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Drivers of post-pandemic price dynamics and labour market tightness in the euro area

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Abstract

We study recent inflation and labour market dynamics in the euro area within a general equilibrium framework. Rapid inflation was mainly caused by demand and supply shocks, but labor market-specific shocks also contributed to the surge in inflation. Our results underscore the significance of import price shocks in explaining the recent interactions between wages and prices. The observed exceptional labour market tightness has also been influenced by a decline in hours worked per person, alongside more commonly studied demand and supply shocks.

Keywords: euro area, labour market shocks, inflation, labour market tightness

JEL codes: 24, E31, E32, E37, F41

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Introduction

During and after the COVID-19 pandemic, the euro area labour market has been exceptionally tight, as evidenced by a high number of job vacancies, record-low unemployment, and widespread reports of labour shortages by firms. Simultaneously, the above-target headline inflation has been traced not only to an increase in energy prices but also to considerably sticky core inflation. Service inflation has remained elevated, partly driven by nominal wage increases.

Beyond the prevailing tightness in the labour market, several structural and cyclical developments have influenced the euro area labour market since 2020 (See, e.g. van Doornik et al., 2023, Nelimarkka and Vilmi, 2024 and Theofilakou and Vasardani, 2024). Employment has grown steadily since 2020, despite the ageing population. Unemployment has declined to historically low levels, reflecting both cyclical recovery and underlying structural shifts. The expansion of the labour force has been supported by increased immigration and rising labour force participation, especially among older cohorts (Berson and Botelho, 2023; Bodnár and Nerlich, 2020; Botelho, 2022). On the other hand, the growth in total working hours has been more modest because the average working time has shortened (Astinova et al., 2024).

In this article, we analyse how post-pandemic inflation dynamics and labour market tightness are connected and to what extent labour market and nominal developments are driven by common factors. There are two alternative explanations for recent labour market dynamics. First, a series of demand and supply shocks may have induced firms to post more vacancies, creating more jobs, faster wage growth and eventually higher inflation. Alternatively, shocks stemming from the labour market and affecting labour demand and supply directly could have increased job creation and shifted wages up, finally inducing price pressures in the economy.

We distinguish these channels with a dynamic stochastic general equilibrium (DSGE) model and analyse the sources of recent price and labour market dynamics in the euro area. Our model, based on Obstbaum et al. (2023), features a carefully defined frictional labour market and staggered wage-setting. The model framework enables us to study the significance of different shocks and labour market dynamics for the entire economy.

Our results suggest that general demand and supply shocks explain a large part of euro area wage and price dynamics in the post-pandemic era but also shocks specific to the labour market contributed to the inflation surge particularly in 2022-2023. Especially supply shocks, including negative terms-of-trade shocks, have estimated to be a significant driver of the rapid inflation. These shocks also explain wage developments, including the initial deceleration of wage growth and its subsequent acceleration. Labour market tightness is, in turn, seen as a response to strong demand, weak productivity growth and the decrease in average hours per worker.

While labour-market-specific shocks have not been particularly important for output, the exogenous reduction in average hours caused a large part of the tightening of the labour market. Especially during the first years of the pandemic, the dramatic fall in average working hours encouraged firms to post more vacancies, resulting in higher

employment and lower unemployment as well as slightly higher wage pressure. The fall in average hours may explain why firms increased the number of workers despite weak output growth, i.e., the observed labour hoarding (Botelho 2024). In other words, a decrease in the labour input along the intensive margin (hours per person) has been compensated by an increase in the labour input along the extensive margin (number of people employed).

We complement the recent reduced-form evidence on the drivers of inflation and wage developments after the pandemic. Similarly to Bernanke and Blanchard (2024) as well as to their euro-area applications (Arce et al., 2024; Oinonen and Vilmi, 2024), we find that import price and supply shocks account for most of the inflation surge. On the other hand, unit profits have been argued to play a significant role in post-pandemic price developments (Hahn 2023). Our evidence suggests that the increase in unit profits was closely linked to cost-push dynamics, with firms adjusting mark-ups in a way that quickly translated higher input prices into higher prices and profits.

