Policy Brief
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Should we worry about a wage-price spiral in Slovakia? Likely not!

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The prospect of a “wage-price spiral” or the secondary effect from wages to inflation has raised concerns among various European countries. Using unit labour cost as a measure of nominal wage adjusted for productivity, we do not find any evidence supporting such occurrence in Slovakia in the aggregate economy or in the non-housing service sector. Even though lagged inflation has significant impact on the growth rate of unit labour cost, the predictive power of lagged unit labour cost for inflation is not observed. We do not find significant pass-through effect from unit labour cost growth rate to inflation at any point in time (2000-2023) including the recent period of accelerated inflation. Nevertheless, it is worth noting that labour market tightness remains important for inflation, possibly through the transmission channel of wage expectation.

Lagged inflation affects the growth rate of unit labour cost (ULC) in both the aggregate economy and the non-housing service sector in Slovakia.

Changes in growth rate of unit labour cost (ULC) or nominal wages does not have any significant impact on inflation.

Deviations in the ratio of price to unit labour cost get adjusted more by wages .

Small increase in pass through of lagged ULC to inflation has been observed in the Slovak Non-Housing Service Sector (since 2020)

There has been an uptick in impact of expected inflation on ULC growth rate in recent years.

Introduction

The contribution of tight labour market along with increasing wage to accelerate inflationary pressure remains an important topic of consideration for monetary policy decisions. Although the restrictive monetary policy along with slowdown in energy and food prices have managed to ease most measures of inflation, domestic price pressures remain high, partly due to strong growth in wages[1]. In a tight labour market with low unemployment rate and strong labour demand, expectation of high inflation can prompt workers to negotiate for higher wages. Then higher wages could lead to a further escalation in prices. An extreme case of such situation is called a wage price spiral where the feedback loop or second round effect from increased wages to prices is large and significant. This could be responsible for sustaining high levels of inflation over an extended period. Therefore, nominal wage growth is required to be contained over the medium term to bring inflation to the current target of ECB[2].

In this policy brief, we investigate the potential occurrence of a wage price spiral in Slovakia using historical data. Specifically, we analyze the role of wage inflation in predicting price inflation and vice versa in Slovakia using the expectation augmented Phillips curve framework. We use productivity adjusted nominal wage or unit labour cost (ULC) as the wage measure. Additionally, we assess the impact of inflation expectation on growth rate of unit labour cost. Our analysis, focusing on both the aggregate economy and the non-housing service sector of Slovakia, aligns with existing research in this area. Our results indicate that unit labor costs show limited predictive power for inflation, whereas inflation proves to be a more effective predictor of ULC growth. We find that the growth rate of unit labor costs lags behind inflation, reflecting the relatively sluggish adjustment of wages. By mapping the relationship between unit labour cost and inflation over time, we confirm that the pass through from wage increase to inflation remains modest and stable, even during recent periods of heightened inflation. Additionally, we explain how labour market tightness can still influence inflation dynamics through wage expectations.

Change in inflation and growth rate of unit labour cost

Analysing the trends of unit labour cost and inflation over time we find a robust relationship between these two variables. Charts 1 and 2 show the growth rates of unit labour cost, the headline inflation. The difference between inflation and unit labour cost growth rate, also called the long-run markup or the error correction term is also plotted and labelled in Figures 1 and 2. The observed fluctuations are consistent with theory. In the simplest profit maximization model, where the firm operates as a price taker in both labour and product markets, the gap between price inflation and wage inflation remains consistently zero. However, when these assumptions are relaxed, certain conditions may arise that weaken the tight link between wages and prices in the

[1] ECB press release on Monetary Policy Decisions, 7th March 2024 (https://www.ecb.europa.eu/press/pr/date/2024/html)

[2] Lagarde, C. (2024), "Building confidence in the path ahead", speech at The ECB and its Watchers XXIV Conference, Frankfurt am Main, 20 March; Cipollone, P. (2024) "The confidence to act: monetary policy and the role of wages during the disinflation process", speech at the House of the Euro and the Centre for European Reform, Brussels, 27 March

short run. If there is a deviation in the long run markup or the error correction term in the short run, it should revert to its mean in the long run. Consistent with this, in these two figures, we observe that the disequilibrium term has been fluctuating around a mean of zero.

Chart 1
ULC Growth Rate, Headline Inflation and Long Run Markup Growth Rate/ Error Correction Term (Inflation – ULC Growth Rate) (% YoY)

