an increase (decrease) in the share of items being driven by positive (negative) shock momentum. Furthermore, the information conveyed by a change in the ISMI depends on its initial level. For instance, a given increase in the index may indicate either a modest

[1] The ISMI could also be constructed from the monthly rate of headline inflation but the disaggregated approach yields a superior measure as shown in Lansing and Shapiro (2026).

[2] For robustness purposes, we also construct the ISMI using richer AR(3), AR(6) and AR(12) specifications and find only negligible differences between the measures.

[3] As Lansing and Shapiro (2026) also point out, the share of observations whose indicator functions are equal to 1 in a given month t is decreasing in k as the condition for sustained shocks becomes more stringent. As a robustness check, we also construct the ISMI by assuming (smaller) larger k, which (widens) narrows the indicator somewhat, however the general narrative remains the same. The indicator becomes smoother but might be less informative for the purposes of monitoring in real time.

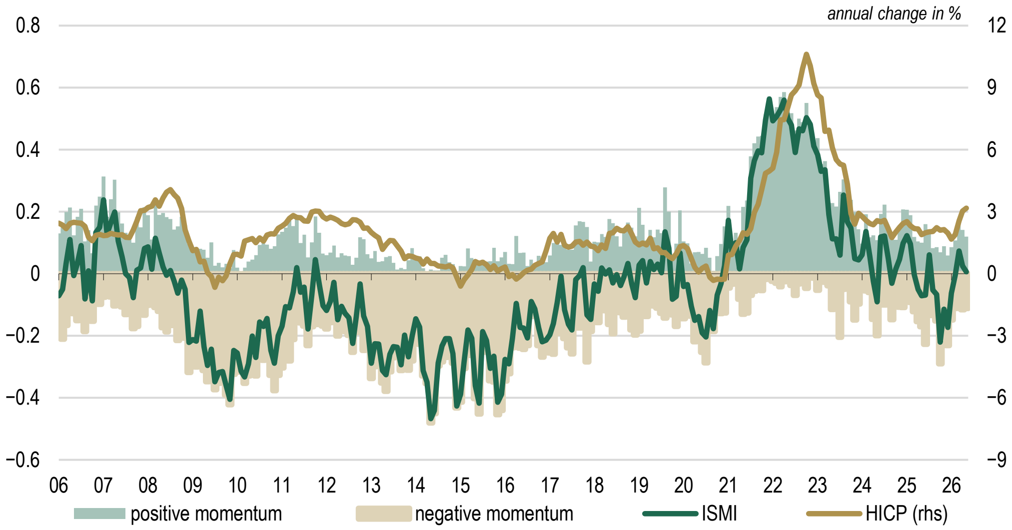
shift towards positive shock momentum when the index is negative or a further broadening of already pervasive upward inflationary pressures when the index is elevated.

In their analysis for the United States, Lansing and Shapiro (2026) use monthly price and expenditure data from the Bureau of Economic Analysis for 129 categories at the fourth level of disaggregation. For the euro area, an analogue would be the Eurostat's data for HICP items at the fourth level of the ECOICOP classification. Although the expenditure weights are only available at an annual frequency, it can be assumed that the unobserved changes within the year are relatively minor. To extend the analysis as far back as possible, a few HICP items, representing around 2% of the basket, are excluded from the analysis. When other data limitations are accounted for as well, the dataset includes 125 HICP items with seasonally adjusted price indices and expenditure weights going back to February 1996. Thus the first rolling window spans from February 1996 to January 2006, while the sample ends in May 2026.

2.2 Results

Figure 1 plots the evolution of the ISMI at monthly frequency together with the positive and negative momentum shares, where the latter is expressed as a negative contribution. Generally, the index tracks inflation dynamics closely. Until 2009, the ISMI moved around zero, as the shares of items driven by more persistent inflationary pressures were very similar, staying between 10% and 20% with a slight divergence in 2007. They then converged once again in 2012 but otherwise differed substantially, with inflation dynamics clearly being dominated by negative shock momentum, which at its peak affected around 40% of items in the HICP basket, until inflation converged back to the target in 2017.

