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How do monetary and fiscal determinants affect inflation? Evidence from Azerbaijan

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ABSTRACT

By employing OLS, Robust OLS, and ARDL models, the research evaluates the effects of minimum wages (both in PPP and national currency), government expenditures, and unemployment on inflation. The results demonstrate that government expenditures significantly and positively influence inflation in both short- and long-term perspectives. Minimum wages in the national currency are shown to increase inflation in the short run but exhibit a reducing effect with a time lag. Conversely, minimum wages measured in PPP have a deflationary effect, reflecting their stabilizing influence on purchasing power and consumer prices. Unemployment is found to reduce inflation in the short term, aligning with the Phillips Curve theory, while past unemployment levels display a delayed positive effect on inflation, underscoring the complex nature of the relationship. The study highlights the crucial role of fiscal policy in managing inflation in Azerbaijan, particularly in a resource-dependent economy. Furthermore, the impact of Azerbaijan's 2015 currency devaluation was analyzed using a dummy variable approach, confirming no significant structural break in the inflation determinants post-devaluation. These findings provide valuable insights for policymakers in implementing effective inflation control strategies through employment policies, wage regulation, and government spending adjustments.

Contribution/ Originality: This study is one of the few investigations conducted in this area. It also contributes to the existing literature on the Azerbaijan economy. The paper provides the first logical analysis of the relationship between monetary and fiscal determinants, particularly the minimum wage and inflation.

1. INTRODUCTION

Inflation, as a critical macroeconomic indicator, plays a pivotal role not only in economic theory but also in shaping macroeconomic policy decisions. Therefore, evaluating the factors that influence inflation is essential for effectively understanding and managing its impact on economic processes. The importance of assessing these factors can be highlighted through several key points:

First, inflation serves as a key indicator of economic stability. Analyzing inflation enables governments and central banks to formulate appropriate monetary and credit policies. High inflation can destabilize economies and trigger crises, whereas deflation introduces the risk of prolonged economic stagnation (Krugman, 1999). Second, effective inflation management is integral to fostering economic growth. Inflation affects production costs and

consumer demand. Maintaining a stable inflation rate simplifies investment decisions for entrepreneurs, thereby contributing to long-term economic growth (Adaramola & Dada, 2020; Ekinci, Tüzün, & Ceylan, 2020; Su & Soon, 2024). Third, inflation assessments offer valuable insights into the real income levels and standard of living of the population. High inflation leads to the depreciation of savings, exacerbating socio-economic disparities and deepening financial challenges.

Fifth, inflation assessment is very important for every economy. Forecasting inflation is necessary for effective planning of state budget revenues and expenditures. Many studies claim that inflation affects tax efficiency, as well as the formation of national debt policy (Aimola & Odhiambo, 2021). Sixth, inflation affects international trade. Inflation and exchange rates are interconnected. Since the exchange rate affects all aspects of the domestic market, the correct assessment of macroeconomic indicators, including inflation, on which it depends, is of great importance (Theibech, Akbar, & Panigrahi, 2024). Seventh, inflation indicators also play a central role in assessing investors' risks. Thus, investors pay attention to the favorability of the business environment. In countries with high inflation or high uncertainty, the risks for investors are greater. Investors move away from high-inflation business environments (Belanová, 2023). Finally, inflation affects wage dynamics (Morrissey, Dworkin, & Quinn, 2023) and unemployment rates (Omran & Bilan, 2021). A comprehensive understanding of inflation is crucial for shaping wage indexation mechanisms and social protection policies, and for ensuring economic sustainability. This study aims to empirically evaluate the impact of four macroeconomic indicators on inflation in Azerbaijan, specifically: a) MW_PPP (minimum wage in PPP terms); b) MW_NC (minimum wage in national currency); c) Unemp (unemployment rate); and d) Gov_exp (government expenditures as a percentage of GDP). It is important to note that Azerbaijan is an oil and gas-exporting nation. From 1995 to 2021, the share of Azerbaijan's resource rent in GDP ranged from a minimum of 5.3% (in 1998) to a maximum of 43% (in 2008). The inflation determinants and their dependency on these indicators may exhibit variations in oil-exporting countries. In light of this, particular emphasis has been placed on the aforementioned determinants. Specifically, the relatively low minimum wage and the limited proportion of salaried employees in total employment are characteristics shared by many oil-exporting and developing countries. Consequently, empirical evaluations have been conducted to test the validity of the following hypotheses:

1st Hypothesis: An increase in the nominal minimum wage in Azerbaijan is associated with an increase in inflation.

2nd Hypothesis: An increase in the minimum wage in PPP terms in Azerbaijan is associated with an increase in inflation.

3rd Hypothesis: An increase in government expenditures in Azerbaijan is associated with an increase in inflation.

4th Hypothesis: An increase in unemployment in Azerbaijan is associated with a decrease in inflation.

2. LITERATURE REVIEW

The importance of evaluating inflation for economic policy-making necessitates its continuous management. Managing inflation is possible through the management of the determinants that directly or indirectly affect it. According to economic theories, the indicators that directly influence investment are related to various factors, and these factors encompass broad areas such as macroeconomic stability, financial markets, the business environment, and institutional factors.