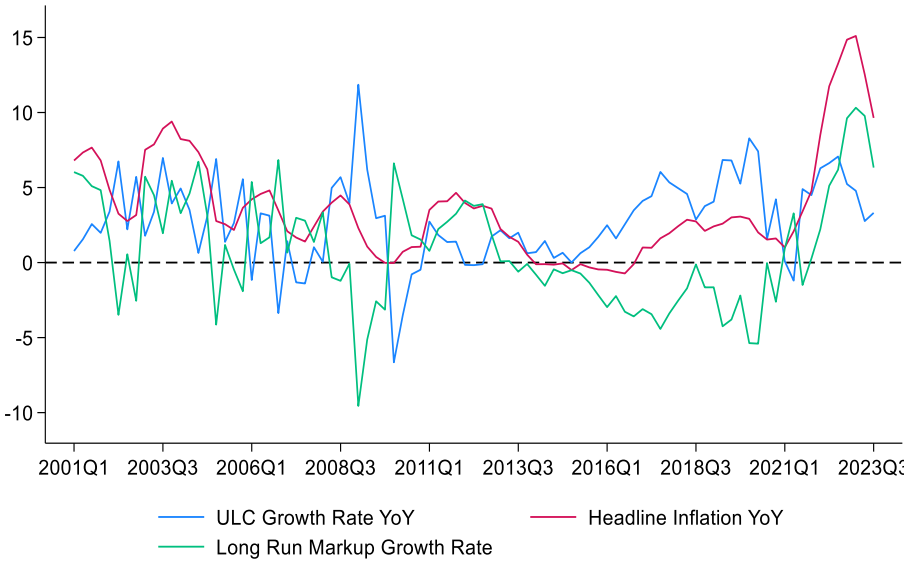
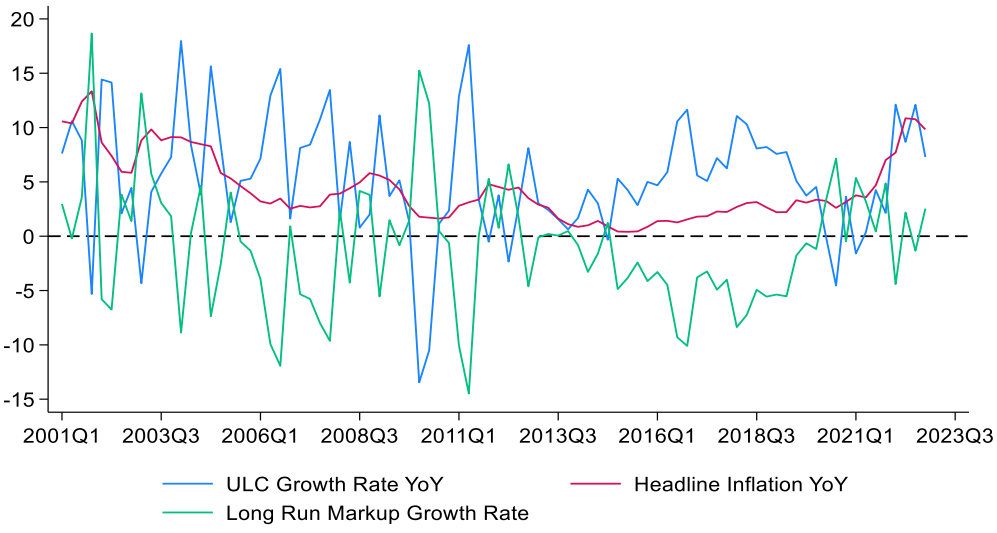


Chart 2
ULC Growth Rate, Headline Inflation and Long Run Markup Growth Rate/ Error Correction Term (Inflation – ULC Growth Rate) in the Non-Housing Service Sector (% YoY)



Source: Eurostat, NBS Calculation

Relationship between inflation and unit labour cost

While there appears to be a long-term relationship between the two series (unit labour cost growth rate and inflation), it is a priori unclear, which variable is causing changes in the other. We, therefore, conducted formal estimations with a view to establish the direction of causality.

We do not find evidence of unit labour cost or nominal wages adjusted for productivity having significant predictive power over inflation; however, we find that inflation helps in predicting change in unit labour cost. Examining the outcomes for both the aggregate economy and the non-housing service sector of Slovakia, our analysis reveals that inflation exerts influence on wages in the short term across both sectors but not the other way around.

Box 1
Empirical Methodology

We use a similar framework as Barlevy and Hu (2023) as well as Hu and Toussaint-Comeau (2010) to examine the relationship between change in inflation and unit labour cost[3]. Our dataset comprises of data spanning from 1996 Q1 to 2023 Q3 from Eurostat. The following two equations utilize changes in price and changes in the growth of unit labour cost as the response variables[4]. If lagged changes in the growth of unit labour costs help predict changes in inflation, the coefficients δ_j^p would be statistically different from zero. Likewise, if lagged changes in inflation help predict changes in the growth in unit labour costs, the coefficients γ_j^{ulc} should be statistically different from zero.

