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The emergence of wage-price spirals: Implications for Monetary Policy Response

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Abstract

This paper examines the interaction between nominal wage dynamics and consumer price inflation in Uzbekistan, with the aim of assessing the risk of wage-price spirals in an emerging market context. Using quarterly data covering the period from 2007 to 2025, the analysis investigates whether wage and price developments reflect self-reinforcing feedback mechanisms or primarily capture compensatory adjustments driven by external and institutional factors. The empirical framework combines cointegration analysis, conditional Granger causality tests, and a vector error correction model *(VECM)*, complemented by impulse response functions to characterise the dynamic transmission of wage and price shocks. The results establish the presence of a stable long-run equilibrium between wages and prices, with adjustment operating exclusively through wages rather than prices. Granger causality tests reveal a clear unidirectional pattern: consumer prices drive nominal wages, while wages do not feed back into prices in either the short or long run. Impulse response analysis confirms that wage shocks generate only a moderate and gradual price response, whereas price shocks produce a persistent wage adjustment consistent with compensatory indexation. These findings do not support the existence of a self-sustaining wage-price spiral in Uzbekistan. Instead, wage dynamics appear to reflect institutionally driven responses to inflation, shaped by centralized public-sector wage setting, while exchange rate pass-through emerges as the dominant driver of price dynamics.

Keywords: wage-price spirals, inflation, wages, Granger causality, pass-through, VECM

JEL classification: E24, E31, E52

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1. Introduction and Related Literature

Recent years have witnessed a renewed surge in inflationary pressures across both advanced and emerging economies, reviving concerns about the potential emergence of wage-price spirals. Following a prolonged period of low and stable inflation, global supply disruptions, rising commodity prices, and the post-pandemic recovery in demand led to a sharp acceleration in consumer prices. At the same time, labour markets tightened and nominal wages increased in many economies, raising concerns that stronger wage growth could reinforce inflationary dynamics through second-round effects.

From a policy perspective, these concerns are particularly relevant for inflation-targeting central banks. A wage-price spiral[1] can be described as a dynamic process in which increases in wages and prices mutually reinforce each other over time, potentially generating persistent inflationary pressures. Such dynamics can complicate disinflation efforts and require a stronger monetary policy response. At the same time, distinguishing genuine wage-price feedback from simple comovement driven by common macroeconomic factors remains an empirical challenge.

The theoretical foundations of wage-price spirals originate in early macroeconomic models emphasizing nominal rigidities, bargaining power, and adaptive expectations *(Blanchard, 1986)*. In such frameworks, rising prices trigger compensatory wage demands as workers attempt to maintain real purchasing power, while higher wages increase firms' marginal costs and lead to further price increases. However, this mechanism does not operate mechanically. Its strength depends on institutional features of labour markets, productivity developments, the formation of inflation expectations, and the credibility of monetary policy.

Recent empirical research has increasingly questioned the prevalence of wage-price spirals, particularly in advanced economies. Using cross-country evidence, the IMF *(Alvarez et al., 2022)* shows that sustained wage-price spirals have historically been rare and typically short-lived. Similarly, the BIS *(2022)* emphasizes that episodes of high inflation and rapid wage growth often reflect common underlying drivers, such as inflation expectations or labour market conditions, rather than strong causal feedback between wages and prices.

[1] In the public debate, the term "wage-price spiral" is often used loosely to describe periods of simultaneously high inflation and wage growth. In the economic literature, however, a wage-price spiral typically refers to a dynamic feedback mechanism in which wages and prices exert mutually reinforcing causal effects on each other over time, leading to persistent inflation *(see BIS, 2022)*.

A key insight of the modern New Keynesian literature is that wage-price dynamics are closely linked to the formation of inflation expectations. Galí *(2011)* highlights that in the presence of real wage rigidity and forward-looking wage setting, nominal wages respond primarily to expected inflation rather than to contemporaneous price movements. In this framework, inflation expectations play a central role in shaping wage dynamics and, by extension, inflation persistence. When expectations remain well anchored, nominal wage growth tends to adjust gradually, limiting the scope for self-reinforcing wage-price dynamics. Consistent with this view, Blanchard and Bernanke *(2023)* argue that the post-pandemic surge in inflation in advanced economies does not require abandoning existing wage-price frameworks. Their analysis shows that tight labour market conditions accounted for only a limited share of the inflation increase, while inflation expectations and supply-side shocks played a more dominant role. These findings reinforce the view that wage-price spirals are unlikely to emerge in environments where monetary policy credibility keeps inflation expectations anchored.

Meanwhile, evidence from firm-level pricing behaviour further challenges the notion of a mechanical transmission from wages to prices. Using detailed microdata, Gopinath and Itskhoki *(2010)* show that firms adjust prices infrequently and that pricing decisions depend on strategic considerations, market power, and demand conditions. As a result, increases in marginal costs, including labour costs, are often absorbed through profit margins rather than fully passed through to consumer prices. This incomplete and heterogeneous pass-through implies that even sizeable wage increases do not necessarily translate into proportional increases in aggregate inflation. Sectoral evidence also supports the view that wage-price pass-through is limited and heterogeneous. Heise et al. *(2022)* document that the pass-through from labour cost growth to prices has declined over time in advanced economies and varies substantially across sectors. In particular, wage-price transmission tends to be weaker in service sectors and in industries exposed to international competition. These findings suggest that structural changes in production, globalization, and market concentration have reduced the sensitivity of prices to domestic labour cost pressures. Sectoral evidence from the United States during the COVID-19 pandemic further confirms that the pass-through from wages to consumer prices remained limited and heterogeneous across industries *(Chin and Lin, 2023)*.

Taken together, this strand of the literature points to a weakening of traditional wage-price transmission channels, reinforcing the importance of expectations and external factors in explaining inflation dynamics.

Country-specific studies provide further evidence in this direction. For Switzerland, recent research by the Swiss National Bank shows that the pass-through from prices to wages has historically been substantial, while the effect of wage growth on prices has remained modest, even during periods of elevated inflation *(Leutert et al., 2025)*. These findings suggest that second-round inflationary effects operate primarily through expectations rather than through direct labour-cost pressures. Similar results have been documented for other advanced economies, including the United States and the euro area *(Peneva and Rudd, 2017; Bobeica et al., 2021)*. For the euro area specifically, wage-price pass-through has been found to vary across growth regimes and sectors *(Hahn, 2020; Ampudia et al., 2024)*.

Despite these advances, empirical evidence for emerging market economies remains relatively limited. Labour markets in emerging economies often differ substantially from those in advanced economies, reflecting weaker institutional frameworks, lower unionization rates, higher levels of informality, and less firmly anchored inflation expectations. These structural differences raise the question of whether conclusions drawn from advanced-economy evidence can be generalized to emerging market contexts.

This paper contributes to the literature by providing the first comprehensive empirical assessment of wage-price dynamics in Uzbekistan. Following the transition toward an inflation-targeting framework, the Uzbek economy experienced a period of elevated inflation alongside rising nominal wages in the aftermath of global shocks. These developments provide a useful setting for examining whether the observed comovement between wages and prices reflects genuine feedback mechanisms or simply common macroeconomic drivers.

Methodologically, the paper combines several complementary empirical approaches. First, cointegration analysis is used to examine whether nominal wages and consumer prices share a stable long-run equilibrium relationship. Second, Granger causality tests within an error-correction framework are employed to identify the direction of short-run and long-run interactions between wages and prices while controlling for key macroeconomic factors. Third, a vector error correction model *(VECM)* is estimated to analyse the dynamic transmission of wage and price shocks, using impulse response functions.

Together, these approaches allow for a comprehensive assessment of wage-price feedback mechanisms and their relevance for inflation persistence.

2. Conceptual Framework: Wages, Prices, and Feedback Mechanisms

This section outlines the conceptual framework underlying the empirical analysis. It clarifies the mechanisms linking wages and prices, distinguishes wage-price feedback from simple comovement[2], and motivates the empirical strategy adopted in the paper, with a specific focus on the institutional particularities of the Uzbek economy.

