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Assessing Country-Specific Macroeconomic and Financial Risks: An Empirical Approach

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A B S T R A C T :

This study quantitatively assesses macroeconomic risks in Uzbekistan's economy. Macroeconomic risk assessment factors were developed by adjusting indicators from the external, real, monetary, and fiscal sectors. The difference between actual and potential GDP was selected as the primary risk measure. The study considered the influence of factors such as the inflation rate, unemployment rate, real output, exchange rate, trade deficit, public debt-to-GDP ratio, and budget deficit. Results showed that real GDP growth, the trade balance, and the budget deficit exhibited the highest sensitivity to the economy's risk level, while the exchange rate, public debt-to-GDP ratio, and inflation showed relatively weaker correlations. All hypothesis tests conducted to determine the significance and reliability of the model's indicators and results yielded positive outcomes.

Keywords: Output gap, macroeconomic risk, economic turbulence, macro-prudential policy, macroeconomic uncertainty, coordination of macroeconomic policy.

1. Introduction.

Today, countries worldwide are experiencing disruptions in global production chains and international capital flows due to the COVID-19 pandemic and geopolitical conflicts, leaving national economies in a precarious situation. Hodula M. et al. (2024) note that over the past decade, the global economy has faced numerous challenges stemming from the China-US trade war that began in 2018, the global pandemic in 2020, the conflict between Russia and Ukraine that erupted in 2022, and the escalation of the Israel-Hamas conflict in the Middle East. These conflicts have intensified international relations and heightened the potential threats of geopolitical risks to economic growth and financial stability [1].

According to World Bank analyses, countries are experiencing slowdowns in economic growth, tightening fiscal constraints, rising debt levels, decreasing private sector investments, and declining international aid to developing countries [2]. Moreover, the increase in interest rates in developed countries to control inflation has also intensified the debt-servicing burden in developing countries and led to a deterioration of financial conditions [3]. This situation requires governments to implement effective macroeconomic policies aimed at mitigating the impact of external shocks on the country's economy and preventing macroeconomic and macro-prudential risks.

Exogenous shocks stemming from geopolitical instability and shifts in the global economic landscape can induce structural changes in aggregate demand and supply. These impacts manifest as reduced foreign direct investment and national output, increased unemployment, lower household income, disruptions to foreign trade due to spillovers from partner economies, fluctuations in official reserves and exchange rates, elevated external debt and service costs, and inflationary pressures. These adverse economic consequences can be attributed, in part, to an output gap where actual output consistently lags behind potential output.

Uzbekistan's economy is also experiencing significant turbulence, characterized by a widening foreign trade deficit, rising external debt and budget deficits, currency devaluation, substantial depletion of official reserves due to exchange rate interventions, and persistently high inflation. This necessitates the implementation of effective government policies to mitigate macroeconomic risks and ensure economic stability. This study, therefore, aims to develop a model for quantifying macroeconomic risk in Uzbekistan, assess the magnitude of this risk, and formulate policy recommendations for its mitigation and prevention.

