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The Impact of Economic Growth on Unemployment in Central Asia

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Abstract

This study examines the relationship between economic growth and unemployment in Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan using a balanced annual panel for 1999–2024 (130 country-year observations). Unemployment is the dependent variable, real GDP growth is the principal explanatory variable, and consumer-price inflation is included as a macroeconomic control. The empirical strategy combines descriptive analysis, a Fisher-type panel unit root test based on Augmented Dickey–Fuller procedures, Fixed Effects (FE) and Random Effects (RE) estimation, the Hausman specification test, and a Modified Wald test for groupwise heteroskedasticity. The Hausman test ($\chi^2=0.43$, $p=0.8051$) favors the RE specification. In the preferred model, GDP growth has a positive and statistically significant coefficient ($\beta=0.0645$, $p=0.033$), while inflation is positive but statistically insignificant ($\beta=0.0175$, $p=0.285$). The positive growth coefficient is contrary to the conventional negative relationship predicted by Okun's Law and suggests that output expansion in Central Asia was not uniformly employment-generating during the sample period. The result is interpreted as an association rather than a causal effect and may reflect capital-intensive growth, migration, informality, demographic pressure, and skills mismatch. Because groupwise heteroskedasticity is detected and unemployment is non-stationary in levels, statistical inference is interpreted cautiously. The study contributes region-specific evidence on the limits of translating aggregate GDP growth into broad labor-market improvements and highlights the importance of the sectoral composition and employment intensity of growth.

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1. INTRODUCTION



Economic growth and unemployment are among the most closely monitored indicators of macroeconomic performance and social welfare. Economic expansion is generally expected to increase production, investment, and labor demand, thereby lowering unemployment. This mechanism underlies Okun's Law, which predicts an inverse relationship between output growth and changes in unemployment (Okun, 1962). Subsequent research has shown, however, that the strength and even the

direction of this relationship can vary across countries because labor-market institutions, sectoral composition, productivity, informality, and demographic conditions differ substantially (Lee, 2000; Ball, Leigh, & Loungani, 2017).

Central Asia provides a particularly important setting in which to reassess this relationship. Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan share a post-Soviet transition history but differ markedly in resource dependence, economic diversification, labor migration, demographic pressures, and institutional development. Growth driven by oil, gas, mining, infrastructure, or other capital-intensive activities can raise aggregate output without creating employment at the same pace. This possibility is consistent with the broader literature on employment-poor or jobless growth in developing and transition economies (Kaser, 2005; Loayza & Raddatz, 2010; Rodrik, 2016; Pomfret, 2021).

Inflation is included as a control variable because labor-market outcomes are shaped not only by output expansion but also by broader macroeconomic conditions. The traditional Phillips Curve suggests a possible short-run inverse relationship between inflation and unemployment, although later research emphasizes that the relationship is unstable and depends on expectations, supply shocks, policy regimes, and institutional conditions (Phillips, 1958; Friedman, 1977; Ball & Mankiw, 2002). In Central Asia, inflation can reflect demand pressures as well as exchange-rate movements, food and energy prices, import costs, and supply constraints, so its employment effect is theoretically ambiguous.

This study therefore asks two questions: (1) Does economic growth have a statistically significant relationship with unemployment in Central Asian countries? and (2) Does inflation have a statistically significant relationship with unemployment? The analysis uses annual panel data for 1999–2024 and estimates Fixed Effects and Random Effects models. Unlike a pooled model, these estimators explicitly account for country-level heterogeneity. The Hausman test is used to select between FE and RE, while a Fisher-type panel unit root test and a Modified Wald test provide additional diagnostic evidence.

The contribution of the paper is threefold. First, it provides an updated five-country panel analysis covering twenty-six years. Second, it evaluates the conventional Okun relationship while explicitly controlling for unobserved country heterogeneity. Third, it interprets the results in the structural context of Central Asia, emphasizing that the employment effect of growth depends on its composition and labor intensity rather than on the aggregate growth rate alone.

Okun's Law and the growth–unemployment relationship

Okun's Law is the principal theoretical framework linking economic activity to unemployment. Okun (1962) documented a systematic inverse relationship between output performance and unemployment in the United States. Later cross-country research generally confirmed the negative relationship, while also demonstrating substantial heterogeneity in the size of the Okun coefficient (Lee, 2000; Ball et al., 2017). Differences in labor-market flexibility, employment protection, productivity, participation, and industrial structure help explain why output fluctuations translate into different employment responses across economies.