2.1 Wages, prices, and cost-based transmission

In standard macroeconomic frameworks, firms set prices as a markup over marginal costs, with labour costs constituting a central component of production costs *(Blanchard, 1986; Galí, 2011)*. As a result, changes in nominal wages can influence price-setting behaviour through their impact on unit labour costs. When wage growth exceeds productivity growth, unit labour costs increase, potentially exerting upward pressure on consumer prices. This cost-based transmission channel represents the traditional mechanism through which wages may affect inflation. However, cost-based transmission is neither mechanical nor uniform across firms and sectors. Firm-level evidence suggests that labour cost increases are often absorbed through margin adjustments, productivity improvements, or changes in pricing strategies rather than being fully passed through to consumer prices *(Gopinath and Itskhoki, 2010)*. Competitive pressures, exposure to international markets, and demand conditions further constrain firms' ability to pass labour cost increases on to consumers. Consequently, wage increases do not automatically translate into higher aggregate inflation.

Blanchard and Katz *(1999)* further show that wage dynamics reflect both labour market conditions and price developments, with the long-run relationship between wages and prices shaped by productivity trends and labour market institutions.

[2] Observed comovement between wages and prices may reflect common responses to shared macroeconomic factors, such as inflation expectations, labour market conditions, or external price shocks. Such comovement does not necessarily imply causal feedback between wages and prices.

The strength of cost-based transmission also depends on structural characteristics of the economy. Sectoral composition, market concentration, and the degree of openness influence how firms adjust prices in response to cost shocks. Empirical evidence indicates that wage-to-price pass-through tends to be weaker in more open economies and in sectors exposed to international competition *(Heise et al., 2022)*. In the case of Uzbekistan, these structural features take a distinctive form. The public sector remains the dominant formal employer, with the public wage bill accounting for almost half of the government budget[3] and wage growth in state institutions being driven primarily by administrative decisions rather than market-clearing mechanisms. Wages in Uzbekistan have remained broadly similar across industries for decades, in part because most salaries in the public sector are structurally linked to changes in the minimum wage through a Unified Tariff Scale, creating little incentive to reallocate labour between sectors[4]. This institutional rigidity constrains the extent to which firm-level cost pressures translate into flexible price adjustments.

Importantly, cost-based transmission differs conceptually from wage-price feedback. While higher wages may raise costs and prices contemporaneously, a wage-price spiral requires that price increases subsequently feed back into wage-setting behaviour, generating a self-reinforcing intertemporal process *(Blanchard, 1986).* Cost-based transmission alone therefore does not constitute a wage-price spiral but represents a necessary, though not sufficient, condition for such dynamics to emerge.

2.2 Price-to-wage transmission and compensatory wage setting

The transmission from prices to wages operates primarily through wage-setting behaviour. When consumer prices increase, real wages decline, potentially triggering compensatory wage adjustments as workers seek to preserve purchasing power. This price-to-wage channel plays an important role in shaping nominal wage dynamics following inflationary shocks *(Galí, 2011).*

Compensatory wage setting can take different institutional forms. In some economies, formal indexation mechanisms or collective bargaining agreements link wage growth explicitly to past inflation. In others, wage adjustments occur

[3] World Bank (2019). “Uzbekistan Public Expenditure Review”, Washington, DC: World Bank. (43-55)
[4] World Bank (2022). “Uzbekistan: Second Systematic Country Diagnostic”, Washington, DC: World Bank.

more informally through individual negotiations, public sector wage revisions, or changes in statutory minimum wages *(BIS, 2022).* The prevalence and strength of these mechanisms influence the responsiveness of wages to price developments.

In Uzbekistan, compensatory wage adjustments are predominantly implemented through centralized administrative decisions rather than through collective bargaining mechanisms. The minimum wage, public-sector wages, and pensions are adjusted periodically, typically once or twice per year, with the objective of preserving purchasing power in the presence of inflation. These adjustments are enacted through presidential decrees and reflect broader macroeconomic conditions as well as social policy considerations. Because public-sector wage scales are structurally linked to the minimum wage through the Unified Tariff Scale, changes in administratively determined wage benchmarks propagate across a large share of the formal wage distribution. As a result, wage dynamics tend to exhibit discrete and infrequent adjustments rather than continuous changes. This pattern contrasts with the more decentralized and market-based wage-setting processes commonly observed in advanced economies.

Collective bargaining plays a relatively limited role in shaping wage-setting dynamics in Uzbekistan. Trade unions have a more constrained role compared to advanced economies, and wage-setting processes are more centralized and influenced by employers and public institutions. This institutional setting may affect the distribution of bargaining power and the evolution of wage dynamics. In the private sector, particularly among smaller enterprises, wage setting often remains informal and less well documented. Informal employment accounts for a substantial share of total employment, and many workers in small private firms lack full social protection coverage. For this segment of the labour force, wage responses to inflation are likely to be heterogeneous and driven by firm-level conditions and individual negotiations rather than formal indexation mechanisms.

Inflation expectations are a key determinant of price-to-wage transmission. According to Alvarez et al. *(2022),* empirical evidence from recent inflation episodes suggests that even in periods of elevated inflation, wage responses tend to remain limited when expectations are well anchored and institutional constraints are strong. Recent experimental evidence further suggests that the pass-through of inflation expectations into wages and prices depends critically on how expectations are formed and communicated *(Abberger et al., 2024)*.

Similarly, according to Galí *(2011)*, when expectations are backward-looking or weakly anchored, past inflation is more likely to feed into nominal wage growth, amplifying compensatory behaviour. By contrast, under forward-looking wage setting and well-anchored expectations, inflation shocks are more likely to be perceived as temporary, limiting wage responses and reducing the risk of persistent second-round effects. Blanchard and Bernanke *(2023)* also argue that well-anchored expectations play a central role in preventing temporary inflation shocks from translating into persistent wage-price dynamics. Labour market conditions also shape compensatory wage setting. In tight labour markets, stronger bargaining power increases the likelihood that price increases translate into higher nominal wages, whereas in the presence of labour market slack wage responses to inflation tend to remain muted.

In Uzbekistan, labour market slack is further influenced by structural factors related to labour migration. A substantial share of workers, predominantly low-skilled, seek employment abroad, where wage opportunities are generally higher than those available domestically. This reflects differences in labour market conditions across countries, including wage levels and employment opportunities. Remittances from these workers constitute an important source of household income and may partly substitute for domestic labour earnings, while also affecting domestic demand conditions and, through their conversion into soums, exerting influence on the nominal exchange rate. These features suggest that domestic wage-setting may be influenced not only by internal labour market conditions but also by external labour market opportunities. In particular, the availability of employment abroad may affect reservation wages and labour supply decisions, potentially weakening the transmission from domestic price increases to formal wage adjustments. At the same time, fluctuations in remittance inflows linked to exchange rate movements represent an additional channel through which the nominal exchange rate, explicitly controlled for in the empirical framework of this paper, shapes domestic macroeconomic conditions beyond its direct import cost pass-through role.

Importantly, compensatory wage adjustments do not necessarily imply the existence of a wage-price spiral. Wages may respond to inflation without subsequently feeding back into prices, particularly when firms absorb cost pressures or when productivity growth offsets higher labour costs *(Leutert et al., 2025).* Only when wage increases translate into higher production costs and are passed on to prices does a self-reinforcing feedback mechanism arise.

Distinguishing compensatory wage setting from genuine feedback is therefore essential for assessing inflation persistence.

2.3 Wage-price spirals versus comovement

A central objective of this paper is to distinguish wage-price spirals from simple comovement between wages and prices. Although wages and prices often move together over time, such comovement does not necessarily imply the presence of self-reinforcing feedback mechanisms.

A wage-price spiral can be defined as a dynamic process in which wages and prices exert mutually reinforcing effects on each other over time. In this framework, price increases lead to higher nominal wages through compensatory wage setting, while rising wages subsequently feed back into prices by increasing firms' production costs. This intertemporal feedback mechanism can generate persistent inflationary pressures even in the absence of new shocks.

Inflation may rise due to external or demand-side shocks, with wages adjusting subsequently to preserve real purchasing power, without generating further price increases.

