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Sectoral Shock Transmission in Euro Area Services Inflation

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Abstract

This paper examines the propagation of demand and supply shocks in euro area services inflation at a granular level. Documented heterogeneity allows grouping of services into slow-propagating, fast-propagating and transitory components, with shock propagation concentrated primarily in the slow-propagating group. Wage sensitivity emerges as an important transmission mechanism. Wage-sensitive services display systematically stronger internal propagation and slower dissipation of shocks than wage-insensitive services. These findings suggest that assessing medium-term services inflation pressures requires placing greater weight on slow-propagating components rather than relying solely on aggregate services inflation.

This paper¹ studies how demand and supply shocks propagate through services prices in the euro area. The objective is to identify which service components generate sustained inflationary pressures to extract a clearer signal for medium-term services inflation.

Services inflation emerged as the main source of headline inflation persistence in recent years, as the effects of post-pandemic supply chain disruptions and energy price shocks gradually dissipated (Figure 1).

Aggregate services inflation masks heterogeneity at the subcomponent level, motivating the analysis in this paper. Price growth of some services components, such as package holidays and transport services, accelerated already in the early phase of the inflationary episode, while others, particularly housing-related and entertainment and repair services, adjusted more gradually and remain elevated. At the same time, prices in communication-related services declined, despite economy-wide cost pressures. Differences in wage-sensitivity also contributed to the heterogeneity. Wage-insensitive services drove the initial acceleration in services inflation, whereas wage-sensitive services prevented faster moderation in the disinflation phase (Figure 2).

Against this background, the paper addresses three research questions. First, does the propagation of demand and supply shocks differ across subcomponents? Second, what is the role of wage sensitivity? Third, can heterogeneous transmission of shocks across services subcomponents help with the assessment of aggregate services inflation developments?

These questions are examined using a small-scale, services-oriented Bayesian structural VAR model. The model is estimated using a dummy observation prior approach following Bańbura et al. (2010) and is extended to the services subcomponent level. To mitigate the influence of extreme pandemic-related observations, the analysis incorporates the Pandemic Prior method of Cascaldi-Garcia (2022).

The analysis delivers three main findings. First, demand-side shocks, on average, exhibit the strongest propagation into services prices, although the role of supply-side shocks is also non-negligible. Second, analysis of the sectoral shock propagation allows grouping of services into three categories: slow- and fast-propagating and transitory services. Inflation persistence is concentrated in a small set of services with large medium-term amplification and slow dissipation of shocks. Third, wage sensitivity arises as a propagation mechanism, as shocks transmit through wage-sensitive services for longer than through wage-insensitive services.

These results have direct policy relevance. When searching for a medium-term inflation signal, policymakers should place a greater weight on services activities where shocks propagate more slowly into final prices. The proposed grouping of services in this paper provides a structured framework for interpreting movements in aggregate services inflation and for assessing the policy relevance of inflation surprises. Services inflation

¹ The author would like to thank Gašper Ploj (Banka Slovenije) for an in-depth review of the paper. The author is also grateful to Mario Porqueddu (ECB), Nuno Vilarinho Gonçalves (ECB), Miha Breznikar (Banka Slovenije), colleagues at Banka Slovenije and participants at the DG-E Research Seminar at the ECB for their helpful comments and suggestions. Any errors that remain are entirely the responsibility of the author.

developments are more informative for medium-term inflation outlook when they originate from slow-propagating components, whereas deviations driven by transitory items are more likely to dissipate faster and carry limited policy relevance.

The remainder of the paper is organised as follows: Section 2 reviews the related literature, Section 3 describes the data and methodology and outlines the identification strategy, Section 4 presents the results, Section 5 discusses robustness checks, and Section 6 concludes.

2 Literature review

Following the outbreak of the COVID-19 pandemic, the services sector, like the broader economy, was hit by large shocks. Pandemic restrictions and the subsequent reopening of the economy directly influenced demand for services. On the supply side, cost pressures were amplified by the energy price spike associated with Russia's aggression against Ukraine, global supply chain bottlenecks and higher shipping costs (Carriere-Swallow et al., 2023; De Santis, 2024). Labour market developments also contributed: tight post-pandemic labour markets and robust wage growth increased cost pressures in the services sector, while elevated profit margins enabled firms to hoard labour, a phenomenon in which firms retain more employees than required by the workload and expected business conditions (Botelho, 2024).

This paper is related to the growing literature that explores the drivers of the post-pandemic inflation surge. De Santis (2024) jointly identifies supply chain and energy supply shocks and explores their role in the acceleration of core inflation between January 2020 and September 2022. Similarly, Bańbura et al. (2023) identify a broad set of structural shocks affecting core and services inflation in the euro area. Their findings support the “bad luck” narrative: multiple supply-side disturbances simultaneously exerted upward pressure on inflation.

Amatyakul et al. (2024) argue that services inflation is more persistent than goods inflation due to (i) lower sensitivity to energy prices, (ii) higher labour intensity and (iii) the large post-pandemic deviation of core goods prices from their long-run relationship with services prices, implying a potential for prolonged relative price adjustment. Labour market factors also supported post-pandemic services inflation: Ampudia et al. (2024) find a near one-for-one long-run pass-through of labour costs into private services prices.

In the US, Bernanke and Blanchard (2025) show that the initial inflation phase was driven by product market disruptions (product shortages and energy price increases), while labour market factors became increasingly important in the second phase amid persistent labour market tightness. Bernanke and Blanchard (2024) extend this framework to a broader set of countries and highlight similar post-pandemic drivers: as product supply shocks faded, labour market tightness and elevated wage growth became increasingly important. Hajdini (2024) links sector-level labour market tightness and wages to disaggregated services price inflation in the US and finds heterogeneous responses across sectors and systematically positive wage pass-through for education,

health, and leisure and hospitality services. Chen et al. (2024) likewise identify labour market tightness as a main driver of services inflation through the wage channel.

Services-related demand and supply shocks are identified with sign restrictions in this paper. Given the high labour intensity of service activities, the shock identification strategy draws on the literature that analyses labour market disturbances. Berg-holt et al. (2022) simulate a DSGE model over wide parameter ranges to establish theory-driven sign restrictions for structural shocks. In their application, Berg-holt et al. (2022) investigate the determinants of the declining labour share in the US and identify automation as the main driver. Foroni et al. (2018) disentangle labour supply and wage bargaining shocks and highlight their importance for output and unemployment. Labour market dynamics are closely related to inflation outcomes. Bobeica et al. (2019) demonstrate that the relationship between labour costs and inflation is both shock- and state-dependent and is stronger in high inflation environments. Bobeica et al. (2021) investigate the factors behind the declining pass-through of labour costs to inflation in the US. Foroni and Furlanetto (2025) analyse the structural drivers of deviations from Okun's law.

3

Data and empirical methodology

3.1 Data

Services prices emerged as the main driver of inflation in the euro area as the effects of post-pandemic supply chain and energy price shocks faded. Specifically, HICP services inflation averaged 3.4% in 2025, contributing around 1.6 percentage points to headline inflation, which stood at 2.1%. Figure 1 illustrates the evolution of headline, core and services inflation in the euro area. While services inflation lagged behind headline inflation during the initial phase of the post-pandemic inflation cycle, it remained elevated as inflation in other components moderated.

Aggregate services inflation masks heterogeneity across subcomponents (Figure 2, left). For example, price growth of package holidays and transport services accelerated early, while prices of services related to housing and entertainment and repair services adjusted more gradually. In contrast, communication services prices declined on average over the post-pandemic period, despite broad-based cost pressures. Appendix A.1 provides an overview of the specific services activities included in each group.

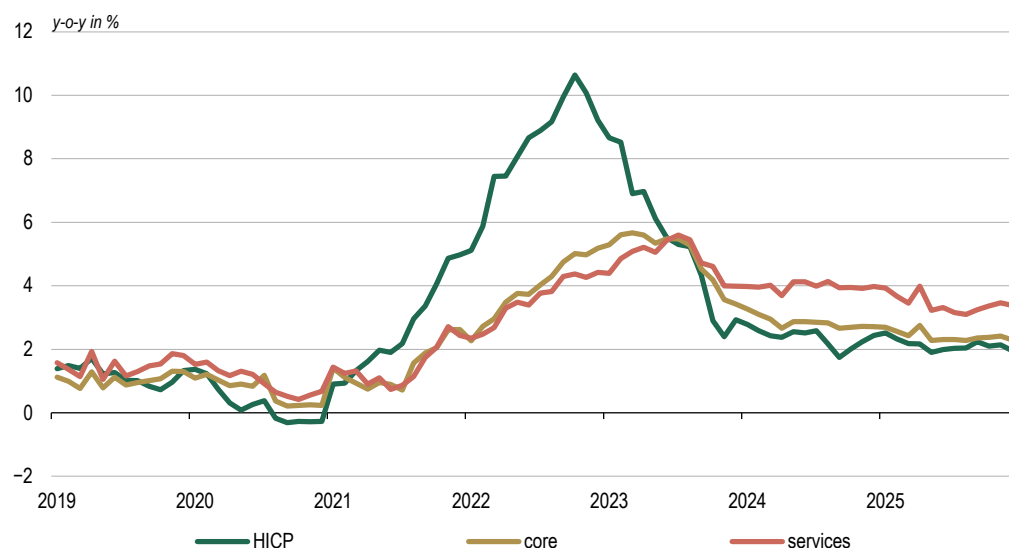
Wage sensitivity further differentiates services inflation dynamics: wage-insensitive services contributed more to the initial acceleration, whereas wage-sensitive services prevented faster moderation of price growth during the disinflation phase (Figure 2, right).