We use Granger causality test to examine whether lagged values of unit labour cost have significant explanatory power for inflation and vice versa. Finally, the second term in each equation $(\pi_{t-1}^p - \pi_{t-1}^{ulc})$, with coefficient β^p or β^{ulc} represents an error correction term (inflation – growth rate in ULC) or the long run markup growth rate. Including this term implies the assumption that the ratio of price to unit labour cost or the long run markup tends to grow at a constant rate over time. In that case, if this term deviates from its long-run rate, either inflation or the growth in ULC or both will adjust to make to ensure it continues growing at the constant long-run rate. If inflation adjusts, we should see $\beta^p < 0$ and significant. Similarly, if labour costs adjust, we should see $\beta^{ulc} > 0$ and significant.

$$\pi_t^p - \pi_{t-1}^p = \alpha^p + \beta^p(\pi_{t-1}^p - \pi_{t-1}^{ulc}) + \sum_{j=1}^4 \gamma_j^p (\pi_{t-j}^p - \pi_{t-j-1}^p) + \sum_{j=1}^4 \delta_j^p (\pi_{t-j}^{ulc} - \pi_{t-j-1}^{ulc}) + \varepsilon_t^p \quad \text{(i)}$$

[3] Similar to a group of literature (Campbell and Rissman, 1994; Ghali, 1999; Mehra, 2000) looking at wage price relationships, these two papers use expectation augmented Phillips curve and Granger test methodology to check for direction of causality between inflation and ULC. As econometric methodology, they include an error correction term to the Gordon triangle model to allow for cointegration between prices and ULC in the long run.

[4] We have also used supply and demand side controls in the model for robustness check and have found very similar results as the main framework.

$$\pi_t^{ulc} - \pi_{t-1}^{ulc} = \alpha^{ulc} + \beta^{ulc}\left(\pi_{t-1}^{p} - \pi_{t-1}^{ulc}\right) + \sum_{j=1}^{4} \gamma_j^{ulc} \left(\pi_{t-j}^{p} - \pi_{t-j-1}^{p}\right) + \sum_{j=1}^{4} \delta_j^{ulc} \left(\pi_{t-j}^{ulc} - \pi_{t-j-1}^{ulc}\right) + \varepsilon_t^{ulc} \quad \text{(ii)}$$

We also check for impact of inflation expectation on unit labour cost growth rate in the same framework by adding inflation expectation $E_t[(\pi_{t+1}^{p} - \pi_t^{p})$ in the second equation. In this regression, with the coefficients and we are also interested in the coefficients γ_{-1}^{ulc} to see the impact of inflation expectation on unit labour cost growth rate. Unfortunately, we cannot check the impact of wage expectation on inflation due to data unavailability. However, we were able to leverage European Commission Consumer survey data to quantify inflation expectations. This restricts our data period to 2003-2023.

$$\pi_t^{ulc} - \pi_{t-1}^{ulc} = \alpha^{ulc} + \beta^{ulc}\left(\pi_{t-1}^{p} - \pi_{t-1}^{ulc}\right) + \sum_{j=0}^{4} \gamma_j^{ulc} \left(\pi_{t-j}^{p} - \pi_{t-j-1}^{p}\right) + \gamma_{-1}^{ulc} E_t[(\pi_{t+1}^{p} - \pi_t^{p})] + \sum_{j=1}^{4} \delta_j^{ulc} \left(\pi_{t-j}^{ulc} - \pi_{t-j-1}^{ulc}\right) + \varepsilon_t^{ulc} \quad \text{(iii)}$$

$E_t[(\pi_{t+1}^{p} - \pi_t^{p})]$= From EC consumer survey

In our Granger causality tests using equation i and ii from box 1, we find that wages do not impact price inflation[5]. However, we do observe that prices cause wage inflation. We also find that wages, rather than prices, adjust to maintain the long-run equilibrium relationship.

Examining the dynamic relationship over time between lagged unit labour cost (ULC) and inflation, our analysis does not indicate an increased impact of lagged wages adjusted for productivity on inflation. Charts 3-6 illustrate the time varying or evolving relationship between ULC growth rate and inflation, in both the aggregate economy and the non-housing service sector. We use a rolling window regression to estimate equation (i) and (ii) from Box 1. The charts 3 and 5 represent how the coefficient $\delta_{j=1}^{p}$ or the relationship between change in inflation and 1 quarter lagged change in ULC growth rate varies over time. Similarly charts 4 and 6 illustrate the time varying nature of coefficient $\gamma_{j=1}^{ulc}$ or the relationship between change in ULC growth rate and lagged change in inflation (1 quarter)[6].

Following a surge during the global financial crisis, the pass through of 1 quarter lagged inflation on ULC growth has remained subdued in Slovakia in both sectors (chart 3). We also observe a positive and large impact of inflation on the next period's growth rate of unit labor costs (ULC) during recessionary periods (e.g., 2008, 2020), characterized by decreases in nominal wages or ULC growth rates alongside headline inflation (Chart 1). However, between 2010 and 2020, the ULC growth rate continued to rise even during periods of low inflation, as evidenced by the negative value of $\gamma_{j=1}^{ulc}$ in chart 3. It is also important to remember that historically the impact of inflation on ULC growth rate is found to be sluggish[7].

[5] The results of testing for Granger causality between ULC and prices are presented in Table 1 in Annex.