By contrast, comovement between wages and prices may arise without feedback effects. Both variables may respond to common underlying factors such as inflation expectations, labour market conditions, productivity developments, or external price shocks. In such cases, wages and prices move together, but neither variable acts as the primary driver of the other. In the Uzbek context, a particularly relevant source of common variation is the role of presidential decrees that adjust the minimum wage in response to observed inflation, while simultaneously influencing prices in sectors where administered wages represent a significant cost component, notably public services and education. This institutional feature may generate apparent comovement between wages and prices even in the absence of genuine feedback, complicating the identification of a wage-price spiral.

Distinguishing between these two mechanisms is crucial for monetary policy. While comovement driven by common factors does not necessarily threaten price stability, a wage-price spiral implies a heightened risk of inflation persistence and may require a stronger policy response. Misinterpreting comovement as a spiral could lead to unnecessary policy tightening, while failing to identify genuine feedback effects could undermine disinflation efforts.

This conceptual distinction directly motivates the empirical strategy adopted in this paper. Cointegration analysis is used to examine whether wages

and prices share a stable long-run relationship. Conditional Granger causality tests are employed to assess the direction of predictive relationships between the two variables while controlling for key macroeconomic drivers. Finally, a vector error correction model is used to analyse the dynamic transmission and persistence of wage and price shocks. Together, these approaches allow for a comprehensive evaluation of whether wage-price dynamics in Uzbekistan reflect self-reinforcing feedback mechanisms or whether the observed comovement is primarily driven by common macroeconomic influences, including the discretionary, government-led wage adjustment process that characterises the Uzbek institutional setting.

The interaction between wages and prices is not invariant across time or economic conditions. A growing body of research highlights the state-dependent nature of wage-price transmission. Pass-through effects may differ across inflation regimes, phases of the business cycle, and the type of shocks affecting the economy. In particular, stronger wage-price feedback may emerge in high-inflation environments, during periods of tight labour markets, or when inflation expectations become weakly anchored. These considerations are particularly salient in Uzbekistan, given its history of high inflation following independence and the recurrent use of administrative wage adjustments as a policy tool for protecting real incomes.

Institutional features further shape wage-price dynamics. The dominance of administered wage setting, the structural linkage of public sector salaries to the minimum wage, weak collective bargaining, and high labour market informality all influence how wages respond to price developments and how firms adjust prices to labour costs. These features suggest that the standard wage-price transmission channels identified in advanced economy research may operate with different intensity and timing in the Uzbek context, underscoring the need for an empirical investigation grounded in country-specific institutional realities.

3. Data and Stylised Facts

This section describes the data used in the empirical analysis and presents key stylised facts on wage and price dynamics in Uzbekistan. The objective is to provide descriptive evidence that motivates the subsequent econometric analysis, while avoiding causal interpretation at this stage.

3.1 Data

The empirical analysis is conducted using quarterly macroeconomic data for Uzbekistan covering the period from 2007Q4 to 2025Q3. The chosen sample spans both the pre- and post-reform phases of monetary policy[5] in Uzbekistan and includes periods of heightened inflationary pressures following global and regional shocks. This allows for an assessment of wage-price dynamics across different macroeconomic environments.

The core variables of interest are consumer prices and nominal wages. Consumer prices are measured by the headline Consumer Price Index *(CPI)*, while nominal wages are proxied by the average nominal wage level in the economy. In line with standard practice in the wage-price literature, all nominal variables are transformed into natural logarithms prior to analysis. This transformation facilitates the interpretation of estimated coefficients in growth-rate terms and helps stabilise variance.

A set of additional macroeconomic variables is included to control for domestic and external factors affecting wage and price formation. The nominal exchange rate is included to capture external cost-push pressures and exchange rate pass-through to domestic prices, which constitutes a particularly important transmission channel in a small open economy such as Uzbekistan. Labour productivity is incorporated to control for supply-side developments in wage-setting, as productivity growth affects the cost pressures faced by firms and the real wage-setting capacity of the economy.

Data are compiled from official national sources, including the Statistics Agency and the Central Bank of Uzbekistan. All variables are expressed in natural logarithms. Stationarity properties are assessed using Augmented Dickey-Fuller unit root tests, with results indicating that log-level series are non-stationary while their first differences are stationary, confirming integration of order one. Given the presence of cointegration, all subsequent analyses, including Granger causality tests and impulse response analysis, are conducted within a vector error-correction framework that jointly models short-run dynamics in first differences and long-run equilibrium relationships in log-levels. All series are aligned to a quarterly frequency.

[5] Uzbekistan officially adopted an inflation-targeting framework in 2020, with a medium-term inflation target of 5 percent. The transition to inflation targeting marked a shift toward a more forward-looking and rules-based monetary policy framework, following a period characterised by exchange rate liberalisation and structural reforms. Notably, the adoption of the inflation-targeting framework coincided with the onset of the COVID-19 pandemic, which introduced additional macroeconomic volatility during the early phase of the new regime. For an overview of the monetary policy transition, see Central Bank of Uzbekistan *(2020)* and IMF *(2021)*.

Lag lengths are selected based on standard information criteria and residual diagnostic checks, with particular attention paid to residual autocorrelation in the estimated equations. These data preparation steps ensure internal consistency across the Granger causality tests and vector error correction models presented in the subsequent sections.

3.2 Stylised facts on inflation and wage dynamics

A first inspection of the data reveals a pronounced and sustained increase in both consumer prices and nominal wages over the sample period. As illustrated in Figure 1a, consumer prices rose from a base of approximately 100 percent to over 500 percent by 2025Q3, while nominal wages increased from around 100,000 soums to over 6,000,000 soums over the same period. The parallel upward movement of the two series is visually striking, pointing to a positive long-run comovement between wages and prices.

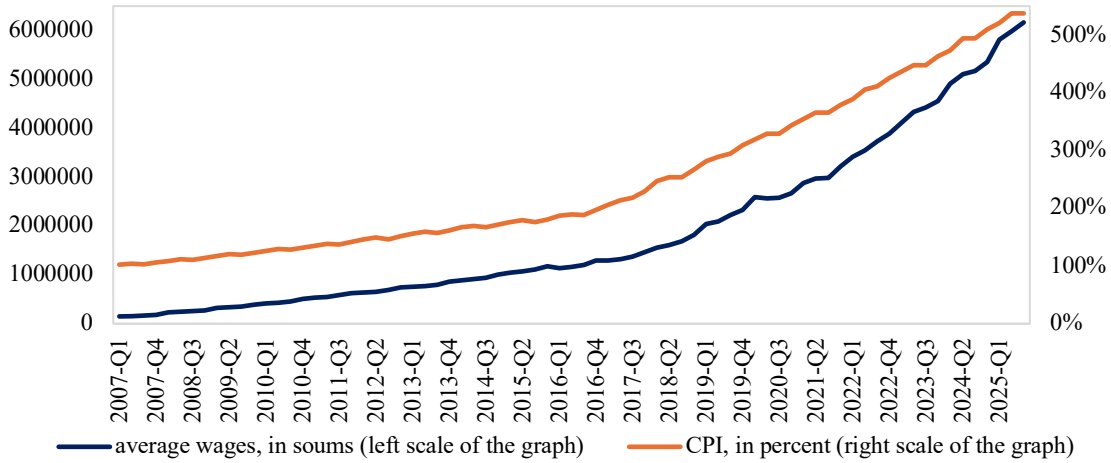
Several distinct episodes are discernible in the data. Prior to 2017, both series grew at a relatively moderate and stable pace, reflecting a period of administered exchange rate policy and contained inflationary pressures. From 2017 onwards, the pace of adjustment accelerated markedly, coinciding with the liberalisation of the Uzbek soum exchange rate in September 2017, which led to a significant depreciation and a subsequent surge in inflation. Nominal wages also accelerated sharply over this period, consistent with compensatory adjustments to rising price levels. The post-2020 period saw a further acceleration in both series, reflecting the combined influence of global commodity price shocks, supply chain disruptions, and post-pandemic demand pressures.

