Short economic and financial analyses

# Wage and price dynamics in Slovenia

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# 1 Introduction

***The euro area economy's strong rebound from the COVID-19 crisis, accompanied by high inflation rates, has prompted central bankers to closely monitor wage dynamics, as overly high wage growth could delay the return of inflation to the 2% target.***

The euro area and Slovenian economies have shown a robust rebound in the aftermath of the COVID-19-induced economic crisis. However, this rapid recovery has been accompanied by inflationary pressures, surpassing the European Central Bank's targeted 2% inflation rate. The persistence of such elevated inflation rates in the future depends, among other things, on the evolution of wage dynamics. Therefore, central bankers are closely monitoring wage trends, recognising them as a significant obstacle to achieving the objective of a 2% inflation rate.

***Existing empirical evidence shows that the link between labour costs and prices is shock-dependent.***

One of the challenges in empirical analysis of the link between wages and prices arises from the fact that the dynamics between two variables may simultaneously depend on several factors, such as inflation expectations, the state of the business cycle and the structure of the economy, particularly the labour market. One strand of the literature focuses on the shock-dependent dynamics of wages and inflation. This concept was stimulated by the structure of New Keynesian models, where the conditional correlation between wages and prices differs for demand and supply shocks. For instance, Bobeica et al. (2019) found empirical evidence for the four biggest euro area countries that it is more likely that labour costs are passed on to inflation with demand shocks than with supply shocks. Likewise, Hahn (2021) confirmed this empirical finding for the euro area as a whole.

***This paper addresses a research gap by estimating shock-dependent dynamics in Slovenia, comparing it to the euro area.***

Unlike other studied economies, the characteristic of shock-dependent wage and price dynamics has yet to be confirmed in the context of the Slovenian economy. Firstly, this paper seeks to address this analytical gap by providing estimations of shock-dependent developments specific to Slovenia. A comprehensive understanding of the shock-dependent paths of wages and prices is valuable for policymakers, as this knowledge helps them gauge likely trajectories of these variables, conditional upon the different shocks affecting the economy. These estimations are subsequently compared to results obtained for the euro area. It is important to recognise possible

discrepancies in economic dynamics, as the shared monetary policy of the European Central Bank lacks the ability to address enduring divergences in dynamics across two countries. Hence, policymakers must be attentive to any distinct dynamics observed in Slovenia to inform the development of appropriate national economic policy.

***The analysis examines wage and inflation dynamics in the euro area and Slovenia using a BVAR model.***

This paper explores the dynamics of wages and inflation in response to different economic shocks in the euro area and Slovenia, utilising a Bayesian Structural Vector Autoregression model. The analysis utilises the sign-restrictions identification method to distinguish between different economic shocks. Specifically, it examines five types of economic shocks: two demand shocks (demand and monetary policy shocks), and three supply shocks, of which two originate from the labour market (wage bargaining and labour supply shocks), and a technology shock.

# 2 Empirical strategy

***Analysis is based on two models using quarterly macroeconomic data from 2002–2022.***

The analysis is based on quarterly aggregated macroeconomic data observed over the time period from 2002Q1 to 2022Q4. The study consists of two models, each with an identical set of variables and a consistent lag length of three quarters.[1] The variables considered in the models are real gross domestic product (GDP), Harmonized Index of Prices (HICP), unemployment[2], compensation per employee (CPE), labour productivity, and shadow interest rate. While unemployment and interest rate are expressed in percentages, the remaining variables are defined as annual rates of changes in percent.

***The study uses Bayesian estimation with the hierarchical approach proposed by Giannone et al. (2015).***

Owing to limited data, the study adopts a Bayesian framework for its estimation approach, given its demonstrated effectiveness under such conditions. The specification of the prior is a crucial step in Bayesian analysis. In conducting this analysis, the framework follows the hierarchical procedure introduced by Giannone et al. (2015). Thus, I do not choose the priors subjectively, but instead the model derives them from data from the data. The identification of five shocks is achieved using sign restrictions

[1] I choose to use the same lag length for both models to simplify comparisons. However, this decision may lead to slight misspecification of the models.
[2] Unemployment is seasonally adjusted.

following Uhlig (2005). Sign restrictions have proven particularly useful as a method for imposing restrictions on the responses of variables in SVAR models, ensuring that impacts of shocks align with economic theory. These sign restrictions are used to identify structural shocks by constraining the impulse response functions' signs over a specific period following a shock. The primary component of the sign restriction identification strategy is the construction of a reasonable set of sign restrictions.