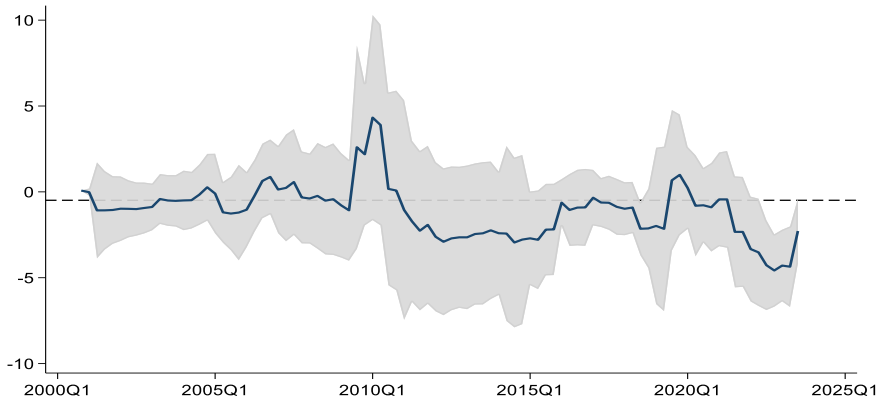
[6] The dotted line in each chart represents the average value of the coefficients ($\gamma_{j=1}^{ulc}$ and $\delta_{j=1}^{p}$) in the full sample time invariant regressions.

[7] Hu, Luojia, and Maude Toussaint-Comeau. "Do labor market activities help predict inflation?" Economic Perspectives 34.2 (2010)

The Granger test results from table 1 (annex) implies that lagged inflations over multiple quarters collectively play a significant role in influencing ULC growth rate. Therefore, it can take multiple quarters for ULC growth rate to catch up with inflation. We also illustrate the time-varying relationship between the ULC growth rate and 2nd, 3rd, and 4th quarter lagged inflation in charts 8, 9, and 10 in the annex. We observe a positive impact extending over more periods for higher lags. $\gamma_{j=1}^{ulc}$ remains negative even in recent periods of high inflation across the economy, possibly indicating a slower adjustment of ULC to inflation over more than a few quarters.[8]

In the non-housing service sector, we observe an increase in $\gamma_{j=1}^{ulc}$ (chart 5) indicating a quicker adjustment in wages within the service sector following the surge in prices experienced in recent years. The transmission of 1 quarter lagged ULC growth rate to inflation ($\delta_{j=1}^{p}$) has remained stable and maintained a low level even in recent years (chart 4)[9]. Therefore, similar to the time-invariant outcomes, our results do not find any support for the existence of a wage-price spiral in contemporary Slovakia. Nonetheless, we observe a marginal uptick in the pass-through of 1 quarter lagged ULC on inflation in recent years within the non-housing service sector (chart 6).

Chart 3
Time varying relationship between ULC growth rate and 1 quarter lagged inflation ($\gamma_{j=1}^{ulc}$) in the aggregate economy

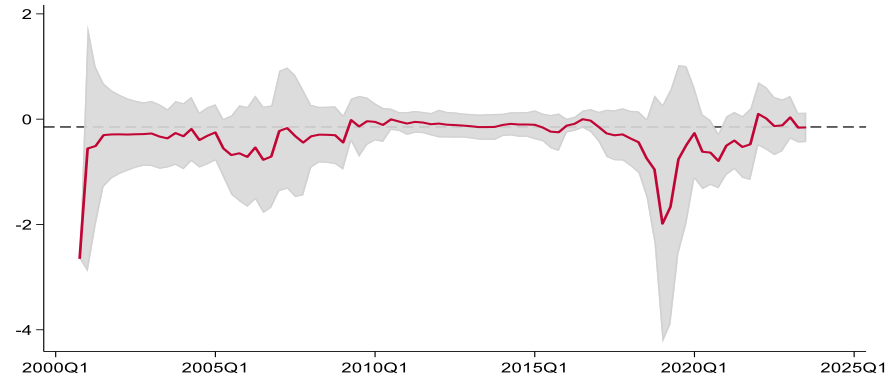


Source: Eurostat Data, Own Calculation
Note: The grey area represents 95% confidence interval. The dotted line represents the average estimate of $\gamma_{j=1}^{ulc}$ using the time invariant regression (ii) from box 1 for the aggregate economy of Slovakia

[8] The charts show the relationship with only 1 quarter lagged inflation. It is possible that ULC growth rate responds more strongly over the next few quarters following an increase in inflation.
[9] The impact on inflation remains stable and low even for 2nd, 3rd and 4th quarters lagged ULC growth rate as is evident in chart 11,12 and 13 in Annex. However, as we find in table 1, the lagged (1,2,3,4) ULC growth rate do not Granger cause or do not have significant impacts on inflation.