According to economic theory, investment is primarily shaped by six blocks of conditions: 1) financial conditions (interest rates, access to finance) (El Bourainy, Salah, & El Sherif, 2021; Özen, Özdemir, & Grima, 2020); institutional-political quality (rule of law, regulatory quality, political and geopolitical risks) (Caldara, Conlisk, Iacoviello, & Penn, 2022); external sector parameters (exchange rate regime and trade policies and agreements) (Kwark & Lim, 2020; Valogo, Duodu, Yusif, & Baidoo, 2023); market demand and market size (Kumar, Lim, Sivarajah, & Kaur, 2023); fundamentals of the real economy (infrastructure, labor market dynamics, technology and innovation) and input-cost shocks (energy and raw materials (Lv, Liu, & Xu, 2019; Magweva & Sibanda, 2023; Nucci & Riggi, 2018). The minimum wage occupies an important place among the state's instruments of

intervention in the economy. That is why studies on the macroeconomic effects of the minimum wage (MW), including its impact on economic growth, inflation, and income inequality, are often found in the economic literature. For example, empirical assessments of the potential effects of the MW on inflation have been carried out by Majchrowska (2022), Dervishi (2023) and Pérez (2020). Studies show that the introduction of the MW and its convergence to the average wage reduce income inequality (Gulaliyev, Veliyeva, Sultanova, Mehdiyeva, & Gulaliyev, 2023). However, along with the positive effects of the MW policy, negative effects are also claimed. It is claimed that setting the MW above a certain level can increase unemployment (Neumark, 2018; Paun, Nechita, Patruti, & Topan, 2021).

Increasing public spending is also one of the instruments of state intervention in the economy. Such interventions also affect inflation. The impact of government spending on inflation has been extensively studied across countries. Akobi, Umeora, and Atueyi (2021) found that the relationship between government spending and inflation in Nigeria was statistically significant and positive. The study specifically highlighted that unproductive government spending contributes to inflationary pressures. Moreover, it emphasized that effective monetary policy management plays a key role in reducing such inflationary effects. Mandala (2020) similarly examined the impact of government spending on inflation in Indonesia and concluded that there is a relationship between the two indicators. However, the results showed that government spending has a more positive impact on economic growth than on inflation. Korkmaz and Güvenoğlu (2021) analyzed OECD countries and found that the impact of government spending on inflation varied across countries. In some OECD countries, government spending had a positive impact on inflation, while in others, this impact was either negative or negligible. This difference in results was mainly attributed to the different economic structures and distribution of expenditures across countries. Nguyen (2019) found a significant and positive impact of government spending on inflation in India, China, and Indonesia, highlighting that particularly unproductive spending exacerbates inflationary tendencies. Similarly, Shifaniya, Hettiarachchi, Weeraddana, and Parmila (2022) found a significant and positive relationship between government spending and inflation in both Sri Lanka and India. They highlighted that the increase in public sector spending is the main factor driving inflation in these countries.

A comparative analysis of various studies on the relationship between government spending and inflation shows that, in most cases, the impact is both positive and significant. This impact tends to be stronger in developing countries.

In contrast, in OECD countries, the direction and magnitude of the effect are more variable, depending on the specific country context. The classification of government expenditures whether productive or unproductive, emerges as a critical determinant of the scale and nature of the inflationary effect.

The relationship between the unemployment rate and inflation is represented in economic theory by the Phillips Curve. In the economic literature, the impact of inflation on unemployment has been more extensively studied, while the reverse effect, i.e., the impact of unemployment on inflation, has been less explored. The effect of inflation on unemployment has been empirically evaluated by various researchers in different countries, such as Muhammad (2023); Omran and Bilan (2021), and Berentsen, Menzio, and Wright (2011). These and many other studies provide evidence that, in the short term, according to the Phillips Curve, an increase in inflation tends to reduce unemployment. However, in the long term, if high inflation persists and leads to economic instability, the unemployment rate may rise.

From these studies, several conclusions can be drawn regarding the impact of unemployment on inflation. In the short term, a reduction in unemployment tends to lead to higher inflation (as suggested by the Phillips Curve). In the long term, sustained unemployment may lower inflation due to weakened economic activity. However, prolonged instability and a decline in production can later increase inflationary pressures. It is worth noting that in developing economies, the impact of unemployment on inflation may be weaker because inflation is more strongly influenced by structural issues and external shocks.

3. METHODOLOGY

In the article, the impacts of macroeconomic indicators: a) MW_PPP (minimum wage in PPP); b) MW_NC (minimum wage in national currency); c) Unemp (unemployment rate); d) Gov_exp (government expenditures in GDP) on "Inflation" are empirically evaluated using the case of Azerbaijan. Data related to these indicators covering the period from 1995 to 2023 were obtained from the official website of the World Bank.