Expressing the same series in natural logarithms, Figure 2a facilitates a clearer assessment of the long-run co-movement between wages and prices by removing the scale differences between the two series and allowing proportional changes to be compared directly. Both series exhibit a similar underlying trend throughout the sample, with the log wage series tracking the log CPI series consistently over time, suggesting the presence of a stable long-run relationship between wages and prices. Notably, the slope of both series steepens visibly after 2017, reflecting the structural break associated with exchange rate liberalisation and the subsequent inflationary episode. This visual evidence of parallel trending in logarithms motivates a formal cointegration analysis in the subsequent section.

However, visual evidence based on levels and trends alone does not allow for conclusions regarding causal feedback between wages and prices. In several episodes, wage growth increases alongside inflation but does not appear to be

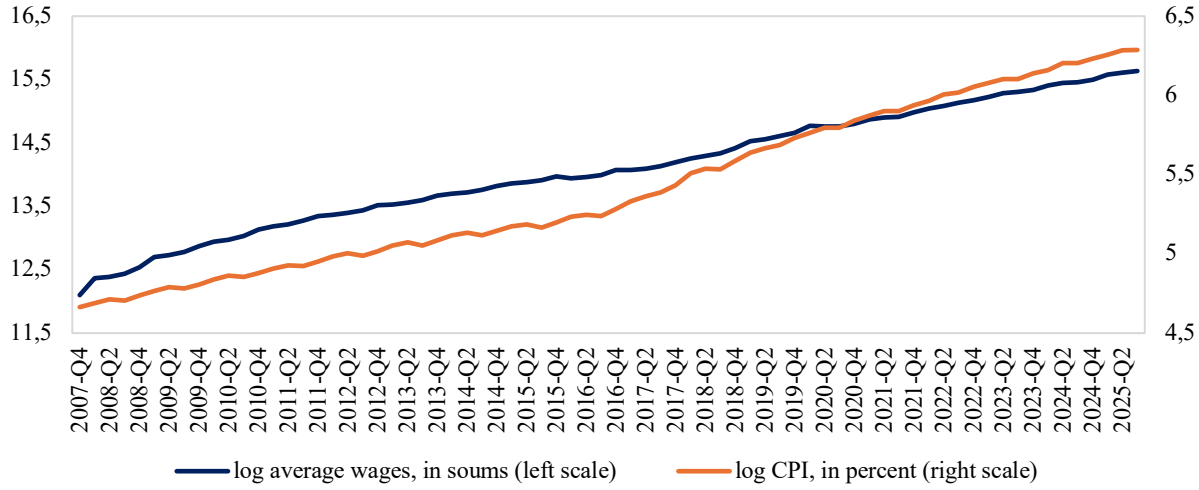
followed by further inflationary acceleration. Conversely, price increases often precede subsequent adjustments in nominal wages, which is consistent with compensatory wage-setting rather than wage-driven cost-push dynamics. These descriptive patterns highlight the need for a more formal econometric analysis to assess the direction and nature of wage-price interactions.

Figure 1a. The dynamics of average wages and CPI



Source: National Committee of the Republic of Uzbekistan on Statistics

Figure 2a. The dynamics of average wages and CPI (natural logarithms)



Source: National Committee of the Republic of Uzbekistan on Statistics

Inflation in Uzbekistan is strongly influenced by external conditions, particularly exchange rate movements. Given the economy's high dependence on imported goods and inputs, exchange rate depreciations tend to feed directly into domestic prices through import cost pass-through. Periods of elevated inflation often coincide with episodes of exchange rate depreciation, most notably

following the liberalisation of the Uzbek soum in 2017. This underscores the importance of controlling for exchange rate dynamics when analysing wage-price interactions, which is reflected in the empirical framework adopted in this paper.

The stylised facts reveal a persistent comovement between wages and prices throughout the sample period, with both series exhibiting parallel upward trends and shared responses to major macroeconomic episodes. While this descriptive evidence is consistent with the presence of wage-price interactions, it does not allow for conclusions regarding the direction or nature of causality between the two variables. In particular, it remains unclear whether wage growth drives inflationary pressures, whether inflation feeds into wages through compensatory adjustment, or whether the observed comovement reflects common responses to external shocks. These considerations motivate the empirical strategy adopted in the next section, which aims to distinguish causal feedback from correlation driven by common factors and to employ a multivariate framework that explicitly controls for external price pressures and supply-side conditions.

4. Empirical Strategy

This section outlines the empirical approach used to assess wage-price dynamics in Uzbekistan. The analysis proceeds in three steps.

First, we examine the time-series properties of nominal wages and consumer prices and test for the presence of a stable long-run equilibrium relationship between the two variables using Johansen cointegration methods. Second, conditional on the existence of cointegration, we investigate the direction of dynamic interactions between wages and prices by applying Granger causality tests within an augmented vector error-correction framework. This framework allows us to distinguish between short-run predictive relationships and long-run error-correction adjustment, while conditioning on relevant macroeconomic controls, specifically, the log-difference of the exchange rate and labour productivity, to account for common external and supply-side drivers of wages and prices. Third, we estimate a reduced-form VECM to characterise the structural dynamics of the system and derive impulse response functions, which trace the dynamic transmission of wage and price shocks over time under a recursive identification scheme.

This sequential strategy enables a comprehensive assessment of wage-price interactions, separating comovement driven by common macroeconomic

factors from genuine cost-based transmission and equilibrium adjustment mechanisms.

4.1 Cointegration analysis

This subsection examines whether consumer prices and nominal wages in Uzbekistan are linked by a stable long-run relationship. Given the descriptive comovement observed in Section 3, a formal cointegration analysis is required to assess whether this relationship reflects a shared stochastic trend rather than spurious correlation driven by common shocks. This approach follows earlier applications of cointegration methods to wage-price dynamics, as in Ghali *(1999)*, who employs multivariate cointegration analysis to examine the long-run relationship between wage growth and inflation.

All variables are expressed in natural logarithms. Standard unit root tests indicate that both consumer prices and nominal wages are non-stationary in levels but become stationary after first differencing *(Table 1)*. For level series, the lag length is selected automatically using the Akaike Information Criterion. For first-differenced series, a fixed lag length of two is imposed to avoid over-parameterisation given the sample size. Accordingly, log consumer prices and log nominal wages are integrated of order one, I(1), satisfying the necessary condition for cointegration analysis.

Table 1. Unit Root Tests

Variable	Transformation	Linear trend	ADF statistic	p-value	Order of integration
w	log-level	yes	-2.880	0.176	
	log-diff	no	-4.953	0.000	**I(1)**
p	log-level	yes	-2.001	0.589	
	log-diff	no	-5.759	0.000	**I(1)**

Note: *ADF test with automatic lag selection (AIC) for level series and fixed lag length of 2 for first-differenced series. Trend and intercept included for level tests; intercept only for first-difference tests. Critical values from MacKinnon (1996).*

To formally assess whether prices and wages are linked by a stable long-run relationship, we apply the Johansen cointegration test following Johansen and Juselius *(1990)*. The analysis is conducted within a bivariate vector autoregressive framework using logarithmic levels of consumer prices and nominal wages.

Formally, we consider a VAR model in levels of the form:

$$Y_t = \mu + \sum_{i=1}^{p} \Psi_i Y_{t-i} + \varepsilon_t , \qquad (1)$$

where $Y_t = [logCPI_t,\ logWAG_t]'$, μ denotes a constant, and ε_t is a vector of innovations. The VAR is re-parameterised as a vector error-correction model *(VECM)*[6]*:*

$$\Delta Y_t = \nu + \sum_{i=1}^{p-1} \theta_i \Delta Y_{t-i} + \Pi Y_{t-1} + \varepsilon_t , \qquad (2)$$

where the matrix Π captures the long-run relationships among the variables. The rank of Π determines the number of cointegrating vectors in the system.

The Johansen test is implemented using a specification with a constant restricted to the cointegrating relationship *(Case 3, Johansen-Hendry-Juselius)*. The lag length of the VAR in levels is set to two quarters, corresponding to one lag of differenced terms in the error-correction representation. This specification balances parsimony with the need to capture short-run dynamics in quarterly data.

