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KEY MACROECONOMIC FACTORS AFFECTING THE UNEMPLOYMENT RATE

Tolagan Botirovich Sodiqov
Associate Professor, Faculty of Economics and Tourism,
Oriental University

Annotation: This study investigates the macroeconomic factors affecting unemployment in the Shanghai Cooperation Organization (SCO) member countries over the period 2004–2023, based on data extracted from the World Bank database. We constructed a model and conducted a regression analysis using the Ordinary Least Squares (OLS) method to explore the relationships among the variables. The findings are presented below.
Keywords: Unemployment, Inflation, Foreign Direct Investment (FDI), STATA-14 software, OLS method, VIF indicators, Breusch-Pagan test, Breusch-Godfrey test.

1. Introduction. In today's context, unemployment has become one of the most frequently debated issues. The global rise in unemployment has led many people in various countries and cities to seek employment abroad rather than in their own countries. Moreover, in developed nations, unemployment has been associated with increased crime rates and heightened social tensions.

Let us first define the term "unemployment." Unemployment is a socio-economic phenomenon that reflects the underutilization of a portion of the available labor force within a country. Individuals who are able to work and willing to be employed but are not currently working are considered unemployed.

Unemployment can be classified into several types, including structural, frictional, institutional, technological, regional, hidden, stagnant, and cyclical unemployment.

Among the primary causes of unemployment are the transitional periods during which workers leave one job for another or require time to acquire new skills and adapt to a new workplace. These factors mainly account for structural and frictional unemployment, which together constitute natural unemployment.

In addition, factors such as a decline in aggregate demand, reduction in production, underdevelopment or inefficiency of enterprises that generate jobs, and the automation of labor, including the adoption of robotics and information technologies, also contribute to rising unemployment levels.

Furthermore, enterprise managers may not be able to lay off all workers at once. As a result, some employees may not be fully employed during the workday or workweek, leading to hidden unemployment.

In some countries, there are individuals who are physically able to work but have lost their jobs and have no interest in seeking employment or receiving unemployment benefits. Such conditions give rise to stagnant unemployment.

Among the key macroeconomic factors influencing unemployment, the most prominent are inflation and investment, along with other economic variables.

Inflation refers to the depreciation of a currency due to the supply of money exceeding the demand for goods and services, leading to a general increase in prices.

Investment, on the other hand, is the allocation of financial resources for the restoration and expansion of fixed and working capital, as well as for the enhancement of production capacity. Investments can take the form of cash, bank loans, shares, and other securities. Nominal

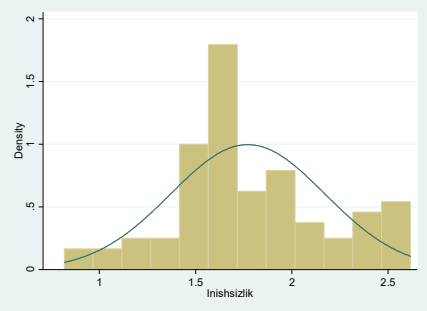
investment refers to investment in monetary terms, while real investment refers to the actual acquisition of investment resources with that money.
Based on this data and the World Bank Databank, we constructed a model to study the influence of investment and inflation on unemployment using STATA-14 software.
Methodology . As mentioned above, we collected relevant data from the World Bank Databank. Specifically, we used the following indicators:
"Inflation, consumer prices (annual %)"
"Unemployment, total (% of total labor force) (modeled ILO estimate)"
"Foreign direct investment, net inflows (% of GDP)"
From these, we developed an econometric model.
Our dependent variable (Y) is:
Unemployment, total (% of total labor force) (modeled ILO estimate)
The independent variables (X1 and X2) are:
X1 = Inflation
X2 = Investment
Thus, we briefly labeled our variables:
Y = Unemployment
X1 = Inflation
X2 = Investment

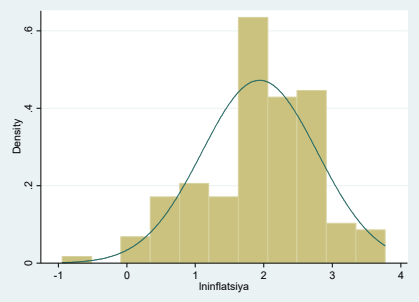
Unemployment it = B0 + B1*Inflation it + B2* Investment it + u it

