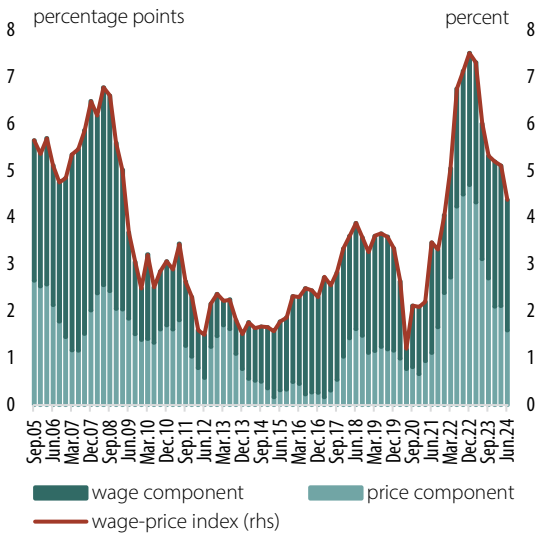
Box 3. Wage-price spiral: A Macro-at-Risk approach

This Box provides an empirical assessment of the 'wage-price spiral' risk, where wage hikes and price increases mutually reinforce one another, leading to persistent inflation. The topic is highly relevant in the context of the latest debates on a relatively slow global disinflation process, especially in the non-food and services segments.

Chart A. Wage-price index determined for Romania



Source: NIS, NBR calculations

The assessment is based on the Macro-at-Risk approach substantiated by Adrian *et al.* (2019) and, from a methodological point of view, uses the econometric quantile regression model to estimate the distribution of possible values of the wage-price index. The risk of a spiral is assimilated to the 95th percentile of this index (the portion of the statistical distribution of the wage-price index that cumulates 5 percent of its highest values).

According to Alvarez *et al.* (2022), the simultaneous increases in wages and prices for 3 consecutive quarters out of 4 may indicate the formation of such a spiral, while Bossay *et al.* (2022) look at periods when wage dynamics exceeded the inflation rate. Despite the different approaches, both empirically and theoretically it is generally accepted that such an event is preceded by simultaneous accelerated increases in the two variables.

The paper by Franta and Vlček (2024), which was also the source of methodological inspiration for this Box, proposes the use of an index calculated as a weighted sum of price growth and nominal wage growth. For Romania, this index (Chart A) is determined based on the equation (1):

$$wage - price\ index_t = 100 * \left[\frac{1}{std(\Delta 4p)} * \Delta 4p_t + \frac{1}{std(\Delta 4w)} * \Delta 4w_t\right] \quad (1)$$

where p_t is the consumer price index (CPI) at time t, adjusted for the first-round effect of VAT rate changes (expressed in natural logarithms) and the gross nominal wage in the private sector[1] at time t (expressed in natural logarithms). The price growth and wage growth are then standardised (using the standard deviation of each of the variables, $std(\Delta 4p)$ and $std(\Delta 4w)$), to balance the contribution of each component, starting from their historical volatility. Thus, the components become comparable in terms of size.

A wage-price index above its value at risk (as proxied by the 95th percentile of its distribution) indicates a substantial likelihood of a wage-price spiral. The 95th percentile was determined conditional on a set of explanatory variables and

[1] From the perspective of the theoretical mechanism of the spiral effect, wage developments in the public sector are less relevant since they are not the direct financial responsibility of private companies, which are price setters, but they can indirectly (e.g. via demonstration effects) influence price setting in the private sector.

estimated using the quantile regression model. At the same time, the analysis also involves quantifying "normal" thresholds for the wage-price index and the estimated risk[2]. The deviations from these thresholds signal wage-price spiral risks, with potential unfavourable consequences.

Table A. Quantile regression estimates for the wage-price index, Romania

Dependent variable	Wage-price index (95th percentile)
Persistence term	0.78** (0.29)
Real effective exchange rate gap (-4)	0.09* (0.06)
Output gap (-4)	0.28* (0.14)
3M ROBOR gap (-4)	-0.48*** (0.15)
Annual GSCPI dynamics (-4)	0.45** (0.22)
Constant	2.26** (1.07)
R^2	58.95%

( ) standard deviations

*,**,*** indicate that the coefficient is statistically significant for a confidence level of 90%, 95%, and 99%, respectively

Source: NIS, New York Federal Reserve, NBR calculations and estimates

The set of explanatory variables used to estimate the conditional distribution of the possible values of the wage-price index included a number of factors relevant to the aggregate demand in the economy (the deviation of real GDP from its potential level, the deviation of the real effective exchange rate from the equilibrium level, the deviation of the nominal 3M ROBOR interbank rate from the equilibrium level), but also the Global Supply Chain Pressure Index (GSCPI), expressed in the form of annual dynamics, as a proxy for global supply-side shocks[3]. These disruptions, stemming from bottlenecks in global value chains as well as from extreme developments in energy commodity markets, were the main driver of the latest inflation bout.