Table 2. Johansen cointegration test results

Null hypothesis	Trace statistic	5% critical value	Decision
r = 0	39.19	15.49	Reject
r ≤ 1	2.49	3.84	Do not reject

Note: *Johansen trace test, Case 3 (constant restricted to cointegrating relationship), lags 1-2 in first differences, sample 2007Q4-2025Q3. Critical values from MacKinnon-Haug-Michelis (1999).*

The results of the Johansen trace test reject the null hypothesis of no cointegration at the 5 percent significance level, while failing to reject the null hypothesis of at most one cointegrating vector *(Table 2)*. This indicates the presence of a single cointegrating relationship between log consumer prices and log nominal wages. The cointegrating vector is normalised on log nominal wages, yielding a long-run relationship of the form:

$$\log CPI_t = 1.660 \cdot \log WAG_t + c , \qquad (3)$$

The estimated long-run elasticity is 1.660 *(standard error 0.043, t-statistic -38.43)*. This coefficient exceeds unity, indicating that nominal wages grew more than proportionally relative to consumer prices over the sample

[6] The theoretical foundations of the error-correction representation used here follow Banerjee et al. (1993), who provide a comprehensive treatment of cointegration and error-correction modelling for non-stationary data.

period. This suggests that real wages increased on average over the estimation period, consistent with active government wage policy in the public sector and the broader economic liberalisation initiated in September 2017, when the Uzbek soum was allowed to float freely, leading to a significant exchange rate depreciation and subsequent inflationary pressure.

The VECM error correction terms provide further insight into the adjustment dynamics. The estimated adjustment coefficient in the wage equation is -0.136 *(standard error 0.024, t-statistic -5.63),* indicating that approximately 13.6 percent of any deviation from the long-run equilibrium is corrected each quarter. In contrast, the adjustment coefficient in the price equation is 0.025 *(t-statistic 1.52)*, which is not statistically significant at conventional levels. This asymmetry implies that consumer prices are weakly exogenous with respect to the long-run relationship: prices drive wages in the long run, while prices themselves do not adjust to restore equilibrium. This finding is consistent with a wage-setting framework in which workers and firms index nominal wages to observed price levels.

The existence of cointegration has important implications for the subsequent analysis. First, it implies that standard Granger causality tests conducted solely in first differences may be misspecified, as they ignore the long-run equilibrium relationship between wages and prices. Second, it motivates the use of an error-correction framework that allows short-run dynamics to be analysed while explicitly accounting for long-run adjustment mechanisms. These issues are explored in the next subsection.

4.2 Granger causality analysis

The cointegration analysis in the previous subsection established the existence of a stable long-run relationship between consumer prices and nominal wages. This implies that deviations from the long-run equilibrium are corrected over time by adjustments in at least one of the two variables. To investigate the direction and nature of dynamic interactions between wages and prices, we conduct Granger causality tests within an **augmented vector error-correction framework**[7].

[7] This approach follows the standard treatment of Granger causality in the presence of cointegration, where short-run and long-run causality are jointly assessed within a vector error-correction model *(see Engle and Granger, 1987; Johansen, 1991; Toda and Phillips, 1993)*. Augmented specifications with exogenous controls are commonly used to account for additional macroeconomic drivers of wage and price dynamics.

Let

$$Y_t = \begin{bmatrix} p_t \\ w_t \end{bmatrix} = \begin{bmatrix} logCPI_t \\ logW_t \end{bmatrix}, \quad ECT_{t-1} = \beta Y_{t-1} + c_0 , \tag{4}$$

where ECT_{t-1} denotes the lagged error-correction term derived from the estimated cointegrating relationship, β is the cointegrating vector normalised on log nominal wages, and c_0 is a constant.

The augmented VECM used for Granger causality analysis is specified as:

$$\Delta Y_t = \nu + \sum_{i=1}^{q} \Theta_i \Delta Y_{t-i} + \alpha ECT_{t-1} + \sum_{j=0}^{s} \wedge_j \Delta Z_{t-j} + e_t \ , \tag{5}$$

where ν is a vector of constants, Θ_i are coefficient matrices capturing short-run dynamics between wages and prices, $\alpha = [\alpha_p, \alpha_w]$ contains the speed-of-adjustment coefficients to deviations from the long-run equilibrium, ΔZ_{t-j} is a vector of exogenous control variables in first differences, $e_t = [\varepsilon_{p,t}, \varepsilon_{w,t}]$ is a vector of innovations. This specification allows us to distinguish short-run predictive effects, long-run equilibrium adjustment, and joint causality in a coherent system.

The lag length of the VAR in levels is set to five quarters, corresponding to four lags of differenced terms in the VECM formulation, as selected by standard information criteria. Both the inflation and wage equations include the same set of exogenous controls: the log-difference of the exchange rate ($\Delta\log EXR_t$) and the log-difference of labour productivity ($\Delta\log PROD_t$). The exogenous variables enter the model contemporaneously, reflecting their role as macroeconomic conditioning variables rather than sources of endogenous dynamics.

Seasonal adjustment was considered but rendered the wage series stationary in levels under standard ADF tests, precluding cointegration analysis with unadjusted prices. The analysis therefore proceeds with seasonally adjusted series obtained via the Census X12 method, applied to both the wage and price series prior to log-transformation. Seasonal patterns in the quarterly data are further accounted for through the lag structure of the VECM.

Within the augmented vector error-correction framework described above, Granger causality between wages and prices is assessed along three complementary dimensions, allowing for a clear distinction between short-run dynamics and long-run adjustment mechanisms.

Short-run Granger causality is evaluated by testing the joint significance of the lagged first differences of the other endogenous variable in each equation. Specifically, wage-to-price causality in the short run is assessed by testing whether the coefficients on lagged changes in nominal wages, $\Theta_{wp,i}$, are jointly equal to zero in the inflation equation. Analogously, price-to-wage short-run causality is examined by testing the joint significance of lagged changes in inflation, $\Theta_{pw,i}$, in the wage equation. These tests capture whether past movements in one variable contain predictive information for the current change in the other variable beyond its own dynamics and the included controls.

Long-run Granger causality is assessed through the significance of the error-correction term in each equation. The error-correction coefficient α measures the speed at which each variable adjusts to deviations from the long-run equilibrium implied by the cointegrating relationship. A statistically significant error-correction term in a given equation indicates that the corresponding variable responds systematically to disequilibria in the long-run relationship, implying long-run Granger causality running from the other variable to that equation's dependent variable.

Joint Granger causality is tested by jointly evaluating the significance of both the short-run dynamics and the error-correction term. This joint test allows for the possibility that causality operates through a combination of short-run adjustments and long-run equilibrium correction, which is particularly relevant in systems characterised by cointegration.

By conducting Granger causality tests within this system-based VECM framework, the analysis explicitly conditions on the presence of a long-run equilibrium relationship between wages and prices and controls for relevant macroeconomic factors. This approach avoids the potential misspecification that would arise from conducting Granger causality tests in first differences alone and ensures a coherent interpretation of both short-run and long-run wage-price interactions.

4.3 Granger causality results

The Granger causality tests provide evidence of a systematic unidirectional predictive relationship running from consumer prices to nominal wages in Uzbekistan *(Table 3)*. The null hypothesis of no Granger causality from consumer prices to nominal wages is rejected at conventional significance levels across all three dimensions of causality assessed.

The joint test rejects the hypothesis that lagged changes in consumer prices and the error-correction term jointly do not enter the wage equation (p-value = 0.004), indicating that price developments contribute to wage dynamics through a combination of short-run adjustments and long-run equilibrium correction. The short-run block-exclusion test rejects the null hypothesis that lagged changes in consumer prices do not enter the wage equation (p-value = 0.040), indicating that past inflation contains predictive information for current wage growth beyond wages' own dynamics and the included macroeconomic controls.