Our results contrast with Benigno and Eggertsson (2024) who underscore the importance of the nonlinear Beveridge and Phillips curves in triggering inflationary pressures. Rather than labour market tightness fueling wage growth and persistent inflation, we find that tightness has largely been a consequence of demand and supply shocks, and notably of an exogenous reduction in hours worked. Consolo et al. (2023) draw, in turn, attention to wage bargaining shocks in explaining tightness. Our theoretical model with microfoundations finds that changes in hours worked caused tightness instead of changes in bargaining power.

The sources of labour market tightness and inflation in the euro area appear to differ from those observed in the United States. The “Great Retirement” has been identified as a key contributor to the US post-pandemic labour market tightness and upward wage pressures, as a wave of early retirements led to a persistent contraction in labour supply (see Ascari et al. 2024). In contrast, the euro area did not experience a comparable decline in participation rates. Instead, the main contribution to inflation stemmed from reduced hours worked and other labour market-specific shocks. These may include compositional changes in the labour market, which – as shown by Siena and Zago (2024) – affect labour market fluidity and the relationship between unemployment and inflation by changing the slope of the Phillips Curve.

The rest of the article is organised as follows. Section 2 presents the key features of the model used in the analysis. Section 3 analyses the recent macroeconomic fluctuations in the euro area. Section 4 provides concluding remarks.

1 Analysis of labour market dynamics in general equilibrium

We use the dynamic stochastic equilibrium model with search and matching frictions and staggered wage setting of Obstbaum et al. (2023) to study the interactions of labour market developments and the rest of the economy.¹ We focus on the period

¹ A detailed exposition of the model can be found in Obstbaum et al. (2023). The model of Obstbaum et al. (2023) is based on a small member state of the monetary union. We modify the model to represent the open economy with independent monetary policy.

starting from the COVID-19 pandemic and covering the recent high-inflation period. The detailed labour market block with real frictions and nominal wage rigidity as well as with the adjustable working hours (intensive margin) and employment (extensive margin) makes the model suitable for analysing recent labour market developments and their aggregate consequences.

The labour market of the model is characterised by matching frictions between unemployed job seekers and job vacancies based on the framework of Mortensen and Pissarides (see, for example, Ljungqvist and Sargent, 2004). Accordingly, employers post job vacancies, and unemployed job seekers look for new jobs. Unemployment and labour market tightness evolve endogenously according to a dynamic process governed by a matching function which is increasing in both unemployed job seekers and open vacancies. Thus, the more available job vacancies and the fewer unemployed individuals, the more likely a job seeker is to find a new job. From the employer's perspective, filling a job vacancy is more difficult when the labour market is tight, i.e., when there is a large amount of vacancies in relation to job seekers. Matches may dissolve contemporaneously according to an exogenous probability of job destruction.

When matched, employees and employers negotiate both wages and the number of working hours, i.e., both are endogenously determined. But wages can only be set at regular intervals during wage negotiation rounds. They do not immediately adjust to changes in economic fundamentals or new shocks. The staggered multiperiod Nash wage bargaining follows closely Gertler and Trigari (2009) and Gertler, Sala and Trigari (2008) but also includes the adjustment of hours worked.

Finally, in equilibrium, the decision of firms to open new job positions is based on the marginal cost of adding a worker, labour market tightness and labour productivity as well as on aggregate demand and supply. Firms set consumer prices and decide on output, households make decisions on their consumption and labour supply, and the central bank adjusts the interest rate.

The model features a range of different shocks which explain the macroeconomic dynamics (See Obstbaum et al., 2023 for details). We categorise the shocks into five groups (Table A1). First, labour market-specific shocks stem from exogenous changes in the bargaining power of workers, costs of posting vacancies, job separation rate and labour force size. As a separate category there is hours shock category which includes shock to the elasticity of labour supply, that is, household's willingness to provide working hours. Second, the model includes general shocks not related to the labour market. On the demand side, there are shocks to foreign demand, government expenditure and monetary policy as well as to preferences affecting private consumption. On the supply side, the model includes labour-augmenting technology, cost-push, terms-of-trade and investment-specific productivity shocks.