The estimates of the 95th percentile are shown in Table A. The accuracy of the model, as measured by a R^2 index, is 58.95 percent[4].

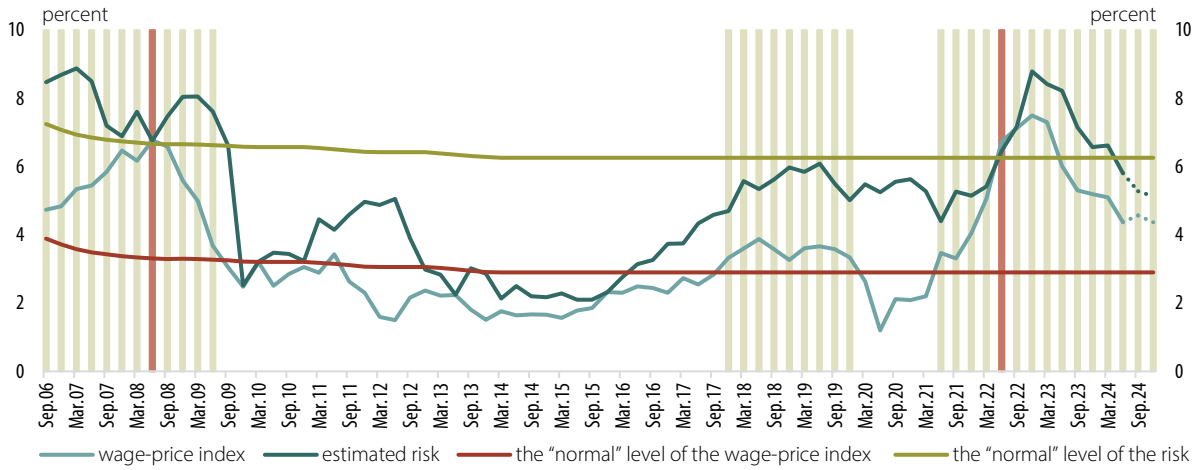
In the period under review (2005 Q3 – 2024 Q2) two episodes were identified when the wage-price index was slightly above the estimated value at risk: 2008 Q2 and 2022 Q2; Chart B shows the specificities of these moments (the episodes in red). The first episode precedes the 2008-2009 financial crisis. Prior to this period, the NBR had pointed to a wage-price spiral risk in the February 2008 *Inflation Report*, before declaring this risk to be the main factor leading to the monetary policy tightening in February and March 2008 (see, for example, the May 2008 *Inflation Report*). As regards the second episode, the risk of a wage-price spiral was constantly flagged in the minutes of the monetary policy meetings of the NBR Board between October 2021 and July 2022, being one of the factors underlying the decisions to raise the key interest rate.

2 The reference ("normal") level of the wage-price index is determined based on equation (1), where price dynamics are set at the central inflation target and wage dynamics at the historical average of the variable. The reference ("normal") level of risk is obtained by applying two standard deviations from the "normal" level of the index.

3 An alternative specification was also tested, using the dynamics of the industrial producer price index in manufacturing as a proxy for supply-side shocks. Unlike the GSCPI, this index captures developments in the domestic economy. The results do not differ significantly from those presented in this Box.

4 The value is comparable to the results presented by France and Vlček (2024) for the United Kingdom, the USA and the Czech Republic.