The research initially employed the OLS method, followed by the ARDL models. The relationships between inflation and indicators with I(0) stationarity were evaluated using the OLS and robust LS methods based on the (1) regression equation.

$$inflation_t = \beta_0 + \beta_1 * \Delta\text{Unemp}_{it} + \beta_2 * \Delta\text{loggovexp}_t + \beta_3 * \Delta MWNC_t + \beta_4 * \Delta\text{MWPPP}_t + \varepsilon_t \quad (1)$$

For ARDL model

$$inflation_t = \beta_0 + \beta_1 * inflation_{t-1} + \beta_2 * \text{Unemp}_t + \beta_3 * \text{Unemp}_{t-1} + \beta_4 * \text{loggovexp}_t + \beta_5 * \text{loggovexp}_{t-1} + \beta_6 * MWNC_t + \beta_7 * MWNC_{t-1} + \beta_8 * \text{MWPPP}_t + \beta_9 * \text{MWPPP}_{t-1} + \varepsilon_t \quad (2)$$

(2) regression equation will be used.

During the research, descriptive statistics and stationarity tests were conducted for the variables, and the normality of residuals was checked in the results obtained through OLS and RLS methods.

In the application of the ARDL model, the significance and suitability of the results, as well as the testing of long-term and short-term relationships, were evaluated using the ARDL Bounds Test and the ECM Model, respectively. Necessary diagnostic tests were conducted to improve the reliability of the model. To check for a structural break, meaning whether an event during a specific period disrupted the stability of the model, a dummy variable (dummy-2015) was used. Specifically, 2015 is considered a year of significant change for the Azerbaijani economy. In 2015, the Azerbaijan manat experienced two major devaluations, and the national currency lost value twice within a year. Taking this into account, the "dummy-2015" variable was included in the ARDL model, and the evaluation was recalculated. However, it should be noted that since the bulk of Azerbaijan's oil revenues are deposited in the State Oil Fund of Azerbaijan, short-term fluctuations in oil prices are not directly reflected in the national currency exchange rate (Gülaliyev et al., 2022). Therefore, the potential structural breaking of the 2015 devaluation should be tested separately.

4. RESULTS

4.1. Descriptive Statistics of the Variables

Although a normal distribution of variables is not a fundamental requirement for OLS, RLS, and ARDL models, we considered it necessary to perform descriptive statistics for each variable identified for the research and their annual differences. This data allows us to obtain at least some information regarding the normality of the variables. Table 1 presents the descriptive statistics data for the five indicators involved in the study and the logarithms of some of them.

Table 1. Descriptive statistics of the variables (1995-2023).

Variables	Mean	Median	Maximum	Minimum	Std.Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
INFLATION	20.0961	4.0277	411.7596	-8.5252	75.5999	5.0438	26.6498	798.7960	0.0000
MW_PPP	229.1727	252.1990	648.8320	4.9500	193.8744	0.5464	2.3855	1.8992	0.3869
MW_NC	91.1931	75.0000	345.0000	1.1000	98.3697	1.1648	3.3827	6.7349	0.0345
UNEMP	6.9843	6.0400	11.7800	4.9000	2.1368	0.8561	2.4220	3.9461	0.1390
GOV_EXP	5.00e+09	3.96e+09	1.72e+10	2.73e+08	4.81e+09	0.9975	3.1621	4.8405	0.0889
LOGGOV_EXP	9.4261	9.5977	10.2365	8.4362	0.5582	-0.2846	1.6879	2.4719	0.2906
LOGMW_PPP	2.0099	2.4017	2.8121	0.6946	0.7453	-0.8750	2.1956	4.4828	0.1063
LOGMW_NC	1.4758	1.8751	2.5378	0.0414	0.8747	-0.6793	1.9816	3.4834	0.1752

The Descriptive Statistics results indicate that the average inflation rate during the period from 1995 to 2023 was 20.1%. High inflation levels in Azerbaijan occurred in 1993 (1128%), 1994 (1662%), and 1995 (412%). Consequently, the inflation time series for 1995 to 2023 does not follow a normal distribution; however, the series from 1996 to 2023 does follow a normal distribution. During this latter period, the average inflation rate was 6.1%. The median was 3.85, the maximum was 20.85, the minimum was -8.5, the standard deviation was 6.5, skewness was 0.51, kurtosis was 3.26, Jarque-Bera was 1.31, and the probability was 0.5180. Since our research employs OLS and ARDL models and the non-normality of the inflation time series is not considered problematic, we will proceed with the analysis.

Based on the data in Table 1, the time series for MW_PPP (Minimum Wage in PPP) has a slight positive skewness, but Kurtosis = 2.3855, and this time series can be considered normal. For MW_NC (Minimum Wage in National Currency), the time series has Skewness = 1.1648 and Kurtosis = 3.3827, Jarque-Bera Test = 6.7349, p-value = 0.0345, indicating that it cannot be considered normally distributed. For UNEMP (Unemployment), Skewness = 0.8561 (slightly positively skewed distribution), Kurtosis = 2.422, Jarque-Bera Test = 3.9461, p-value = 0.1390, meaning it can be considered normally distributed. For GOV_EXP (Government Expenditures), Skewness = 0.9975 (slightly positively skewed distribution), Kurtosis = 3.1621, Jarque-Bera Test = 4.8405, p-value = 0.0889, indicating that it can be considered normally distributed. For LOGGOV_EXP (Logarithmic form of Government Expenditures), Skewness = -0.2846 (slightly negatively skewed distribution), Kurtosis = 1.6879 (platykurtic distribution), Jarque-Bera Test = 2.4719, p-value = 0.2906, suggesting it can be considered normally distributed. For LOGMW_PPP (Logarithmic form of MW_PPP), Skewness = -0.875 (negatively skewed distribution), Kurtosis = 2.1956, Jarque-Bera Test = 4.4828, p-value = 0.1063, which indicates that it can be considered normally distributed. For LOGMW_NC (Logarithmic form of MW_NC), Skewness = -0.6793 (negatively skewed distribution), Kurtosis = 1.9816 (platykurtic distribution), Jarque-Bera Test = 3.4834, p-value = 0.1752, meaning it can be considered normally distributed.