2. Literature Review

Extensive research has explored the assessment of country-specific economic risks. Solnik (1974) highlighted the negative impact of political instability, exchange rate volatility, and government intervention on international investment flows, emphasizing the importance of considering geopolitical factors and market uncertainty in risk analysis [4]. Erb, Harvey, & Viskanta (1996) examined quantitative risk assessment methodologies, focusing on economic and financial variables such as GDP growth, inflation, and balance of payments, concluding that political risk often outweighs purely economic factors [5]. Hoti and McAleer (2004) developed a quantitative model incorporating political, economic, and financial variables, demonstrating the multidimensional nature of country risk and the primacy of political factors, particularly in developing economies [6]. Jinjarak (2007) analyzed the sensitivity of foreign direct investment in the US to macroeconomic risks, finding that vertical investment is particularly vulnerable to demand, supply, and sovereign risks [7]. Aizenman, Hutchison, & Jinjarak (2013) investigated the relationship between macroeconomic conditions (debt-to-GDP, inflation, fiscal deficit) and sovereign credit risk in European countries, highlighting the increased risk associated with weak fiscal systems and global financial instability [8]. Milan (2014) explored the link between liquidity preference and macroeconomic instability in the US, finding that financial derivatives are not always effective in mitigating liquidity hoarding during periods of high instability [9]. Carriero, Clark, & Marcellino (2018) modeled the impact of macroeconomic and financial uncertainty shocks on the US economy, demonstrating that macroeconomic uncertainty significantly affects macroeconomic variables, while financial uncertainty affects both macroeconomic and financial variables [10]. Finally, Staehr and Uusküla (2021) used a panel regression model to analyze the relationship between non-performing loans and macroeconomic indicators in the EU, finding that GDP growth, inflation, and debt levels are significant predictors of non-performing loan dynamics [11]. Furthermore, the trade balance and real house prices are more significant for Western Europe than for Eastern and Central European countries [11]. Abaidoo, R., & Agyapong, K. (2023) examined the impact of macroeconomic risks and uncertainties on the activities of financial institutions in sub-Saharan African countries, using a panel regression model based on observations from 1996 to 2019. They concluded that currency volatility hinders the effectiveness of financial institutions, while inflation uncertainty has a significant impact on their efficiency in the observed regions; political instability further intensifies the negative effect [12]. Nakajima, J. (2024) investigated the nonlinear relationship between financial volatility and real economic activity in the United States and Japanese economies, using financial volatility as an index of macroeconomic uncertainty. The results indicated that an increase in financial volatility leads to a significant decline in industrial output and business investment when macroeconomic uncertainty is high [13].

Existing literature highlights the multifaceted nature of macroeconomic risk assessment, emphasizing the interplay of economic and political factors. While quantitative models utilizing economic indicators like GDP growth, inflation, and balance of payments are valuable, political risk often plays a dominant role, particularly in developing economies. Studies demonstrate the sensitivity of investment flows to political instability and exchange rate fluctuations, and the significant impact of macroeconomic uncertainty on real economic activity. Furthermore, research indicates that specific macroeconomic variables, such as the trade balance and real house prices, may hold varying degrees of importance across different regions. Finally, the effectiveness of financial institutions is shown to be vulnerable to macroeconomic risks and uncertainties, with currency volatility, inflation uncertainty, and political instability all exerting negative influences. Notably, while extensive research exists on macroeconomic risk assessment in various countries and contexts, there is a dearth of studies specifically focused on analyzing macroeconomic risks within the Republic of Uzbekistan. This paper aims to address this gap by analyzing and appraising the macroeconomic risks inherent in the Uzbek economy.

3. Methodology.

3.1. The data.

The primary challenge in conducting research is the lack of reliable statistical data. To address this issue, we used data from the official website of the Statistics Agency of the Republic of Uzbekistan. In our analysis, all observations are quarterly covering the period from the Q1 of 2005 to the Q2 of 2024. To remove the effects of seasonality, we selected the changes in all numerical variables relative to the corresponding quarter of the previous year. As a dependent variable of the model, the gap between actual and potential GDP is conventionally considered macroeconomic risk. Variables such as changes in real output, inflation, exchange rate, wages, government budget deficit, and foreign trade deficit were chosen as independent variables. Foreign trade and budget deficit indicators were used as dummy variables and the time series for the period of deficit observation were taken as 1, while the period of surplus observation was taken as 0. Below is a general description of the model variables (Table 1).

Table 1. General description of model variables.

Variable Name	Description	Obs.	Icon
The gap in GDP	The gap between actual and potential GDP developed using the Hodrick-Prescott filter (%)	66	gap_gdp
Real output growth	Change in real GDP (%)	66	realgdp
Inflation	The change in inflation reflected in the consumer price index (%)	83	cpi
Exchange rate	The ratio of national currency to US dollars (%), (USD/UZS)	78	exch_end
Wage	Changes in official wages by sector of the economy excluding wages in agriculture and small business entities (%)	31	wage
Public debt	Change in government debt-to-GDP ratio (%)	70	govdebt
Budget deficit	The dummy variable obtained from the change in the difference between income and expenses of the fiscal budget (0;1)	83	fis_deficit

Trade deficit	The dummy variable obtained from the change in the difference between exports and imports in foreign trade (0;1)	59	cab_deficit

The selection of these factors in the formation of the model is due to their consideration as elements that lead to macroeconomic instability or uncertainty, according to macroeconomic theory and the author's hypothesis.