We fit the model to euro area data covering years 2000-2024.² Each time series is decomposed into a trend component, measurement errors and a cyclical model

² The calibration of the model follows Obstbaum et al. (2023). Shock variances are estimated based on euro area data. The variables are 3-month Euribor, GDP, government consumption,

component. The latter component is driven by the structural shocks included in the model. By this approach, we aim to identify the most significant cyclical factors influencing price and labour market movements in the short and medium run.³ Hence, we do not analyse here permanent changes and trends in the euro area economy and labour markets.

Figure 1 Trend and model components of hours per worker and employed persons.

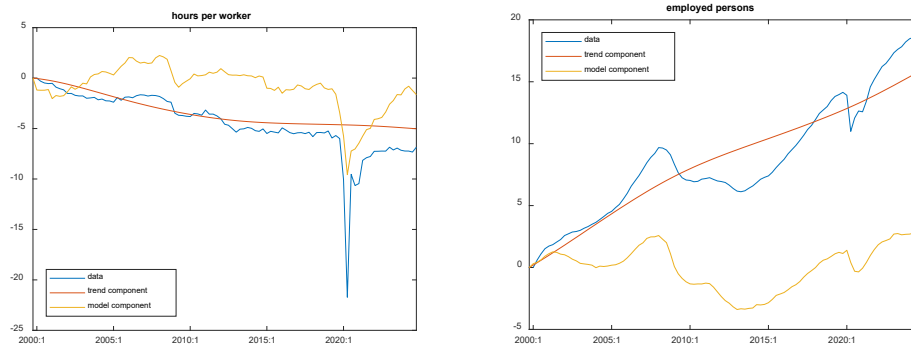


Figure 1 illustrates the trend and model components of hours worked and employment. Both labour market variables have significant long-run trend components. Employment features a strong upward trend whereas hours per worker have steadily trended downwards. In addition, their cyclical components – on which we focus – have strongly deviated from their long-run trends in the past few years (Figure 1). The employment gap turned positive quickly after 2021 and, in particular, the cyclical component of average hours worked shows exceptional volatility compared to its historical development. In 2020, average hours plummeted in an unprecedented way and have since then only partially recovered. The upward trend in employment reflects the strong increase in euro area workforce caused by both increases in participation rates and migration but these developments are outside the scope of this paper.

2 Results

This section examines the factors driving recent economic fluctuations and labour market dynamics in the euro area. We examine first the sources of output and inflation dynamics. Then we turn to analysing the shocks that have moved the labour market

private consumption, investments, vacancy rate, compensation of employees, hours worked, employment, unemployment, price deflators of GDP, private consumption and imports. The foreign demand is measured as trade weighted average of imports of euro area trading partners, compiled by the ECB. National accounts and labour market data are retrieved from Eurostat, interest rate data from the ECB.

³ Time series are decomposed according to $\ln(Y_t) = Y_t^T + \hat{y}_t + e_t$, where Y_t is observed variable, Y_t^T is a trend component, $\hat{y}_t$ is a cyclical model component and e_t is a measurement error. For simplicity, we do not consider common trend components such as population growth and productivity in this analysis but leave a more careful characterisation of balanced growth path for future research.

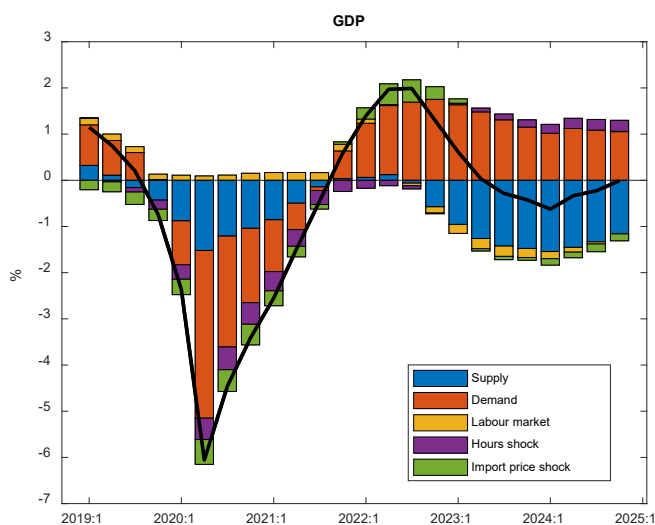
variables. In the final subsection, we investigate briefly the role of unit profits and unit labour costs for price dynamics.