Figure 1: **Monthly ISMI with momentum contributions and headline inflation**



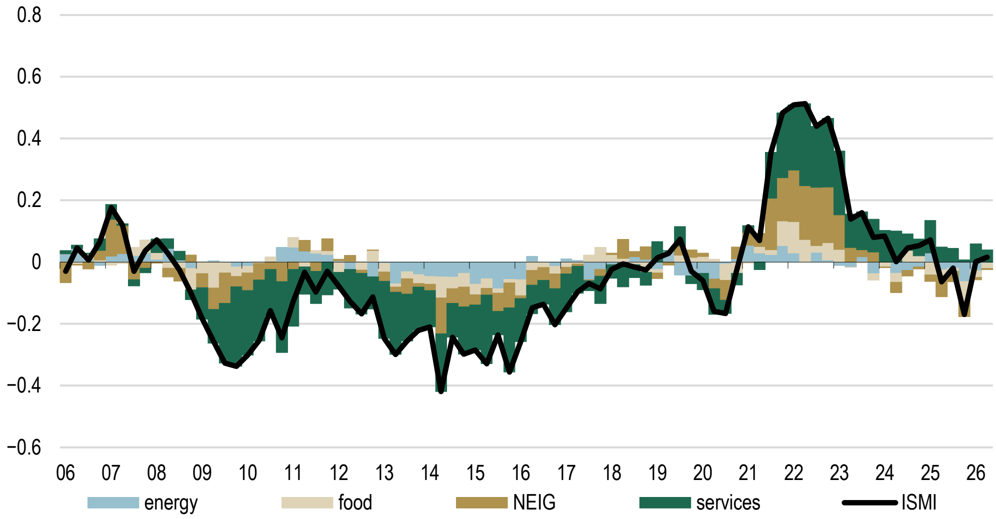
Sources: Eurostat, own calculations.

After a pandemic-related dip at the onset of the crisis, the dynamics shifted markedly as the ISMI moved into positive territory. By early 2022, the index almost exclusively reflected broad-based persistent upward inflationary pressures, which affected more than half of the HICP basket. Notably, it peaked six months before headline inflation, suggesting that persistent inflationary pressures became increasingly broad-based well before inflation itself reached its peak. In the aftermath, the shares converged to the 10–20% interval yet again and have since been moving sideways, with a slight deviation in 2025.

As can be inferred from Figure 2, persistent inflationary pressures mainly stem from core components, especially services. This underscores the importance of monitoring core inflation as a gauge for medium-term inflation dynamics. While the contribution of services partly reflects their substantial weight in the HICP basket, the component-level ISMIs reveal that the services basket is indeed driven by shock momentum to a relatively large extent (see Figure 8 in the Appendix). Furthermore, services shock momentum remains elevated for longer, affirming its stronger underlying persistence. These findings are consistent with the observation that the frequency of price changes is lower for services on account of a smaller share of intermediate energy inputs, a larger share of labour input and a lower degree of competition, which leads to a prolonged adjustment after a shock (Altissimo, Ehrmann and Smets, 2006; Carvalho, 2006).

Although the contributions of energy and food are smaller and tend to dissipate more quickly, as was the case in the post-pandemic inflation period, they are nonetheless important to consider, as they may reinforce persistent inflation dynamics through second-round effects (Bańbura and Bobeica, 2020).

Figure 2: **Quarterly decomposition of the ISMI according to the main inflation components**