For transition and developing economies, the expected relationship may be weaker. Economic growth concentrated in capital-intensive sectors can raise GDP with limited labor absorption, while informality and migration can disconnect official unemployment indicators from domestic output conditions. The composition of growth therefore matters for labor-market outcomes: sectors with stronger employment multipliers can generate more jobs than extractive or highly capital-intensive activities (Loayza & Raddatz, 2010; Rodrik, 2016).

Inflation and unemployment

The Phillips Curve provides the conventional theoretical starting point for the inflation–unemployment relationship. Phillips (1958) identified an inverse relationship between wage inflation and unemployment, while Samuelson and Solow (1960) extended the discussion to macroeconomic policy. Later work, particularly Friedman (1977), emphasized expectations and the absence of a permanent long-run trade-off. Consequently, inflation may be negatively, positively, or insignificantly related to unemployment depending on whether price pressures originate from demand expansion, supply shocks, exchange-rate movements, or macroeconomic instability.

In the present study, inflation is treated as a control variable rather than the principal explanatory variable. Its inclusion helps separate the association between GDP growth and unemployment from contemporaneous price dynamics.

Central Asian context and research gap

Central Asian economies combine common historical legacies with markedly different development structures. Kazakhstan and Turkmenistan have substantial resource sectors; Kyrgyzstan and Tajikistan are strongly influenced by migration and remittances; and Uzbekistan has undergone significant market-oriented and structural reforms. These differences imply that the same GDP growth rate can be associated with different labor-market outcomes across countries (Kaser, 2005; Pomfret, 2021).

The empirical gap addressed here is therefore not whether growth matters in theory, but whether annual GDP growth is associated with lower unemployment after country-specific heterogeneity is controlled for across the five Central Asian economies over a common 1999–2024 period. Based on Okun's Law, the expected sign of GDP growth is negative. The expected sign of inflation is ambiguous.

Table 1. Research questions, hypotheses, and expected signs

Component	Statement	Expected sign	Empirical decision rule
Research Question 1	Does economic growth affect unemployment in Central Asia?	GDPG: negative	H1 supported statistically if the GDPG coefficient is significant; Okun's Law additionally requires a negative sign.
Research Question 2	Does inflation affect unemployment in Central Asia?	INF: ambiguous	H2 supported if the INF coefficient is statistically significant.

2. METHODS

Data and variables

The study uses a balanced annual panel covering Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan from 1999 to 2024. The dataset contains 130 country-year observations, with 26 observations for each country. The empirical variables are the unemployment rate (UNEMP), annual real GDP growth (GDPG), and consumer-price inflation (INF). Data are compiled from internationally comparable macroeconomic and labor-market sources, principally the World Development Indicators and ILOSTAT, with national statistical sources used where necessary to complete the panel (World Bank, 2026; International Labour Organization, 2026).

UNEMP is measured as a percentage of the labor force and is the dependent variable. GDPG is the annual percentage growth rate of real GDP and is the main explanatory variable. INF is the annual percentage change in consumer prices and serves as a control variable. Rate variables are retained in percentage form to preserve direct interpretation in percentage points.

Table 2. Variables used in the empirical model

Variable	Symbol	Measurement	Role	Expected sign
Unemployment rate	UNEMP	% of total labor force	Dependent variable	—
Real GDP growth	GDPG	Annual real GDP growth (%)	Main independent variable	Negative
Inflation	INF	Annual CPI inflation (%)	Control variable	Ambiguous

Econometric specification

The baseline panel specification is:

$$\text{UNEMP}_{it} = \alpha + \beta_1 \text{GDPG}_{it} + \beta_2 \text{INF}_{it} + \mu_i + \varepsilon_{it}$$

where UNEMP_{it} is the unemployment rate in country i at time t , GDPG_{it} is real GDP growth, INF_{it} is inflation, μ_i captures unobserved time-invariant country-specific effects, and ε_{it} is the idiosyncratic error term. The Fixed Effects estimator allows μ_i to be correlated with the regressors, whereas the

Random Effects estimator assumes that the country-specific effect is uncorrelated with the explanatory variables (Baltagi, 2005; Wooldridge, 2010).

Estimation and diagnostic strategy

The empirical procedure consists of four stages. First, descriptive statistics are used to summarize the distribution and cross-country variation of the variables. Second, stationarity is examined using a Fisher-type panel unit root test based on individual Augmented Dickey–Fuller tests. Individual lag lengths are selected using the Akaike Information Criterion with a maximum of two annual lags. The null hypothesis is that all panels contain a unit root (Maddala & Wu, 1999).