3.2. Model.

This analysis is carried out based on a multiple regression model. The initial algebraic function in constructing the model takes the following form:

$$Y_t = f\ (x) \qquad (1)$$

Taking into account the linear relationship, the standard form of the model can be presented as follows:

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_{kt} + \epsilon_t \qquad (2)$$

Here:

Y_t – dependent variable;
$X_{1t},\ X_{2t},\ldots, X_{kt}$ – independent variable;
β_0 – intercept;
$\beta_1,\ \beta_2,\ldots, \beta_k$ – unknown parametres;
ϵ_t – residual.

What is the actual origin of Y_t which represents the difference between real and potential GDP and is used as a dependent variable in our model? The following formula describes the derivation of the HP (Hodrick-Prescott) filter [14]:

$$\min_{\tau t} \sum_{t=1}^{T}(y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1}[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \qquad (3)$$

Here:

y_t – real variable (in our model, this is real GDP);
τ_t – the trend component (in our model, this is the potential GDP);
λ – The smoothing parameter based on the type of time series (Q=1600 for quarterly data).

In this study, the GDP gap obtained through the HP filter is used as a macroeconomic risk indicator. Although this methodology is actually not free of shortcomings, it can be conditionally applied to express macroeconomic uncertainties [15].

3.3. The accuracy of model.

In the study, the normal distribution of variables included in the model was checked using the Skewness-Kurtosis test, the VIF test for multicollinearity, and Breusch-Pagan test to assess the reliability of the final model results (heteroscedasticity /homoscedasticity).

Analysis and results.

First, begin the analysis from the descriptive statistics of the model variables. This is because these statistics provide information about the central tendencies in the variables (Table 2).

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
gap_gdp	66	1.52e-09	1.710555	-6.620045	4.925432
realgdp	66	93.51177	2.100971	89.76311	101.5722
cpi	83	8.606024	3.622637	-1.3	19.9
exch_end	78	14.44334	14.12185	-2.967563	63.74683
wage	31	20.96519	5.489479	11.27751	31.73081
govdebt	70	4.394238	2.809995	1.864067	13.37785
fis_deficit	83	.1445783	.353813	0	1
cab_deficit	59	.5932203	.4954498	0	1

As evident from the table data, the indicator with the largest variance among variables is the exchange rate, with its lower dispersion at -2.96% while its upper dispersion reached 63.7%. The consumer price index ranges from a low of -1.3% to a high of 19.9%. The wage indicator corresponds to 11.27% and 31.73% respectively. It can be observed that the dispersion deviation in the remaining indicators is not significantly large. The magnitude of variance in the indicators may potentially lead to a unnormal distribution issue. However, descriptive statistics alone do not allow for making decisions about normal distribution. Below, we will assess the normal distribution using the Skewness-Kurtosis test (Table 3).

Table 3. Test for Normal Distribution

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint	
				adj chi2(2)	Prob>chi2
gap_gdp	66	0.1567	0.8535	2.21	0.3308
realgdp	66	0.2559	0.7415	3.21	0.2918
cpi	83	0.2145	0.6524	1.36	0.4869
exch_end	78	0.6514	0.7852	0.17	0.9102
wage	31	0.0001	0.0015	18.98	0.0001
govdebt	70	0.3247	0.8458	4.53	0.2325

Note: ***p > 0.05

According to the results of the normal distribution test, the significance level of the wage indicator is lower than 5%, which leads to conclude that the conditions for normal distribution are not satisfied for this indicator. Therefore, we have concluded that this indicator is unsuitable for the model. Also, this test is not necessary for foreign trade and budget deficit indicators, as they are dummy variables consisting of 0 and 1. We can see that all other variables are higher the 5 percent significance level meaning that the conditions for normality are fully satisfied for these variables. Now we will focus on the results of the correlation analysis of the model variables (Table 4).