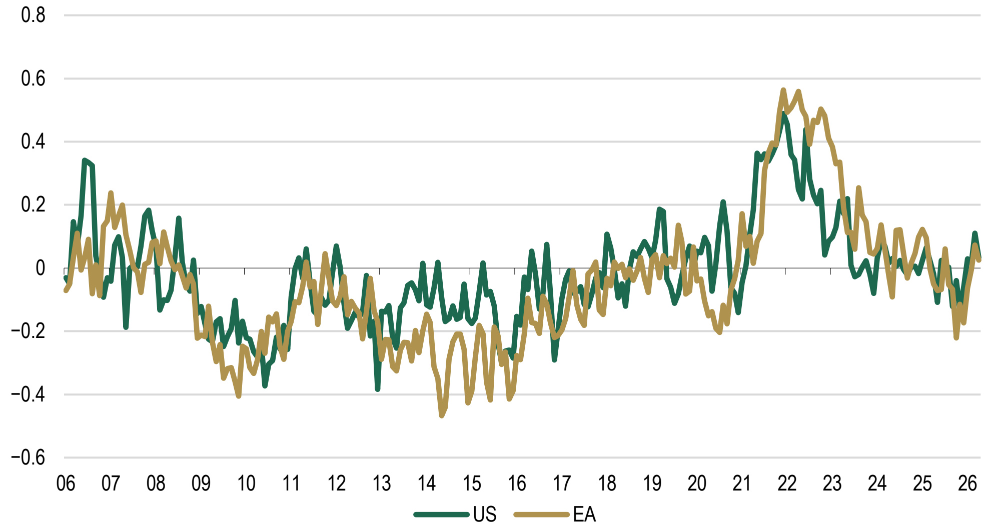


Source: own calculations.

For the majority of the time, inflation in the euro area was dominated by mutually reinforcing domestic and global shocks, as the prevailing momentum for all components was of the same sign. This covers most of the 2010s, which were plagued by a series of crises, the subsequent pandemic and the period of high inflation. In recent years, the ISMI has been propped up by predominantly positive shock momentum for services, which has persisted since the post-pandemic inflation surge, while the opposite holds for volatile components, on account of lower commodity prices. Furthermore, NEIG has contributed negatively overall, marking a reversal from its historically positive contributions during 2021–2023. This shift accelerated in 2025, as disinflationary shocks associated with the appreciation of the euro and increased imports of cheaper goods from China pushed the ISMI into negative territory. At the beginning of 2026, it moved back above zero on account of services and remained there under the influence of the Iran war.

Comparison with the ISMI for the US shows that the persistent inflationary pressures have been broadly similar in direction and breadth (see Figure 3). More pronounced differences can be observed during 2013–2016, when inflation in the euro area was more broadly driven by negative shock momentum, owing to weaker domestic conditions following the sovereign debt crisis. Furthermore, the euro area ISMI was higher for longer after the post-pandemic inflation surge, which was reflected in the divergence of inflation rates.

Figure 3: **Comparison between the ISMI for the euro area and the US**



Sources: Lansing and Shapiro (2026), own calculations.

2.3 Responses to exogenous shocks

Given that the constructed index captures inflation disturbances, it should react to demand- and supply-side externally identified exogenous shocks. Following Lansing and Shapiro (2026), validity is established by using local projections based on Jordà (2005) and estimating the responses of the ISMI to the oil supply news shock from Känzig (2021), while the monetary policy shock is taken from Jarociński and Karadi (2020). The long-difference specification is the following:

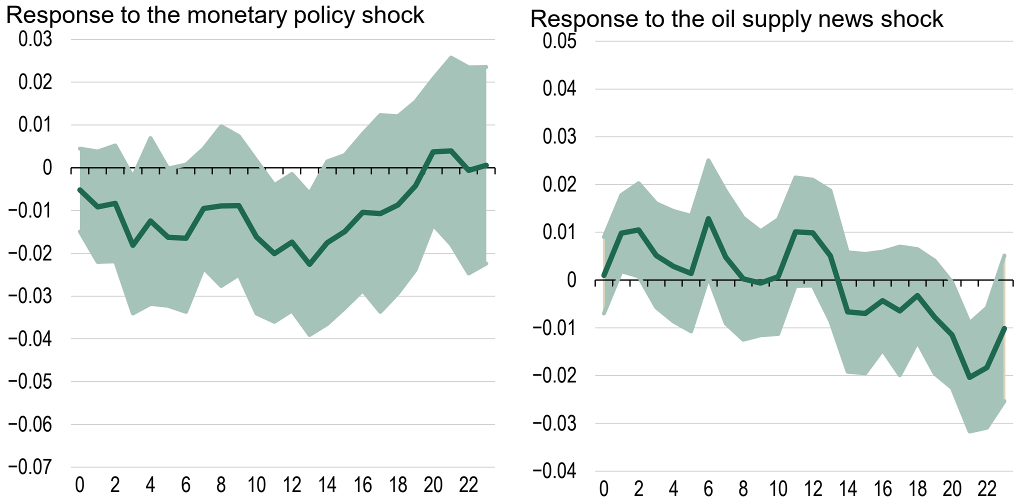
$$ISMI_{t+h} - ISMI_{t-1} = \alpha_h + \beta_h shock_t + \gamma_h x_{t-1} + u_{t+h}$$