***Demand and supply shocks are decomposed into five distinct shocks.***

The main idea of the paper is to identify the shock-dependence of the dynamics of wages and prices, specifically whether demand and supply shocks produce distinct dynamics of wages and prices. Economic theory recognizes numerous types of shocks that produce demand or supply-like dynamics. However, there exists a limit on the number of shocks one can identify within SVAR model, imposed mainly by the data availability constraint. Therefore, we are required to designate a select few shocks that hold the greatest relevance to the specific analysis at hand. Accordingly, this paper breaks down the demand shock into two widely recognised shocks: the aggregate demand shock, and the monetary policy shock. The supply shock is split into the aggregate supply shock and two distinct shocks emanating from the labour market: the labour supply shock and the wage bargaining shock. The latter are incorporated given that wages are determined in the labour market, thus rendering it sensible to include labour market-specific shocks within the identification set. Nevertheless, it is important to acknowledge that other specific shocks exist that are observationally equivalent to the aforementioned shocks.[3]

***The identification set, with the exception of two shocks emanating from the labour market, is fairly stylised.***

Table 1 provides a summary of the sign restrictions which are imposed on the variables' impact response to shocks. All shocks are presented as inflationary, meaning that inflation increases on impact.[4] An expansionary aggregate demand shock moves output and prices in the same direction and lowers unemployment; interest rates increase due to the assumption that the central bank reacts to an increase in demand by contractionary monetary policy. An expansionary monetary policy shock produces the same dynamics as aggregate demand, with the exception of interest rates, which move in the opposite direction. On the supply side, prices and output move in different directions. Distinction between shocks on the supply side is achieved through different restrictions on responses of unemployment and wages. In the case of a negative aggregate supply shock, wages fall as workers become less productive and unemployment increases.[5] The main difference between the two shock emerging from the labour market is the reaction of unemployment. In the case of a negative labour supply, unemployment falls; this holds as long as the share of the unemployed among

[3] For instance, an oil shock may be observationally equivalent to a wage-bargaining shock, thereby suggesting that the results pertaining to the latter could also be influenced by oil shocks.

[4] VAR models are linear by nature, so the direction of shocks does not play a role in identification as long as the relative responses are consistent with the theory. For instance, identification of negative and positive demand shock is obtained with the same identification restrictions.

[5] Note that wages are denoted in annual growth rates, expressed as percentages. Thus the restrictions imply that the growth rates decline below their steady-state level, which should not be misinterpreted as an actual decrease in wage levels.

those leaving the labour force is higher than the unemployment rate. On the other hand, a positive wage-bargaining shock increases unemployment due to higher cost of labour.[6]

Table 1: **Sign restrictions**

| | Demand | Technology | Labour Supply | Wage Bargaing | Monetary policy |
|---|---|---|---|---|---|
| GDP | + | - | - | - | + |
| Prices | + | + | + | + | + |
| Wages | / | - | + | + | / |
| Unemployment | - | + | - | + | - |
| Labour productivity | + | - | / | / | / |
| Interest rate | + | / | / | / | - |

Note: A (+) implies a positive reaction on impact, while (-) corresponds to a negative reaction. A (/) denotes no a priori restrictions.

# 3 Results

***I present the impulse responses of HICP and compensation per employee to five shocks, with each graph showing the dynamic evolution of the variables over 16 quarters.***

The impulse responses of the HICP to all five shocks are illustrated in the top panels of Chart 1 and Chart 2. The bottom panel presents impulse responses of compensation per employee to the same five shocks. All shocks are normalised to a one percentage point increase in HICP on impact. Each graph in each panel depicts dynamic evolution of the respective variable over 20 quarters after the shock as an impulse response function.

***Negative supply shocks lead to divergent responses in compensation per employee and inflation.***

In examining the effects of supply shocks, distinct response patterns emerge between compensation per employee growth and inflation. Notably, the HICP tends to revert to its equilibrium approximately two years subsequent to the occurrence of the shock. Conversely, compensation per employee growth – by construction of sign restrictions – experiences a large decline of 1.5 percentage points upon impact, with the majority of this effect dissipating within six quarters of the initial shock. These empirical findings signify that, following a contractionary supply shock, wage adjustments fail to align with inflationary trends. Therefore, it seems unlikely that a negative supply shock would spur wage-driven inflation.