3.2 Empirical framework

To explore the drivers of services price growth, a small-scale, services-oriented BVAR model is constructed. The model includes four variables. HICP services are used to measure consumer price developments in the services sector. They are complemented

by three variables drawn from the national accounts, i.e. real value added, employment and real compensation per employee in services. The last is defined as the ratio of total compensation divided by the number of employees in services and deflated by the services value added deflator. The model is estimated on quarterly data spanning from 2001Q2 to 2025Q4. Series are seasonally adjusted and enter the model in log differences, approximating quarterly growth rates.

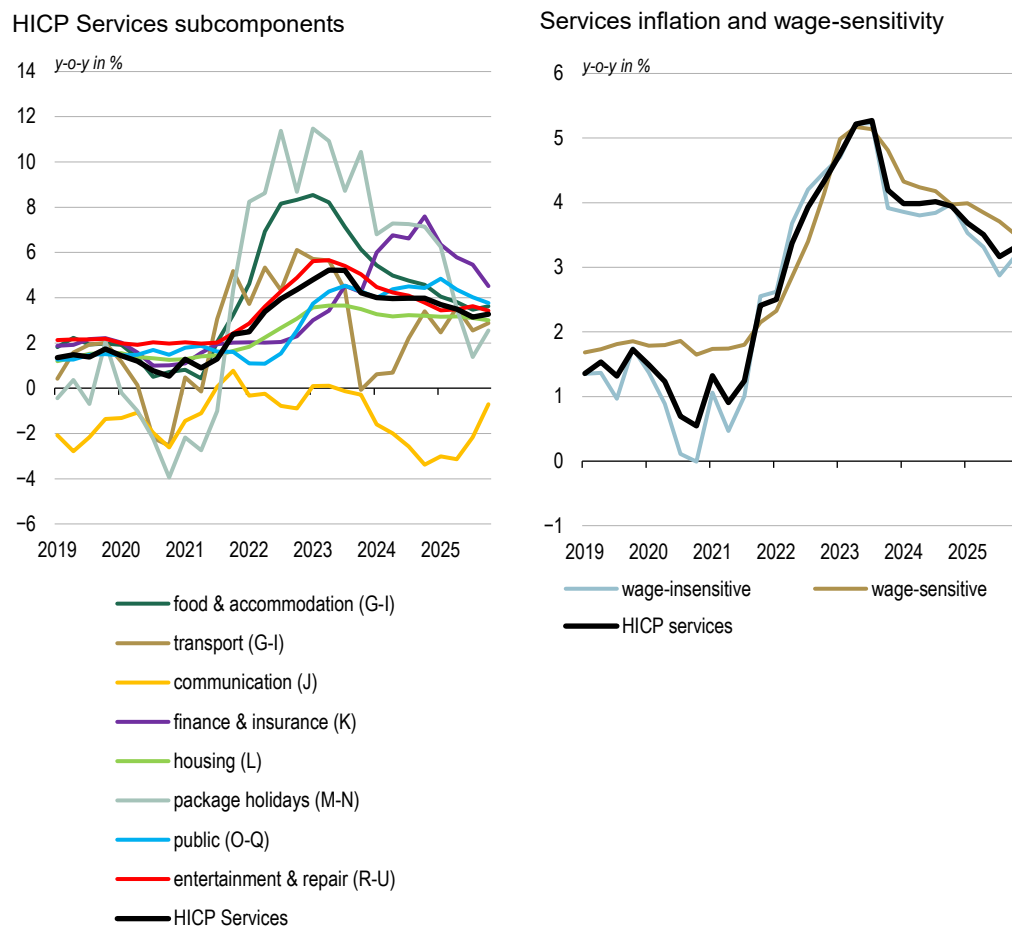
Figure 1: **Headline, core and services inflation in the euro area**



Note: Last data: December 2025.
Source: Eurostat.

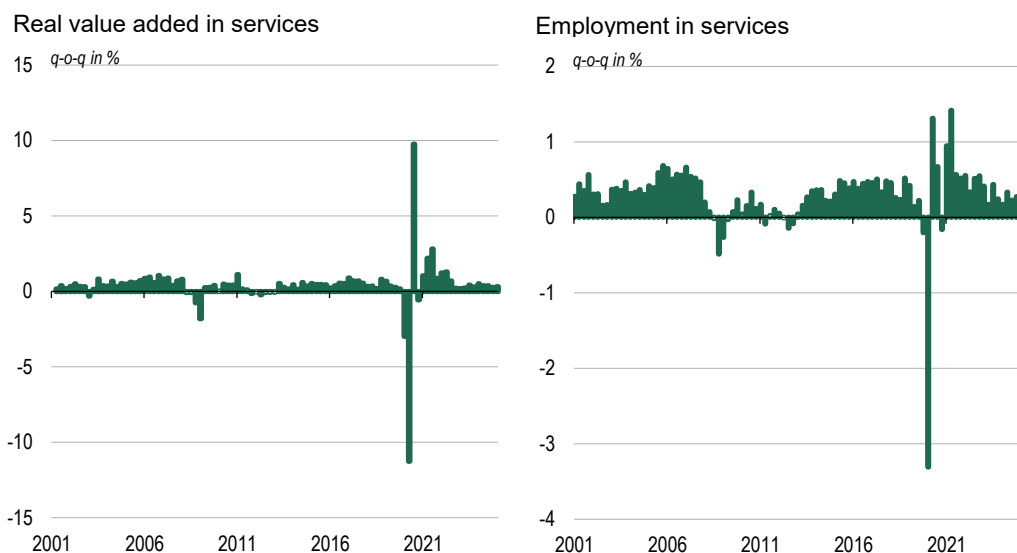
Variables based on national accounts data are constructed by aggregating the following NACE sectors: wholesale and retail trade, transport, accommodation and food services (G–I); information and communication (J); financial and insurance activities (K); real estate (L); professional, scientific and technical activities, administrative and support services (M–N); public administration, defence, education, health and social work (O–Q); and arts, entertainment and recreation, other services, and activities of households and extra-territorial organisations (R–U). Figures 3 and 4 report the evolution of the key model variables.

Figure 2: **HICP Services subcomponents inflation in the euro area**



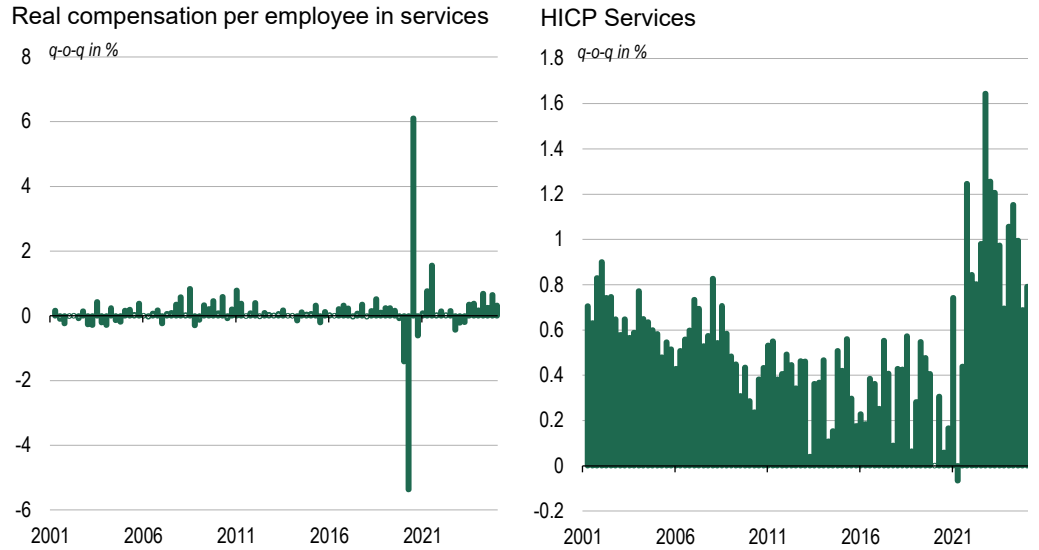
Notes: Last data: 2025Q4. Wage-sensitive services inflation follows Fagandini et al. (2024).
Sources: Eurostat, own calculations.

Figure 3: **Real value added and employment in services activities in the euro area**



Notes: Data are seasonally adjusted and displayed in log-differences. Last data: 2025Q4.
Source: Eurostat.

