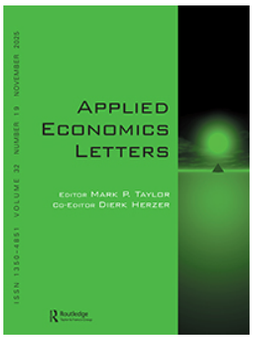

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Economic structure and the real effects of monetary policy*

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ABSTRACT
We study how changes in economic structure shape the impact of monetary policy on output. Using granular data on economic activity in the euro area, we show that the service sector is less responsive to monetary policy than the industry sector. The rise in service intensity observed over recent decades thus dampens the effect of monetary policy on total output. However, we find this dampening effect to be moderate, implying that the transmission of monetary policy to economic activity remains effective. By contrast, differences in economic structure emerge as an important source of heterogeneity in transmission across space.

KEYWORDS
Monetary policy; economic structure; local projections; shift-share instruments

JEL CLASSIFICATION
C23; E52

I. Introduction

In many advanced economies, the share of services in total output has risen over recent decades, while that of industry has declined (see Figure 1 for examples). This shift in economic structure has raised concerns over the effectiveness of monetary policy: services are typically less capital-intensive than manufacturing or construction, and a key channel through which monetary policy transmits to economic activity is by influencing the cost of capital.[1]

This paper provides empirical evidence to evaluate this concern for the euro area – and, more broadly, to assess how changes in economic structure shape the transmission of monetary policy to output. Our focus is on standard interest rate policy, the main tool by which the European Central Bank typically steers its stance. We find that exogenous increases in policy interest rates depress services activity, but the impact is weaker and slower than for industry. Consistent with this differential response, we also find that a higher services share dampens the impact of monetary policy on total output. However, this dampening effect is moderate: according to our estimates, the rise in the services intensity since the start of the euro should have reduced the maximum response of output to a given monetary policy shock by less than 10% on average; by contrast, we find that the large differences in economic structure across regions lead to pronounced geographical heterogeneity in the real effects of monetary policy. Our estimates point to a 40% weaker output contraction at the 75th percentile of the services-share distribution than at the 25th percentile.

Taken together, the paper makes two main contributions. First, it adds to a broad empirical literature on sectoral differences as a source of (regional) heterogeneity in the transmission of monetary policy. For instance, Carlino and DeFina (1998) provide evidence for differential effects of monetary policy across US states, depending on the relative size of the manufacturing sector. Also using subnational data for the US, Owyang and Wall (2009) confirm manufacturing intensity as an important driver of geographic differentiation in monetary policy transmission. Georgopoulos (2009) presents similar findings for Canada and Peersman and Smets (2005) document substantial heterogeneity in the response to monetary policy across sectors in

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*The views in this paper are those of the authors and do not necessarily reflect the views of the European Central Bank or the Eurosystem.

[1]See, for instance, the Financial Times article from October 4, 2023 on 'Why are interest rate rises not taming inflation?', which argues that '*[a] long-term shift away from manufacturing towards services, which require less capital, could also mean slower transmission of tighter monetary policy*'. The notion underlying this 'cost-of-capital channel' is that firms typically use credit to finance a substantial part of their real investment (e.g. in machinery and equipment) and of their working capital. Since industrial firms tend to have greater investment needs, their business is more affected as the respective financing costs rise or fall.