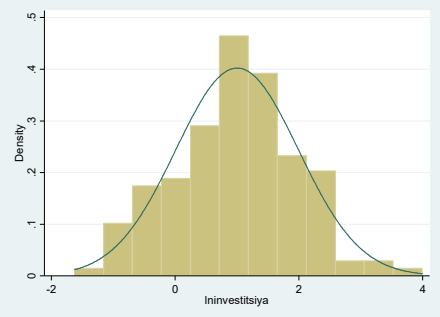
These statistical data were obtained from the World Bank's World Development Indicators (WDI) database. The data were collected for the eight member countries of the Shanghai Cooperation Organization (SCO). These countries include Azerbaijan, Uzbekistan, the Russian Federation, the Islamic Republic of Iran, China, Kyrgyzstan, Tajikistan, and Kazakhstan. The dataset covers the period from 2004 to 2023.
After inputting our model into STATA, we tested for the presence of multicollinearity, heteroskedasticity, and autocorrelation issues. The results revealed the presence of heteroskedasticity in the model. Therefore, we transformed the variables by applying logarithmic conversion.
Following that, we began our analysis by conducting descriptive statistics on the model.
To do this, we used the sum command in STATA-14, which generated the following statistical indicators:

Variable	Obs	Mean	Std. Dev.	Min	Max
lnunemployment	160	1.770793	0.3999066	0.8175747	2.615935
lninflation	136	1.939353	0.8446514	-0.9445917	3.772496
lninvestment	147	1.003031	0.9917011	-1.624575	3.995722

The values in the Mean column represent the arithmetic average of each variable, while the Std. Dev. column displays the standard deviation, reflecting the average dispersion of the observations around the mean.
Next, we will examine the distribution series and normality characteristics of the dataset.
To accomplish this, we will generate histograms of the variables in STATA-14 and compare them against the graphical normal distribution curve.







As can be seen, Diagram 1 indicates that unemployment approximately follows a normal distribution. Similarly, Diagram 2 also suggests that inflation aligns well with a normal distribution pattern. Compared to Diagram 1, Diagrams 2 and 3 exhibit a higher degree of normality, showing a closer fit to the theoretical normal curve.

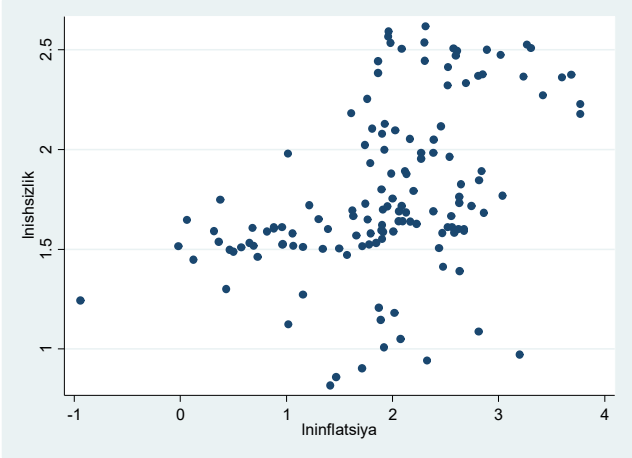
To assess normality more precisely, we used the swilk command in STATA-14, which generated a statistical table for formal analysis of the normal distribution.

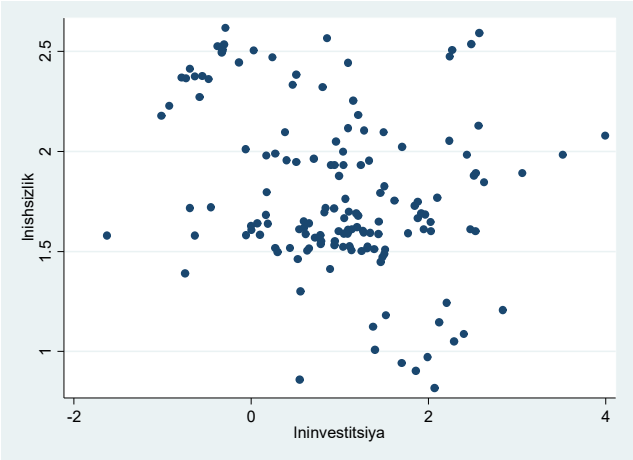
Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
lnishsizlik	160	0.95911	5.028	3.674	0.00012
lninflatsiya	136	0.97582	2.588	2.144	0.01601
lninvestit~a	147	0.99270	0.835	-0.409	0.65878

According to the results in this table, the unemployment and inflation variables appear to conform to the assumptions of normal distribution. However, the investment variable does not satisfy the conditions of normality.

To understand the relationship among these three economic indicators, we first turned to the use of a scatter plot for visual inspection.





It is clearly observed that inflation has an impact on unemployment, and this effect appears to be statistically significant. However, we can conclude that investment does not have a significant impact on unemployment.