where $shock_t$ are the standardized shocks, while controls in x_{t-1} include 12 lagged first differences of the ISMI to control for its inherent autocorrelation and four lags of macroeconomic and financial controls including the 1Y German bond yield, log of the Brent oil price, the VSTOXX index, log of industrial production, the EUROSTOXX index and the unemployment rate. The number of lags is chosen based on the sample size, which is somewhat constrained by the shock series. While the oil supply news shock is currently available until December 2025, the monetary policy shock series ends in October 2025.

Figure 4 plots the two-year impulse responses of the ISMI to the corresponding one-standard-deviation shocks. The responses confirm the empirical relevance of the ISMI. A restrictive monetary policy shock generates a decrease in the ISMI as inflation starts to deviate persistently to the downside. The impact reaches its peak after 13 months, after which the consumption basket becomes progressively less dominated by negative shock momentum. Conversely, negative news about future oil supply leads to upward but less persistent deviations in inflation, which is in line with the findings of Lansing and Shapiro (2026).[4] Towards the end of the two-year horizon, the response turns negative, reflecting a downward deviation in inflation driven by the slowdown in economic activity.

[4] The impulse responses of the ISMIs corresponding to the main HICP components further support this conclusion. Specifically, monetary policy shocks propagate across all major HICP components, with the exception of energy, suggesting a broad-based transmission mechanism that contributes to the sustained deviations in the aggregate.

Figure 4: **Impulse responses of the ISMI to exogenous shocks**

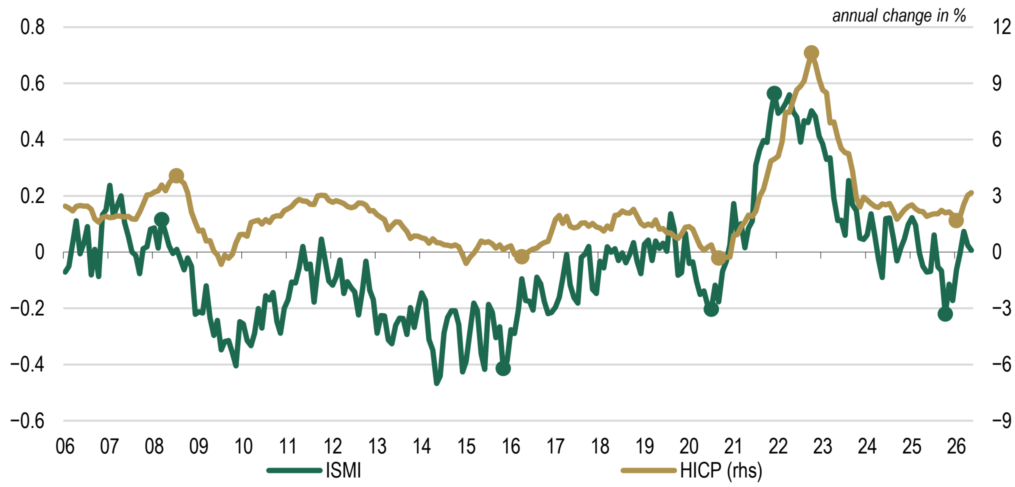


Source: own calculations.
Note: The shaded areas show 95% confidence intervals constructed with Newey–West errors.

3 Leading properties of the ISMI

Expanding on the observation that the ISMI peaked before the headline inflation during the post-pandemic inflation surge, Figure 5 indicates the months in which the index visibly leads headline inflation and serves as motivation for the question of whether the index could be used as an additional timely indicator for signalling future inflation dynamics. To answer this question, a formal analysis is conducted using lead–lag correlations, responses of the price level to changes in the ISMI and the shock momentum shares, and RMSFE ratios based on direct OOS inflation forecasts.

Figure 5: **Turning points of the ISMI and headline inflation**



Sources: Eurostat, own calculations.