Chart 4

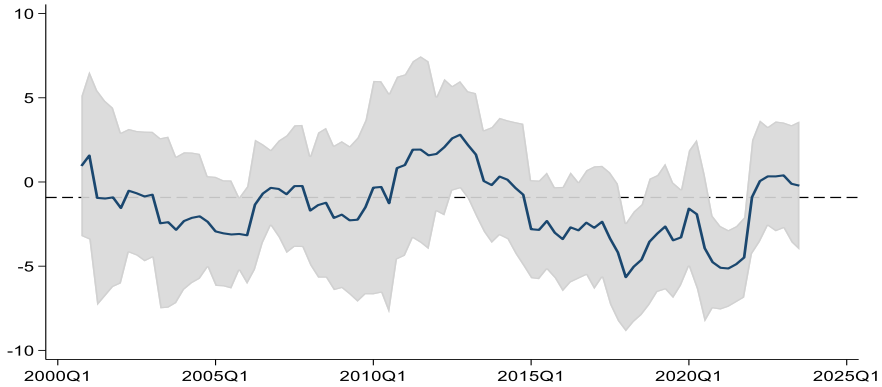
Time varying relationship between inflation and 1 quarter lagged ULC growth rate ($\delta_{j=1}^{p}$) in the aggregate economy



Source: Eurostat Data, Own Calculation
Note: The grey area represents 95% confidence interval. The dotted line represents the average estimate of $\delta_{j=1}^{p}$ using the time invariant regression (ii) from box 1 for the aggregate of Slovakia

Chart 5

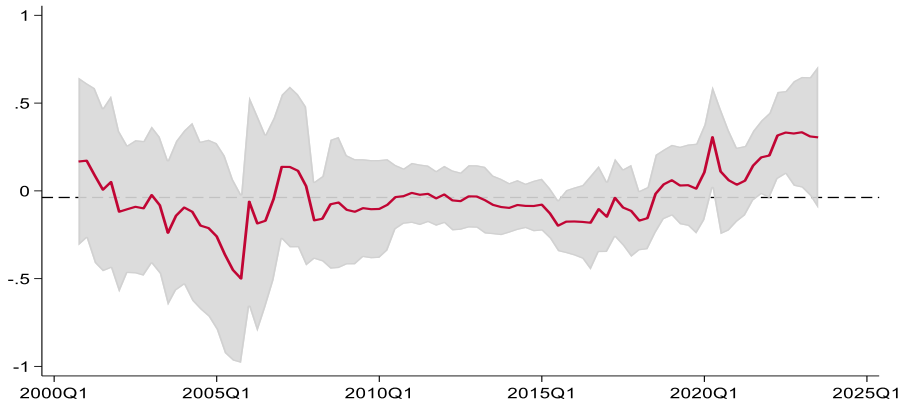
Time varying relationship between ULC and 1 quarter lagged inflation ($\boldsymbol{\gamma_{j=1}^{ulc}}$) in the non-housing service sector



Source: Eurostat Data, Own Calculation
Note: The grey area represents 95% confidence interval. The dotted line represents the average estimate of $\gamma_{j=1}^{ulc}$ using the time invariant regression (ii) from box 1 for the non-housing service sector of Slovakia

Chart 6

Time varying relationship between inflation and 1 quarter lagged ULC ($\delta_{j=1}^{p}$) in the non-housing service sector



Source: Eurostat Data, Own Calculation
Note: The grey area represents 95% confidence interval. The dotted line represents the average estimate of $\delta_{j=1}^{p}$ using the time invariant regression (ii) from box 1 for the non-housing service sector of Slovakia

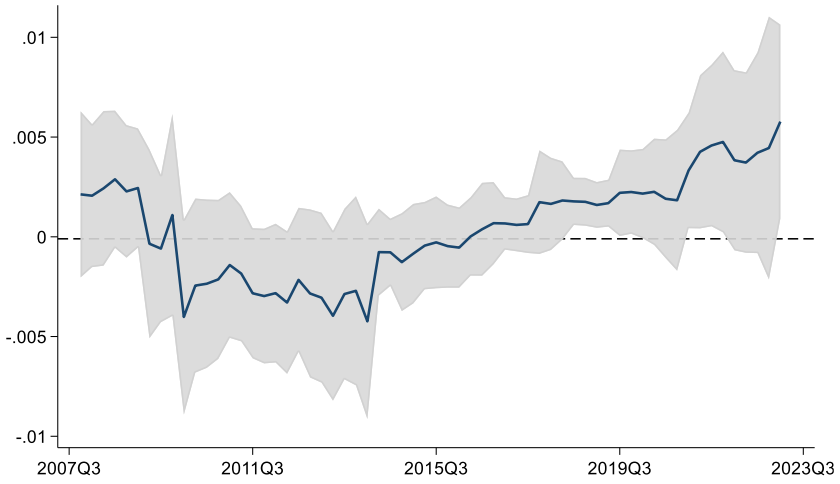
Relationship between inflation expectation and unit labour cost

We observe that inflation expectations did not have much influence on wages until recent times. Looking at the time invariant results of the long run markup growth rate, lagged inflation and inflation expectation on change in growth rate of unit labour cost we do not find significant impact of next period inflation expectation on unit labour cost growth rate. However, after examining the time-varying relationship between ULC growth rate and inflation expectations (chart 7), we note a slight increase in the pass-through of inflation expectations on ULC growth rate in recent years (since 2014). Similar to previous section, we use a rolling window regression to estimate equation (iii) from Box 1.

