Evaluation of Wage-Inflation Association: Evidence form Uzbekistan

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Abstract

Wage inflation is often a non-monetary phenomenon that has two basic explanations. First, inflation results from the government's stimulation of demand through an increase in official salaries. Second, when the labor market's demand for workers rises, wages rise as well, raising the cost of manufacturing and resulting in cost-push inflation. In developing economies, this process typically manifests itself in two ways at once. Thus, the objective of this research is to evaluate experimentally how pay increases affect inflation in Uzbekistan. We use a basic OLS model to examine the association between these variables. The findings indicate that wages and inflation in Uzbekistan have a somewhat favorable association. We have concluded that it is reasonable to indexation of official pay to the price level and implement an efficient supply policy in order to lessen the detrimental impact of wages on inflation.

Keywords: Wage inflation; consumer price index; Phillips curve; production cost; OLS model.

1. Introduction

Prior to the global COVID-19 pandemic, inflation in the United States had been kept low for the past 30 years, however, consumer price inflation and average wage growth increased respectively from 2.0 and 3.7 percent to 9.1 and 6.7 percent in 2022. This activity fluctuation of these indicators has caused many economists to reconsider the existing macroeconomic models and enhanced panics about structural changes in the economy. Also, this trend led to significant changes in labour markets as inflationary pressures shifted from goods to more labour-intensive services in 2022. Understanding the factors behind this reality as well as the potential association between wages across sectors and prices, is one of the key policy issues to mitigate inflation [1].

In recent years, indicators of the consumer price index and nominal wage in Uzbekistan have also witnessed some fluctuations. Specifically, as compared to the same quarter in the prior year, the inflation rate and average nominal wages in the third quarter of 2022 grew from 10.8 and 15.3 to 12.2 and 25.4 percent, respectively [2]. The current trends demonstrate that, there is a certain relationship between these quantities calling for the need to conduct certain studies in this regard. Thus, the goal of this research is to critically evaluate the empirical evidence about the wage-inflation linkage in Uzbekistan and to provide related recommendations.

2. Literature Review

Since now, multiple economists have been carrying out a lot of research on the connection between salaries and inflation in many different countries. Specifically, Lorenzoni G., & Werning, I. (2023) have studied the impact of inflationary pressures on the goods and services and labor markets resulting from various shocks. According to the research, there is a certain short-term relationship between the output gap, wage of workers and the real profits of firms. At the same time, the aspirations of workers for real wages can affect changes in the labor market. Changes in the market conditions of such goods can gradually affect the expected profit of firms. This is the source of inflation, which occurs from the