Third, Fixed Effects and Random Effects models are estimated. The Hausman specification test evaluates whether differences between FE and RE coefficients are systematic. A p-value above 0.05 implies that the null hypothesis cannot be rejected and supports the use of Random Effects; a lower p-value favors Fixed Effects (Hausman, 1978).

Fourth, the Modified Wald test is used to assess groupwise heteroskedasticity in the Fixed Effects framework. Because heteroskedasticity is detected, conventional standard errors and associated probability values are interpreted cautiously. In addition, the unit root results show that unemployment is $I(1)$ while GDP growth and inflation are $I(0)$. For this reason, the level-based regressions are treated as evidence of association under the selected specification rather than as definitive causal or long-run equilibrium estimates.

3. RESULTS AND DISCUSSION

Descriptive evidence

The balanced panel contains 130 observations. Average unemployment across the five countries is 7.656%, with a standard deviation of 1.979 percentage points. GDP growth averages 6.643% and is substantially more volatile, ranging from -8.0% to 20.5% . Inflation is the most volatile variable, averaging 9.935% with a maximum of 38.6%. The dispersion in all three variables confirms substantial macroeconomic heterogeneity across countries and years.

Table 3. Descriptive statistics, 1999–2024

Variable	Mean	Std. Dev.	Minimum	Maximum	Observations
Unemployment (%)	7.656	1.979	4.100	13.500	130
GDP growth (%)	6.643	3.845	-8.000	20.500	130
Inflation (%)	9.935	6.561	0.400	38.600	130

Country-level averages also reveal that high GDP growth did not translate uniformly into lower unemployment. Kazakhstan experienced the largest reduction in unemployment between 1999 and 2024, whereas Uzbekistan, Turkmenistan, and Kyrgyzstan recorded moderate increases despite positive average growth. Tajikistan combined relatively high average growth with the highest average unemployment rate. These patterns provide descriptive motivation for explicitly controlling for country-specific effects.

Table 4. Country-level summary statistics, 1999–2024

Country	Avg. unemployment	Avg. GDP growth	Avg. inflation	UNEMP 1999	UNEMP 2024	Change
Kazakhstan	7.835	5.658	8.792	13.5	4.8	-8.7
Uzbekistan	7.042	6.369	13.427	6.0	7.3	$+1.3$
Turkmenistan	5.150	9.765	7.962	5.2	5.4	$+0.2$
Kyrgyzstan	8.154	3.935	7.665	8.7	9.1	$+0.4$
Tajikistan	10.100	7.488	11.827	11.2	10.7	-0.5

Note: Change = unemployment rate in 2024 minus unemployment rate in 1999.

Panel unit root tests

The Fisher-type panel unit root results indicate mixed integration properties. Unemployment is non-stationary at level but becomes stationary after first differencing, whereas GDP growth and inflation are stationary at level. Accordingly, unemployment is classified as I(1), while GDP growth and inflation are I(0).

Table 5. Fisher-type panel unit root test results

Variable	Level statistic	Level p-value	First-difference statistic	First-difference p-value	Conclusion
Unemployment	15.119	0.1278	48.808***	0.0000	I(1)
GDP growth	48.502***	0.0000	—	—	I(0)
Inflation	53.941***	0.0000	—	—	I(0)

*Note: *** indicates statistical significance at the 1% level. The null hypothesis is that all panels contain a unit root.*

Model selection and panel regression results

The Hausman test is used to choose between the Fixed Effects and Random Effects specifications. The test statistic is 0.43 with a p-value of 0.8051. Because the p-value is well above 0.05, the null hypothesis that FE and RE coefficient differences are not systematic cannot be rejected. The Random Effects estimator is therefore selected as the preferred specification, while FE results are retained as a comparison.