3.1 Lead–lag correlation analysis

As an indicator of persistent inflationary pressures, the index should convey a signal akin to the measures of underlying inflation which the ECB uses to gauge medium-term inflation dynamics. These include measures based on permanent exclusion (e.g. core inflation), temporary exclusion (e.g. trimmed means and weighted median) and frequency exclusion (e.g. supercore and PCCI). As such, apart from providing possible evidence of a leading relationship, the lead–lag correlation analysis is also used for a general comparison against these other measures.

The results in Table 1 indicate that the ISMI exhibits the strongest leading relationship with both headline and core inflation, with the highest correlation observed at the fourth month lead for headline inflation (ρ=0.81) and tenth month lead for core inflation (ρ=0.84). These findings highlight its value as an indicator of future inflationary developments, particularly those related to the more persistent component of inflation. Among the alternative measures considered, only the PCCI displays a positive lead, albeit to a lesser extent. This likely reflects the fact that the PCCI is also constructed using disaggregated monthly inflation data and incorporates energy- and food-related items. Still, unlike the PCCI, which is derived from a generalized dynamic factor model, the ISMI remains relatively transparent and easy to interpret.

In general, the results highlight two limitations of the ISMI. First, the measure exhibits greater volatility, resulting in a lower signal-to-noise ratio and, consequently, weaker correlation. This feature is inherent to the underlying methodology, which does not rely on annual inflation rates or extracted common components that abstract from high-frequency fluctuations. Second, the measure itself does not signal the level of inflation in the medium term. While the latter cannot be dealt with by construction, the former can be ameliorated by making the shock criterion more stringent. This, however, presents a trade-off between timeliness and better signal extraction.[5]

[5] Lansing and Shapiro (2026) also propose two alternative constructions of the ISMI incorporating an intensive margin. The first enriches the measures by accounting for the cumulative magnitude of consecutive same-signed shocks:

$$M_{i,t}^{+} = \prod_{k=0}^{K} 1(\hat{\varepsilon}_{i,t-k} > 0) * \left|\sum_{k=0}^{2} \hat{\varepsilon}_{i,t-k}\right| \tag{9}$$

$$M_{i,t}^{-} = \prod_{k=0}^{K} 1(\hat{\varepsilon}_{i,t-k} < 0) * \left|\sum_{k=0}^{2} \hat{\varepsilon}_{i,t-k}\right| \tag{10}$$

where the indicator functions from (4) and (5) are multiplied by the absolute sum of the shocks. The expectation would be that a larger shock might have a stronger impact on future inflation. A second extension assigns greater weight to items exhibiting higher inflation persistence:

$$M_{i,t}^{+} = \prod_{k=0}^{K} 1(\hat{\varepsilon}_{i,t-k} > 0) * \left(\frac{1}{1-\hat{\rho}_i}\right) \tag{11}$$

$$M_{i,t}^{-} = \prod_{k=0}^{K} 1(\hat{\varepsilon}_{i,t-k} < 0) * \left(\frac{1}{1-\hat{\rho}_i}\right) \tag{12}$$

where the second term places a larger weight on items with stronger inflation persistence, as captured by $\hat{\rho}_i$. Figure 9 in the appendix presents both alternative specifications. We can see that the additional intensive margins make the ISMI more volatile, which is reflected in lower correlation coefficients reported in Table 1. However, accounting for the shock size does seem to provide additional information regarding future inflation, as the peak correlation is associated with a longer lead.

Table 1: **Lead–lag correlations among various inflation indicators**

Indicator	Correlation vis-a-vis headline inflation	Correlation vis-a-vis core inflation
Core inflation	0.88 (6)	-
ISMI	0.81 (-4)	0.84 (-10)
ISMI (persistence)	0.79 (-4)	0.78 (-10)
ISMI (shock-size)	0.73 (-7)	0.69 (-11)
PCCI	0.94 (-2)	0.90 (-7)
Supercore	0.93 (5)	0.94 (0)
Total excluding energy	0.92 (5)	0.97 (0)
Trimmed mean 10%	0.98 (1)	0.92 (-3)
Trimmed mean 30%	0.96 (3)	0.95 (-2)
Weighted median	0.95 (3)	0.94 (-1)

Source: own calculations.
Note: Details on the methodology and interpretation of the ISMI (persistence) and ISMI (shock-size) measures are provided in Footnote 5.