Table 2. The stationarity of the time series for the indicators related to Azerbaijan (intercept, intercept, and trend).

Variables	I(0)				I(1)			
	intercept		Intercept and trend		intercept		Intercept and trend	
	t-stat	I(0)	t-stat	I(0)	t-stat	I(1)	t-stat	I(1)
Gov_exp	5.4217	-	1.6017	-	-2.6713	-	-1.6107	-
inflation	-64.4085***	+	-63.0328***	+	-5.8898***	+	-5.7213***	+
Loggov_exp	-1.5550	-	-1.5573	-	-3.6284**	+	-3.7422**	+
Logmw_nc	-1.1672	-	-2.7988	-	-2.1056	-	-5.2956***	+
Logmw_ppp	-1.3425	-	-1.0660	-	-5.0098***	+	-5.2394***	+
Mw_nc	1.9746	-	-0.4296	-	-4.5412***	+	-5.4743***	+
Mw_ppp	0.5427	-	-1.8777	-	-4.5402***	+	-4.6745***	+
unemp	-0.8093	-	-1.8671	-	-3.7600***	+	-3.6561**	+

Note: **, *** -denote significancy at 10%, 5%, and 1% respectively. "–" and "+" –denote "non-stationary" and "stationary" respectively.

4.2. The Stationarity of the Time Series for the Indicators

Based on the results in Table 2, the "Inflation" variable is stationary at both the "Level" and "First Difference" levels. Most of the other variables are non-stationary and become stationary at the first difference level (I(1)), indicating the presence of long-term trends for these variables. Gov_exp, however, does not show stationarity at either the level or the first difference, which may indicate potential structural breaks or non-linearity. Therefore, we will use the variables that are stationary at the I(0) level in the OLS model (Equation 1).

Table 3. The regression dependence of the "*Inflation*" on some macroeconomic variables (OLS).

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D_LOGGOV_EXP	81.222	13.969	5.814	0.0000
D_MW_NC	0.349	0.120	2.903	0.0078
D_MW_PPP	-0.154	0.058	-2.660	0.0137
D_UNEMP	-3.063	1.374	-2.229	0.0354

Based on the results in Table 3, the impact of government expenditures on inflation is substantial (81.22), indicating that expansionary fiscal policy leads to price increases. The increase in the minimum wage in national currency raises inflation because higher income boosts consumption, creating demand-pull inflation. However, the increase in the minimum wage in PPP terms reduces inflation, which may reflect the influence of international price levels. When unemployment rises, inflation decreases, which aligns with the Phillips curve theory.

With an R-squared of 0.3989, the model explains 39.89% of the variability, and the adjusted R-squared is 0.3238. The Durbin-Watson statistic is 1.5693, suggesting that there is no significant autocorrelation in the residuals. To assess the model's quality, it is necessary to ensure that the residuals are normally distributed. Based on the Jarque-Bera test results, with a p-value of 0.0002, we cannot claim that the residuals are normally distributed. To enhance the model's reliability, it is necessary to ensure the normality of the residuals. However, since we cannot add additional variables to the model, we will use an alternative approach, specifically the HAC standard error method, to improve the model's reliability. The results of this method are presented in Table 4.

Table 4. The regression dependence of the "*Inflation*" variable on some macroeconomic variables (OLS with HAC standard errors & covariance).

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D_LOGGOV_EXP	81.222	10.802	7.519	0.0000
D_MW_NC	0.349	0.066	5.281	0.0000
D_MW_PPP	-0.154	0.036	-4.272	0.0003
D_UNEMP	-3.063	1.243	-2.464	0.0213

Since the normality of the residuals was not ensured in the model with the application of HAC standard errors and covariance in the OLS method, we will use robust regression analysis. The results of the robust regression analysis are presented in Table 5.

Table 5. The regression dependency of the *Inflation* variable on some macroeconomic variables (Robust OLS).