[6] See Foroni and Furlanetto (2018) for a more in-depth discussion of the identification set.

***Supply shocks emerging in the labour market result in wage growth initially slightly surpassing inflation, but this effect diminishes over time.***

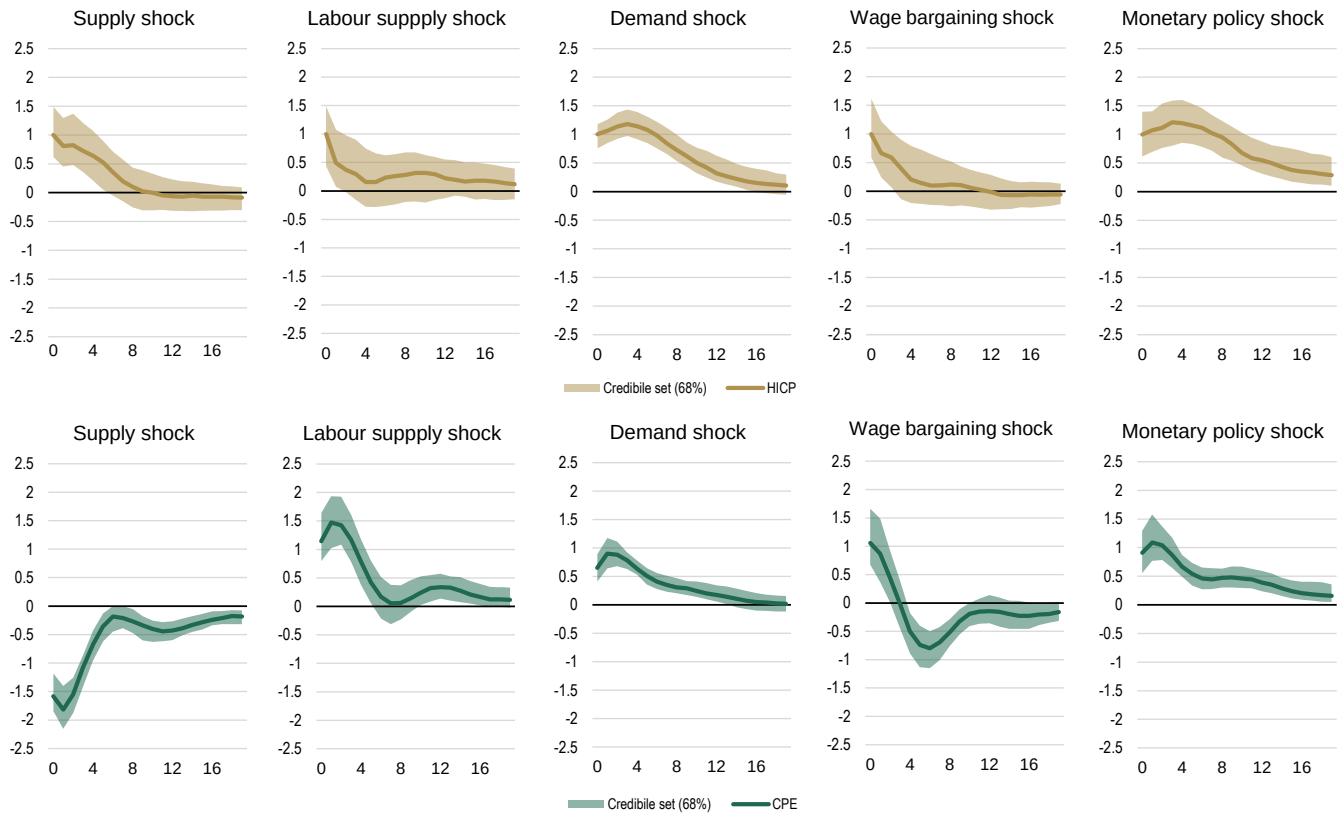
In addition to classical supply shocks, paper identifies two distinct supply shocks emanating from the labour market: negative labour supply shock and positive wage bargaining shock.[7] The latest empirical works propose that supply shocks, when originating from the labour market, have a greater tendency to result in wage-driven inflation (for instance, see Bobeica et al. (2019)). Examining the labour supply shock, we observe that compensation per employee growth actually exceeds inflation, with the strongest effect occurring two quarters after the initial shock and diminishing after seven quarters. These results occur due to lower number of job-seekers, as firms need to provide higher compensation to attract workers. Shifting the focus to the wage bargaining shock, its impact on wages is initially positive in the first year following the shock but subsequently turns negative and converges to the mean approximately ten quarters after the initial impact. In general, while it appears unlikely for classical supply shocks to trigger wage-driven inflation, this is not necessarily the case for supply shocks originating from the labour market.