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views of economic agents about relative prices. Disagreements between employers and employees contribute to inflation even in situations where inflationary expectations are steady [3]. Huidrom R. (2023) studied the relationship between wages and inflation in Denmark. The author implemented two approaches (models) to ensure that the research generated adequate results. The Phillips model was used to analyze the linkage between inflation and nominal wage patterns. Also, the interacted panel VAR model (IPVAR) has been applied to evaluate the effects of wage pressures on core inflation, inflation expectations, and firm profitability. The findings indicate that despite the wages not being formally linked to inflation, there is an upward correlation between the variables which have been observed. Inflation is also brought on by a decline in economic activity and labor market conflicts. Additionally, it is anticipated that there will be significant wage pressure in the upcoming years, which will contribute to core inflation. This implies ongoing inflation [4]. Furthermore, Chin, M., & Lin, L. (2023). examined the association between prices and salaries. Specifically, they examined how increases in production costs led to pay inflation in the US economy, or how wage inflation flows into price inflation. They primarily compare the circumstances that existed prior to and during the COVID-19 pandemic's recovery phase. The most significant contributing reason to the rise of prices in service sector is, therefore, the growth in salaries. The consumer sector's price level is influenced by the stimulation of demand [5]. The implications of monetary policy on wage inflation and unemployment are examined by Gabriel, RD (2023). The primary technique adopted by the study to examine 18 advanced countries between 1870 and 2019 involves the traditional Phillips model. The study ultimately came to the conclusion that the biggest challenge for monetary policy is the linkage between wage inflation and unemployment. Additionally, in circumstances of low inflation, there could be a limited association between wage inflation and unemployment [6]. Jordà Ò. et al. (2022) focused on the transmission of inflation to wages in 10 developed countries (Canada, Denmark, Finland, France, Germany, the Netherlands, Norway, Sweden, the United Kingdom, and the United States) in the global post-COVID-19 period based upon the quarterly data from 2007 to 2022. The model of the study was Phillips curve. The findings revealed that the impact of inflationary expectations on wage dynamics intensified in the post-pandemic period. Also, the impact of inflationary expectations on wages would be seen over a long period of time. Thus, wage pressure would increase with duration of inflation and inflationary expectations [7]. The pass-through effect of wage growth to inflation in industrial sector of the US was investigated by Heise, S. et al. (2022) using a VAR model. The study aims to reveal that the weakening of the transmission of wages to inflation in the manufacturing sector is the source of the slowdown in inflation. Consequently, the study conclude that import competition and increased market concentration are important factors in reducing wage-price pass-through in industrial sector [8]. Also, the transmission of wage shocks to core inflation was studied by Boranova, V. et al. (2021) in case of 27 EU countries based upon the panel VAR (PVAR) and the interacted panel VAR models (IPVAR), covering the periods from the first quarter of 1995 to the first quarter of 2019. As to findings, the pass-through of wage growth to inflation is significantly lower during periods of moderate inflation and inflationary expectations, increased competitive pressures as well as high corporate profitability [9]. Using quarterly data spanning the years 1960 to 2018, Bobeica, E. et al. (2021) examined the wage and inflation dynamics in the US economy using the VAR model. Likewise, the study focuses on how wage inflation is transmitted to prices. The findings verified that during the past 30 years, there has been a decline in the transmission between these determinants in the United States. This is also due to factors including the enhancement of enterprises' global competitiveness, stability of external and internal shocks, integration of international trade, and improvements in the inflationary environment and expectations [10]. Di Bartolomeo, G. et al. (2020) also investigated the correlation between price level and wage inflation in 7 industrialized countries based on the Neo-Keynesian DSGE model. Owing to the findings, all of the sample countries had favorable relationships between wages and price level. Furthermore, in countries with price stability, wages are mostly sticky. [11]. The relationship between inflation, unemployment, annual wages and GDP also studied by Zayed, NM et al. (2018) within the Philippines through Phillips and OLS models covering the period from 1950 to 2017. Findings suggested that annual wages and inflation had a beneficial association [12].

It is evident from these studies that they were conducted within countries and under certain economic circumstances. Nevertheless, studies regarding the relationship between inflation and wages in the context of Uzbekistan has not been conducted. Hence, we attempt to fill in this gap in our study whilst taking into consideration the specific problems associated with Uzbekistan.

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3. Research methodology.

3.1. Theoretical justification of the research hypothesis.

Inflation is a constant problem of the market economy, and its occurrence usually happens due to structural changes in aggregate demand and aggregate supply. Also, a high level of inflation is characterized by a negative impact on the activity of economic agents. Wage inflation may cause both cost-push and demand-pull inflation at the same time. Precisely, an increase in wages activates the aggregate demand due to the stimulation of households' expenditure. Also, an increase in wages may lead to inflation due to an increase in cost of production. Thus, the hypothesis of the study is to evaluate the effect of an increase in nominal wages to the price inflation (on the consumer prices) in the economy of Uzbekistan.