We observe the time varying value of coefficient γ_{-1}^{ulc} which explains how the impact of inflation expectations on ULC growth rate has been escalating over the last decade. It is important to notice how this impact continues to increase in recent periods of high inflation, highlighting the significance of inflation expectations in nominal wage growth. Due to the unavailability of reliable data on wage expectations, we cannot determine the significance of expected wages in relation to inflation in this exercise.

Chart 7

Time varying relationship between ULC growth rate and expected change in inflation (1 quarter ahead) (γ_{-1}^{ulc}) in the aggregate economy



Source: Eurostat Data, Own Calculation

Note: The grey area represents 95% confidence interval. The dotted line represents the average estimate of $\gamma_{j=-1}^{ulc}$ using the time invariant regression (iii) from box 1 for the non-housing service sector of Slovakia

Conclusion and main takeaways

In summary, while inflations from previous quarters affect wages or unit labor costs in both the aggregate economy and the non-housing service sector of Slovakia, we do not find a significant impact of unit labor cost on inflation. Based on our findings, the likelihood of a wage-price spiral occurring in Slovakia appears to be low. However, this does not diminish the importance of the labor market in influencing inflation. Shocks in the labor market that prompt firms to anticipate higher nominal wage growth in the future, consequently leading to higher growth in unit labor costs, do result in increased inflation according to standard macroeconomic models. We find that wages adjust at a slower pace compared to prices. Therefore, unit labor costs tend to rise following inflation, rather than the other way around.

The potential impact of wage expectations on inflation has been gaining attention in various central banks, including the European Central Bank. Therefore, it would be valuable to assess the influence of expected change in nominal wages or expected change in unit labor cost growth rates on inflation in Slovakia once reliable data on firms' expectations of future wages becomes available. Additionally, given the lagging nature of unit labor costs, caution is required when using a slowdown in the growth rate of unit labor costs to identify a reduction in inflationary pressures.

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Annex: Empirical Results

Relationship between inflation and lagged unit labour cost and vice versa

We use GDP deflator, headline inflation and core inflation as inflation measures for the aggregate economy. However, our focus remains on headline inflation. Panel A of table 1 reports if the column variables Granger-cause inflation, panel B reports the evidence for whether the column variables Granger-cause ULC growth. The cells report the p-values of tests that the respective coefficients differ from zero. We can accept a coefficient to be significantly different from zero if the p-value is below 0.05. The number of lags for both change in inflation and change in ULC growth rate is set to four.

Table 1

Granger Test Results for the Aggregate Economy and Non-Housing Service Sector

	A. Is Inflation caused by			**B. Is change in ULC growth rate caused by**		
	Long run markup (p value of β^p)	**ULC (p value of joint test of all lagged ULC growth rate $\delta^p_{j=1,..,4}$)**	**Both (p value of joint test long run markup and ULC growth rate)**	**Long run markup**	**Inflation (p value of joint test of all lagged inflation $\gamma^{ulc}_{j=1,..,4}$)**	**Both (p value of joint test long run markup and inflation)**
Aggregate economy	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**
GDP deflator	0.697	0.9728	0.9909	**0.000**	**0.0000**	**0.0000**
Headline inflation	0.674	0.9788	0.8245	**0.001**	**0.0070**	**0.0002**
Core inflation	0.559	0.4769	0.6145	**0.000**	**0.0043**	**0.0000**
Non-housing service sector	**No**	**No**	**No**	**Yes**	**No**	**Yes**
Inflation	.281	0.1168	0.1374	**0.000**	0.2589	**0.0000**

Note: The table shows the p values for the error correction term (inflation-ULC growth rate), the Granger test of the lagged dependent variables and p value of the joint Granger test (lagged dependent variable and error correction term). The cells marked by red boxes represent statistically significant results.

Looking at the results in table 1, we observe that coefficients of lagged inflations ($\gamma^{ulc}_{j=1,..,4}$) from equation (ii) are statistically significant in a Granger causality test. However, coefficients from lagged ULC growth rates ($\delta^p_{j=1,..,4}$) from equation (i) are not statistically significant. Therefore, it can be inferred that lagged unit labour cost does not Granger cause inflation or does not have a significant impact on inflation, both within the aggregate economy and the non-housing service sector. Additionally, we

find that the coefficient of the long run markup growth rate is statistically significant for change in ULC growth rate (β^{ulc}) whereas it is not for change in inflation (β^{p})[10]. So, a sudden increase in the long run markup from its long-run growth rate predicts higher growth in unit labor costs rather than change in inflation. Similarly, from the joint test of both the long run markup and lagged variables we observe that change in long run markup and lagged inflation Granger cause change in ULC growth rate, but not the other way around. From the economic point of view, it means that we cannot see spiraling effect of higher wages into inflation.

Relationship between inflation expectation and unit labour cost

Table 2

Granger Test Results for the Aggregate Economy (including inflation expectation)

	Is ULC caused by			
	Long run markup growth rate (p value of β^{ulc})	**Inflation Expectation (p value of** γ_{-1}^{ulc})	**Inflation (p value of joint distribution of** $\gamma_{j=-1,0,\dots 4}^{ulc}$)	**Both (p value of joint test of long run markup growth rate and inflation)**
Aggregate Economy	**Yes**	**No**	**No**	**No**
Headline Inflation	0.009	0.877	0.6534	0.1054

Note: The table shows the p values for the error correction term (inflation-ULC growth rate), inflation expectation, p values of the Granger test of inflation variables (expected and lagged) and of the joint Granger test (inflation variables and error correction term). The cells marked by red boxes represent statistically significant results.