We use shock decompositions of the model to identify the mechanisms and shocks that explain the movements of model variables. In the decompositions, the shocks listed in the previous section are aggregated into the following groups: general demand and supply shocks, import price shocks and labour-market-specific shocks. The shock on hours worked is reported separately from the other labour-market-specific shocks. To analyse the recent large changes in average working time (Figure 1), we separately report the impact of the hours shock. We focus on the cyclical development of the model variables, that is, on their relative deviations from the estimated trends.

2.1 Output and price dynamics

According to the model, both strong demand shocks and large, negative supply shocks – most notably adverse technology shocks – account for the largest share of recent output fluctuations (Figure 2).⁴ Demand decreased sharply during the initial phase of the COVID-19 crisis but began to recover in 2021, leading to relatively robust recovery of GDP. However, more negative supply, particularly adverse technology, shocks dampened the GDP growth from 2022 onwards.

Figure 2 Fluctuations of the model component of GDP and its shock contributions during 2019–2024



While output fluctuations have largely been determined by changes in both aggregate demand and supply (Figure 2), supply shocks appear more important in explaining the variation in quarterly cyclical inflation (Figure 3).⁵ Import price shocks were the most

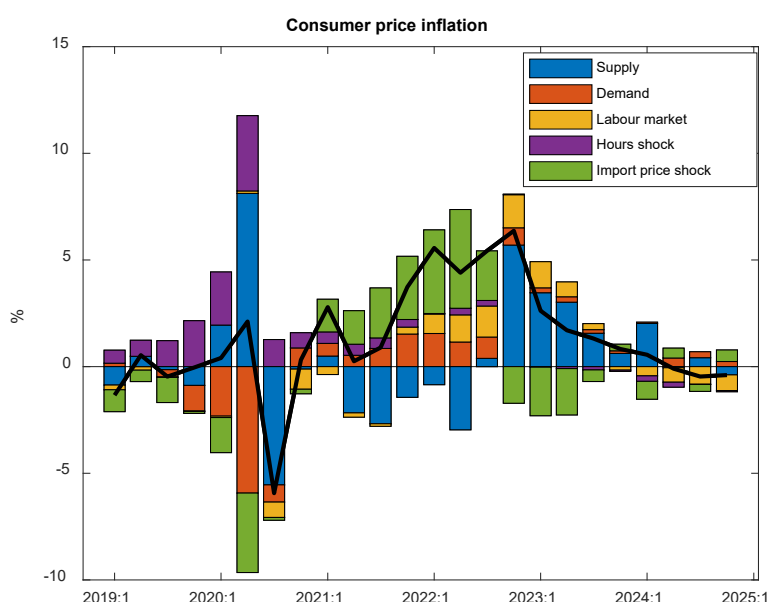
⁴ The figure shows the deviation of the model component of GDP from the model's equilibrium.

⁵ Figure 3 shows the annualised quarterly change in the cyclical model component of consumer price deflator. The model component is a deviation of quarterly inflation from the trend, estimated to be approximately 2 %.

important contributors to the recent surge in euro area inflation, as visible in the green bars of Figure 3, consistent with the findings of Bernanke and Blanchard and Oinonen and Vilmi (2024). Import prices rose sharply in 2022 and later stabilised, contributing to a decline in inflation. At the end of 2022, inflation was significantly affected by a transitory mark-up shock and more persistent negative technology shocks. On the contrary, demand shocks have had a smaller role, explaining a share of the price changes in 2021–2022.

The labour-market-specific shocks contributed to the inflation surge in 2022–2023. These shocks occurred due to the weakening efficiency in the labour market, identified by the model as increasing hiring costs. In addition, the reduction in working hours raised prices during the first wave of the pandemic and counteracted the disinflationary effect of the negative demand shocks, but its effect has worn off since.