3.2. The data.

The credibility of the research's hypotheses and the accuracy of its findings depend on the data's trustworthiness. Therefore, the data in this study were imported from official sources. More specifically, the official web page of the Central Bank of the Republic of Uzbekistan provides the quarterly inflation data that is reflected in the consumer price index, while the official website of the Statistics Agency of the Republic of Uzbekistan provides the data on nominal wages by sector. Nevertheless, it should be noted that the average wage data by sectors excludes wages of agricultural and small business entities. Additionally, we use modifications to the data compared to the corresponding quarter of the prior year to eliminate these variables from seasonal movements (seasonal adjustment). Furthermore, the data spans the years 2016:Q1 through 2023:Q3. The Skewness-Kurtosis test was used to figure out whether the variables' distribution was normal or not while The Dickey-Fuller unit root test was applied to determine stationarity.

3.3. The model.

We partially followed Zayed, NM et al. (2018)'s technique in study. More specifically, the OLS model has been used to examine the relationship between wages and inflation. Due to the fact that this model provides a benefit when analyzing simple liner relationships. The model characters as follows:

$$\pi_t = a_0 + \sum_{t=1}^{n} a_1 w_t + \mathcal{E} \qquad (1)$$

Here, p_t – the inflation rate reflected in the consumer price index in period t (%), w_t – average nominal wages by sectors in period t (%), a_t – unknown parameters; $\mathcal{E}$ – standard errors.

In most cases, it is appropriate to convert model variables to natural logarithmic values when their weights differ. However, even the variables are in the same weight, it can be converted them to natural logarithmic values to smooth the time series, that is, to satisfy the normal distribution conditions. Based on this, the model can be written as follows:

$$ln\,(\pi_t) = a_0 + \sum_{t=1}^{n} a_1 ln\,(w_t) + \mathcal{E} \qquad (2)$$

In addition to maintaining the requirements of a normal distribution, the variables' stationarity is also essential. Model variables may be non-stationary due to the relatively small number of observations, constant and similar cyclic pattern of time series based on quarterly data. In order to address this problem, we use first differences in variables. The model looks as follows:

$$ln\,(\pi_t - \pi_{t-1}) = a_0 + \sum_{t=1}^{n} a_1 ln\,(w_t - w_{t-1}) + \mathcal{E} \qquad (3)$$

Here, $\pi_t - \pi_{t-1}$- changes in inflation, $w_t - w_{t-1}$- changes in wages.

4. Analysis and Results.

We begin the study with the model variables' descriptive statistics in accordance with the approach (Table 1).

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Table 1: Descriptive statistics.

Variable	Obs.	Mean	Std.Dev	Min	Max
ln_cpi	31	2.502916	0.1991026	2.174752	2.821379
ln_wage	31	2.963892	0.2265209	2.610070	3.315558

This table describes a set of statistical data of variables, i.e. their central tendencies. The number of observations for both variables was 31 meaning that the time series were strongly balanced. During the observing period, the upper limit of the dispersion of the consumer price index was equal to 2.82 percent, while its minimum limit was 2.17 percent. Its average value was 0.19 percent. Accordingly, the upper limit of the variance of the wage indicator reached 3.31 percent while its minimum limit was 2.61 percent indicating the average value was 0.22 percent. Although the table of descriptive statistics describes the general state of the variables, it does not provide an opportunity to draw conclusions about their normal distribution. Below we analyze the hypothesis tests on the normal distribution of model variables (Table 2).

Table 2: Normal distribution of variables.

Variable	Obs.	Pr(Skewness)	Pr(Kurtosis)	joint	
				adj chi2(2)	Prob>chi2
ln_cpi	30	0.8542	0.0152	5.62	0.0601*
ln_wage	30	0.7756	0.0148	5.69	0.0581*

****p<0.01; **p<0.05; *p<0.1*

Seemingly, the level of significance of the inflation indicator is less than the critical values of 10 percent and slightly greater than the 5 percent value while the nominal wage also made up the same value accordingly. The requirements of a normal distribution are often satisfied by the hypothesis test findings upon the normal distribution of variables. The graphic below also displays same results (Fig 1).