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D_LOGGOV_EXP	77.656	12.552	6.186	0.0000
D_MW_NC	0.307	0.067	4.605	0.0000
D_MW_PPP	-0.138	0.031	-4.438	0.0000
D_UNEMP	-2.548	0.722	-3.527	0.0004
c	-0.301	1.028	-0.293	0.7696

Despite the application of robust regression analysis, the normality of the residuals is not satisfied. Specifically, in this case, skewness = 1.093342, kurtosis = 5.593748, Jarque-Bera = 13.42730, and probability = 0.0012. Taking this into account, we will attempt to evaluate the relationship between these variables using the ARDL model. To implement the ARDL model, we will utilize the second equation. The Akaike Information Criterion (AIC) will be used as the selection criterion, and the chosen model will be ARDL (1,1,1,1,1) (i.e., one lag for each variable). INFLATION (-1) (the inflation rate from the previous year) will help us assess the autocorrelation effect, while LOGGOV_EXP, MW_NC, MW_PPP, and UNEMP will be used to evaluate the short-term impacts on inflation. LOGGOV_EXP (-1), MW_NC (-1), MW_PPP (-1), and UNEMP (-1) will allow us to assess the long-term impacts on inflation. The results obtained from the ARDL model are presented in Table 6.

Table 6. The regression dependency of the *Inflation* on some macroeconomic variables (Robust OLS).

Variables	Coefficient	Std. Error	t-Statistic	The results of the ARDL model
INFLATION (-1)	0.0517***	0.0166	3.1133	The previous value of inflation has a positive effect on current inflation, meaning that past inflation partly persists.
LOGGOV_EXP	89.0177***	23.6631	3.7619	When government expenditures (in log form) increase, inflation rises.
LOGGOV_EXP (-1)	-83.2917***	20.3189	-4.0992	An increase in government expenditures in the previous period reduces inflation, indicating a lagged effect of government spending.
MW_NC	0.2864*	0.1377	2.0710	When the minimum wage in national currency increases, inflation rises.
MW_NC (-1)	-0.2990	0.1711	-1.7474	The increase in the minimum wage in the previous period has a reducing effect on current inflation.
MW_PPP	-0.1289**	0.0583	-2.2095	As the minimum wage in PPP increases, inflation decreases, meaning that the rise in real income levels reduces inflation.
MW_PPP (-1)	0.1239	0.0726	1.7063	The increase in MW_PPP in the previous period raises inflation in the current period.
UNEMP	-3.8512**	1.5775	-2.4414	As unemployment increases, inflation decreases, which is consistent with the Phillips curve.
UNEMP (-1)	3.6825***	1.2313	2.9907	The increase in past unemployment raises inflation, indicating that the relationship between unemployment and inflation is complex.
C	-51.9713	84.0970	-0.6180	The intercept of the model is significant but not statistically significant.

Note: *, **, *** -denote significancy at 10%, 5%, and 1% respectively.

R-squared = 0.7116; Adjusted R = 0.5674; Durbin-Watson statistic = 2.6299, and F-statistic = 4.9341; p = 0.001966 indicate that the model is significant and there is no autocorrelation in the model. It should be noted that, based on the VAR Lag Order Selection Criteria, the optimal lag is determined to be 2 (Table 7). In the table, * indicates the lag order selected by the criterion. LR: sequential modified LR test statistic (each test at the 5% level); FPE: final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Table 7. VAR Lag Order Selection Criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-409.601	NA	14975985	30.711	30.951	30.782
1	-263.818	226.774	2023.512	21.764	23.204	22.192
2	-215.872	56.825*	457.652*	20.065*	22.704*	20.849*

Note: * indicates the lag order selected by the criterion (each test at the 5% level).

4.3. ARDL Model

The results of the ARDL model built based on Lag=2 are presented in Table 8. According to the Akaike Information Criterion selection, the ARDL (2, 2, 2, 1, 2) model has been constructed using data from 1997 to 2023 (27 years). The equation of the model is as follows.

$$inflation_t = \beta_0 + \beta_1 * inflation_{t-1} + \beta_2 * inflation_{t-2} + \beta_3 * \text{loggovexp}_t + \beta_4 * \text{loggovexp}_{t-1} + \beta_5 * \text{loggovexp}_{t-2} + \beta_6 * MWNC_t + \beta_7 * MWNC_{t-1} + \beta_8 * MWNC_{t-2} + \beta_9 * \text{MWPPP}_t + \beta_{10} * \text{MWPPP}_{t-1} + \beta_{11} * \text{Unemp}_t + \beta_{12} * \text{Unemp}_{t-1} + \beta_{13} * \text{Unemp}_{t-2} + \varepsilon_t \quad (3)$$

Table 8. The results of the ARDL(2, 2, 2, 1, 2) model regarding the dependency of inflation on certain indicators.