Figure 4: **Real compensation per employee in services and HICP Services**



Notes: Data are seasonally adjusted and displayed in log-differences. Last data: 2025Q4.
Source: Eurostat.

3.3 BVAR framework

The model is estimated using Bayesian methods with a Normal-Inverse-Wishart (NIW) prior, combining a Minnesota-type prior for the VAR coefficients with an inverse-Wishart prior for the residual covariance matrix, and includes four lags.² To prevent extreme pandemic observations from influencing the parameter estimates, I augment the model with pandemic time dummies for 2020Q2 and 2020Q3, the quarters of greatest distortion, following the approach of Cascaldi-Garcia (2022). A reduced-form VAR is:

$$Y_t = c + \sum_{j=1}^p A_j Y_{t-j} + \Gamma D_t + u_t,$$

where Y_t and c represent endogenous variables and intercepts respectively and D_t shows $h = 2$ pandemic time dummies with associated coefficients stored in Γ . Specifically, the elements of D_t equal one in 2020Q2 and 2020Q3 and zero otherwise. Finally, u_t represents reduced-form innovations and $\mathbb{E}[u_t u_t'] = \Psi$.

Following Bańbura et al. (2010), I impose prior beliefs on the moments for VAR coefficients with dummy observations:

$$\mathbb{E}[(A_k)_{ij}] = \begin{cases} \delta_i, & j = i, k = 1 \\ 0, & \text{otherwise} \end{cases}, \quad V[(A_k)_{ij}] = \begin{cases} \frac{\lambda^2}{k^d}, & j = i \\ \theta \frac{\lambda^2}{k^d} \frac{\sigma_i^2}{\sigma_j^2}, & \text{otherwise} \end{cases}$$

where λ represents overall tightness parameter, k number of lags, d governs tightness of lag decay, θ controls tightness of lags for other variables, and σ_i^2 is the residual variance from a univariate autoregressive model with p lags for variable i . This prior shrinks the first own lag (the diagonal elements of A_1) towards δ_i and all other coefficients to zero, with stronger shrinkage at longer lags. The prior on intercept is diffuse. For the reduced-form innovation covariance matrix Ψ , I use an inverse-Wishart prior. Selection of prior hyperparameters follows the standard values found in the literature (e.g. Cascaldi-Garcia, 2022; Dieppe et al., 2016).

² For robustness, the analysis was repeated with a model including two and five lags, which yielded similar conclusions.

Let Y_d and X_d denote the dummy observations for the left- and right-hand sides. These are stacked with the observed data to form Y_t^* and X_t^* , where

$$Y_t^* = \begin{bmatrix} Y_t \\ Y_d \end{bmatrix}, X_t^* = \begin{bmatrix} X_t \\ X_d \end{bmatrix},$$

and X_t contains lagged endogenous variables, a constant and the exogenous dummy vector D_t . The dummy observations are constructed as:

$$Y_d = \begin{bmatrix} \frac{\text{diag}(\delta_1 \sigma_1, \dots, \delta_n \sigma_n)}{\lambda} \\ 0_{n(p-1) \times n} \\ \dots \\ \text{diag}(\sigma_1, \dots, \sigma_n) \\ \dots \\ 0_{1 \times n} \\ 0_{h \times n} \end{bmatrix}, \quad X_d = \begin{bmatrix} J_p \otimes \frac{\text{diag}(\sigma_1, \dots, \sigma_n)}{\lambda} & 0_{np \times 1} & 0_{np \times h} \\ \dots & \dots & \dots \\ 0_{n \times np} & 0_{n \times 1} & 0_{n \times h} \\ \dots & \dots & \dots \\ 0_{1 \times np} & \epsilon & 0_{1 \times h} \\ 0_{h \times np} & 0_{h \times 1} & \text{diag}(\phi_1, \dots, \phi_h) \end{bmatrix}.$$

The first n rows impose the prior on the coefficients of A_1 , while the next $n(p-1)$ rows impose the prior on the remaining lag coefficients. The subsequent block contributes to the prior on Ψ , followed by the diffuse intercept prior. The final h rows implement pandemic dummy priors, where ϕ_i governs the tightness of the prior on the corresponding coefficient in Γ . Larger values of ϕ_i imply stronger shrinkage on that coefficient towards zero, while smaller values make the dummy less informative and allow the data to determine its estimate. I select ϕ_i using a data-driven procedure that maximises the model's marginal likelihood (Cascaldi-Garcia, 2022).

Let $B = [A_1, \dots, A_p, c, \Gamma]'$ collect all coefficients and let $m = np + 1 + h$. Stacking dummy observations with data yields Y_t^* and X_t^* . Under the NIW conjugate structure, the posterior distributions are:

$$\text{vec}(B) \mid \Psi, Y_t \sim \mathcal{N}(\text{vec}(\tilde{B}), \Psi \otimes (X_t^{*'} X_t^*)^{-1}) \text{ and } \Psi \mid Y_t \sim i\mathcal{W}(\tilde{\Sigma}, T_d + 2 + T - m),$$

where T is the sample size, T_d is the number of dummy observations and

$$\tilde{B} = (X_t^{*'} X_t^*)^{-1} (X_t^{*'} Y_t^*) \text{ and } \tilde{\Sigma} = (Y_t^* - X_t^* \tilde{B})'(Y_t^* - X_t^* \tilde{B}).$$

3.4 Shock identification

This section describes the identification of structural shocks using a sign restrictions approach (Arias et al., 2018). Four structural shocks are identified: a services demand shock, a labour supply shock, a labour intensity shock and another supply shock. This classification is designed to capture the main sources of fluctuations in services inflation, with particular emphasis on labour market-related disturbances given the high labour intensity of services. Table 1 summarises the sign restrictions imposed on the impact matrix.

The services demand shock is identified in line with standard macroeconomic theory. An expansionary services demand shock shifts the services demand curve outwards and is therefore characterised by positive co-movement in economic activity, labour market variables and prices.

The remaining shocks capture distinct supply-side innovations. The labour supply shock is caused by an exogenous increase in the availability of labour, for instance due to demographic changes, immigration or a lower disutility of labour. A larger effective

labour supply streamlines vacancy filling and reduces unit labour costs and inflationary pressures. On impact, this shock is therefore characterised by an upward surprise in employment and value added growth and a downward surprise in real wages and services price growth.

The labour intensity shock captures an exogenous increase in the labour input required to produce a given level of services output, implying a higher labour share in production. It is identified by an increase in employment combined with a decline in services value added on impact, reflecting lower labour productivity. This raises unit labour costs and puts upward pressure on services prices. Conceptually, the shock can be interpreted as the inverse of an automation shock (Foroni and Furlanetto, 2025; Berg-holt et al., 2022). It also captures phenomena such as labour hoarding, whereby firms retain more workers than warranted by current demand or expected business conditions. Such behaviour was particularly relevant in the euro area in the post-pandemic period, peaking in the second half of 2022 (Botelho, 2024).

Finally, the other supply shock captures residual non-labour cost-push shocks. This shock is identified with contraction in services value added, employment and real wages, combined with an upward surprise in services prices on impact. In the post-pandemic period, this shock is expected to capture, among other things, the effects of supply chain and geopolitical disruptions on services prices.

Table 1: **Sign restrictions**

	services demand	labour intensity	labour supply	other supply
Value added in services activities	+	-	+	-
Employment in services activities	+	+	+	-
Real wages in services activities	+		-	-
HICP Services	+	+	-	+

Note: The signs in the table show the restrictions imposed on the impact matrix.

4 Results

This section presents the empirical results. It begins with a discussion of the impulse response functions (IRFs), followed by a historical decomposition that provides a narrative of the post-pandemic services inflation surge. The analysis then turns to the sub-component level, where the model is estimated separately for each subcomponent to assess the propagation of shocks.

To compare shock propagation across subcomponents, shock dissipation speed and amplification measures are computed. Shock dissipation is measured by the half-life of the inflation response, defined as the number of quarters required for the impulse response to halve. Amplification is measured by a medium-term price level multiplier, defined as the ratio of the cumulative change in the services price level after 12 quarters to the contemporaneous impact response.

Based on these propagation measures, services are grouped into three categories and corresponding price indices are constructed. The role of wage sensitivity in shock transmission is subsequently examined. Finally, a forecasting exercise evaluates the usefulness of the propagation-based classification for assessing aggregate services inflation.

4.1 Analysing the headline model

Impulse response functions

Appendix A.2 reports the IRFs of HICP services to the identified structural shocks.³ The left-hand panel shows the responses of quarterly services inflation, while the right-hand panel shows the corresponding responses of the services price level. All shocks are scaled to increase the HICP services price level by 1% on impact,⁴ and responses are reported over a 12-quarter horizon.