Table 6. Hausman specification test

Test	Null hypothesis	χ^2 statistic	p-value	Decision
Hausman	Differences in FE and RE coefficients are not systematic	0.43	0.8051	Fail to reject H_0 ; RE preferred

Table 7. Fixed Effects and Random Effects estimates

Variable / statistic	Fixed Effects	Random Effects
GDP growth	0.0664** (0.0305)	0.0645** (0.0303)
Inflation	0.0171 (0.0164)	0.0175 (0.0164)
Constant	7.0449 (0.2755)	7.0535 (0.9522)
Observations	130	130
Number of countries	5	5
Within R ²	0.0462	0.0462
F-statistic / Wald χ^2	2.98	5.80
Model probability	0.0544	0.0549

*Note: Conventional standard errors are in parentheses. ** indicates statistical significance at the 5% level. Because heteroskedasticity is present, significance should be interpreted cautiously.*

The FE estimate for GDP growth is positive (0.0664) and statistically significant at the 5% level ($p=0.031$). The preferred RE estimate is very similar: 0.0645 with $p=0.033$. Holding inflation constant, the RE coefficient implies that a one-percentage-point increase in annual GDP growth is associated with

an approximately 0.065-percentage-point increase in the unemployment rate. The magnitude is small, but the positive sign is contrary to the conventional negative relationship predicted by Okun's Law.

Inflation is positive in both specifications but statistically insignificant. In the RE model, its coefficient is 0.0175 with $p=0.285$. The analysis therefore does not provide sufficient evidence that contemporaneous inflation systematically affected unemployment during the sample period.

The within R^2 of 0.0462 indicates that GDP growth and inflation explain only a limited share of within-country variation in unemployment. This low explanatory power is substantively important: unemployment in Central Asia is influenced by demographic change, migration, labor-force participation, sectoral transformation, informality, education, skills mismatch, institutional quality, and employment policy, many of which are not included in the parsimonious specification.

Diagnostic evidence

The Modified Wald test strongly rejects homoskedasticity. The test statistic is 1304.50 with $p=0.0000$, indicating that error variances differ across countries. The coefficient estimates are not automatically biased by heteroskedasticity, but conventional standard errors and p -values may be affected. Consequently, the statistical significance reported in Table 7 is treated with caution and the results are interpreted primarily as conditional associations.

Table 8. Modified Wald test for groupwise heteroskedasticity

Diagnostic test	Null hypothesis	Statistic	p-value	Conclusion
Modified Wald	Constant error variance across countries	1304.50	0.0000	Heteroskedasticity is present

Discussion of the growth-unemployment relationship

The positive GDP coefficient does not imply that economic growth causes unemployment. Rather, it indicates that within the selected level-based specification, years of stronger GDP growth were associated with slightly higher unemployment after inflation and country heterogeneity were taken into account. Several structural mechanisms can generate such an outcome without implying a direct causal effect.

First, output expansion may be concentrated in capital-intensive activities. Resource extraction, energy production, large infrastructure projects, and productivity-enhancing investment can produce substantial output gains with relatively limited labor absorption. Second, labor supply may expand faster than job creation, particularly in economies with young populations and growing working-age cohorts. Third, international migration can alter domestic unemployment independently of domestic GDP growth. Fourth, informal employment and self-employment can weaken the relationship between aggregate output and officially measured unemployment. Finally, skills mismatch can allow vacancies and unemployment to coexist when expanding sectors demand qualifications that job seekers do not possess.

The country-level descriptive patterns are consistent with this structural interpretation. Turkmenistan recorded the highest average GDP growth but little long-term improvement in unemployment, while Tajikistan combined strong average growth with the highest average unemployment. Kazakhstan, by contrast, achieved the largest long-run fall in unemployment with a lower average growth rate than Turkmenistan. Thus, the employment consequences of growth depend not only on how fast GDP expands but also on which sectors expand and how effectively they absorb labor.

The results therefore do not support the conventional negative form of Okun's Law for this particular specification and sample. H1 is statistically supported in the limited sense that GDP growth has a significant coefficient, but the expected negative sign is not supported. H2 is not supported because inflation is statistically insignificant. These conclusions should be read together with the stationarity and heteroskedasticity diagnostics rather than as definitive causal statements.

4. CONCLUSION

Conclusion

This paper examined the relationship between economic growth and unemployment across five Central Asian economies over 1999–2024 using a balanced panel of 130 observations. The empirical framework employed Fixed Effects and Random Effects estimators, with the Hausman test selecting Random Effects as the preferred specification. The main finding is a small positive and statistically significant association between GDP growth and unemployment, while inflation is positive but statistically insignificant.

The positive growth coefficient differs from the conventional prediction of Okun's Law. The result suggests that higher aggregate growth alone did not guarantee proportional employment creation across Central Asia during the sample period. The evidence is consistent with an employment-poor growth interpretation in which the labor-market effect of expansion depends on sectoral composition, labor intensity, migration, demographics, informality, skills, and institutional conditions.