Table 4. The correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) gap_gdp	1.0000						
(2) realgdp	-0.8184	1.0000					
(3) cpi	0.2171	0.4040	1.0000				
(4) exch_end	0.1002	0.0891	-0.3677	1.0000			
(5) govdebt	0.0302	0.2848	0.3345	-0.2614	1.0000		
(6) fis_deficit	0.3028	0.2326	0.4068	-0.0544	0.4755	1.0000	
(7) cab_deficit	0.4454	0.4718	-0.0167	0.3721	-0.0060	0.1079	1.0000

The strongest correlation between variables is between real GDP growth and the GDP gap (-0.8184). Since this correlation is between the independent and dependent variable, it is not negative. The correlation between all other variables is statistically insignificant. These relationships can also be observed in the following image (Fig. 1).

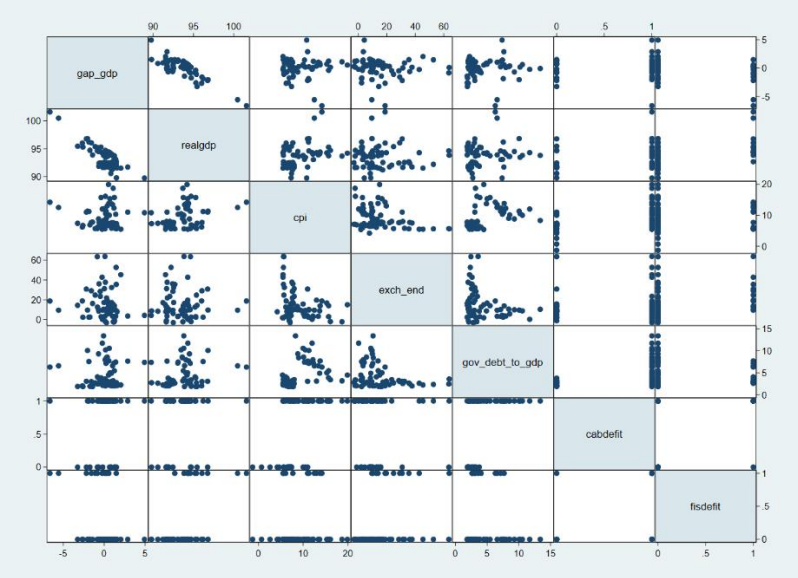

Fig 1. An illustration of the correlation on a scatterplot.

The correlation between variables can also be observed through a scattergram. In the following table, we will focus on the results of the regression analysis (Table 5).

Table 5. Model output

	(model 1)	(model 2)	(model 3)
	gap_gdp	gap_gdp	gap_gdp
realgdp	-0.926***	-0.876***	-0.886***
	(0.000)	(0.000)	(0.001)

cpi	0.174***	0.164***	0.169***
	(0.000)	(0.000)	(0.000)
exch_end	0.0153*	0.0131*	0.0149*
	(0.049)	(0.057)	(0.041)
govdebt	0.0857*	0.0796*	0.0797*
	(0.032)	(0.039)	(0.034)
cab_defit	0.476	0.4466	0.4258
	(0.086)	(0.089)	(0.090)
fis_defit	0.572	0.491	0.499
	(0.096)	(0.098)	(0.098)
Constant	83.94***	82.83***	82.89***
	(0.000)	(0.000)	(0.000)
Observations	47	47	47
R2	0.864	0.852	0.846
Adjusted R2	0.844	0.831	0.830

p-values in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

The results show that the model's coefficient of determination is 0.86. This indicates that the independent variables explain 86 percent of the dependent variable. It can be seen here that there is no endogenous problem. The strongest relationship among the variables is with the increase in real GDP, the change of which by one percent reduces the level of macroeconomic risk by 0.92 percent. Fiscal deficit is also considered a source of risk. A one percent increase in it raises the risk level by 0.57 percent. The next significant risk factor corresponds to the foreign trade balance deficit. Its increase raises macroeconomic risk by 0.47 percent. The indicators of exchange rate, inflation, and the ratio of public debt to GDP are also significant, with their increases changing the risk level by 0.17, 0.01, and 0.08 percent, respectively. Furthermore, the consistency of the model results across all three approaches proves that it is free from errors.