The services demand shock generates the strongest response: the effect on services prices remains credibly positive for the longest period and yields the largest medium-term price level effect. By contrast, the effects of supply-side shocks dissipate faster. Overall, the IRFs underscore the shock-dependent nature of services inflation dynamics. Both the magnitude and persistence of price responses vary across shocks. Although the effects of supply-side shocks tend to be less persistent and less amplifying than demand shocks, supply-side shocks can still generate non-negligible medium-term price level effects. This suggests that supply-driven inflation developments should not be disregarded, particularly given the potential for second-round effects through wage and cost interactions.

Historical decomposition

This section presents a historical decomposition of post-pandemic services inflation developments, as suggested by the small-scale model. The model is estimated in log differences, approximating quarterly inflation rates. To ensure comparability with benchmark results expressed in year-on-year terms, an approximate year-on-year historical decomposition is constructed in two steps.

First, the level of HICP services is reconstructed by cumulatively summing the contributions of the identified structural shocks, exogenous variables and deterministic components implied by the model. This yields a synthetic log price index in which each component reflects the cumulative effect over time.

Second, year-on-year contributions are computed as four-quarter differences of cumulative components. Specifically, the contribution of each shock to year-on-year inflation at time t is calculated as the difference between its cumulative effect at t and at $t - 4$. This procedure delivers a decomposition of year-on-year inflation that is directly comparable to the existing literature, while remaining consistent with estimation in log differences.

Figure 5 shows the historical decomposition of euro area services inflation. During the inflationary period following the reopening of the economy, services demand shocks

³ Appendix A.3 shows the IRFs to a 1 standard deviation shock for all endogenous variables.

⁴ For the labour supply shock, this implies a sign inversion, such that the reported responses correspond to a negative labour supply shock.

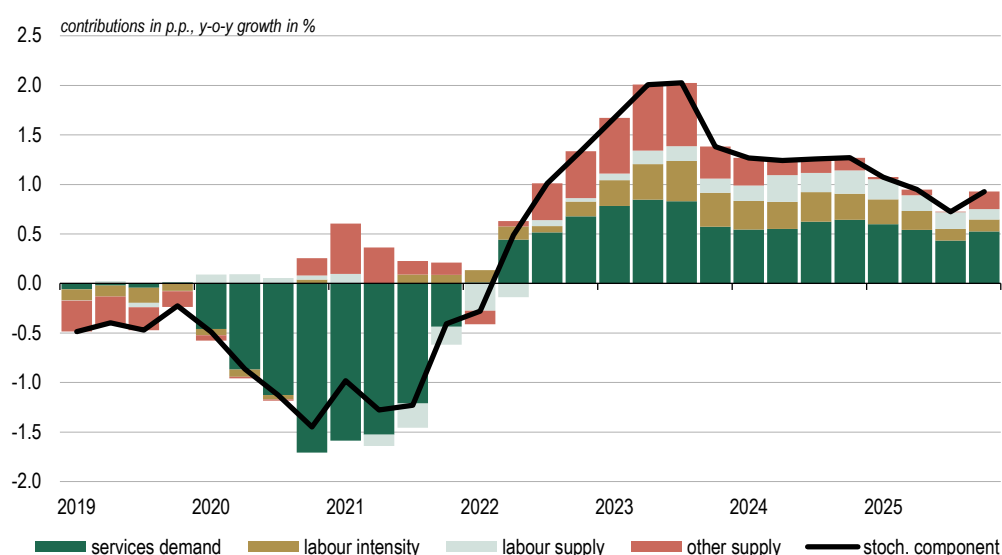
provided the main support to services inflation, reflecting the rebound in contact-intensive activities and the normalisation of consumption patterns.

In the early phase of the inflation surge, services inflation was also supported by non-labour supply shocks. These contributions capture price pressures related to global supply chain bottlenecks and the energy price shock following Russia's invasion of Ukraine, which affected services prices through non-labour cost channels. With the stabilisation of energy markets, the relevance of these shocks gradually diminished. At the same time, the contribution of labour market-related shocks to services inflation started increasing, reflecting labour market tightness and labour hoarding.

In the most recent period, the decomposition indicates that the persistence of services inflation is primarily driven by the joint contribution of demand and labour market-related shocks, while the role of non-labour supply disturbances has become limited.

Overall, the qualitative pattern of shock contribution is broadly consistent with the existing literature (e.g. Bańbura et al., 2023; Hernández et al., 2025). This supports the suitability of the small-scale framework for analysing the propagation of shocks in services inflation and their heterogeneity across subcomponents.

Figure 5: **Historical decomposition of HICP Services inflation in the euro area.**



Note: The figure shows the pointwise median contribution of structural shocks to services inflation in deviation from the impact of initial conditions and exogenous variables. Last data: 2025Q4.
Source: Eurostat.

4.2 Under the hood: Sector-specific heterogeneity

This section classifies services activities into propagation-based groups according to how shocks transmit into final prices. The analysis proceeds in four steps. First, HICP services items at the four-digit ECOICOP level are mapped to NACE activities, assigning each component to a specific services activity group. Second, the matched services activities are aggregated to construct group-specific price indices. Third, for each group, a corresponding dataset of sector-level national accounts variables, i.e. value added, employment and real compensation per employee, is compiled.⁵ Finally, the

⁵ Sectoral real compensation per employee is calculated by deflating nominal sectoral compensation per employee with the corresponding sectoral value added deflator.

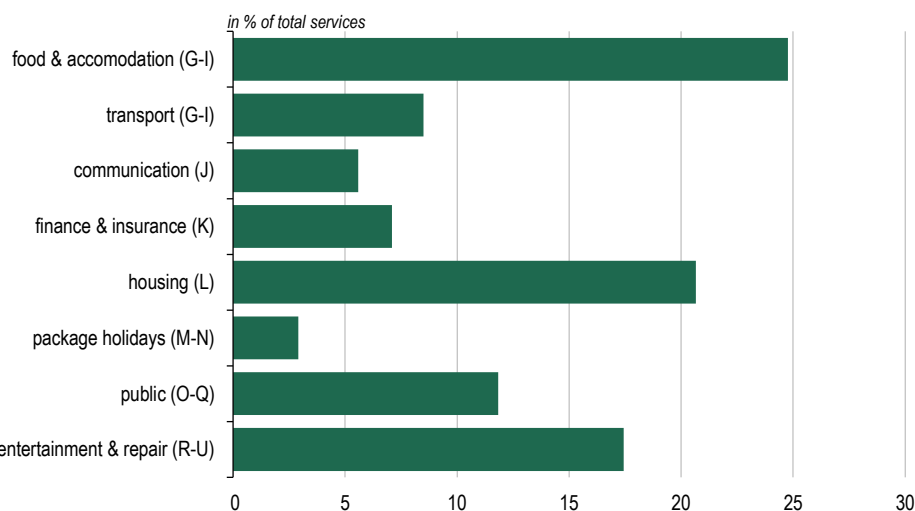
model is estimated separately for each category.⁶ Next, shock dissipation speed and amplification are obtained to measure the propagation characteristics of each services category.

Appendix A.1 provides the detailed mapping. Table 2 summarises the matching between the constructed services categories and their associated national accounts sectors. Figure 6 reports the distribution of HICP services weights across groups. Food and accommodation services account for the largest share, followed by housing-related services.

Table 2: **services groups and corresponding national accounts sectors**

services category	national accounts group (NACE)
food & accommodation	Wholesale and retail trade, transport, accommodation and food service activities (G-I)
transport	Wholesale and retail trade, transport, accommodation and food service activities (G-I)
communication	Information and communication activities (J)
finance & insurance	Financial and insurance activities (K)
housing	Real estate activities (L)
package holidays	Professional, scientific and technical activities, administrative and support service activities (M-N)
public	Public administration, defence, education, human health and social work (O-Q)
entertainment & repair	Arts, entertainment and recreation, other service activities, activities of household and extra-territorial organizations and bodies (R-U)

Figure 6: **Services groups weights**



Last data: 2025.
Sources: Eurostat, own calculations.

Tables 3 and 4 summarise shock propagation across groups based on the median IRFs. Table 3 reports dissipation speed, measured by the half-life of the IRF. The results reveal differences across groups. Housing and entertainment & repair services

⁶ Each model for every subcomponent is estimated with four lags, following the same methodology as the baseline specification.

exhibit the slowest dissipation, with average half-lives of 7.8 and 5.3 quarters respectively. By contrast, package holidays, transport and public services display the fastest dissipation, with half-lives closer to two quarters.

Table 4 reports the amplification, measured by the 12-quarter multiplier. The ranking broadly mirrors the dissipation speed estimates. Housing and entertainment & repair services display the largest medium-term multipliers, while package holidays, transport and public services show the smallest amplification.

These propagation characteristics allow services to be grouped into three categories. Housing and entertainment & repair services form the slow-propagating group, combining long half-lives and large amplification multipliers. Food & accommodation, communication, and finance & insurance constitute fast-propagating services. These components exhibit meaningful amplification effects but dissipate faster than the slow-propagating group. Finally, the transport, public services and package holidays groups are classified as transitory services, characterised by rapid dissipation and limited medium-term amplification.