***Demand shock and monetary policy shock impact wages similarly, but monetary policy shocks have somewhat stronger effects.***

Lastly, paper presents findings regarding two demand-side shocks in the economy: positive demand shock and expansionary monetary policy shock. These shocks exhibit similar dynamics, but monetary policy shocks demonstrate somewhat stronger impacts on wages. In both cases, the effect on compensation per employee growth peaks after two quarters and gradually diminishes over approximately 16 quarters. Specifically, in response to a demand shock, wage growth consistently lags behind inflation in all subsequent periods following the initial shock. In contrast, following a monetary policy shock, wage growth aligns with inflation during the initial few quarters but then starts to lag behind in later periods.

[7] Positive wage bargaining shock refers to an increase in workers bargaining power.

Chart 1: **Impulse response functions of HICP and CPE for Slovenia.**

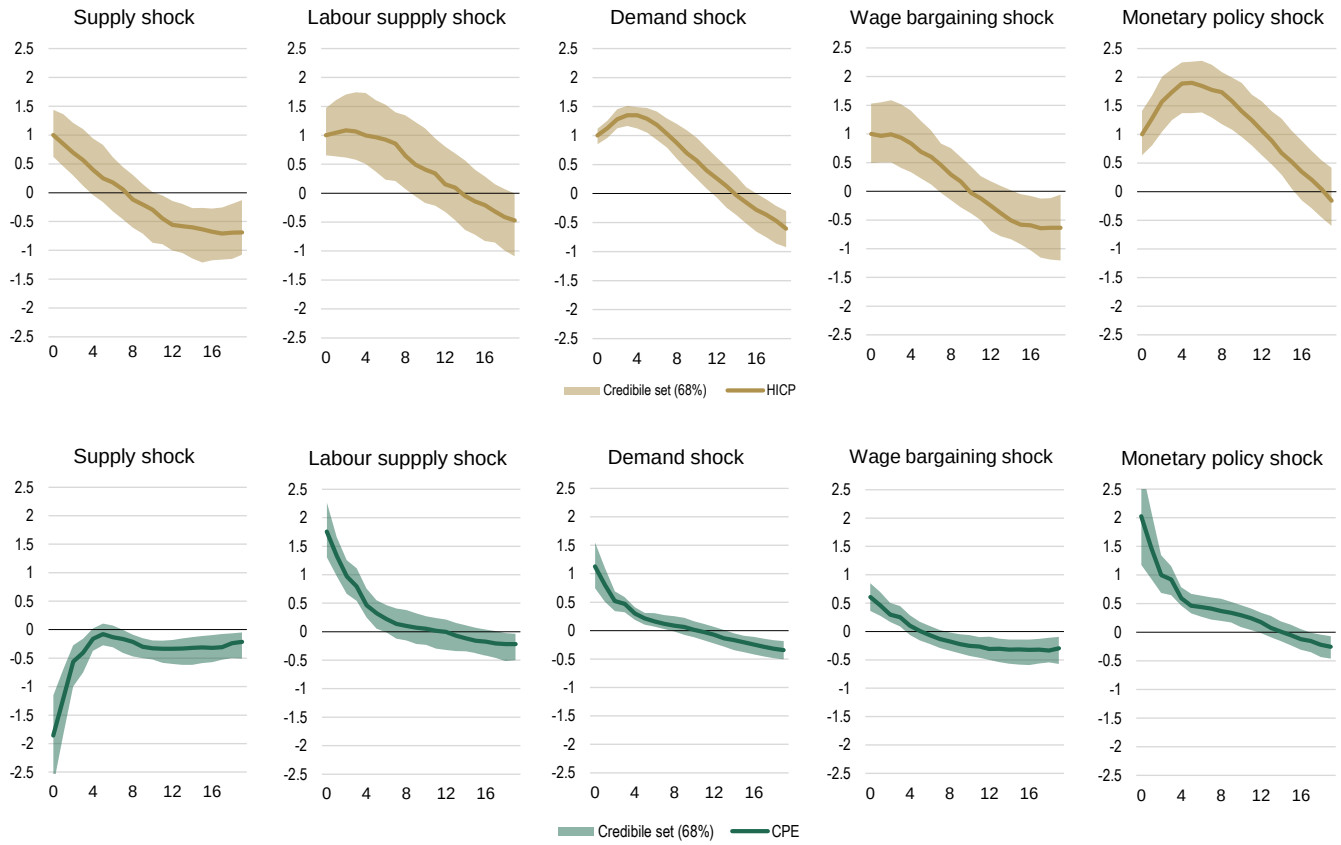



Note: Impulse responses are normalized to 1 percentage point increase in HICP on impact. All units are in percentage points.