Table 2 shows the Granger test results of the impact of long run markup growth rate, lagged inflation and inflation expectation on change in growth rate of unit labour cost (based on equation (iii)). Same as table 1, the cells report the p-values of tests that the respective coefficients differ from zero[11]. We find that inflation expectation alone (γ_{-1}^{ulc}) or together with lagged inflation ($\gamma_{j=-1,0,\dots 4}^{ulc}$) does not have a significant impact on change in wages.

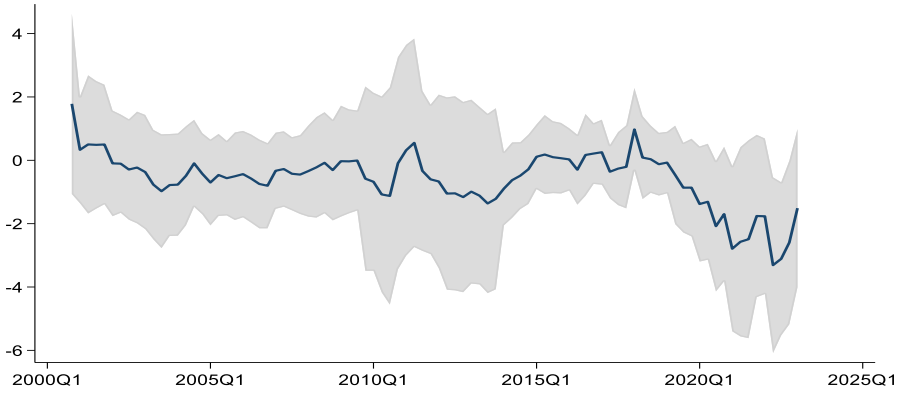
[10] In order for inflation and ULC growth rate to be cointegrated, it is important that the coefficient of at least one of the error correction terms is significant. We also used an ADF test to check for stationarity between the two series and confirm that the growth rate of prices and wages are both integrated of order 1.

[11] We can accept a coefficient to be significantly different from zero if the p-value is below 0.05.

Time-varying relationship between ULC growth rate and inflation (2nd, 3rd and 4th lags)

Chart 8

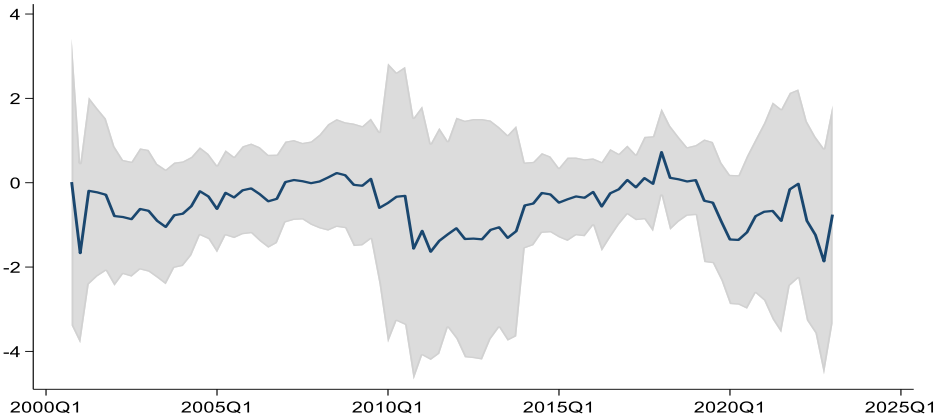
Time varying relationship between ULC growth rate and 2nd quarter lagged inflation ($\gamma_{j=2}^{ulc}$) in the aggregate economy



Source: Eurostat Data, Own Calculation

Chart 9

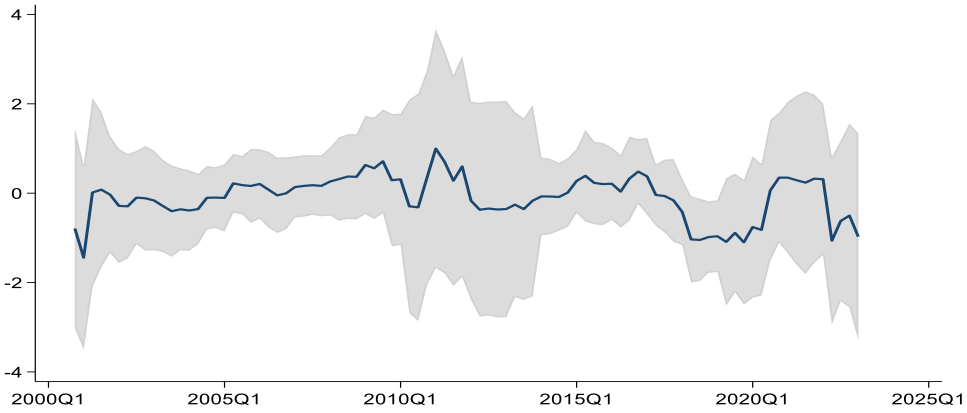
Time varying relationship between ULC growth rate and 3rd quarter lagged inflation ($\gamma_{j=3}^{ulc}$) in the aggregate economy