Table 3: Dissipation speed of shocks for each services subcomponent

	services demand	labour intensity	labour supply	other supply	average half-life
food & accommodation (G–I)	7	5	3	2	4.3
transport (G–I)	3	2	2	2	2.3
communication (J)	3	3	4	3	3.3
finance & insurance (K)	3	4	2	3	3.0
housing (L)	9	13	4	5	7.8
package holidays (M–N)	2	2	2	2	2.0
public (O–Q)	3	2	3	3	2.8
entertainment & repair (R–U)	6	5	5	5	5.3

Note: The table measures the half-life of IRFs, i.e. the number of quarters it takes for the IRF to halve.

Table 4: Shock amplification of services subcomponents

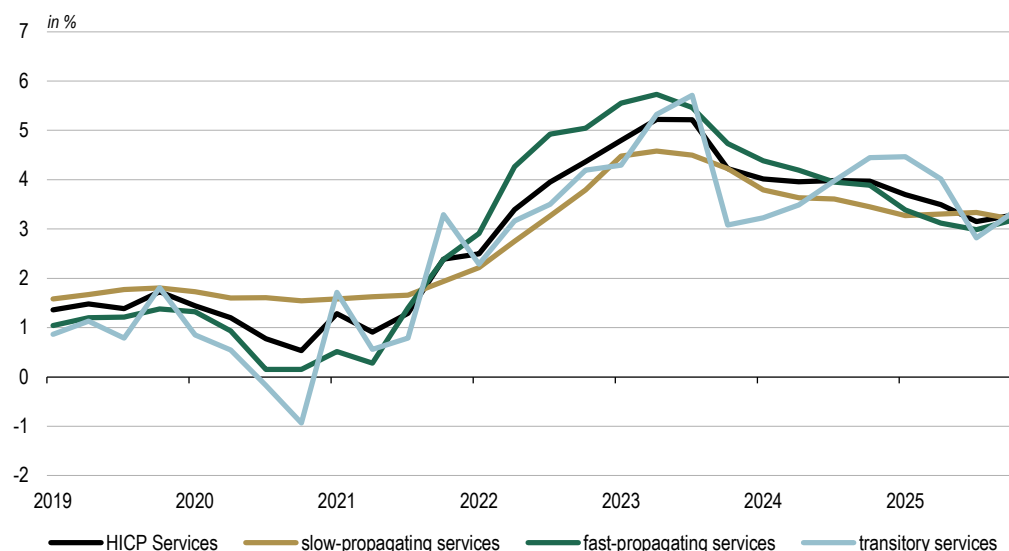
	services demand	labour intensity	labour supply	other supply	average multiplier
food & accommodation (G–I)	7.1	4.5	1.6	2.5	3.9
transport (G–I)	2.1	1.9	1.4	1.6	1.8
communication (J)	2.5	3.0	3.8	2.5	3.0
finance & insurance (K)	2.6	4.1	1.9	2.4	2.7
housing (L)	7.4	12.9	4.4	5.4	7.5
package holidays (M–N)	1.8	1.9	1.9	1.8	1.9
public (O–Q)	2.1	1.8	3.4	2.3	2.4
entertainment & repair (R–U)	5.8	5.0	4.7	4.8	5.1

Note: The table reports the 12-quarter cumulative change in the price level (in %) following a shock that raises the price growth by 1 percentage point on impact.

Figure 7 plots the year-on-year change of the newly generated indices, along with headline services inflation. The observed dynamics are consistent with the estimated

propagation patterns. The initial acceleration in services inflation in 2021 was driven primarily by fast-propagating services, which reacted quickly and strongly to shocks hitting the economy. Transitory services also contributed to the early surge, reflecting the rapid price adjustment characteristics of this group. In contrast, inflation in slow-propagating services strengthened and moderated more gradually.

Figure 7:
**Propagation-based
grouping of services
inflation**



Notes: Slow-propagating services include housing and entertainment & repair services; fast-propagating services contain food, accommodation, communication, finance and insurance services; and transitory services contain transport and public services, along with package holidays. Last data: 2025Q4.

Sources: Eurostat, own calculations.

As the inflation episode progressed, fast-propagating services continued to drive headline inflation. Over time, however, inflation in the slow-propagating group steadily caught up, becoming an increasingly important source of persistence.

Following the peak, inflation declined in both fast- and slow-propagating services, albeit at different speeds. Inflation in fast-propagating services moderated more strongly in relative terms, in line with their faster dissipation of shocks. By contrast, inflation in slow-propagating services eased more gradually, reflecting slower internal shock propagation dynamics. Transitory services remained volatile throughout the period, limiting their usefulness as an indicator of medium-term inflation pressures.

Towards the end of the sample, inflation rates across groups converged to broadly similar levels. This convergence masks differences in adjustment dynamics, however. Fast-propagating services reached the current level through a sharper relative decline from the peak, whereas slow-propagating services converged through gradual dissipation of past shocks.

Specifically, inflation in slow- and fast-propagating services stands 28% and 44% respectively, below its peak in the second quarter of 2023. Consequently, similar current inflation rates do not imply similar inflation risks going forward. In the absence of new shocks, transitory and fast-propagating services are expected to normalise more rapidly, while slow-propagating services are likely to remain elevated for longer, due to their propagation characteristics.

Two policy conclusions emerge. First, services inflation persistence is concentrated in a subset of components where shocks generate long-lived price effects. Second, assessing medium-term services inflation pressures requires placing greater weight on slow-propagating services and, to a lesser extent, fast-propagating services, rather than on volatile transitory components.

4.3 Does wage-sensitivity matter for the transmission of shocks?

This section examines whether wage sensitivity influences the propagation of shocks in services inflation. Fagandini et al. (2024) document that, since late 2023, wage-sensitive services inflation started exceeding wage-insensitive services inflation, consistent with strong labour cost growth during that period.

Wage-sensitive and wage-insensitive services price indices are constructed following Fagandini et al. (2024). They identify wage-sensitive services by combining input–output tables with HICP item-level data to compute the share of direct wage costs in total input costs for each item. Services items are classified as wage-sensitive if their wage cost share exceeds a threshold (set at 38%), reflecting above-average labour cost intensity.

Relative to Fagandini et al. (2024), this paper applies one key adjustment. This paper uses four-digit ECOICOP data, as the five-digit price indices used by Fagandini et al. (2024) have only been available since 2017. Aggregation at the four-digit level requires two adjustments, as this level bundles the prices of several services activities and sometimes also goods. First, groups in which services account for only a negligible share are excluded (e.g. CP12313 represents less than 2% of CP1231).⁷ Second, when a four-digit group contains both wage-sensitive and wage-insensitive services, it is classified as wage-sensitive if wage-sensitive items account for more than half of the group's services weight. In 2025, wage-sensitive and wage-insensitive services accounted for 35% and 65% of all consumer services activities respectively.

Two otherwise identical SVARs are then estimated, differing only in the services inflation measure (either wage-sensitive or wage-insensitive), while the macroeconomic block and identification scheme remains unchanged. Shock propagation is subsequently compared across the two specifications.

Appendix A.4 shows that responses to the identified shocks propagate longer for the wage-sensitive services. The difference is particularly pronounced for services demand and other supply shocks capturing non-labour cost-push shocks. A natural interpretation is that wage-sensitive services, characterised by a higher labour share in average costs, exhibit stickier price adjustment and stronger internal cost propagation. As a result, shocks generate more persistent wage-cost dynamics and keep inflation elevated for longer. By contrast, wage-insensitive services dissipate faster, consistent with a greater role for non-labour inputs and more flexible pricing.

Tables 5 and 6 summarise these findings. Across all shocks, wage-sensitive services exhibit longer half-lives and larger 12-quarter multipliers than wage-insensitive services. Average half-lives amount to 5.0 quarters for wage-sensitive services compared with 2.3 quarters for wage-insensitive services. The corresponding average 12-quarter multipliers are 5.0 and 1.8 respectively. These differences indicate that wage sensitivity

⁷ ECOICOP CP12313 refers to repair of jewellery, clocks and watches (level 5), while CP1231 denotes the broader jewellery, clocks and watches category (level 4).

is closely associated with slower dissipation and stronger medium-term amplification of shocks.

Table 5: Dissipation speed of shocks based on wage sensitivity

	services demand	labour intensity	labour supply	other supply	average half-life
wage-sensitive	4	6	4	6	5.0
wage-insensitive	2	3	2	2	2.3

Note: The table measures the half-life of IRFs, i.e. the number of quarters it takes for the IRF to halve.

Table 6: Shock amplification and wage sensitivity

	services demand	labour intensity	labour supply	other supply	average multiplier
wage-sensitive	4.6	5.3	4.7	5.4	5.0
wage-insensitive	2.0	2.2	1.5	1.7	1.8

Note: The table reports the 12-quarter cumulative change in the price level (in %) following a shock that raises the price growth by 1 percentage point on impact.