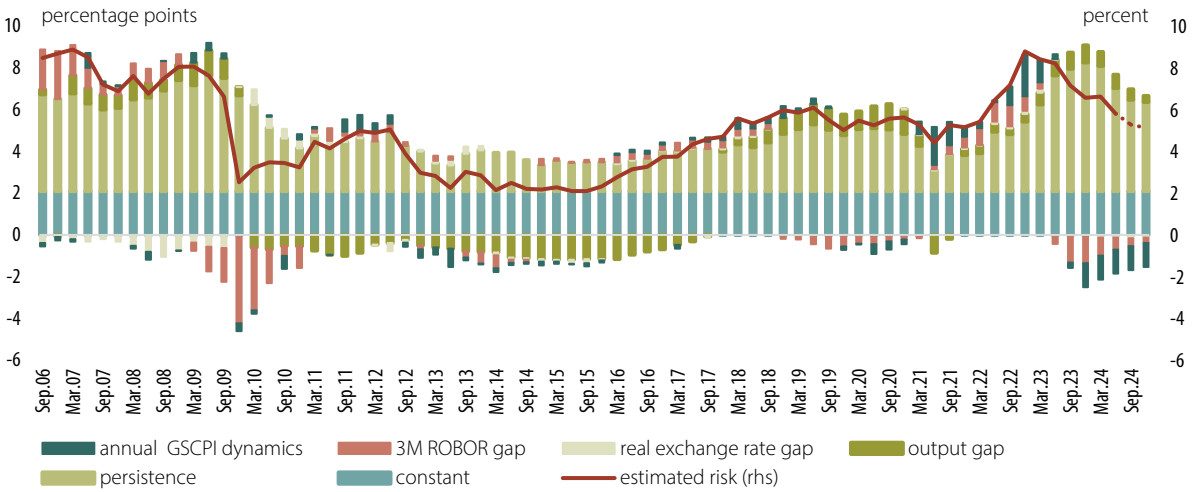
Chart B. Wage-price index and the 95th percentile of its conditional distribution



Notes: (1) The "normal" level of the wage-price index is determined based on equation (1) where price dynamics are set at the central inflation target and wage dynamics at the historical average of the variable (considered as reference values for the period under review). (2) Areas in light green refer to the episodes when the wage-price index was above the "normal" level, while those in red to the episodes when it also exceeded (marginally) the 95th percentile of the distribution (the estimated risk). (3) The dotted lines indicate forecast values.

Source: NIS, NBR calculations and estimates

Chart C. Decomposition of the risk associated with the 95th percentile of the conditional distribution of the wage-price index



Note: The dotted line indicates forecast values.

Source: NBR calculations and estimates

The comparison with the "normal" level of the index identifies three periods when it recorded higher values (shown in light green in Chart B): the period before the 2008 financial crisis, the period spanning 2017 Q4 – 2019 Q4 and the period after 2021 Q2. All three periods were marked by substantial wage increases in both the public and private sectors, *inter alia* amid the successive hikes in the minimum wage economy-wide, as well as by CPI inflation rates generally above the upper bound of the variation band. Moreover, in the first and last period mentioned, the estimated risk of a high wage-price index and, implicitly, of an inflationary spiral, was at least "normal". Such developments called for the adoption of a prudent, proactive monetary policy focused on anchoring medium-term inflation expectations, with a view to preventing a self-sustained rise in the overall level of consumer

prices. The decomposition of risk by influencing factors, as shown in Chart C, indicates that monetary policy[5] acted generally towards reducing the risk during these periods.

For the recent period, the risk is estimated to have fallen below the "normal" level in 2024 Q2, which points out a lower probability for an inflationary spiral. At the same time, according to the forecasts in the baseline scenario of the projection, the wage-price index is expected to remain below the "normal" level of risk until the end of this year (Chart B). However, despite its recent reduction, the risk of a wage-price spiral is seen to still be elevated, calling for close monitoring of developments. Monetary policy is deemed to support further risk reduction.

References

Adrian, T., Boyarchenko, N. and Giannone, D. – "Vulnerable Growth", *American Economic Review* 109(4), 2019, pp. 1263-1289

Alvarez, J., Bluedom, J., Hansen, N. J., Huang, Y., Pugacheva, E. and Sollaci, A. – "Wage-price spirals: What is the historical evidence?", IMF Working Paper 22/221, 2022

Boissay, F., De Fiore, F., Igan, D., Pierres-Tejada, A. and Rees, D. – "Are major advanced economies on the verge of a wage-price spiral?", *BIS Bulletin* No. 53, 2022

Franta, M. and Vlček, J. – "Wage-price spirals: A risk-based approach", *CNB Working Paper Series*, No. 1/2024

5 The analysis captures the monetary policy impact with a four-quarter lag.