***Wages in the euro area, on average, react more strongly to shocks compared to those in Slovenia. In the case of a labour supply shock, wages slightly overcompensate for inflation.***

A comparison of results for the euro area and the Slovenian economy shows that the response of compensation per employee in the euro area exhibits a more pronounced reaction to subsequent shocks. Furthermore, the dynamics of inflation display a higher degree of persistence. Similarly to findings observed for the Slovenian economy, labour supply shocks generate dynamics wherein wages mildly outpace inflation, particularly during the initial quarters. Notably, the most substantial disparity between the dynamics of the two economies arises in response to a monetary policy shock. Reactions of both wages and inflation are more pronounced within the euro area.

Chart 2: **Impulse response functions of HICP and CPE for the euro area.**




Note: Impulse responses are normalized to 1 percentage point increase in HICP on impact. All units are in percentage points.

# 4 Conclusion and policy disscusion

***The motivation for the analysis stems from risks of wage-driven inflation.***

Paper evaluates the dynamics of wages and inflation in Slovenia and the euro area. The motivation for this analysis stems from growing concerns that wage growth may lead to a more protracted period of elevated inflation. To delve into this matter, a structural vector autoregression model is used, allowing for the disentanglement of responses of wages and inflation to different inflationary shocks.

***Demand-side shocks appear to be more likely to produce wage-driven inflation.***

Empirical findings reveal shock-dependent dynamics of these two variables. However, the reaction of wages is generally seen to be lower than that of inflation, with the exception of labour supply shocks. Hence this particular shock emerges as the most perilous in terms of its potential to spur wage-driven inflation. Monetary policy shock and demand shock also have the capacity to contribute to the wage-driven inflation. On the other hand, supply shocks and wage bargaining shocks appear to be least likely to cause wage-driven inflation dynamics. These outcomes align with the recent literature, which posits that inflationary pressures originating from wages predominantly manifest within demand-driven inflationary environments (see Bobeica et al. (2019)).

***Overall, the differences in the dynamics of wages and inflation between Slovenia and the euro area economy are not sizable.***

The examination of the results vis-à-vis the euro area does not show any important differences in the transmission dynamics. Although both variables display somewhat stronger reactions to all shocks in the euro area, the relative dynamics between inflation and wages remain very similar. Thus, based on this analysis, it tentatively seems that the heterogeneity in the dynamics of wages and inflation between the euro area and Slovenia may not pose substantial challenges for economic policymakers, although this assumption is made with caution, acknowledging the complex and multi-layered nature of such economic phenomena.

# 5 References


Bobeica, E., Ciccarelli, M., and Vansteenkiste, I. (2019). The link between labor cost and price inflation in the euro area. Working paper series 2235, European Central Bank

Foroni, C., Furlanetto, F., and Lepetit, A. (2018), "The shocks matter: Improving our estimates of exchange rate pass-through", *Journal of International Economics*, 114. 255–275.

Giannone, D., Lenza, M., and Primiceri, G. E. (2015). "Prior Selection for Vector Autoregressions." *Review of Economics and Statistics*, 97(2), 436–451. doi:10.1162/REST_a_00483.

Gumiel, J. E., and Hahn, E. (2018). The Role of Wages for the Pick-Up in Inflation. Box in the Economic Bulletin Issue 5, European Central Bank.

Hahn, E. (2021). How are wage developments passed through to prices in the euro area. Evidence from a BVAR model. *Applied Economics*, 53(22): 2467–2486.

Lahti, L., Huovari, J., Kainu, M., and Biecek, P. (2017). "Retrieval and Analysis of Eurostat Open Data with the eurostat Package." *The R Journal*, 9(1), 385–392. doi:10.32614/RJ-2017-019, https://doi.org/10.32614/RJ-2017-019.

Uhlig, Harald (2005). "What are the effects of monetary policy on output? Results from an agnostic identification procedure", *Journal of Monetary Economics*, Elsevier, vol. 52(2), 381–419, March.