Variable	Coef.	Std. Er.	t-Stat	Interpretation
INFLATION(-1)	-0.4389**	0.2030	-2.1625	The past inflation affects the current inflation in the opposite direction.
INFLATION(-2)	0.0526***	0.0156	3.3685	Inflation from the more distant past positively affects inflation.
LOGGOV_EXP	90.5061***	18.7968	4.8150	As government spending increases, inflation rises significantly.
LOGGOV_EXP(-1)	18.6811	31.3815	0.5953	There is a delayed effect of government spending, but it is not significant.
LOGGOV_EXP(-2)	-84.5802***	22.5494	-3.7509	Government spending from previous periods reduces inflation, meaning there is a balancing effect.
MW_NC	0.4109***	0.1347	3.0507	As the minimum wage in national currency increases, inflation rises.
MW_NC(-1)	-0.2544*	0.1347	-1.8885	The increase in MW_NC from the previous period reduces current inflation.
MW_NC(-2)	-0.1327*	0.0616	-2.1551	The increase in MW_NC two periods ago significantly reduces inflation statistically.
MW_PPP	-0.2150***	0.0583	-3.6872	As the minimum wage in PPP increases, inflation decreases, meaning that the rise in real income has a dampening effect on the price level.
MW_PPP(-1)	0.1454**	0.0644	2.2567	The increase in MW_PPP in the previous period raises inflation in the current period.
UNEMP	-5.7435**	2.0712	-2.7730	As unemployment increases, inflation decreases significantly in a statistical sense.
UNEMP(-1)	3.1575	2.4379	1.2952	Past unemployment increases inflation, but it is not statistically significant.
UNEMP(-2)	2.9437**	1.3427	2.1924	The increase in unemployment two periods ago significantly increased inflation statistically.
C	-227.5858**	89.3725	-2.5465	The constant value of the model is statistically significant.

Note: *, **, *** -denote significancy at 10%, 5%, and 1% respectively.

Based on the ARDL model constructed from Equation 3, R-squared = 0.8762; Adjusted R-squared = 0.7524; Durbin-Watson statistic = 2.7045; F-statistic = 7.0768. We can consider this model significant and appropriate. Specifically, there is no serious autocorrelation in the residuals of the model, and it is statistically significant (p = 0.0006).

Based on the ARDL model results, we will use the Bound test to check for the presence of long-term relationships (cointegration) among the variables. This test is better suited when the variables show different levels of stationarity (I(0) or I(1)) and in small sample sizes.

In the ARDL Bounds Test, the null hypothesis (H_0) is "No long-term relationship (cointegration) exists," while the alternative hypothesis (H_1) is "A long-term relationship exists." The results of the ARDL Bounds Test (Lag=2) are provided in the following table or section Table 9. Based on the obtained results, the F-statistic = 12.85982 significantly exceeds all the upper critical values (i.e., for I(1), 10%, 5%, 2.5%, and 1% thresholds of 3.09, 3.49, 3.87, 4.37, respectively). This result confirms the existence of a long-term relationship (cointegration). That is, inflation and its explanatory variables move together and are in equilibrium in the long run.

Table 9. Cointegration between Inflation and other indicators in the long run.

Variables	Coeff.	t-stat.	Interpretation
LOGGOV_EXP (-1)	17.7501**	2.5546	Government spending increases inflation in the long run
MW_NC (-1)	0.0172	0.3867	The nominal minimum wage does not have a statistically significant effect on inflation.
MW_PPP(-1)	-0.0502**	-2.3402	The value of the minimum wage measured in PPP reduces inflation.
UNEMP (-1)	0.2580	0.2476	Unemployment does not have a statistically significant effect on inflation.
C	-164.1673**	-2.3062	

Note: **, -denotes significance at 5%.

Table 10. Cointegration between Inflation and other indicators in the long run.

Variables	Coeff.	t-stat.	Interpretation
D(INFLATION (-1))	-0.0526***	-3.3685	An increase in inflation one year ago reduces inflation the following year.
D(LOGGOV_EXP)	90.5061***	4.8149	Government spending increases inflation in the short run.
D(LOGGOV_EXP (-1))	84.5802***	3.7508	
D(MW_NC)	0.4109***	3.0506	Nominal minimum wage increases inflation
D(MW_NC (-1))	0.1327**	2.1550	
D(MW_PPP)	-0.2150***	-3.6871	The value of the minimum wage measured in PPP reduces inflation.
D(UNEMP)	-5.7435**	-2.7730	Unemployment reduces inflation
D(UNEMP (-1))	-2.9437**	-2.1923	

Note: **, *** -denote significance at 5%, and 1% respectively.

According to the Bounds Test results, there is a long-term relationship between the variables and the macroeconomic indicators involved in the study (F-statistic exceeds critical limits). Thus, government spending increases inflation in both the long and short run. The value of the minimum wage, measured by PPP, reduces inflation in both the long and short run. Unemployment reduces inflation in the short run.

The results of the Error Correction Model demonstrate that the constructed ARDL model quickly returns to equilibrium when it is out of equilibrium. The ECM coefficient (EC term) $INFLATION(-1)$ = -1.3863, and the P-value is highly significant (p=0.0000). Since the ECM coefficient is negative and statistically significant, it indicates that the model returns to long-term equilibrium when it is out of equilibrium. ECM = -1.3863 suggests that 138.6% of the deviation from equilibrium is corrected each year, implying a rapid adjustment process. These findings confirm that the main long-term determinants of inflation in Azerbaijan are government spending and wages. In the short term, unemployment and wage policies significantly impact inflation.