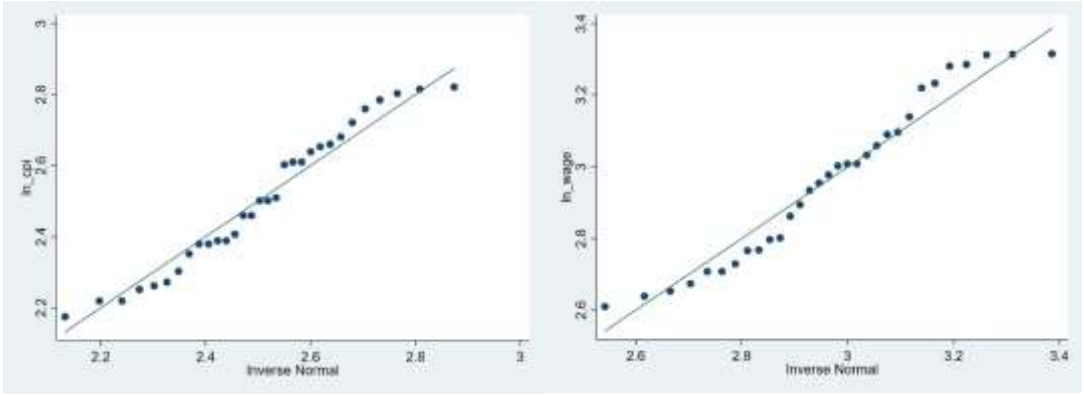

Figure1: A normal distribution graph

We can also determine the normal distribution of the variables visually with the assistance of this graph. We now do hypothesis tests on the variables as to stationarity below (Table 3).

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Table 3:The test of stationarity of variables.

	Test Statistics	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value	p-value for Z(t)
ln_cpi	-3,300	-3.723	-2.989	-2.625	0.0149**
ln_wage	-3.143	-3.723	-2.989	-2.625	0.0001***

*Note: ***p<0.01; **p<0.05; *p<0.1*

As to the result, it can be seen that the consumer price index is below the limits of 5 percent critical values *(p<0.05)* in first differences *(p=0.0149).* The wage indicator was kept at the 1 percent limit *(p=0.0001).* This means that the time series is satisfactory for stationarity conditions and there is no unit root. In this case, we can reject the null hypothesis (H_0) by accepting the alternative hypothesis (H_1).

Correlation analysis is a crucial prerequisite for research. Finding causal connections between time series variables is the primary objectives of this study. Making decisions depends on how strong or weak this relationship is. The model's correlation analysis result is provided below (Table 4).

Table 4: Correlation analysis results.

	ln_cpi	ln_wage
ln_cpi	1.0000	
ln_wage	0.5946	1.0000

Inferences regarding the causal relationship between variables are aided by the correlation coefficient. Greater consistency in the correlation is indicated by a coefficient nearer 1, whereas a lower correlation is seen nearer 0. Our findings indicate a robust positive association, with a ratio of 0.59 percent, between wages and inflation. Moreover, the scattergram exhibited below illustrates this association (Fig 2).