Long-run Granger causality from prices to wages is confirmed by the significance of the error-correction term in the wage equation. The estimated adjustment coefficient is -0.086 (standard error 0.024, t-statistic -3.55), indicating that approximately 8.6 percent of any deviation from the long-run wage-price equilibrium is corrected each quarter through adjustments in nominal wages. The adjustment coefficient differs from the -0.136 reported in Section 4.1, reflecting the inclusion of additional exogenous controls: the exchange rate and labour productivity in the augmented specification, which absorb part of the adjustment previously attributed to the error-correction mechanism. In contrast, the error-correction term in the price equation is not statistically significant (t-statistic = 0.29), confirming that consumer prices are weakly exogenous with respect to the long-run relationship.

The null hypothesis of no Granger causality from nominal wages to consumer prices is not rejected at conventional significance levels in any dimension. The joint test yields a p-value of 0.476, the short-run block-exclusion test yields a p-value of 0.626, and the error-correction term in the price equation is statistically insignificant (p-value = 0.773). Taken together, these results indicate that lagged wage changes contain no significant predictive information for current inflation, and that prices do not adjust to correct deviations from the long-run wage-price equilibrium.

Taken together, these findings point to **unidirectional Granger causality running from consumer prices to nominal wages**, operating through both short-run dynamics and long-run equilibrium adjustment. Consumer prices Granger-cause wages in both dimensions, while wages do not Granger-cause prices in either dimension. This result is consistent with a wage-setting framework in which nominal wages are indexed to observed price levels, rather than wages driving inflationary dynamics. In the context of Uzbekistan, where the public sector dominates employment and wages are frequently adjusted in

response to accumulated inflation, this unidirectional pattern reflects the institutional structure of wage determination rather than a competitive labour market mechanism.

Regarding the timing of adjustment, the lag structure of the VECM indicates that inflation shocks affect wage dynamics primarily over the first one to four quarters, consistent with compensatory wage adjustments following price increases. This pattern suggests sequential adjustment rather than an instantaneous feedback mechanism, reflecting nominal rigidities in wage-setting that are characteristic of economies with a large public sector.

Table 3. Granger causality tests

(p-values reported)

Model: VECM *(rank = 1)*

Endogenous variables:

- logCPI *(seasonally adjusted),* logWAG *(seasonally adjusted)*

Controls *(Z)*:

- CPI equation: ΔEXR, ΔPROD *(contemporaneous)*

Lag length:

- 4 lags in first differences *(VAR lag length = 5 in levels)*

Residual serial correlation (BG LM):

- p = 0.058 at cumulative lag 4, marginally above 5% threshold

Direction	Test	Null hypothesis	p-value
W ⇒ CPI	Joint	No short-run and no long-run causality	**0.476**
	Short-run	Lagged ΔW do not enter CPI equation	**0.626**
	Long-run	Error-correction term = 0	**0.773**
CPI ⇒ W	Joint	No short-run and no long-run causality	**0.004**
	Short-run	Lagged ΔCPI do not enter wage equation	**0.040**
	Long-run	Error-correction term = 0	**0.001**

Note: *Short-run tests correspond to block-exclusion Wald tests. Long-run causality is assessed via the t-test on the error-correction coefficient. Joint causality tests are implemented via Wald tests on individual VECM equations estimated by OLS, with the error-correction term included as a generated regressor constructed from the estimated cointegrating vector. Both equations include exchange rate and labour productivity as exogenous controls entering contemporaneously. Breusch-Godfrey LM tests indicate no residual serial correlation at the 5% significance level in cumulative tests up to lag 3 (p = 0.058 at cumulative lag 4, marginally above the conventional threshold).*

To assess the robustness of the Granger causality results, the analysis is repeated under an alternative lag-length specification. The baseline specification uses four lags in first differences, corresponding to a VAR lag length of five in levels, as selected by standard information criteria. An alternative specification with two lags in first differences is also considered. Across both specifications, the null hypothesis of no Granger causality from consumer prices to nominal wages is rejected, while the null hypothesis of no causality from wages to prices is not rejected. The qualitative conclusions are therefore robust to the choice of lag length. Breusch-Godfrey LM tests indicate no evidence of residual serial correlation at conventional significance levels in cumulative tests up to lag 3, suggesting that the results are not driven by model misspecification.

4.4 VECM estimation

Building on the evidence of cointegration and unidirectional Granger causality running from consumer prices to nominal wages established in the previous sections, this subsection estimates a reduced-form VECM for nominal wages and consumer price inflation. The reduced-form VECM follows the same error-correction representation introduced in equation (5), with the system estimated as a bivariate model comprising nominal wages and consumer price inflation. Relative to the Granger causality framework in Section 4.2, the present specification focuses on the structural interpretation of the estimated dynamics rather than predictive inference, and the reduced-form innovations are subsequently mapped into economically interpretable shocks via a recursive identification scheme.

The baseline specification is estimated using quarterly seasonally adjusted series for nominal wages and consumer price inflation over the period 2009Q1-2025Q3, yielding 67 observations after adjustments. The lag structure is set to intervals of 1 through 4 in first differences, selected based on standard information criteria and residual diagnostic tests. The cointegrating relationship is specified under Case 3 (Johansen-Hendry-Juselius), allowing for a constant inside the cointegrating equation and a constant in the short-run dynamics.

To account for supply-side conditions and external cost pressures, the short-run dynamics include two exogenous control variables. The log-difference of labour productivity captures supply-side developments in the economy, reflecting the influence of productivity growth on wage-setting and cost pressures faced by firms. The log-difference of the nominal exchange rate proxies external

cost-push pressures and exchange rate pass-through to domestic prices, which constitutes an important transmission channel in a small open economy such as Uzbekistan. Treating these variables as weakly exogenous in the short-run dynamics allows the model to control for supply-side and external co-movements without imposing long-run equilibrium relationships with the nominal variables of interest.

Structural identification is based on a recursive *(Cholesky)* ordering of the endogenous variables, reflecting short-run informational frictions and the institutional features of the economy. This identification scheme is used to recover orthogonalised shocks from the reduced-form innovations in the subsequent impulse response analysis.

4.5 VECM estimation results

Table 4. reports the estimated coefficients of the VECM for the system comprising nominal wages and consumer price inflation.

The estimated cointegrating vector indicates the presence of a stable long-run equilibrium between wages and prices. The cointegrating relationship is normalised on nominal wages, yielding a long-run elasticity of wages with respect to consumer prices of approximately 1.57. This implies that a sustained one-percent increase in the price level is associated with a proportionally larger long-run increase in nominal wages, consistent with compensatory wage-setting behaviour whereby nominal wages adjust over time to offset erosion of real purchasing power. The associated adjustment coefficients reveal a strongly asymmetric pattern of convergence towards this long-run equilibrium, consistent with the unidirectional Granger causality from prices to wages established in Section 4.3. Deviations from the long-run relationship are corrected exclusively through adjustments in nominal wages, as evidenced by a negative and statistically significant error-correction coefficient in the wage equation (α_w = -0.086, t = -3.55), indicating that approximately 8.6 percent of any disequilibrium is corrected each quarter through wage adjustment. By contrast, the adjustment coefficient in the inflation equation is small and statistically insignificant (α_p = 0.003, t = 0.29), confirming that consumer prices are weakly exogenous with respect to the long-run wage-price relationship and do not respond systematically to deviations from the long-run equilibrium. Price dynamics are therefore driven primarily by short-run factors rather than by error-

correction mechanisms, fully consistent with the finding that wages do not Granger-cause prices in either the short or long run.

The short-run dynamics exhibit limited own persistence in wage changes *(Table 4)*. Own lags of wages are generally insignificant in the wage equation, with the exception of the fourth lag, which enters positively and significantly *(0.203, t = 2.46)*, suggesting the presence of an annual cycle in wage dynamics, consistent with the periodicity of administrative wage revisions typical of economies with a dominant public sector.