Figure 3 The model component of inflation (annualised) and its shock decomposition



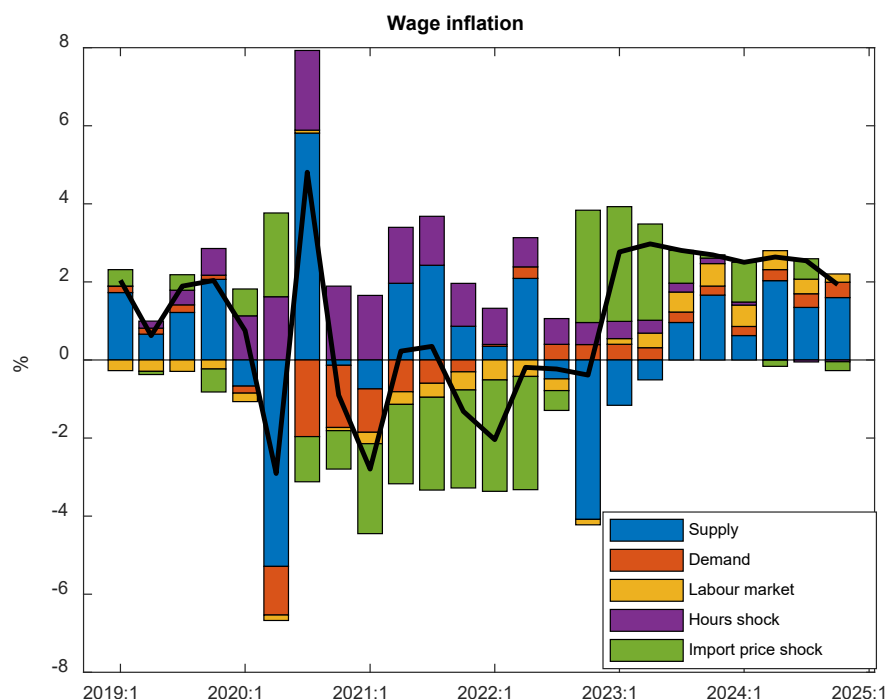
2.2 Post-pandemic labour market dynamics

Next, we evaluate which factors explain recent changes in wages and other labour market variables. Figure 4 shows the shock decomposition of wage inflation.⁶ With a lag of approximately one year with respect to price inflation, euro area wage inflation started to accelerate in 2023. According to the model, the initial terms-of-trade shock had a negative impact on wage inflation. While rising import prices in 2022 significantly increased inflation (Figure 3) they also decreased domestic demand, thereby reducing

⁶ The figure shows the annualised quarterly change of the model component of wages.

wages. Through this general equilibrium effect, the import price shock lowered wage growth until the end of 2022. According to our model, this seems to be the key reason why wage inflation did not yet accelerate during the worst inflation surge.

Figure 4 Shock decomposition of growth in cyclical component of wages



Wage inflation began to rise in 2023 at the time when import prices were already stabilizing and had a downward effect on inflation (Figure 3). Wage increases were a result of the propagation of lagged import price shocks (Figure 4). Through the lens of our model, inflationary import price shocks affected wages with a delay, which may be interpreted as a catch-up of real wages.⁷ This lag is a natural consequence of the staggered bargaining, wages being only gradually renegotiated.

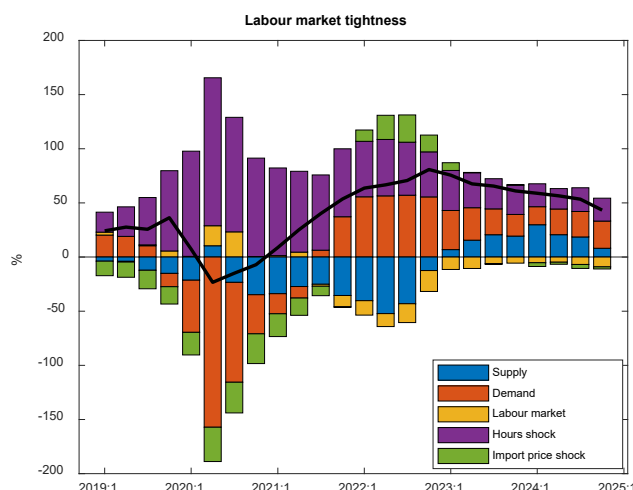
All in all, wage dynamics have mainly been driven by shocks originating from outside the labour market, particularly by the import price and other supply shocks. However, in 2020 – 2022, the reduction in average working hours had a significant accelerating effect on wage increases. Thereafter, labour market shocks, including the decline in hours worked, have contributed to wage inflation only slightly positively.