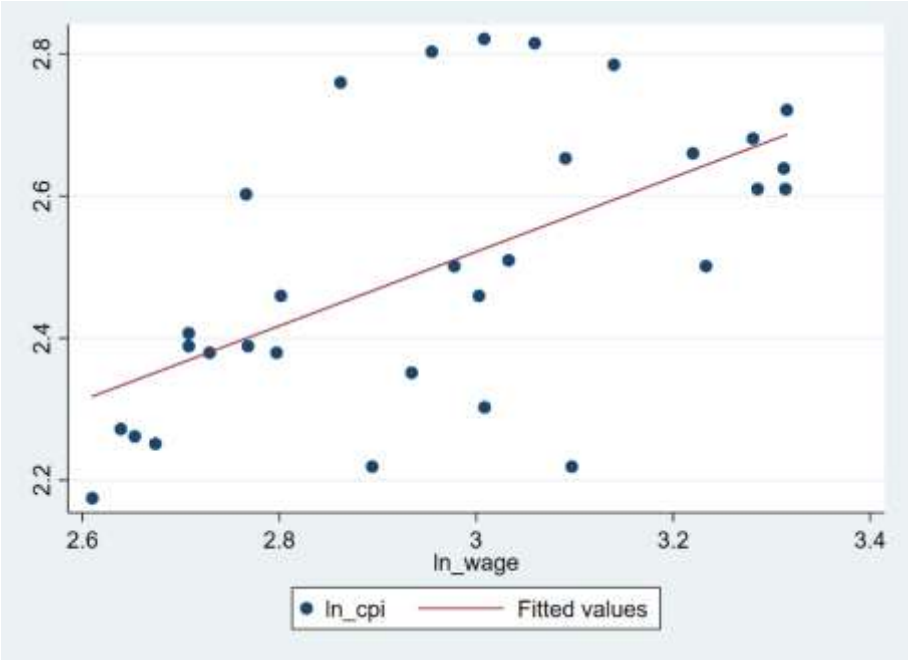

Figure 2: The view of correlation in scattergram.

The presence of a specific correlation between the variables may also be inferred from this graph. We now examine the regression's findings below (Table 5).

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Table 5: Regression analysis results

Source	**SS**	**df**	**MS**		**Number of obs.** =	**30**
Model	0.420472991	1	0.420472991	F(1, 20)	=	15.86
Residual	0.768782455	29	0.026509740	Prob > F	=	0.0004
Total	1.189255450	30	0.039641848	R-squared	=	0.3536
				Adj R-squared	=	0.3313
				Root MSE	=	0.1628

ln_cpi	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. interval]**	
ln_wage	0.5226370	0.1312302	3.98	0.000	0.2542411	0.7910329
cons.	0.9538759	0.3900508	2.45	0.021	0.1561341	1.7516180

*Note: ***p<0.01; **p<0.05; *p<0.1*

The OLS model is dominant because it relies on minimizing the sum of the squares of residuals to estimate the parameters of linear regression model. According to the analysis's findings, the model's determination coefficient is 0.35 (35%). This indicates that 35% of the dependent variable can be explained by the independent variable, which remains the model's sum of square residuals at 0.7687. Furthermore, the regression coefficient indicates that a one percent rise in earnings corresponds to a 0.52 percent change in inflation.

The appropriateness of the model is further explained by the variables' level of significance (P>|t|). This indicator's relevance in our model can be determined because it is below the 1% crucial value (p<0.01). Meanwhile, the last step in determining the model's accuracy is to look at the residuals' normal distribution. To ascertain whether the model is acceptable or not, we apply the Breusch-Pagan/Cook-Weisberg test. The test results are displayed in Table 6 (below).

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Table 6: Examination of the normal distribution of model residuals.

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	
Ho: Constant variance	
Variables: fitted values of ln_cpi	
chi2(1)	= 0.04
Prob > chi2	= 0.8375

Note: p>0.05

The trustworthiness of the data is examined in regards to homoscedasticity and heteroscedasticity. When the result ends up with heteroscedasticity, t-statistics and p-values are not significant respectively. Nevertheless, in our findings these ratios are over the five percent significant level and point to 0.8375 resulting the rejection of heteroscedasticity and confirming the presence of homoscedasticity.