Table 4. VECM Estimation Results

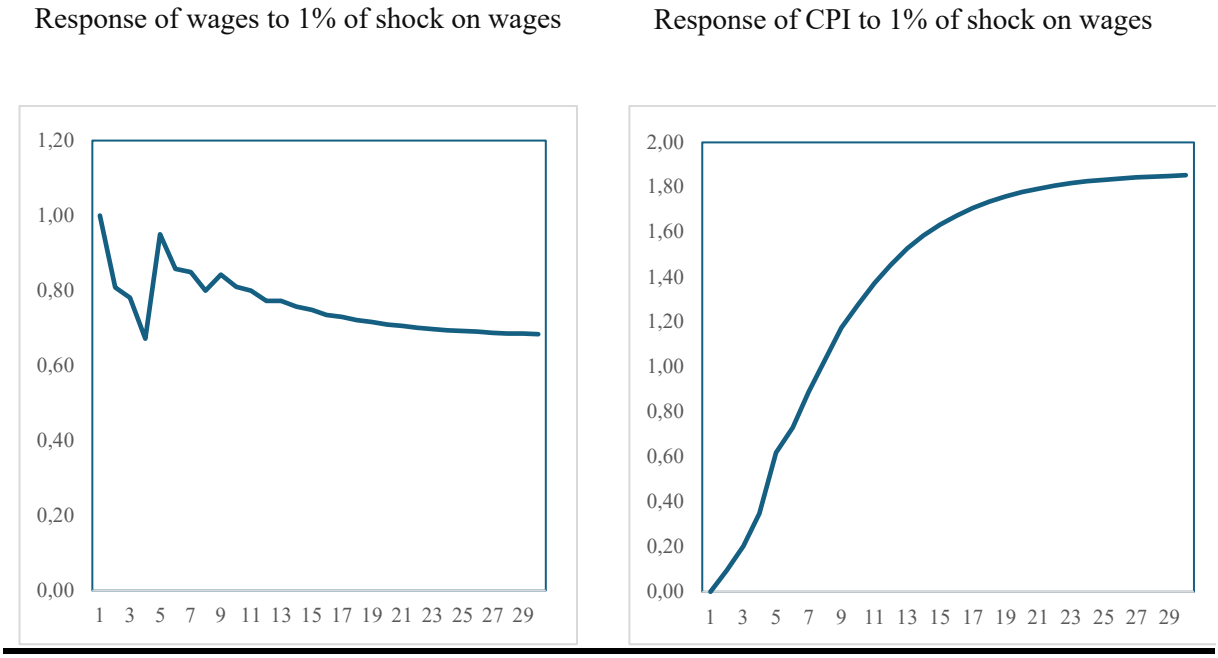
	D(WAG_L_D11)	D(CPI_L_D11)
CointEq1	-0.0862***	0.0031
	(0.0243)	(0.0107)
D(WAG(-1))	-0.1309	0.0217
	(0.1116)	(0.0490)
D(WAG(-2))	-0.0247	-0.0257
	(0.1114)	(0.0489)
D(WAG(-3))	-0.1014	0.0185
	(0.1104)	(0.0485)
D(WAG(-4))	0.2032**	-0.0457
	(0.0826)	(0.0363)
D(CPI(-1))	0.0869	0.1589
	(0.3072)	(0.1349)
D(CPI(-2))	0.1348	0.2967**
	(0.2818)	(0.1238)
D(CPI(-3))	0.1775	0.3047**
	(0.2826)	(0.1242)
D(CPI(-4))	0.4239	-0.0377
	(0.2934)	(0.1289)
C	0.0316***	0.0062
	(0.0108)	(0.0047)
DLOG(Labour productivity)	-0.3222	0.2122*
	(0.2617)	(0.1150)
DLOG(Exchange rate)	-0.2950	0.2769**
	(0.3119)	(0.1371)
Adj. R^2	0.4479	0.4644

Note: *Standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels based on p-values, respectively.*

Lagged inflation terms enter the wage equation with positive coefficients across all lags, consistent with partial backward-looking indexation and compensatory wage adjustments to past price developments, though these coefficients do not individually reach conventional significance levels. In the inflation equation, the second and third lags of CPI inflation enter positively and significantly (0.297 and 0.305 respectively), reflecting pronounced inertia and persistence in price dynamics.

The estimated coefficients on the exogenous control variables are consistent with the expected transmission channels. The log-difference of labour productivity enters positively and marginally significantly in the inflation equation, as well as the log-difference of the nominal exchange rate, which enters positively and significantly in the inflation equation *(0.277, t = 2.02)*, confirming the presence of exchange rate pass-through to consumer prices, consistent with the small open economy nature of Uzbekistan. Neither variable enters significantly in the wage equation, suggesting that wage dynamics are relatively more insulated from these external and supply-side factors in the short run.

Figure 3: Impulse responses to a 1% wage shock.



Note: *Impulse responses are rescaled such that the initial response of the shocked variable corresponds to a one-percent change. Confidence intervals based on Hall's percentile bootstrap with 1000 repetitions are reported in Appendix A, Figure A.1.*

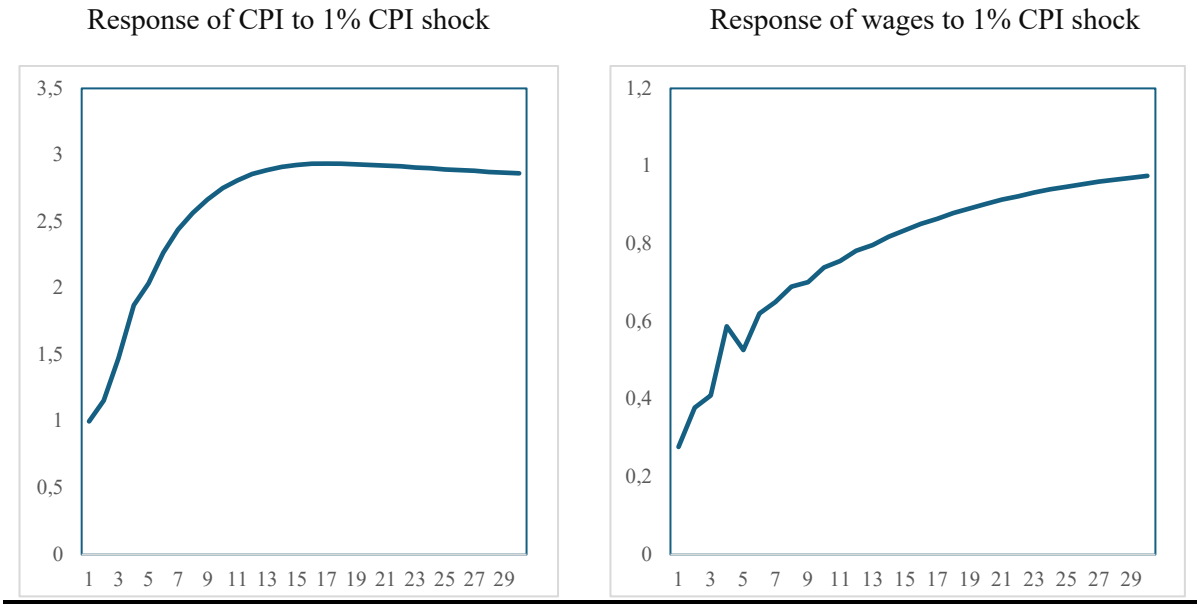
The VECM estimates provide a coherent characterisation of the joint short-run and long-run dynamics between wages and prices, and are fully consistent with the Granger causality results reported in Section 4.3. The findings confirm that prices drive wages in the long run through the error-correction mechanism,

while wages do not systematically feed back into prices. These results form the basis for the subsequent impulse response analysis.

To assess the dynamic transmission of shocks within the system, we analyse impulse response functions *(IRFs)* derived from the estimated reduced-form VECM. Structural interpretation is achieved through a recursive *(Cholesky)* identification scheme. Confidence bands for the impulse response functions *(Appendix A, Figure A.1)* are constructed using a residual-based bootstrap procedure as described in Lütkepohl et al. *(2020).* Impulse responses are reported over a 30-quarter horizon and are rescaled such that the initial response of the shocked variable corresponds to a one-percent change.