The results of Table 10 show that both the demand and labor market channels operate simultaneously in the short-run dynamics of inflation. First, the negative and significant coefficient of D(INFLATION(-1)) (−0.0526; $p<0.01$) confirms the tendency of the price level to return to the mean denominator. The increase in the previous year stimulates a decrease in the next year, i.e., there is a "self-stabilization" component in the system. Second, the large and positive coefficients for D(LOGGOV_EXP) and D(LOGGOV_EXP(−1)), approximately 90.5 and 84.6, respectively, both significant, indicate that the fiscal impulse increases inflation in the short run. This is consistent with the demand-pull effect of expansionary budget spending. Third, D(MW_NC) and its lag are positive and significant (≈0.41 and 0.13). This means that nominal minimum wage increases create price pressure in the initial period, and this effect persists with a short lag. Fourth, the negative and highly significant coefficient of D(MW_PPP) (−0.215; $p<0.01$) indicates the deflationary role of PPP-based wage increases. Finally, D(UNEMP) and D(UNEMP(−1)) are negative and significant, −5.74 and −2.94, respectively. This confirms the short-run inverse relationship of the Phillips curve.

4.4. Diagnostic Tests

Diagnostic tests of the constructed ARDL model also confirm the adequacy of the model. We can use a dummy variable (dummy-2015) to check for a break in the model, that is, an event occurring in any period disrupts the stability of the model. 2015 can be considered a year of significant change for the Azerbaijani economy. In 2015, the manat was devalued, and the national currency lost value twice. Taking this into account, we can re-evaluate by including the "dummy-2015" variable in the ARDL model.

Table 11. Results of the Chow Breakpoint Test with the Dummy Variable Approach.

Estimation statistics	DUMMY_2015	DUMMY_2015(-1)	LOGGOV_EXP	LOGGOV_EXP(-2)	MW_NC	MW_NC (-1)	MW_PPP	MW_PPP(-1)	UNEMP	UNEMP(-2)
Coef.	-1.7401	5.5094	81.1629	-84.1106	0.3753	-0.3032	-0.1947	0.1651	-5.1020	3.2364
t-stat.	-0.3974	1.0174	3.6114	-3.5807	1.9948	-2.0485	-2.1970	2.3093	-1.9620	2.1887
p-value	0.6987	0.3308	0.0041	0.0043	0.0714	0.0651	0.0504	0.0414	0.0755	0.0511

The results of the Chow Breakpoint Test with the Dummy Variable Approach are given in Table 11. The obtained results show that the DUMMY_2015 variable tests for a structural break. The p-value = 0.6987 (greater than 0.05), indicating that the structural break after 2015 is not statistically significant. The t-statistic = -0.3974 is very small, suggesting that the effect is weak. These results demonstrate that there is no significant structural change in the relationship between inflation and other variables after 2015. Government spending increases inflation (positive effect, $p < 0.01$). However, when considering two periods prior (t-2), it has the opposite effect ($p < 0.01$), meaning that spending can reduce inflation in the long run.

In the short run, the nominal minimum wage has a statistically insignificant effect on inflation ($p \approx 0.07$). One period later (MW_NC(-1)), the effect turns negative and approaches significance ($p \approx 0.06$). This may indicate that wage increases initially increase inflation, but their effect diminishes in later periods. The minimum wage with PPP reduces inflation in the short run ($p \approx 0.05$). One period later (t-1), it has the opposite effect (positive effect, $p \approx 0.04$). These results may suggest that the real value of wages has a positive effect on inflation initially, but the effect reverses later.

Unemployment reduces inflation in the short run ($p \approx 0.07$, which is statistically insignificant). Two periods later (t-2), the opposite effect is observed ($p \approx 0.05$), indicating that the initial effect changes over time.

Since R-squared = 0.8870, we can say that it explains 88.7% of the inflation variability. This indicates a high level of fit. Since the Durbin-Watson statistic = 2.74, the model is unlikely to have an autocorrelation problem. Since the F-statistic p-value = 0.0029, it shows that the model is statistically significant overall.

Considering the results and adequacy of the model, we can argue that the devaluation that occurred in Azerbaijan in 2015 did not cause a significant structural break in the relationship between inflation and other variables. That is, the main parameters of the model do not show statistically significant changes before and after 2015. However, the impact of some variables, for example, the minimum wage and government spending with PPP, changes over time.

5. DISCUSSION

The main findings of this study provide valuable insights into the complex relationship between key macroeconomic variables and inflation in Azerbaijan. Empirical results demonstrate that government spending, as

the primary instrument of intervention in the economy, is the main driver of inflation. The empirical study conducted in the case of Azerbaijan aligns with findings from studies in other countries. Therefore, the impact of government spending on inflation was evident in both short- and long-term analyses. Increased government spending directly influences aggregate demand. The lagged deflation effect observed in the ARDL model indicates that some government spending can enhance productivity after a certain period. This may have a stabilizing effect on prices in the long term.

According to another finding of the study, the relationship between the minimum wage, which is one of the instruments of state intervention in the economy, and inflation is multifaceted in Azerbaijan. Increasing the minimum wage in the national currency leads to an increase in the level of inflation in the short term. However, in the long term, this effect may weaken and even be in the opposite direction. This result is consistent with the theoretical expectation that wage-related inflationary pressures may decline as markets adjust to higher labor costs. In contrast, empirical results show that minimum wages measured in PPP have a consistent deflationary effect. This result suggests that wage adjustments to PPP improve purchasing power without significantly increasing inflation.