3.2 Local projections

We further assess whether changes in the ISMI and its components are associated with subsequent cumulative changes in the price level using local projections. The estimated responses should not be interpreted causally, however, as the ISMI is not an exogenous variable. We use the following specification:

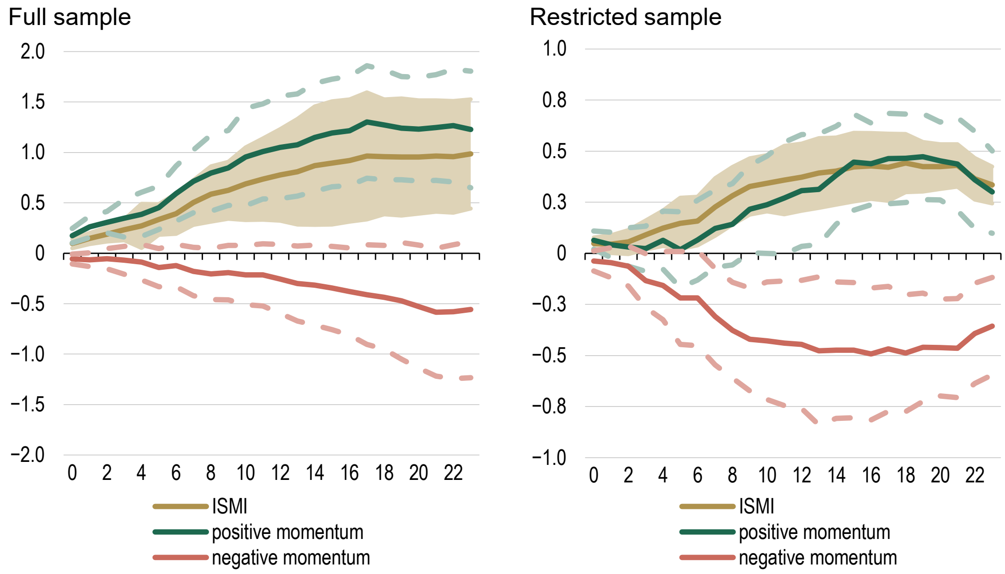
$$\log(HICP)_{t+h} - \log(HICP)_{t-1} = \alpha_h + \beta_h ISMI_t + \gamma_h x_{t-1} + u_{t+h} \qquad (13)$$

where the dependent variable is the log of the HICP index and $ISMI_t$ represents the ISMI and the momentum shares, which are scaled such that β_h corresponds to changes associated with a 0.1-unit increase in $ISMI_t$. The set of macroeconomic and financial controls is identical to that employed in the previous exercise. In addition, four lags of the control variables are included to capture dynamics of at least a quarter while preserving degrees of freedom. To account for the persistence of the ISMI, we further include 12 lags of the ISMI variables and add one lag of the first difference of the log price level to satisfy the long-differences specification.

The full-sample estimates indicate that a 0.1-unit increase in the ISMI is associated with a peak cumulative increase of approximately 1 pp in the price level over a two-year horizon (see Figure 6). The increase is mostly driven by the positive momentum share, whose 0.1-unit increase is associated with a 1.2 pp cumulative increase in the price level in two years. Conversely, the cumulative decrease associated with the negative momentum share is muted and insignificant.

To see whether the size of the changes is to a certain extent driven by the dynamics of the post-pandemic inflation period, we also restrict the sample until 2019. Restricted-sample estimates reveal cumulative increases that are roughly one-third the size of the full-sample estimates. Furthermore, the price level becomes more strongly associated with the negative momentum share, with the decrease now statistically significant. On the other hand, the increase corresponding to the positive momentum share is much lower, indicating that the inflation surge played an important role for the inflation dynamics in recent years.

Figure 6: **Dynamic changes of the price level associated with the ISMI and momentum shares**



Source: own calculations.
Notes: The shaded areas show 95% confidence intervals constructed with Newey–West errors. Plots show cumulative impacts of a 0.1-unit increase in a given measure. The full sample spans from January 2006 to May 2026; the restricted sample ends in December 2019.