4.4 Forecasting performance of propagation-based groupings

The structural analysis indicates that aggregate services inflation comprises components with markedly different propagation properties, potentially masking the medium-term inflation signal. To assess whether the propagation-based classification is useful not only for interpreting past and current inflation developments, but also for forecasting future inflation, this section evaluates a straightforward forecasting exercise.

The objective is to test whether modelling services components with different propagation characteristics separately yields a more informative forecast of aggregate services inflation than forecasting the aggregate directly. The underlying premise is that propagation-based groupings capture heterogeneity across services subcomponents that is masked in the aggregate index. The forecasting framework is deliberately parsimonious, so that any improvement in performance can be attributed to the economic classification rather than to model complexity.

Year-on-year inflation rates are forecasted separately for aggregate HICP services, slow- and fast-propagating services, and transitory services using univariate autoregressive models. The lag order is selected using the Akaike Information Criterion, and forecasts are generated using an expanding window to mimic a real-time exercise. The initial estimation sample consists of 120 monthly observations, after which forecasts are produced up to 12 months ahead.

Formally, inflation in component i is modelled as

$$\pi_{i,t} = \mu_i + \sum_{l=1}^p \phi_{i,l} \pi_{i,t-l} + \varepsilon_{i,t},$$

where p denotes the lag order and i indexes the forecasted inflation measure (HICP services, slow- and fast-propagating services, and transitory services).

Component-level forecasts are then aggregated into a bottom-up forecast for aggregate services inflation using HICP weights. Specifically, the aggregate forecast is constructed as a weighted average of forecasts for slow- and fast-propagating and transitory services:

$$\hat{\pi}_{t+h|t}^{PERS} = \frac{w_t^{SlowP} \hat{\pi}_{t+h|t}^{SlowP} + w_t^{FastP} \hat{\pi}_{t+h|t}^{FastP} + w_t^{TransS} \hat{\pi}_{t+h|t}^{TransS}}{w_t^{SlowP} + w_t^{FastP} + w_t^{TransS}}$$

Forecast accuracy is evaluated by comparing both the bottom-up and aggregate forecasts with realised aggregate services inflation over horizons from one to 12 months. Accuracy is measured using the root mean squared forecast error (RMSFE):

$$RMSFE(h) = \sqrt{\frac{1}{T} \sum_t e_{t,h}^2} = \sqrt{\frac{1}{T} \sum_t (\pi_t^{SERV} - \hat{\pi}_{t+h|t}^i)^2},$$

where π_t^{SERV} denotes actual services inflation and $\hat{\pi}_{t+h|t}^i$ the model-based forecast. To facilitate comparison, performance is summarised by the ratio of RMSFE from the bottom-up forecast to that from the aggregate forecast. Values below one indicate relative outperformance of the bottom-up approach.

Table 7 reports the results across forecast horizons for the full sample, the pre-pandemic period and the post-pandemic period. The bottom-up forecasting approach based on propagation groupings consistently outperforms the aggregate forecast across horizons, both before and after the pandemic.

These findings provide additional evidence that accounting explicitly for heterogeneity in shock propagation across services components improves the assessment of medium-term services inflation relative to relying solely on the aggregate services inflation developments.

Table 7: **Relative forecast accuracy**

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12
entire sample	0.97	0.92	0.89	0.87	0.88	0.88	0.89	0.89	0.89	0.90	0.90	0.90
before pandemic	1.06	1.00	0.97	0.94	0.91	0.88	0.87	0.84	0.82	0.80	0.78	0.77
after pandemic	0.90	0.89	0.86	0.85	0.87	0.88	0.89	0.90	0.91	0.92	0.92	0.93

Note: RMSFE ratio (bottom-up / aggregate). A value below 1 indicates superior forecasting performance of a bottom-up approach.

5 Robustness tests

Three sets of robustness tests are conducted to validate the empirical findings. First, an alternative approach is used to control for pandemic-related volatility in the data. Second, the dissipation speed of shocks is re-evaluated using an alternative dissipation speed metric. Third, inference is performed on a pre-pandemic sample to verify that the classification into propagation-based groups is not driven by the post-pandemic inflation episode.

5.1 Alternative treatment of pandemic volatility

This subsection assesses the robustness of the baseline results to an alternative treatment of pandemic-related volatility. Instead of relying on the Pandemic Prior method (Cascaldi-Garcia, 2022), the model is estimated following the Bobeica and Hartwig (2021) approach, which relaxes the assumption of Gaussian errors and allows for Student's t-distributed errors.

The key idea of the alternative approach is to explicitly account for extreme observations by permitting time-varying shock volatility. In practice, this is implemented through a latent scale factor that inflates the error variance during periods of unusually large movements, such as lockdowns and subsequent reopenings. As a result, large observations are absorbed as temporary volatility rather than interpreted as structural shifts in economic relationships. This approach preserves information from the full sample while limiting the influence of outliers.

Appendix A.5 compares the baseline IRFs of HICP services inflation with those obtained under the t-distributed specification. The responses are both quantitatively and qualitatively similar. This confirms that the baseline findings are not driven by the treatment of pandemic volatility and supports the use of the more parsimonious Pandemic Prior specification.

5.2 Alternative dissipation speed measure

In the main analysis, dissipation speed is measured by the half-life of the impulse response. As an alternative metric, dissipation speed is defined as the number of quarters during which the IRF remains credibly positive, i.e. until the lower bound of the credibility interval falls below zero.

Table 8 reports the results. For each services subcomponent and shock, the table shows how long HICP services price growth remains credibly positive following a shock that raises quarterly price growth by one percentage point on impact. The main conclusions remain broadly unchanged with one adjustment: public services would be assigned into the fast-propagating services group, replacing communication services. Beyond this adjustment, the classification of services into propagation-based groups is robust in terms of the choice of persistence metric.

Table 8: Dissipation speed of shocks across services subcomponents: lower bound of credibility interval

	services demand	labour intensity	labour supply	other supply	average
food & accommodation (G–I)	>12	8	1	2	5.8
transport (G–I)	6	3	2	2	3.3
communication (J)	5	2	3	4	3.5
finance & insurance (K)	8	9	1	4	5.5
housing (L)	>12	>12	2	>12	9.5
package holidays (M–N)	4	3	2	3	3.0
public (O–Q)	6	2	5	5	4.5
entertainment & repair (R–U)	>12	3	4	>12	7.8

Note: The table reports the number of quarters for which the impulse response of HICP services price growth remains credibly positive following each shock. Shocks are normalised such that the corresponding services subcomponent price growth increases by 1 percentage point on impact.

5.3 Pre-pandemic sample

To assess whether the propagation-based classification is driven by post-pandemic services inflation developments, the model is re-estimated for each services subcomponent using a sample that ends in the fourth quarter of 2019.

Tables 9 and 10 report the half-life and amplification measures for the pre-pandemic sample respectively. The propagation patterns observed in the full sample were already present prior to the pandemic, although generally at a lower intensity. Importantly, the relative ranking of services subcomponents remains broadly unchanged. The only notable difference concerns transport and finance & insurance services, which switch groups. Overall, the results indicate that the identified propagation heterogeneity reflects structural features of services activities rather than being solely a product of the post-pandemic episode.

Table 9: **Dissipation speed of shocks across services subcomponents: pre-pandemic sample**

	services demand	labour intensity	labour supply	other supply	average half-life
food & accommodation (G–I)	3	3	3	3	3.0
transport (G–I)	4	3	3	3	3.3
communication (J)	3	3	4	3	3.3
finance & insurance (K)	3	3	3	3	3.0
housing (L)	6	9	3	4	5.5
package holidays (M–N)	2	2	2	2	2.0
public (O–Q)	2	2	3	3	2.5
entertainment & repair (R–U)	4	6	3	4	4.3

Note: The table measures the half-life of IRFs, i.e. the number of quarters it takes for the IRF to halve.

Table 10: **Shock amplification of services subcomponents: pre-pandemic sample**

	services demand	labour intensity	labour supply	other supply	average multiplier
food & accommodation (G–I)	3.4	3.0	3.0	2.7	3.0
transport (G–I)	3.3	2.8	3.3	2.8	3.0
communication (J)	2.3	3.1	4.1	3.3	3.2
finance & insurance (K)	2.4	2.4	2.5	2.3	2.4
housing (L)	6.1	8.4	3.0	4.2	5.4
package holidays (M–N)	1.9	2.0	1.8	1.8	1.9
public (O–Q)	2.0	1.5	3.3	2.2	2.3
entertainment & repair (R–U)	3.9	5.8	2.7	3.5	4.0

Note: The table reports the 12-quarter cumulative change in the price level (in %) following a shock that raises the price growth by 1 percentage point on impact.

This paper analyses how demand and supply shocks propagate through services prices in the euro area, with a focus on heterogeneity across services subcomponents. In recent years, services inflation accelerated markedly and remained elevated even as price pressures eased in other parts of the consumption basket. At the same time, aggregate services inflation concealed substantial differences in pricing dynamics across its underlying components.