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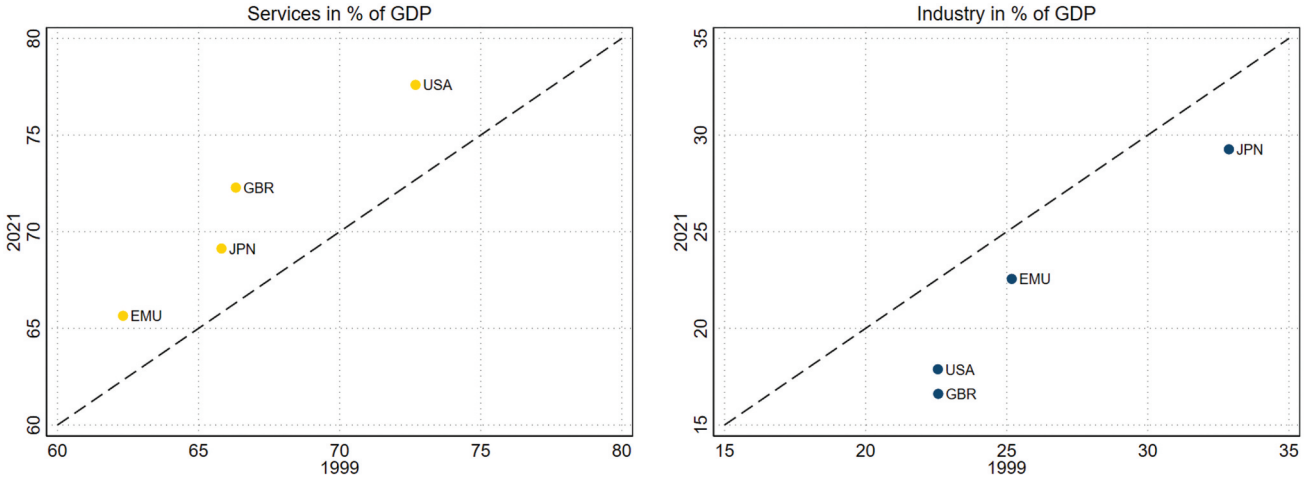

Figure 1. Evolution of economic structure. Gross value added in services (industry) is defined by ISIC divisions 50–99 (05–43). *Source*: World Bank and OECD national accounts data.

the euro area. Our paper goes a step further in that it also quantifies how changes in the sectoral composition of output influence the overall effectiveness of monetary policy.

Second, and more generally, the paper offers a novel approach to assess heterogeneity in the transmission of policy. Relying on a fine geographic and sectoral breakdown of economic activity, it provides a way to identify exogenous variation in monetary policy interest rates, as well as in economic structure, the latter via a shift-share design. This research strategy in turn may be applied also to other settings in which slow-moving state variables affect the relationship between policy and the macroeconomic outcomes it aims at influencing.

II. Empirical analysis

The analysis uses the most granular regional breakdown of the level and composition of economic activity available for the euro area.[2] This breakdown, which roughly corresponds to cities and counties, allows us to identify exogenous changes in policy interest rates. The reason is that, also after controlling for the main macroeconomic variables entering the monetary policy relevant information set, the regional variation in total output and its subcomponents remains substantial (De Groot et al. 2023). Given our focus on standard interest rate policy in the euro area, we let our sample run from 1999 through 2014 (*i.e.* ending before quantitative easing acquired a prominent role in steering the ECB's monetary policy stance from January 2015 onward). At the same time, as part of our robustness checks, we confirm our baseline findings also for a longer horizon (see Section C of the Online Appendix).

The response of services versus industry

We first test the basic premise that services and industrial output respond differently to monetary policy. To this end, we estimate the following model via local projections:

$$y^s_{i,t+h} = \alpha^s_{i,h} + \beta^s_h i_t + \gamma^s_h \mathbf{X}_{i,t} + \delta^s_h \mathbf{X}_{j,t} + \zeta^s_h \mathbf{X}_t + \varepsilon^s_{i,t+h} \quad (1)$$

where $y^s_{i,t+h}$ denotes gross value added (GVA) in region i and year t, at horizon h; the sectors in s include market services and industry GVA, with the latter defined as the sum of manufacturing and construction; $\alpha^s_{i,h}$ is a region fixed effect; i_t is the policy-controlled short-term interest rate; and $\mathbf{X_{i,t}}$, $\mathbf{X_{j,t}}$, and $\mathbf{X_t}$ are a set of control variables at the region, country and euro-area level, respectively. The regional controls include the local population; the country controls include GDP of the country j in which region i is

[2]The data come from the European Commission's ARDECO database and refer to the NUTS3 level.

located; and the most aggregated controls include GDP and HICP at the euro area level, which are crucial to isolate the exogenous variation in the policy rate from its endogenous response to economic conditions.