In general, upward pressure on wages emerges when the labour market is tight. After the pandemic, labour market tightness measured as a ratio of vacancies to the number of unemployed steeply hiked to historically high levels in the euro area. As can be seen

⁷ Towards the end of 2022, the arrival of negative import price shocks also drove wages initially up but later on relieved wage pressures.

in Figure 5, the labour market started to tighten in 2021, as measured by the ratio of cyclical vacancy-unemployment ratio.⁸

Figure 5 The model component of labour market tightness and its shock decomposition



The tightening was a result of stronger demand and an exogenous decrease in average hours worked. According to the model, the reduction in hours worked increased labour market tightness particularly at the beginning of the pandemic. However, labour market tightness did not immediately rise because suppressed overall demand still reduced the willingness of firms to open vacancies. The strengthening of aggregate demand already during 2021 induced firms to post vacancies and tightened labour markets, intensified by the fact that average working hours were still well below their pre-pandemic trend.⁹

As Figure 5 shows, a substantial part of post-pandemic labour market tightness is explained by the reduction in hours worked per person. This decrease has been significant, especially at the beginning of the pandemic (Figure 6).¹⁰ While average hours have recovered to some extent, they are still slightly below their downward sloping trend (Figure 1). Average working time has been shortening in the euro area for

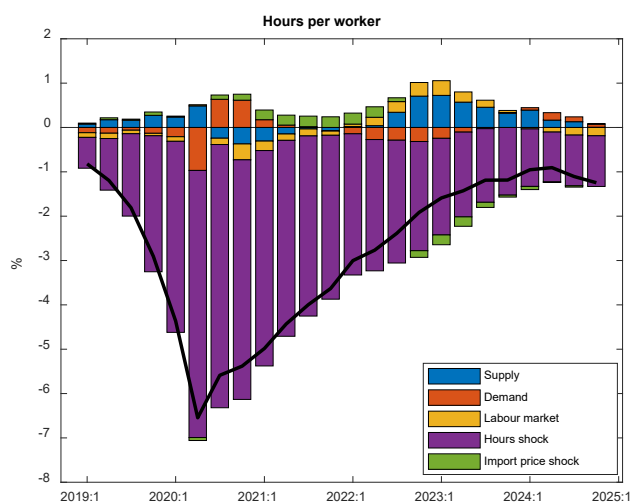
⁸ The figure shows the deviation of the model component of labour market tightness from the model's equilibrium.

⁹ The dynamics of employment has been similar to that of labour market tightness. According to our model, increasing labour supply has not significantly affected employment growth, as only cyclical factors affecting employment are considered here. The increased working-age population and rising participation rate in the euro area are important contributors to the very benign labour market developments in the past years but they are mainly only reflected in the trends of these time series.

¹⁰ The figure shows the deviation of the model component of average working hours from the model's equilibrium.

decades, but the shortening dramatically intensified during the Covid-19 pandemic. According to the model, the reduction originates from households' preferences, or more exactly – from a positive shock on households' utility gained from extra leisure. The reduced hours worked per person potentially explain why according to recent survey data firms seem to hoard labour. That is, they have increased employment despite weak economic growth (see, e.g., van Doornik et al., 2023).

Figure 6 The cyclical component of average working hours and its shock decomposition



2.3 The interaction of unit profits and labour costs

By national accounts identities, a change in the GDP deflator is a weighted sum of unit labour cost and unit profit developments. During the post-pandemic period, increasing unit profits have been argued to, on the one hand, explain the initial rise in inflation. On the other hand, the subsequent decrease of unit profits has been viewed to have a significant dampening role in the pass-through of wages into prices (see, e.g. Hahn 2023). Our model can enlighten the drivers of unit profits and their cushioning role for the recent price and wage dynamics.