At the same time, the findings must be interpreted cautiously. Unemployment is non-stationary in levels, groupwise heteroskedasticity is present, and the model explains a relatively small proportion of within-country unemployment variation. The estimates therefore provide evidence of conditional association under the selected specification rather than proof of causality or a universal rejection of Okun's Law.

Policy implications

For policymakers, the central implication is that the quality and employment intensity of growth matter as much as the aggregate growth rate. Economic diversification toward manufacturing, agro-processing, construction, logistics, tourism, and modern services can broaden employment opportunities beyond capital-intensive sectors. Policies that improve the business environment and financing conditions for small and medium-sized enterprises can further strengthen private-sector job creation.

Human-capital policy is equally important. Vocational education, university curricula, retraining, apprenticeships, and employer partnerships should be aligned more closely with the skills demanded by expanding sectors. Active labor-market programs can improve job matching, while policies that facilitate formalization can make employment growth more visible and sustainable. Migration and remittance strategies should be integrated with domestic employment policy so that returning workers can convert acquired skills and savings into productive activity.

Macroeconomic stability remains important even though inflation is statistically insignificant in the preferred model. High and volatile inflation can weaken purchasing power and investment confidence. Stable prices, predictable policy, and improved labor-market statistics therefore remain complementary conditions for employment-oriented growth.

Limitations and future research

The study has several limitations. The sample contains only five countries, the model includes only GDP growth and inflation, annual data may obscure short-run adjustment, unemployment measurement is complicated by informality and migration, and GDP growth does not reveal the sectoral composition of output expansion. The mixed order of integration and detected heteroskedasticity also require caution in interpreting the level-based panel estimates.

Future research should examine changes in unemployment, dynamic panel specifications, corrected or robust inference, sector-level output and employment, labor-force participation, migration, remittances, education, foreign direct investment, and institutional variables. Such extensions would provide a more complete account of how economic growth is transmitted to employment in Central Asia.

5. REFERENCES

- Acemoglu, D., & Restrepo, P. (2020). Robots and jobs: Evidence from US labor markets. *Journal of Political Economy*, 128(6), 2188–2244.
- Ball, L., Leigh, D., & Loungani, P. (2017). Okun's law: Fit at 50? *Journal of Money, Credit and Banking*, 49(7), 1413–1441.

- Ball, L., & Mankiw, N. G. (2002). The NAIRU in theory and practice. *Journal of Economic Perspectives*, 16(4), 115–136.
- Baltagi, B. H. (2005). *Econometric analysis of panel data* (3rd ed.). John Wiley & Sons.
- Blanchard, O., & Katz, L. F. (1997). What we know and do not know about the natural rate of unemployment. *Journal of Economic Perspectives*, 11(1), 51–72.
- Friedman, M. (1977). Nobel lecture: Inflation and unemployment. *Journal of Political Economy*, 85(3), 451–472.
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, 46(6), 1251–1271.
- International Labour Organization. (2023). *World employment and social outlook: Trends 2023*. International Labour Office.
- International Labour Organization. (2026). ILOSTAT database [Data set]. International Labour Organization.
- Kaser, M. (2005). Labour market policies and Central Asian poverty. *Central Asian Survey*, 24(4), 351–371.
- Lee, J. (2000). The robustness of Okun's law: Evidence from OECD countries. *Journal of Macroeconomics*, 22(2), 331–356.
- Loayza, N. V., & Raddatz, C. (2010). The composition of growth matters for poverty alleviation. *Journal of Development Economics*, 93(1), 137–151.
- Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61(S1), 631–652.
- Okun, A. M. (1962). Potential GNP: Its measurement and significance. In *Proceedings of the Business and Economic Statistics Section of the American Statistical Association* (pp. 98–104). American Statistical Association.
- Phillips, A. W. (1958). The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861–1957. *Economica*, 25(100), 283–299.
- Pomfret, R. (2021). Central Asian economies: Thirty years after dissolution of the Soviet Union. *Comparative Economic Studies*, 63(4), 537–556.
- Rodrik, D. (2016). Premature deindustrialization. *Journal of Economic Growth*, 21(1), 1–33.
- Samuelson, P. A., & Solow, R. M. (1960). Analytical aspects of anti-inflation policy. *American Economic Review*, 50(2), 177–194.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). MIT Press.
- World Bank. (2026). *World Development Indicators* [Data set]. World Bank.