3.3 Out-of-sample forecasting exercise

We further evaluate the predictive content of the ISMI by conducting direct OOS inflation forecasts and quantifying the gains from incorporating the index into two alternative model specifications using the RMSFE ratio. The forecasting framework is as follows:

$$\pi_{t+h}^{h} = \alpha + \sum_{j=1}^{p} \beta_j \pi_{t-j+1} + \sum_{j=1}^{p} \gamma_j x_{t-j+1} + u_{t+h} \tag{14}$$

where π is headline inflation and x_{t-j+1} are the lags of the ISMI or other macroeconomic variables. To strike a balance between the information criteria and available sample size, we set $p = 4$. Forecasts are conducted up to $h = 36$, based on a rolling window estimation spanning 10 years of data. As mentioned above, the forecasting gains from including the ISMI are evaluated using the RMSFE ratio, which compares the forecast accuracy of two benchmark models with the corresponding specifications augmented by the ISMI. The benchmark models consist of a standard AR model and a quasi-Phillips curve specification, which additionally includes the annual change in industrial production and oil prices as control variables.

Table 2 presents the results of the OOS forecasting exercise. Based on the full sample, the ISMI exhibits economically meaningful predictive power for headline inflation, particularly at shorter horizons. Relative to the benchmark specifications, both models augmented with the ISMI improve forecast accuracy, reducing the RMSFE by between 10% and 20%, with the largest improvements observed at the six- and nine-month horizons. At longer horizons (18–36 months), there is no evidence of the ISMI improving forecast accuracy when added to the AR model. However, when included alongside macroeconomic controls, forecast performance continues to improve, with the largest reduction in RMSFE of around 8% at the 24-month horizon.

The absence of meaningful differences and the deterioration in the RMSFE under the restricted sample indicate that the informational content of the ISMI was limited during the pre-pandemic period, when inflation was relatively muted and could be explained reasonably well by its own past dynamics. After the pandemic, incorporating the ISMI substantially improved forecast accuracy, which suggests that timely information on the breadth of sustained inflation disturbances became increasingly relevant for predicting short-term inflation dynamics.

Table 2: **RMSFE ratios for different model specifications**

Horizon	AR + ISMI	AR + Controls + ISMI	AR + ISMI (restricted)	AR + Controls + ISMI (restricted)
1	0.95	0.96	0.99	1.00
3	0.87	0.89	0.99	1.06
6	0.79	0.83	1.06	1.11
9	0.79	0.82	1.14	1.16
12	0.90	0.89	1.36	1.40
18	1.13	0.96	-	-
24	1.07	0.92	-	-
36	1.03	1.01	-	-

Source: own calculations.
Notes: The AR model augmented with the ISMI is benchmarked against the baseline AR model, while the specification including the ISMI and additional controls is benchmarked against the AR model including controls only. Restricted-sample estimates are based on data from January 2006 to December 2019.

4 Conclusions

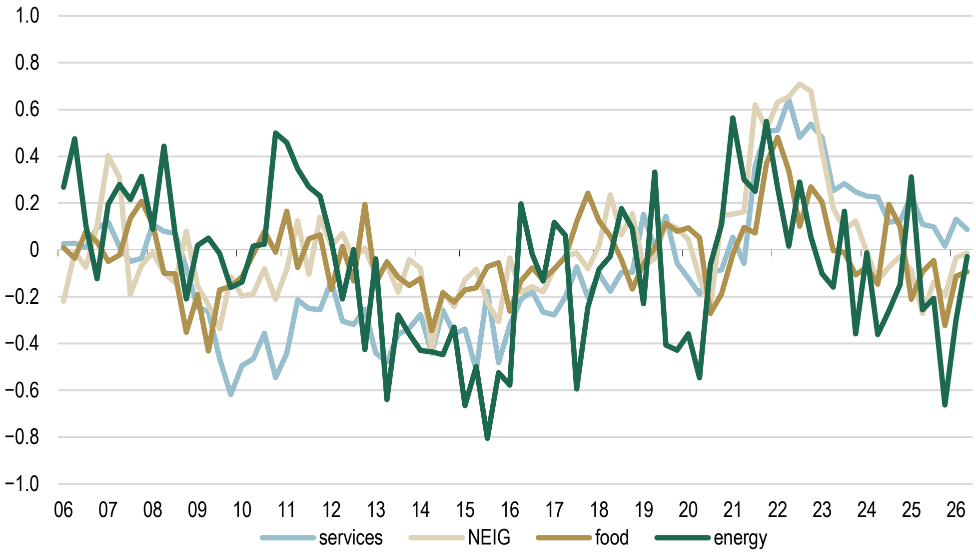
This paper builds a euro area ISMI following Lansing and Shapiro (2026) and assesses its value as a real-time gauge of persistent inflationary pressures by testing how well it captures and anticipates inflation dynamics. The results show that the ISMI closely tracks inflation dynamics. For most of the sample period, the index has been dominated by unidirectional momentum rather than a balanced mix – negative momentum prevailed for much of the past decade, while positive momentum became widespread during the post-pandemic inflation surge. Furthermore, a decomposition according to the main HICP components shows that core components, especially services, account for most of the persistent inflationary pressures.