The empirical results obtained in the case of Azerbaijan confirm once again that wage policy can be used to stabilize price levels in economies with strong foreign trade relations. The results obtained in the study regarding the relationship between unemployment and inflation are also consistent with theoretical studies. Thus, in accordance with the Phillips Curve theory, which shows an inverse relationship between these two variables, unemployment in Azerbaijan is found to reduce inflation in the short run.

However, the fact that lagged unemployment exerts upward pressure on inflation reveals the complexity of this interaction. Such a lagged effect may reflect a decrease in labor market slack over time. Such an outcome constrains labor supply and increases production costs.

The analysis of a dummy variable for the 2015 currency devaluation provides additional insights into the sustainability of Azerbaijan's inflation dynamics. Contrary to initial expectations, no significant structural break in inflation determinants was found after the devaluation. This finding suggests that inflation dynamics in Azerbaijan are shaped by domestic policy measures rather than by sharp exchange rate movements alone. However, the time-varying impact of government spending and the minimum wage underscores the need for policymakers to adopt adaptive strategies that respond to changing economic conditions.

6. LIMITATION OF THE STUDY

The study used the National Currency and Minimum Wage indicators with PPP. It would be beneficial if the ratio of the Minimum Wage to the median wage, i.e., the Kaitz index, was also included in the model. However, the necessary statistical data for calculating the median wage in Azerbaijan are not available.

Purposeful variable selection (parsimony) was performed in the study. Thus, working with four main determinants, i.e., MW_PPP, MW_NC, UNEMP, and GOV_EXP, reduces the risk of overfitting in multi-parameter modeling within a small sample period and simplifies policy interpretation. Variables such as exchange rate and money supply were retained for future extensive studies. The devaluation of 2015 was used as a "dummy" variable. This indicates the stability of the main results.

It should be noted that there are also some limitations on the distribution assumptions and validity procedures. Thus, the normality guarantee in the OLS residuals is not complete. However, the results are multivariately strengthened by applying HAC standard errors, Robust OLS, and finally ARDL with ECM. This is a deliberate "robustification" step as a methodological choice.

Aggregation of public expenditure: GOV_EXP is taken as a general indicator; this allows for comparison over a long period. The productive and unproductive allocation of expenditure is not separately conducted due to data

limitations. The lagged balancing effect observed in ARDL provides a direction for future research on this distinction.

7. POLICY IMPLICATION FOR AZERBAIJAN

A productivity-oriented structural spending mix is essential to offset the price pressures created by budget expansion and nominal wage increases in the short term: a gradual increase in R&D spending boosts productivity in the medium and long term, strengthening growth and dampening inflationary pressures (Gulaliyev, Hasanov, Sultanova, Ibrahimli, & Guliyeva, 2024). Based on the results of the ARDL model, three different scenarios can be proposed for Azerbaijan: First, restructuring the composition of government spending. Moderating the growth rate of current spending and increasing the share of productivity-enhancing investments, including infrastructure and capacity expansion projects, can reduce demand pressures in the short term. This can also strengthen the "balancing" effect in the medium term. This is consistent with the "now +", "later −" pattern observed in the model.

Second, changing the wage regime. This implies PPP-indexation + gradual NC increases. PPP-based indexation, which preserves real income, maintains a deflationary effect. Implementing NC increases in stages and taking into account the timing can soften short-term demand-side pressures and reconcile with the subsequent weakening effect.

Third, implementing Active Labor Market Programs (ALMPs). In the short term, it is possible to manage cost-push risks through vocational training and employment incentives, without relying on the downward price effect of unemployment. This could be counterbalanced by a deflationary effect in the short term, but with some lags, an upward one.

8. CONCLUSION

This study provides a comprehensive understanding of the determinants of inflation in Azerbaijan, focusing on the impact of government spending, the minimum wage in both PPP and national currency terms, and unemployment. The results of the empirical study conducted through ARDL analysis highlight key implications for policymakers and researchers interested in understanding inflation dynamics in resource-dependent economies, including Azerbaijan.

The results confirm that government spending is an important driver of inflation in Azerbaijan. While such spending contributes to short-term inflationary pressures by increasing aggregate demand, its lagged deflationary effect suggests that well-targeted spending can increase productivity and stabilize prices over time. This highlights the importance of carefully managed fiscal policy to balance inflation control with economic growth.

Until the last decade, the minimum wage in Azerbaijan was very small compared to the average wage, so its impact on economic performance could be ignored. However, in recent years, the continuous increase in the minimum wage, and even its approach to the median wage, has led to its impact on inflation to some extent. However, this relationship is bidirectional. Thus, an increase in the minimum wage in national currency initially increases consumer demand and, consequently, increases the level of inflation.

However, this effect decreases over time, suggesting that wage adjustments ultimately lead to improved market stability. On the contrary, the minimum wage measured in PPP consistently reduces inflation. Empirical research proves that an increase in the minimum wage in PPP leads to an increase in real incomes and a stabilization of consumer prices. This finding highlights the potential of wage policy as a tool for controlling inflation.

The role of unemployment in inflation dynamics is consistent with the Phillips Curve theory in the short run and shows an inverse relationship.

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