Figure 3 reports the impulse responses of nominal wages and the consumer price level to a one-percent shock to wages. The own response of wages exhibits a short-run adjustment following the initial one-percent increase, gradually converging to a persistent long-run level of around 0.65-0.70 percent above baseline. This indicates that wage shocks carry a substantial permanent component, with roughly two-thirds of the initial impulse translating into a lasting shift in the wage level, while the remainder is absorbed over the first several quarters through the error-correction mechanism.

Figure 4: Impulse responses to a 1% CPI shock.



Note: *Impulse responses are rescaled such that the initial response of the shocked variable corresponds to a one-percent change.*

The response of the CPI level to a wage shock is positive, smooth, and builds up gradually throughout the horizon. Starting from near zero on impact, the price level rises steadily, accelerating through the first ten quarters before converging to a plateau of approximately 1.85 percent above baseline by quarter

30. The long-run magnitude of the CPI response, approaching twice the initial wage shock points to an amplified and persistent transmission of labour cost pressures into consumer prices, unfolding gradually consistent with delayed price-setting and adjustment frictions.

Figure 4 reports the impulse responses of the consumer price level and nominal wages to a one-percent shock to the consumer price level. The own response of the price level exhibits an immediate one-percent increase on impact, followed by a rapid and persistent upward adjustment, converging to a long-run level of approximately 2.9 percent above baseline by around quarter 13-15, after which it stabilises. This strong persistence confirms that price shocks translate into lasting and amplified shifts in the price level, with the long-run effect nearly three times the initial impulse.

The response of nominal wages to a price level shock is positive and builds up gradually over time, but with a notable pattern: following an initial moderate response of approximately 0.3 percent, wages rise to around 0.6 percent by quarter 5, before a brief pause in adjustment, after which the response resumes its upward trajectory, converging smoothly towards approximately 0.95-1.0 percent above baseline by quarter 30. This gradual and persistent adjustment of wages to price shocks is consistent with compensatory wage-setting behaviour, whereby nominal wages adjust with a lag to restore real purchasing power following sustained price increases. The delayed and stepwise nature of the wage response reflects the presence of nominal rigidities and the institutional pattern of periodic administrative wage revisions in Uzbekistan, generating second-round effects that propagate gradually through the system.

Conclusion

This paper examined the interaction between wage dynamics and inflation in Uzbekistan with the aim of assessing the risk of wage-price spirals in an emerging market context. Using a combination of cointegration analysis, Granger causality tests within an augmented vector error correction framework, and impulse response analysis, the study distinguishes between genuine wage-price feedback mechanisms and comovement driven by common macroeconomic factors.

The results point to the existence of a stable long-run relationship between nominal wages and consumer prices, consistent with standard wage-price setting frameworks. However, Granger causality tests reveal a unidirectional relationship running from consumer prices to nominal wages, operating through both short-

run dynamics and long-run equilibrium adjustment. Price shocks transmit to wages with a delay, reflecting compensatory wage-setting behaviour whereby workers and wage-setters seek to restore real purchasing power following sustained price increases. By contrast, wages do not Granger-cause prices in either the short or long run, indicating that wage dynamics do not independently drive inflationary pressures in Uzbekistan.

The dynamic analysis further confirms these findings. Impulse response functions indicate that price shocks generate a gradual and persistent wage response, consistent with delayed compensatory adjustment, while wage shocks transmit to consumer prices only slowly and incompletely. The error-correction mechanism operates exclusively through the wage equation, confirming that it is wages, not prices, that restore long-run equilibrium following deviations, further reinforcing the asymmetric nature of wage-price interactions in Uzbekistan.

Taken together, the evidence does not support the presence of a self-sustaining wage-price spiral in Uzbekistan over the sample period. The relationship between wages and prices is fundamentally asymmetric: inflation drives wages through both short-run dynamics and long-run equilibrium adjustment, while wages do not feed back into prices in any statistically meaningful way. Inflation dynamics appear to be shaped primarily by own persistence and external cost pressures including exchange rate pass-through, with wage growth representing a consequence of inflation rather than a contributor to it.

From a policy perspective, these findings carry important implications for monetary policy under inflation targeting. Since inflation drives wages rather than the reverse, the primary risk of inflationary persistence in Uzbekistan stems from external cost pressures and exchange rate pass-through rather than from wage dynamics. Policy efforts aimed at containing exchange rate pass-through and anchoring inflation expectations are therefore likely to be more effective in breaking inflation persistence than attempts to directly influence wage growth.

The paper contributes to the emerging market literature by providing evidence that wage-price spirals are not a dominant feature of recent inflation dynamics in Uzbekistan, with causality running predominantly from prices to wages rather than the reverse. Several limitations of the present analysis should be acknowledged. First, inflation expectations data are only available from 2018 onwards; incorporating them into the analysis would have required truncating the sample period and discarding observations from 2007 to 2017, a period covering key structural episodes including the pre-liberalisation phase and the exchange

rate reform of 2017. As a result, the role of expectation formation in wage-price dynamics could not be directly assessed within the present framework. Second, the analysis focuses on aggregate wage and price series, which may obscure heterogeneity across sectors and between formal and informal labour markets. Third, the lack of firm-level data limits the ability to assess how individual price-setting behaviour responds to labour cost pressures. Future research could address these limitations by incorporating measures of inflation expectations, sectoral wage dynamics, and firm-level pricing behaviour to further refine the understanding of inflation persistence in emerging market economies.

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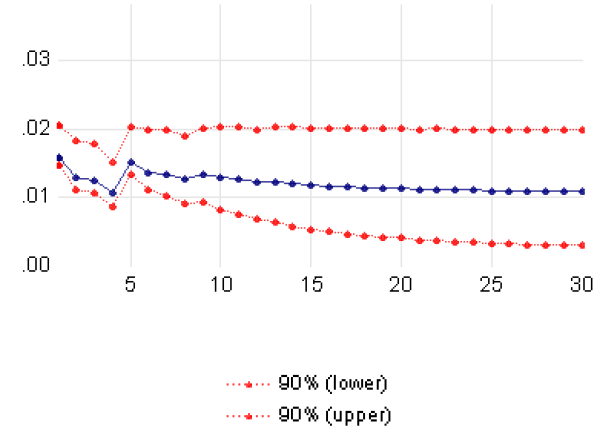
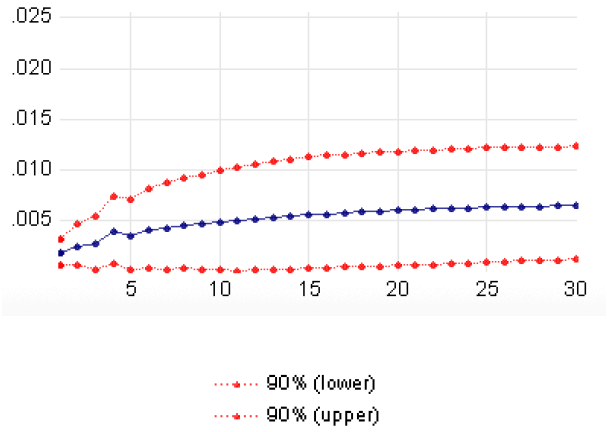
Appendix A

Figure A.1: Response to Cholesky One S.D. (d.f. adjusted) Innovations.
90% CI using Hall's percentile bootstrap with 1000 repetitions and 499 double bootstrap repetitions.

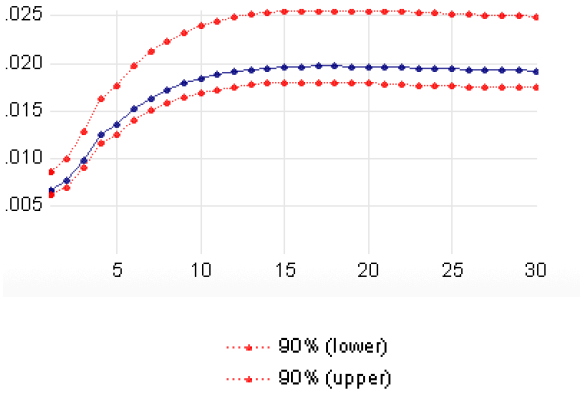
Response of wages to a wage shock



Response of CPI to a wage shock



Response of CPI to a CPI shock



Response of wages to a CPI shock