Figure 7. Quarterly (annualised) change of unit profits (model component) and its shock decomposition

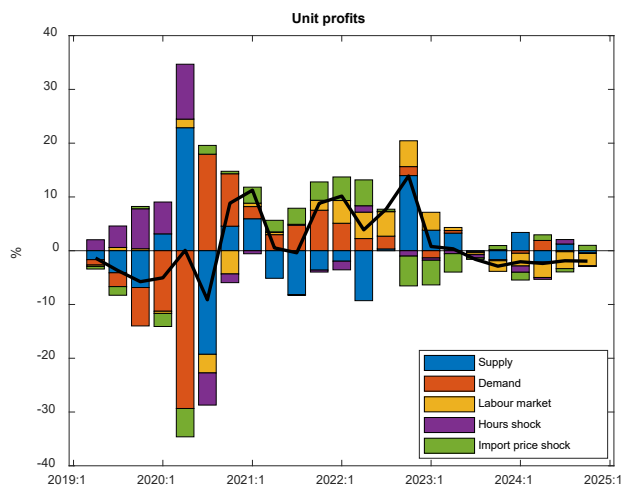
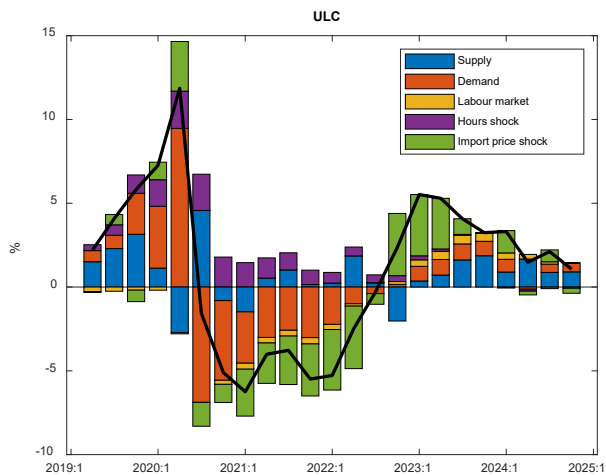


Figure 8. Quarterly (annualised) change of unit labour costs (model component) and its shock decomposition



Both unit profits (Figure 7) and prices (Figure 3) surged towards the end of 2022. The shift was due to strong demand and particularly higher markups (blue bars in Figure 7). However, to a greater extent, the unit profits increased not only in response to higher markups but endogenously to other exogenous shocks.

In 2020–2021, while unit profits grew, unit labour costs (Figure 8) decreased due to moderate wage inflation and robust GDP growth. From 2023 onwards, unit labour costs (Figure 8) started to increase. First, wages started to catch up in response to the lagged import price shocks. Second, the arrival of new shocks that stabilised import prices led to growth in employment. However, the increase in unit labour costs did not materialise as higher inflation since unit profits adjusted simultaneously downwards in the face of waning cost-push shocks. This can be interpreted as the cushioning role of profits in the pass-through of wages into prices. Profits typically respond to shocks on impact but wages are set with a delay to new shocks.

3 Conclusions

We have investigated the interactions between tight labour markets and rapid inflation in the euro area. Our results indicate that strong demand and supply shocks in recent years have been the main causes of inflation and wage growth. The sharp rise in import prices has played a particularly important role in shaping both price and wage dynamics. In addition, the labour market-specific shocks were large enough to explain a part of the inflation surge in 2022–2023.

While the general demand and supply shocks account well for inflation and output developments, they fall short of explaining the considerable tightness observed in the labour market. Our structural model highlights the importance of labour market-specific shocks—especially a reduction in average hours worked—in accounting for post-pandemic labour market dynamics.

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Appendix

Table A 1. Shocks and shock categories

Shock	Category
Labour-augmenting productivity	Supply
Investment specific productivity	Supply
Cost push	Supply
Demand (discount rate)	Demand
Government consumption	Demand
Foreign demand	Demand
Monetary policy	Demand
Shock to the size of the labour force	Labour market
Bargaining power of workers	Labour market
Job destruction rate	Labour market
Vacancy cost	Labour market
Shock to labour supply (Frisch) elasticity	Hours shock
Shock to import prices	Import price

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