5. Discussion.

The classical Phillips curve model, which has an especially significant role in breaking out the impact of wages on monetary inflation, is frequently used in studies related to wage inflation. (*see:* Huidrom R. 2023; Jordà Ò. et al. 2022; Zayed, NM et al. 2018). Since an official core inflation data for Uzbekistan were unavailable for our analysis, we had to use the standard consumer price index instead. Furthermore, the findings indicate that, there has an identical connection between wages and inflation. However, through these results, we are far from the view that wage-control is necessary to reduce inflation since Uzbekistan is one of the low-middle income countries. Also, the insufficient statistical data set of Uzbekistan made us to use of a simple (OLS) model. Alternatively, using somewhat more complex autoregressive models would be adequate (*see* Huidrom R. 2023; Heise, S. et al. 2022; Boranova, V. et al. 2021; Bobeica, E. et al. 2021). Furthermore, it would be more appropriate to look into how wages affect price levels specifically for each economic sector.

6. Conclusion.

In the aftermath of the Covid-19 pandemic, numerous countries are experiencing a sharp rise in wages and a corresponding rise in price levels (*see:* Chin, M., & Lin, L. 2023). Recently, such a situation has been repeatedly observed in Uzbekistan as well (3rd quarter of 2022). This situation required conducting research on the connection between wages and inflation in Uzbekistan. The results illustrated that there exists an optimistic interaction between wages and inflation. Specifically, a one percent increase in wages leads to an increase in inflation by 0.52 percentage points. This situation confirms the need for the government of the Republic of Uzbekistan to take into account an increase in wages to reduce inflation. Based upon the study, we believe that it is necessary to implement the following measures in this regard:

1. Formally indexation of wages to the rate of inflation. This measure helps to preserve the purchasing power of official income earners and prevent other economic losses due to inflation.

2. Conducting an effective supply policy (by improving the business environment). As a result, the output in the country will increase and cause the inflationary pressure to decrease. In turn, this process contributes to average wage growth.

References

[1] China, M. & Lin, L. The Pass-through of Wages to Consumer Prices in the COVID-19 Pandemic. 1–62 (2023).
[2] Information from the Statistics Agency under the President of the Republic of Uzbekistan. https://stat.uz
[3] Lorenzoni, G., & Werning, I. (2023). Wage price spirals. Manuscript available from: www. bpb-us-w2. wpmucdn. com/voices. Chicago. edu/dist/c/3483/files/2023/02/WagePriceSpirals. pdf.
[4] Huidrome, Raju. Wage and Inflation Dynamics in Denmark. IMF Selected Issues Paper (SIP/2023/052). Washington, DC: International Monetary Fund.
[5] Chin, M., & Lin, L. (2023). The Pass-through of Wages to Consumer Prices in the COVID-19 Pandemic: Evidence from Sectoral Data in the US. Available at SSRN 4655685.

Doi : https://doi.org/10.54216/JSDGT.040206

[6] Gabriel, RD (2023). Monetary policy and the wage inflation-unemployment tradeoff. European Economic Review , 159 , 104565.
[7] Jordà, Ò., Liu, C., Nechio, F., & Rivera-Reyes, F. (2022). Wage Growth When Inflation Is High. FRBSF Economic Letter, 25, 1-6.
[8] Heise, S., Karahan, F., & Sahin, A. (2022). The Missing Inflation Puzzle: The Role of the Wage-Price Pass-Through. Journal of Money, Credit and Banking, 54(S1), 7-51.
[9] Boranova, V., Huidrom, R., Nowak, S., Topalova, P., Tulin, V., & Varghese, R. (2021). Wage growth and inflation in Europe: a puzzle?. Oxford Economic Papers, 73(4), 1427-1453.
[10] Bobeica, E., Ciccarelli, M., & Vansteenkiste, I. (2021). The changing link between labor costs and price inflation in the United States.
[11] Di Bartolomeo, G., Di Pietro, M., & Beqiraj, E. (2020). Price and wage inflation persistence across countries and monetary regimes. Journal of International Money and Finance, 109, 102255.
[12] Zayed, NM, Islam, MR, & Hasan, KR (2018). Testing Phillips curve to examine the inflation rate regarding unemployment rate, annual wage rate and GDP of Philippines: 1950-2017. Academy of Accounting and Financial Studies Journal, 22(5), 1-9.

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