All variables enter the equation as 100 times their log levels, except i_t which is in percent. Inference is based on Driscoll and Kraay (1998) standard errors. Further detail on the sample, data sources and variable construction is available in the Online Appendix.

The estimates show that policy rate hikes reduce output in both, services and industry, but the effects differ in strength and timing (Figure 2). The contraction in industry reaches a trough of around 4.0% in the first year following a 100 basis point (bps) policy-rate hike, before entering on a swift recovery path.[3] Services reach their trough only a year later and the contraction is shallower, with a trough of around 2.5%, but then only recover gradually. These differential responses indeed raise the question of whether the observed rise in the services share dampens the overall transmission of monetary policy to economic activity.

Monetary policy effects conditional on economic structure

Method

In the second step, we thus turn to how the impact of monetary policy on total output is shaped by variations in economic structure. To this end, we augment Equation 1 with an interaction between the policy rate and the services share to obtain:

$$y_{i,t+h} = \alpha_{i,h} + (\beta_h + \eta_h \kappa_{i,t}) i_t + \gamma_h \mathbf{X_{i,t}} + \delta_h \mathbf{X_{j,t}} + \zeta_h \mathbf{X_t} + \varepsilon_{i,t+h} \quad (2)$$

where $y_{i,t+h}$ is total GVA in each region i and year t, $\kappa_{i,t}$ measures the regional services share (which is now also included in $\mathbf{X_{i,t}}$ to account for all constituents of the interaction term), η_h captures how changes in the services share alter the real effects of monetary policy, and all other variables are defined as in Equation 1.

In estimating Equation 2, we cannot exclude that the observed variation in the services share is partly driven by unobserved influences that also correlate with regional GVA or by other

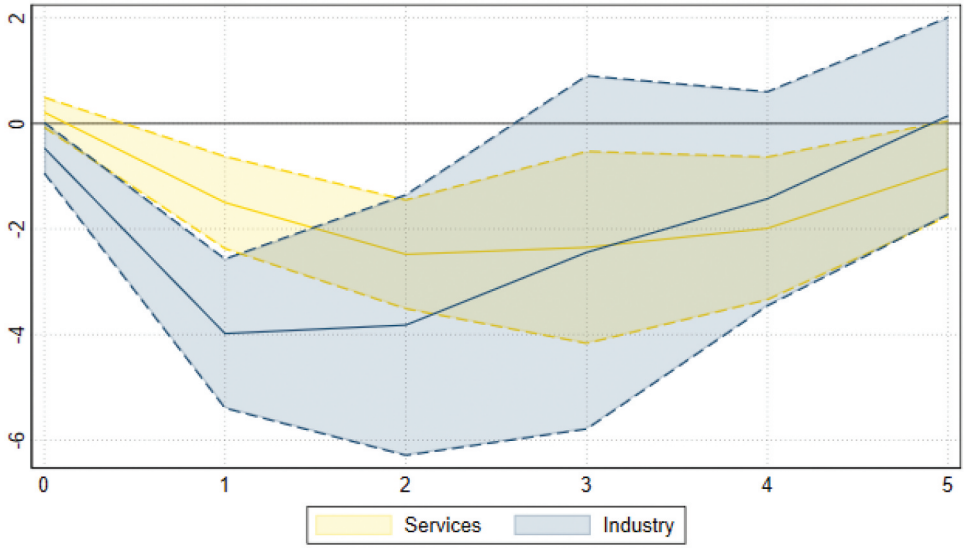

Figure 2. Response of services and industry sectors to a monetary policy shock. The figure shows the annual response of the services and industry sectors to a 100bps monetary policy shock, along with the 90% confidence interval.