In the first scatter plot, although the data points are not perfectly aligned, they generally trend upward and to the right, indicating a positive relationship. From this, we can infer that as inflation increases, unemployment also tends to increase — suggesting a direct correlation in Scatter Plot 1.

In Scatter Plot 2, however, the data points appear randomly scattered, showing no clear pattern. This leads us to conclude that there is no meaningful relationship between investment and unemployment in this case.

To further investigate the interaction among these three economic indicators, we must calculate and analyze their correlation coefficients.

	lnishs~k	lninfl~a	lninve~a
lnishsizlik	1.0000		
lninflatsiya	0.4402	1.0000	
lninvestit~a	-0.2745	-0.1914	1.0000

It is evident that there is a relationship between inflation and unemployment, and we can describe this as a positive correlation.

As for the relationship between unemployment and investment, the correlation coefficients are

close to zero, suggesting a weaker relationship. However, the direction of this weak relationship appears to be slightly negative, allowing us to cautiously conclude the presence of a mild negative correlation.

Now, in order to fulfill the main objective of our study, we proceed to run a regression analysis using our specified model. The outcomes of this regression will be presented and interpreted in the next section.

Analysis of Results. Finally, we arrive at the regression analysis stage. To begin our interpretation, we must first become familiar with the initial regression output generated from our model.

Source	SS	df	MS	Number of obs	=	132
				F(2, 129)	=	19.41
Model	5.43809785	2	2.71904892	Prob > F	=	0.0000
Residual	18.0711163	129	.140086173	R-squared	=	0.2313
				Adj R-squared	=	0.2194
Total	23.5092141	131	.17945965	Root MSE	=	.37428

lnishsizlik	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lninflatsiya	.1999464	.03908	5.12	0.000	.1226257	.2772672
lninvestitsiya	-.081027	.0322739	-2.51	0.013	-.1448816	-.0171723
_cons	1.48008	.0944752	15.67	0.000	1.293159	1.667002

As observed in the regression output table, we obtained the coefficients B_0, B_1, and B_2. All three coefficients are statistically significant, as their p-values are less than 0.05, indicating a high level of reliability.

This allows us to conclude the following interpretations:

If unemployment increases by one unit, inflation increases by approximately 0.2 units.

Conversely, if unemployment rises by one unit, investment decreases by about 0.081 units.

To evaluate the overall quality of the model, it is essential to test for potential problems such as multicollinearity and heteroskedasticity.

Therefore, we conducted the Variance Inflation Factor (VIF) test to assess multicollinearity, and the Breusch-Pagan test to detect the presence of heteroskedasticity.

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lnishsizlik

         chi2(1)      =     1.04
         Prob > chi2  =   0.3069
```

Variable	VIF	1/VIF
lninflatsiya	1.04	0.963362
lninvestit~a	1.04	0.963362
Mean VIF	1.04	

It is evident that our model does not suffer from heteroskedasticity, as the p-value obtained from the Breusch-Pagan test is greater than 0.05. This suggests that the variance of the error terms is constant across observations — an important assumption in linear regression.

Likewise, the issue of multicollinearity is not present in our model. Had the VIF (Variance Inflation Factor) values exceeded 10, we would have concluded that multicollinearity exists. However, since the VIF values are well below this threshold, we can confidently state that multicollinearity is not a concern.

In addition, it is important to assess whether there is any autocorrelation problem in the model. Therefore, checking for the presence or absence of autocorrelation is a logical next step to validate the reliability of our regression model.

Number of gaps in sample: 10

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	95.665	1	0.0000
2	95.671	2	0.0000
3	96.071	3	0.0000
4	96.114	4	0.0000
5	96.210	5	0.0000

As seen in the table, there is clear evidence of autocorrelation in the model, even after the tenth observation. This indicates a violation of one of the key classical regression assumptions.
To address this issue, we applied a solution by implementing lagging (lag transformation) to mitigate the effects of autocorrelation in the model.

Number of gaps in sample: 10

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	0.865	1	0.3523
2	0.879	2	0.6442
3	0.884	3	0.8294
4	2.537	4	0.6381
5	3.828	5	0.5744

Now we can confidently state that there is no autocorrelation present in our model.
Conclusion. This research was conducted using data from Shanghai Cooperation Organization (SCO) member countries over the period 2004–2023. The focus of the study was to examine the main macroeconomic factors influencing unemployment. To explore these relationships, regression analysis was performed using STATA-14 software.

According to the results, all regressors were found to be statistically significant. The analysis showed that an increase in inflation leads to a rise in unemployment, whereas an increase in investment results in a decline in unemployment.

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