Source: Eurostat Data, Own Calculation

Chart 10

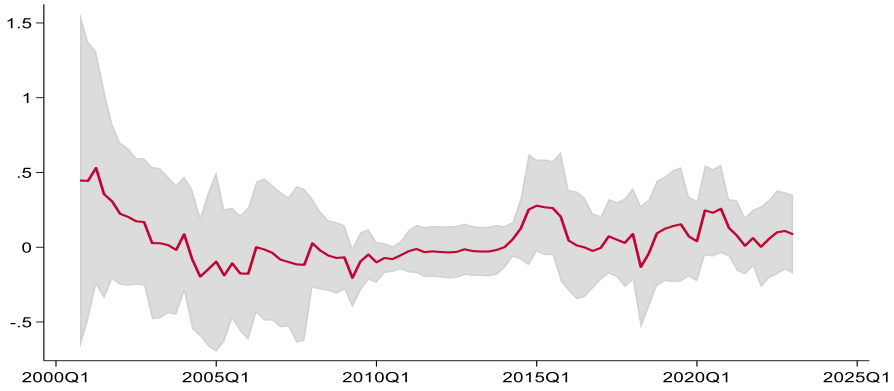
Time varying relationship between ULC growth rate and 4th quarter lagged inflation ($\gamma_{j=4}^{ulc}$) in the aggregate economy



Source: Eurostat Data, Own Calculation

Chart 11

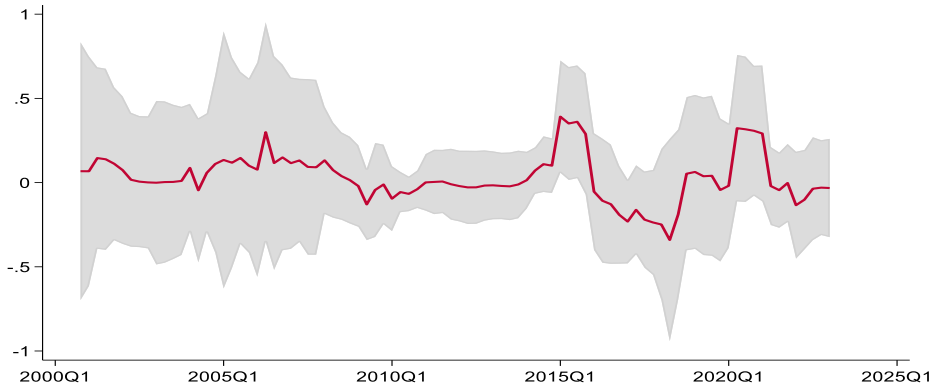
Time varying relationship between inflation and 2nd quarter lagged ULC growth rate ($\delta_{j=2}^{p}$) in the aggregate economy



Source: Eurostat Data, Own Calculation

Chart 12

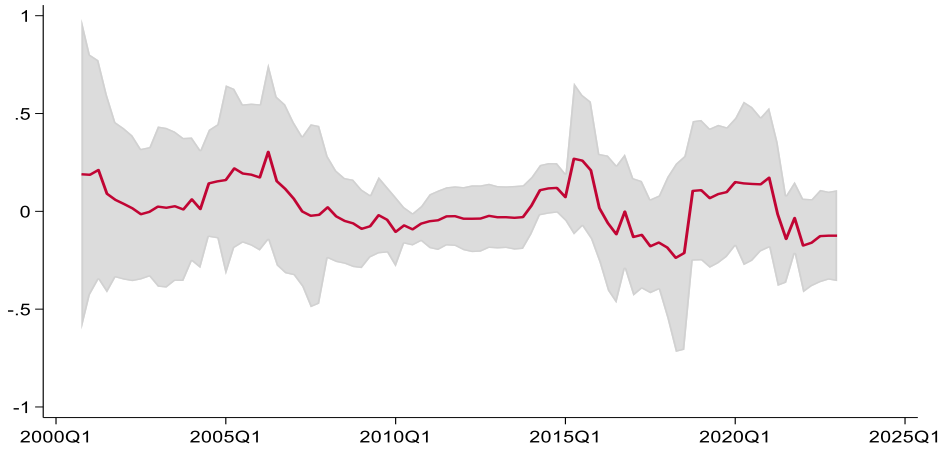
Time varying relationship between inflation and 3rd quarter lagged ULC growth rate ($\delta_{j=3}^{p}$) in the aggregate economy



Source: Eurostat Data, Own Calculation

Chart 13

Time varying relationship between inflation and 4th quarter lagged ULC growth rate ($\delta_{j=4}^{p}$) in the aggregate economy



Source: Eurostat Data, Own Calculation