The analysis yields three main findings. First, at the aggregate level, services inflation in the euro area exhibits shock-dependence, as services demand shocks generate the most persistent response. Conversely, labour supply shocks tend to have relatively transitory effects. Second, moving beyond the aggregate reveals pronounced heterogeneity in shock propagation across services subcomponents. Based on dissipation speed and amplification metrics, services can be classified into slow- and fast-propagating and transitory components. Third, wage sensitivity emerges as an important mechanism underpinning these differences. Wage-sensitive services display stronger internal propagation and slower dissipation of shocks than wage-insensitive services, indicating a closer link to domestic cost dynamics.

These findings have two main policy implications. First, they enhance signal extraction in the assessment of medium-term services inflation. Slow-propagating services provide the clearest indication of underlying inflation persistence, whereas transitory services contribute mainly to short-term volatility. Second, the propagation-based classification improves the interpretation of inflation surprises and the disinflation process. A decline in aggregate services inflation does not necessarily signal a durable easing of inflationary pressures. Specifically, moderation driven by transitory components has limited implications for the medium term, while easing in slow-propagating services points to a more sustained reduction in underlying price pressures. Distinguishing between these dynamics can improve the assessment of services inflation developments and support policy decision-making.

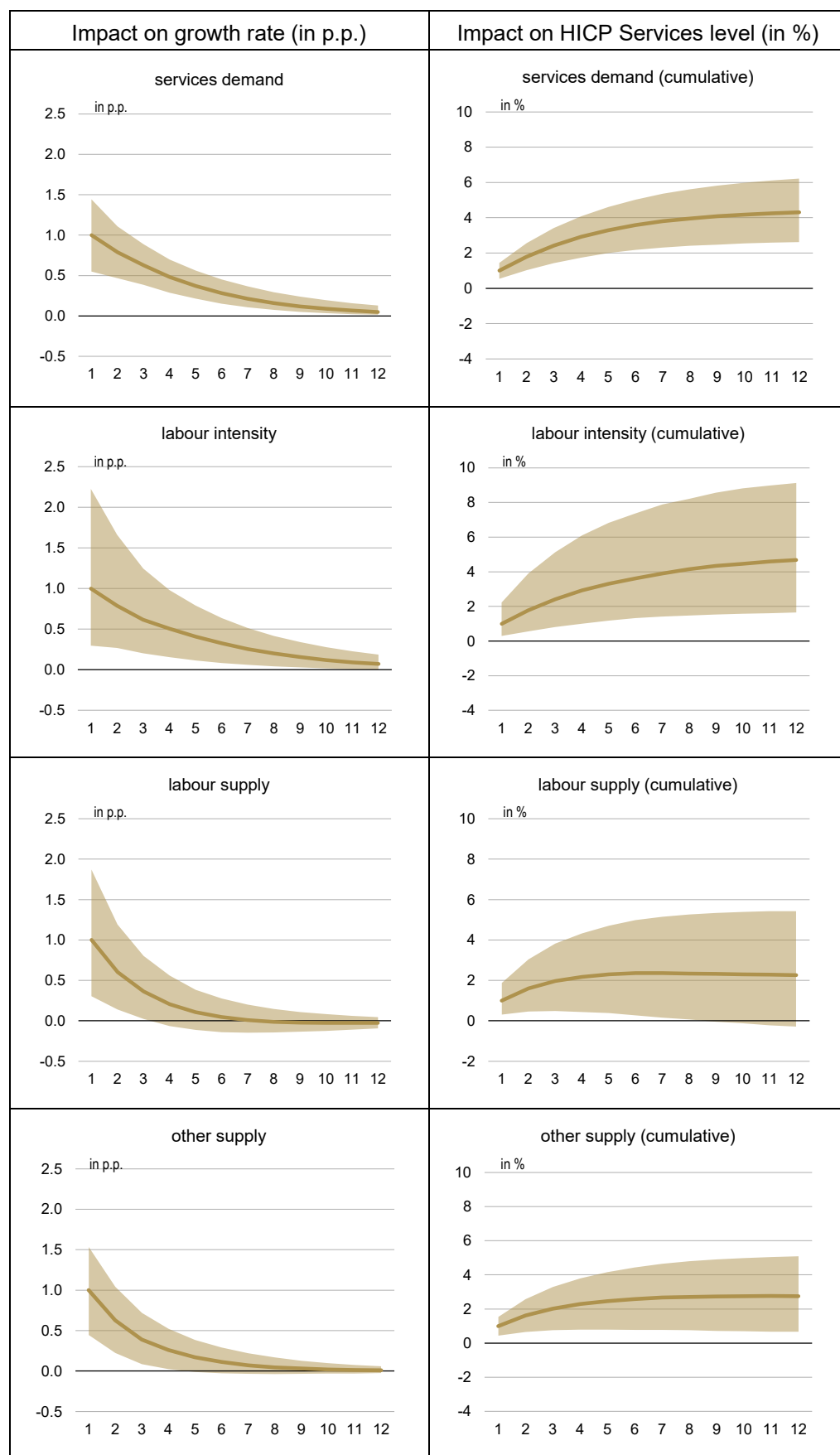
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Appendix

A.1 ECOICOP-NACE mapping of services activities

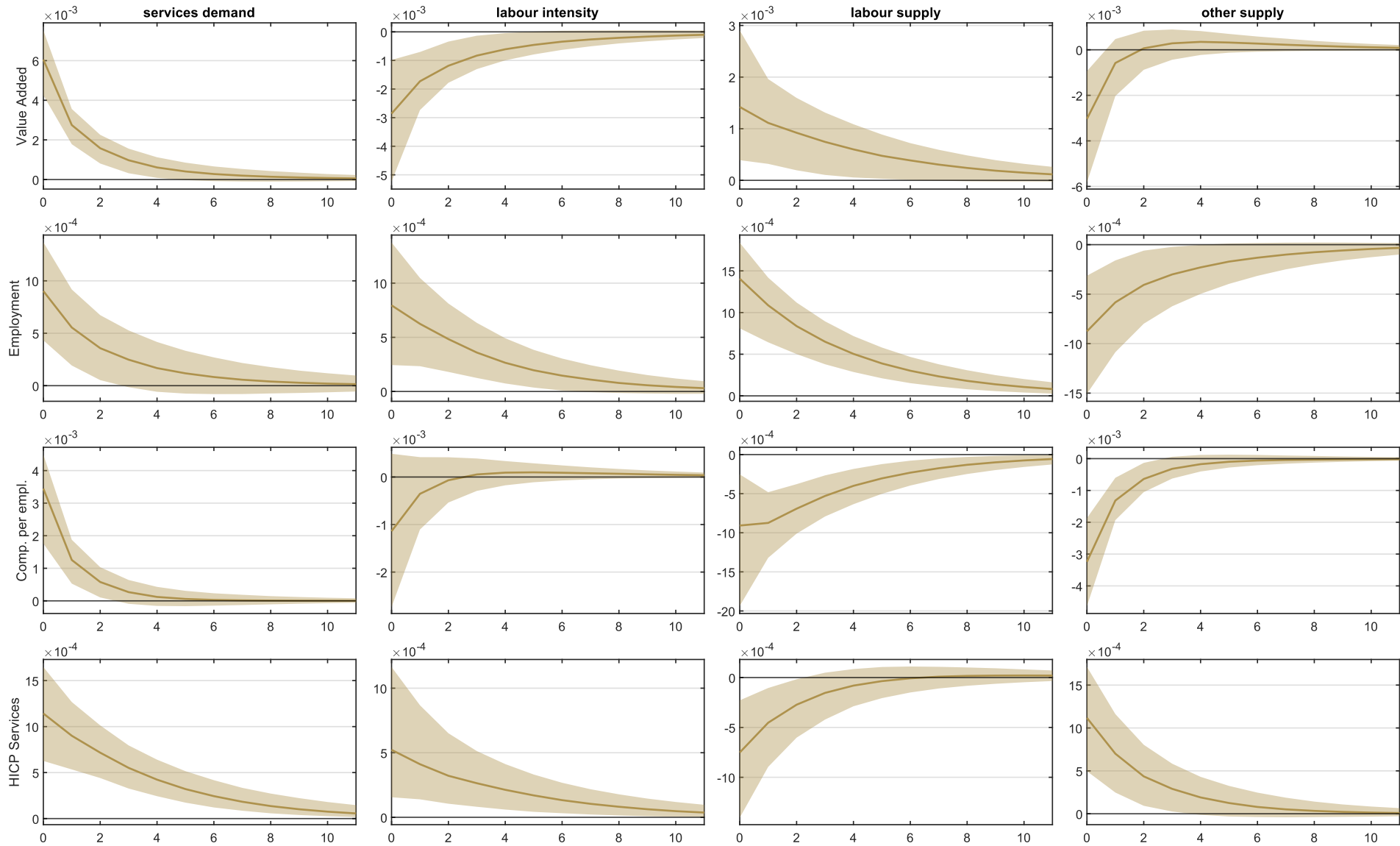
Subcomponent	ECOICOP	Services activity
transport (G–I)	072400	Other services in respect of personal transport equipment
	073100	Passenger transport by railway
	073200	Passenger transport by road
	073300	Passenger transport by air
	073400	Passenger transport by sea and inland waterway
	073500	Combined passenger transport
	073600	Other purchased transport services
food & accommodation (G–I)	111100	Restaurants, cafes and the like
	111200	Canteens
	112000	Accommodation services
communication (J)	08X000	Telephone and telefax equipment and tel. and telefax services
	081000	Postal services
finance & insurance (K)	125200	Insurance connected with the dwelling
	125300	Insurance connected with health
	125400	Insurance connected with transport
	125500	Other insurance
	126000	Financial services n.e.c.
housing (L)	041000	Actual rentals for housing
	043200	Services for the maintenance and repair of the dwelling
	044200	Refuse collection
	044300	Sewerage collection
	044400	Other services relating to the dwelling n.e.c.
	051300	Repair of furniture, furnishings and floor coverings
	053300	Repair of household appliances
	056200	Domestic services and household services
package holi- days (M–N)	096000	Package holidays
public (O–Q)	0621_3	Medical services
	062200	Dental services
	063000	Hospital services
	100000	Education
	124000	Social protection
entertainment & repair (R–U)	031400	Cleaning, repair and hire of clothing
	032200	Repair and hire of footwear
	072300	Maintenance and repair of personal transport equipment
	091500	Repair of audio-visual, photographic, info. processing equip.
	092300	Maintenance and repair of other major durables for recreation and culture
	093500	Veterinary and other services for pets
	094100	Recreational and sporting services
	094200	Cultural services
	121100	Hairdressing salons and personal grooming establishments
	127000	Other services n.e.c.