Also, reliability of model results, multicollinearity and the consistently changes in model residuals with the movement of independent variables are of great importance. We will examine this below using the VIF and Breusch-Pagan tests (Table 6).

Table 6. VIF Test Results

Variables	VIF	1/VIF
realgdp	1.76	0.567298
cpi	1.73	0.577564
fis_defit	1.53	0.651490
cab_defit	1.49	0.670089
govdebt	1.49	0.671086
exch_end	1.47	0.678237
Mean VIF	1.58	

The fact that the average values of the VIF index exceed 10 percent indicates the existence of a multicollinearity problem. Our results for this test are below the 5 percent average level, showing 1.58 percent. This refutes the existence of a risk of multicollinearity among the indicators. Now, let's focus on the analysis of the heteroscedasticity problem (Table 7).

Table 7. Breusch-Pagan test results.

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance Variables: fitted values of gap_gdp chi2(1) = 2.22 Prob > chi2 = 0.1365

Note: ***p > 0.05

The final step in determining the statistical significance of the model in the linear regression model is to ensure the absence of heteroscedasticity. A heteroscedasticity problem is considered to exist if the significance level relative to chi-squared is less than 5 percent (0.05). Our results show 0.1365 percent in this regard indicating that there is evidence to reject the null hypothesis (H0) and accept the alternative hypothesis.

4. Discussion.

This article conducts analyses on assessing the level of macroeconomic risk in Uzbekistan. In the analysis, GDP gap was conditionally applied as a factor representing the country's macroeconomic risk. The results revealed that variables with the strongest sensitivity to macroeconomic risk are real GDP growth, foreign trade balance deficit, and budget deficit. These results are more similar with findings of Fall, F., & Fournier, J. M. (2015) [16]. Although other variables such as inflation and exchange rate are in small, but also proved to be significant in the emergence of risk. The main challange in our

study was the shortage of data based on quarterly statistical observations for some indicators. It would have been appropriate to analyze the relationships between the risk and other variables such as unemployment, official reserves and the amount of interventions.

5. Conclusion.

The aim of this study is to assess the macroeconomic risk. The research reveal that the primary factor causing macroeconomic turbulence in Uzbekistan is the budget deficit (0.572). That is, the larger the fiscal deficit in the short term, the higher level of the risk. The following significant factor in this regard is the foreign trade deficit, which also has a direct correlation with macroeconomic risk (0.476). The growth of real GDP emerged as the variable with the strongest risk-mitigating effect (-0.926). The exchange rate channel also plays a small but notable role in risk formation (0.0153). Inflation can also be a potential factor in shaping risk. Our study found that this variable also has a positive correlation with risk (0.174). All hypothesis tests conducted on the significance and accuracy of model indicators and results yielded positive outcomes. This suggests the need for developing strategies to mitigate macroeconomic risks for Uzbekistan.

Our study suggest that, one of the most crucial tasks in creating a stable macroeconomic and macroprudential environment for Uzbekistan is stimulating domestic good production. But, this requires the institutional formation of a favorable business environment in the economy based on sound competition. As a result, due to an increase in the supply of domestic goods, the market will be saturated with domestic products resulting the decline in demand for imported goods. This, in turn, will eliminate the trade deficit problem, reduce pressure on foreign currency, and lead to the stability of the national currency. Simultaneously, this will prevent import-driven inflation. However, it should be noted that mitigating macroeconomic risks also requires fusioning monetary and fiscal policies. But, developing proposals regarding the channels of macroeconomic risks, such as public debt and fiscal budget deficits, requires additional researches.

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