We further assess the leading properties of the ISMI using three complementary approaches. The lead–lag correlation analysis shows that the ISMI leads headline inflation by four months and core inflation by ten months, comparing favourably to most commonly used measures of underlying inflation in terms of timeliness, albeit at the cost of greater volatility. Moreover, local projection estimates suggest that increases in the ISMI are associated with statistically significant cumulative changes in the price level even beyond the short term. Finally, the out-of-sample forecasting exercise shows that augmenting conventional forecasting models with the ISMI reduces the RMSFE by up to 20% at shorter horizons, with the gains concentrated in the post-pandemic period. This suggests that the informational content of the ISMI becomes particularly valuable in periods of heightened uncertainty, when models based primarily on historical inflation dynamics may become less informative.

Combined with the established measures of underlying inflation, the ISMI can help policymakers form a timelier and more nuanced assessment of medium-term inflationary pressures and better calibrate the appropriate policy response. Moreover, its demonstrated leading properties and short-term forecasting gains suggest that the index can serve as a forward-looking variable in inflation forecasting models, particularly during periods of heightened uncertainty, when historical inflation dynamics alone may offer limited guidance.

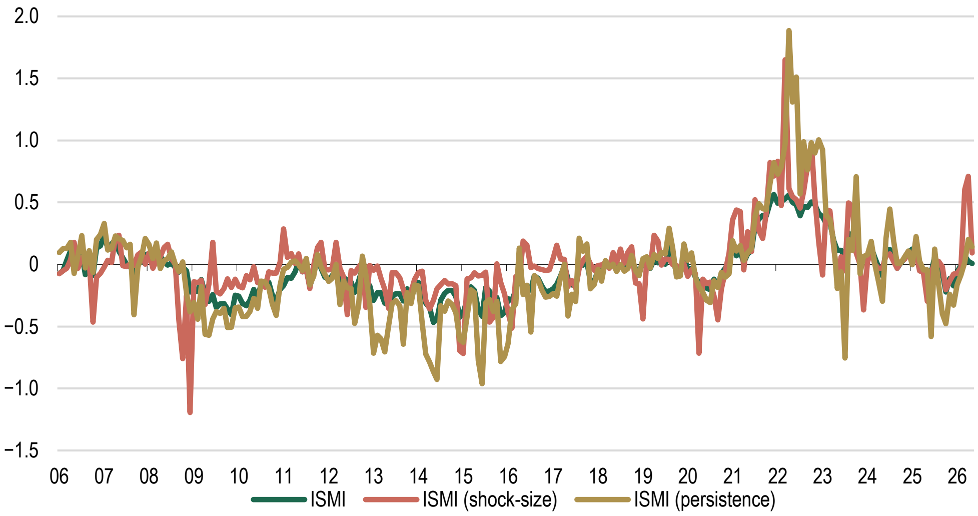
5 Appendix

Figure 8: **Quarterly ISMI for main inflation components**



Source: own calculations.

Figure 9: **Monthly ISMI along with shock-size and inflation persistence adjusted counterparts**



Source: own calculations.

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