A.2 HICP Services IRFs in the baseline model



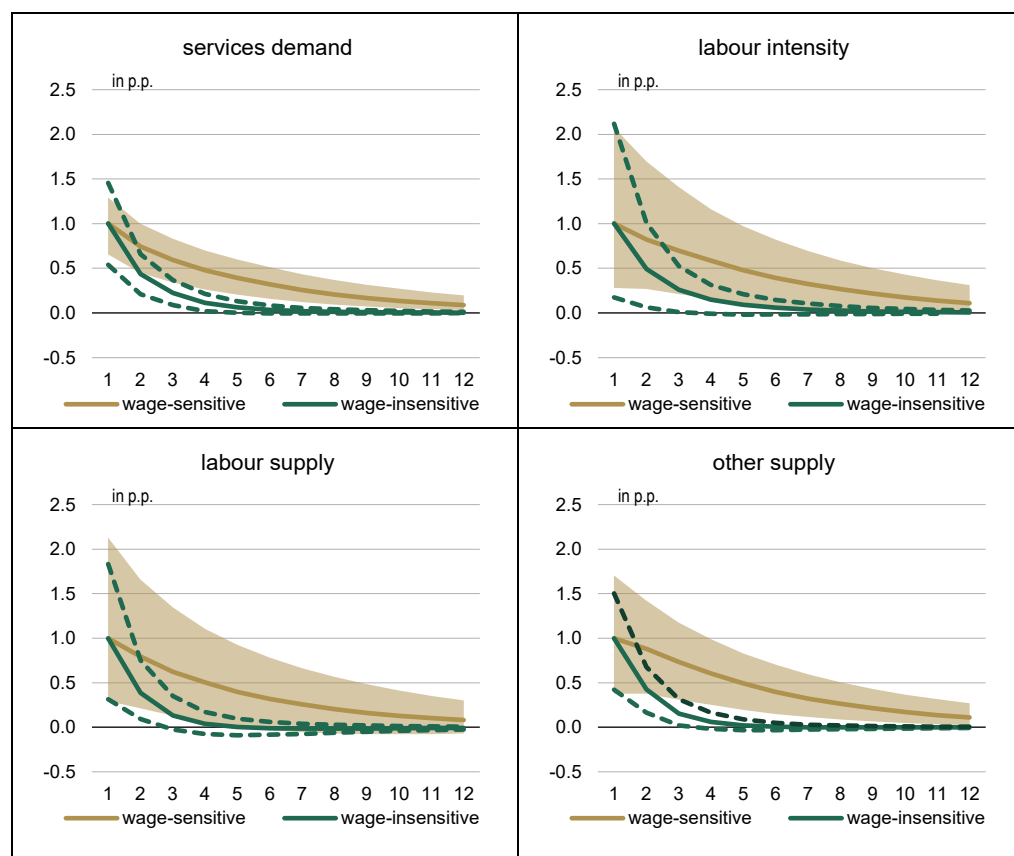
Notes: The left (right) column displays the impact of shocks on HICP Services growth (level). The shaded areas represent 68% credibility intervals. All shocks are normalised to increase HICP Services growth by 1 percentage point on impact.

A.3 IRFs of the baseline model



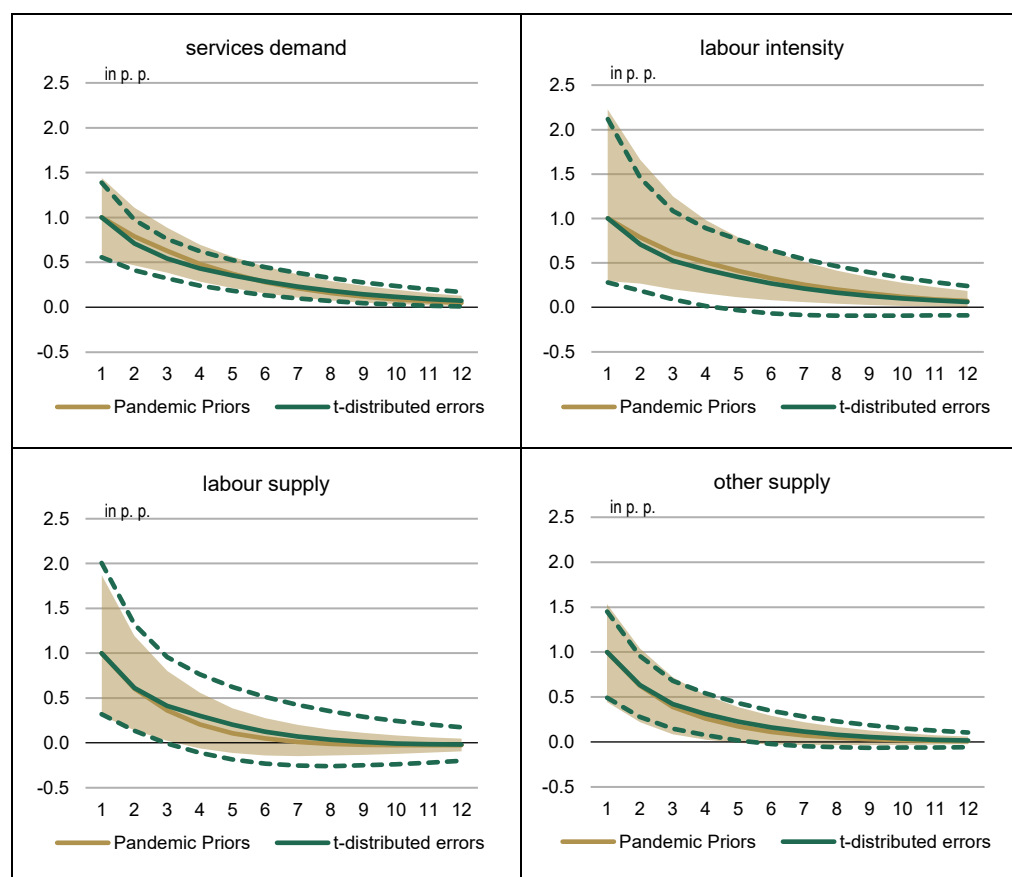
The figure illustrates the effects of a 1 standard deviation shock on the quarterly growth rates of endogenous model variables. "Value Added" refers to value added in services activities, "Employment" refers to employment in services activities, and "Comp. per empl." denotes real compensation per employee in services activities. The x-axis represents quarters following the shock.

A.4 IRFs of wage-sensitive and wage-insensitive services



Notes: The gold line and shaded area show the median response and 68% credibility interval for wage-sensitive services respectively. The green solid and dashed lines represent the median response and 68% credibility interval for wage-insensitive services. All shocks are normalised to increase the respective services price index growth by 1 percentage point on impact.

A.5 Robustness test: Pandemic Prior approach vs t-distributed errors



Notes: IRFs for HICP Services are displayed for structural shocks under two specifications: the baseline model with Pandemic Priors (Cascaldi-Garcia, 2022) and an alternative approach with t-distributed errors (Bobeica & Hartwig, 2021), in gold and green respectively. The gold shaded areas (green dashed lines) indicate 68% credibility intervals for the Pandemic Prior (t-distributed errors) specification. All IRFs are standardised so that HICP Services growth rises by 1 percentage point on impact.