[3]For regression coefficients see Appendix Table 2 and Table 3. For total output, we find a trough of 2.4%, consistent with prior literature (see Appendix Figure 4). The response of total output is similar to the response of the sum of the services and industry sectors. For completeness, we also include the IRFs for the agriculture (Figure 5) and non-market services (Figure 6) sectors in the Appendix.

sources of endogeneity. Similar to Bartik (1991), we thus use a shift-share design to construct $\kappa_{i,t}$, exploiting the detailed breakdown of services GVA into subsectors available in our data.

We first calculate the share of the five services subsectors over total GVA, $w^k_{i,t}$, and the respective annual growth rates, $g^k_{i,t}$ [4]

$$w^k_{i,t} = \frac{y^k_{i,t}}{y_{i,t}} \tag{3}$$

$$g^k_{i,t} = \frac{w^k_{i,t} - w^k_{i,t-1}}{w^k_{i,t-1}} \tag{4}$$

The growth rate of the total services share can then be decomposed as:

$$g^s_{i,t} = \sum_k g^k_{i,t} \left(\frac{w^k_{i,t}}{w^s_{i,t}} \right) \tag{5}$$

Following the broad literature on shift-share designs, we underpin the assumption of instrument exogeneity by combining a pre-determined indicator of local economic structure with aggregate variation in its subcomponents. We fix the shares at their initial values (dating to 1998, the last pre-sample year) and replace the regional growth rates with their national equivalents:

$$\tilde{g}^s_{i,t} = \sum_k g^k_{j,t} \left(\frac{w^k_{i,0}}{w^s_{i,0}} \right) \tag{6}$$

Finally, we transform these growth rates back into levels of the instrumented services share, the variable of interest in Equation 2, again using 1998 as a starting point:

$$\kappa_{i,t} = w^s_{i,0} \prod_{l=1}^{t} \left(1 + \tilde{g}^s_{i,l} \right) \tag{7}$$

Results

In line with the differential responses across sectors documented in Section 2.1, the impact of monetary policy weakens as the service intensity of the economy rises. At the average services share, output reaches a trough of around 2.7% two years after the shock (blue impulse response function (IRF) in Figure 3). But the significant positive coefficient on the interaction term indicates that the output response becomes shallower at higher $\kappa_{i,t}$ (yellow IRF in Figure 3). In particular, at its peak in year 2, the interaction weakens the real effect of a 100 basis point monetary

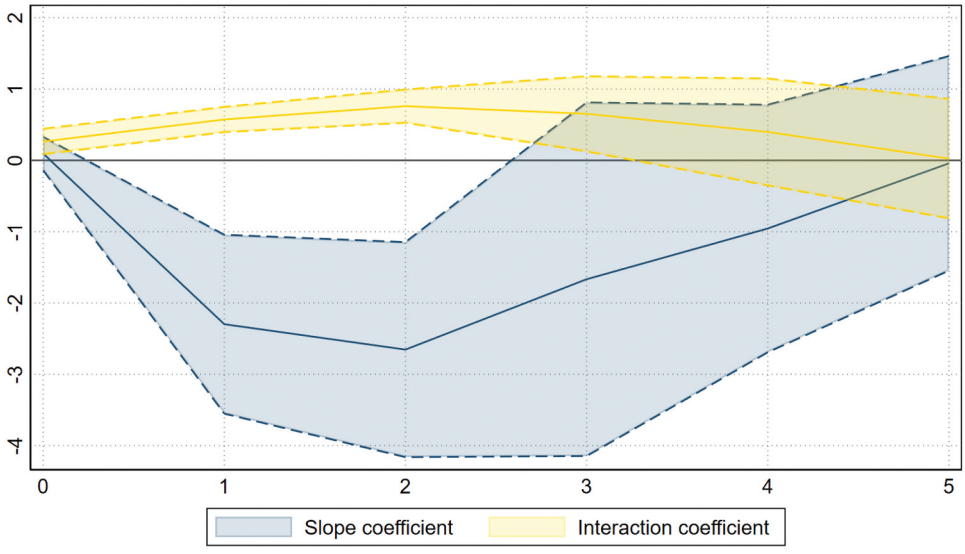

Figure 3. Response of total gross value added to a monetary policy shocks conditional on services share. Interaction coefficient scaled to 10 percentage point changes in instrumented services share; all other elements are defined as in Figure 2.

[4]For the list of subsectors *k*, see Table 1 in the Online Appendix. Together these form the services sector *s*.:

policy tightening by 76 basis points for every ten percentage points added to the services share (see Section C of the Online Appendix for a comprehensive set of robustness checks that: extend the list of controls; follow an alternative approach to construct the shift-share instrument; lengthen the estimation period; and adopt a different definition for the main explanatory variable).[5]

To put these estimates into perspective, we scale them by how the instrumented services share has varied over time and across regions. Since the start of the euro, the regional average of κ has risen by 2.7 percentage points. Combined with the above peak interaction point coefficient, this implies an average dampening impact of around 20 basis points – less than 10% of the maximum output response to a given shock.[6] By contrast, differences in economic structure are an important source of heterogeneity in transmission across regions: for instance, our estimates suggest that monetary policy causes a more than 40% weaker output contraction at the 75^{th} percentile of the services-share distribution than at the 25^{th} percentile.

III. Summary

We show that services in the euro area are less responsive to monetary policy than industrial activity. While rate hikes are followed by a significant contraction in both sectors, the trough in services only stands at around half of that in industry. Consistent with these differential responses, variation in the services share is an important determinant of how monetary policy transmits to the real economy.

Author contributions

CRediT: **Sebastian Hauptmeier:** Writing – original draft; **Fédéric Holm-Hadulla:** Writing – original draft; **Elisa Saporito:** Writing – original draft.

Disclosure statement

The authors declare that there are no relevant financial or non-financial competing interests to report.

References

Bartik, T. J. 1991. *Who Benefits from State and Local Economic Development Policies?* Kalamazoo, MI: W.E. Upjohn Institute.

Carlino, G., and R. DeFina. 1998. "The Differential Regional Effects of Monetary Policy." *Review of Economics and Statistics* 80 (4): 572–587. https://doi.org/10.1162/003465398557843.

De Groot, O., S. Hauptmeier, F. Holm-Hadulla, and K. Nikalexi. 2023. "Monetary Policy and Regional Inequality." Discussion Paper 18319, Centre for Economic Policy Research(CEPR).

Driscoll, J. C., and A. C. Kraay. 1998. "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data." *Review of Economics and Statistics* 80 (4): 549–560. https://doi.org/10.1162/003465398557825.

Georgopoulos, G. 2009. "Measuring Regional Effects of Monetary Policy in Canada." *Applied Economics* 41 (16): 2093–2113. https://doi.org/10.1080/00036840701604362.

Lemke, W., and A. L. Vladu. 2017. "Below the Zero Lower Bound: a Shadow-Rate Term Structure Model for the Euro Area." ECB Working Paper Series, (No. 1991).

Owyang, M. T., and H. J. Wall. 2009. "Regional Vars and the Channels of Monetary Policy." *Applied Economics Letters* 16 (12): 1191–1194. https://doi.org/10.1080/13504850701367247.

Peersman, G., and F. Smets. 2005. "The Industry Effects of Monetary Policy in the Euro Area." *Economic Journal* 115 (503): 319–342. https://doi.org/10.1111/j.1468-0297.2005.00991.x.

[5]For regression coefficients see Table 4 in the Appendix.

[6]These conclusions do not change materially when using variation in the actual, rather than the instrumented, services share or when weighting the (actual or instrumented) shares by region size. While the services share has risen further since our sample cut-off date, these increases also do not materially alter our main conclusions.