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## Analysis of Foreign Trade Flows and Regional Economic Stability: Evidence From The Khorezm Region

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**Abstract:** This paper analyses the impact of foreign trade flows on regional economic stability in the Khorezm region with quarterly data from 2010 to 2024. Utilizing a multivariate linear regression with the log adjusted export, import and GRP as output the study video records on how foreign trade dynamics influence regional economic performance. The empirical results show importing has a significant positive impact on regional product, indicating that the region heavily depends on intermediate goods and capital goods imported to promote production and technology upgrading. On the other hand, exports exhibit negative short-term elasticity; this suggests structural constraints supported by raw materials dominance in export mix and vulnerability toward international price theatre. The model is statistically sound according to the diagnostic tests: it does not indicate autocorrelation, heteroskedasticity or multicollinearity. The strong correlation observed between the actual and predicted GRP values reconfirms the validity of the model. In general, the study demonstrates the importance of structural or trade composition in determining the regional economic stability and stresses that export diversification and increased value added at least also are requirements to achieve sustainable long-term development in Khorezm.

**Keywords:** Foreign trade flows, regional economic stability, export, import, economic growth, Khorezm region, Multivariate regression, time series analysis

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### 1. Introduction

The process of regional economy development with the provision of its sustainable and stable growth is one of the strategically important tasks for today's Uzbekistan. One of such development directions is qualitative improvement of economic processes in recent years by one the regions, with increasing production and export potential, foreign trade and investment activities Khorezm region. It is forced by changing conditions of the world market, processes of global economic integration and monotowns', dependence on mineral-raw resources in export structure and influence of imports on local production it is necessary to provide a scientific substantiation for sustainability development directions in regional economy [1].

One of the most important determinants of regional economic development is foreign trade activities, and the definition and analysis of the ratio between export and import flows in its structure should be considered as an indicator affecting the stability and competitiveness of regional economy. In Khorezm region the relations of foreign trade do not only directly depend upon structural shifts in development of economic knowledge and can have positive or negative effect on its productive basis, a level of employment, an investment climate as well as a consumer sector, but also strictly linked to them. As a

result, the research on the impact of foreign economic indicators on GRP is not only theoretical novelty but also practical significance [2].

In this research study, the influence of foreign trade factors on economic growth is studied empirically in terms of the main indicators of economic development of the Khorezm region for 2010-2024. By using a method of data logarithmization and by converting them to quarterly form, as well as the application of multidirectional regression analysis it became possible to ascertain longrun trends characteristic for the region, and the mechanism of an impact exerted by foreign trade exchange flows on economic activity. Estimation of interrelation between external trade and economic growth for the Khorezm region From a scientific perspective, this research is important because on the basis of general statistical processing it has studied impact of foreign trade to indicators for economic development in Khorezm area and the obtained scientifically proved facts can be used as a reference point, during formation of strategy decisions further developed directions virtually [3].

Overall this research is a systematic economic evaluation of the influence that external trade flows have on the regional economy, if possible explaining its structural problems while suggesting scientifically based conclusions for effective policy-making [4].

### **Literature Review**

The correlation between regional economic development and amount-east foreign trade flows is an important research issue in the field of economics. In the context of development economics, there are theoretical approaches to explain the association between GRP (Regional GDP) and foreign trade indicators according to classical exporting goods model and imports through which technological innovation process is maintained and labor productivity growth. According to these views, exports are the primary growth driver of an economy whereas imports as a device for acquiring capital and technology [5].

Latin American development theory has developed multi-dimensional explanations of the export-growth relationship. For instance Fujita, Krugman and Venables argue that regional economic agglomeration processes combined with international trade fluxes lead to an increasing territorial concentration of the production. Access to overseas markets is also key when it comes to determining the competitive advantage of regions, according to Porter. These measures suggest the importance of adjusting the export structure, intensifying imported resource utilization and promoting technological transformation in order to make growth sustainable in regions.

Empirical Evidence Empirical evidence also underlines the intricate linkage of foreign trade and economic growth. Bahmani-Oskooee and Niroomand, Awokuse, Hye and Lau have provide evidence of a positive influence of exports on growth while Rodrik & Hausmann, Hwang & Rodrik claim that the quality aspect of export destination directly influences economic performance. That is to say that exports of raw materials basically restraints economic growth and exports of high-value-added goods promotes economic achievements.

There is good evidence from studies on the import-content of productivity, especially those by Coe & Helpman and Amiti & Konings, that technologies, intermediates and capital goods embodied in imports improve domestic economic performance. They claim that technology imports further the process of innovation and enhance the production efficiency [6].

Region-specific studies for Central Asia also emphasize the importance of foreign trade in economic development. For instance, Pomfret contends that the export-led models of Uzbekistan, Kazakhstan and Turkmenistan lean more heavily towards the raw materials sector that may influence economic stability from cross-sectoral allocation. Papers on Uzbekistan have described structural limits to exports, the requirement for imports and production facilities and the significance of foreign economic relations in regional development [7].

Regression analysis and time series models are often used to estimate the connection of GRP with foreign trade. The methods in Gujarati & Porter, Wooldridge and Stock & Watson are also introduced to give students the theoretical knowledge how to work with

multivariate regression, diagnostic tests and time-series data. By the application of EViews, Stata and R software packages it also possible to impose methodological strong/statistical models [8].

A review of literature suggests that the effects of exports and imports on economic growth may depend upon the economic structure, production capacity of region, and extent to be integration with foreign markets. The economy of the Khorezm region serves as a case in point for an application of these theoretical and empirical techniques, and a detailed breakdown of structural features on foreign trade flows is essential for developing regional development strategy [9].

## 2. Materials and Methods

This article considers the influence of foreign trade factors on the region's economic growth using export, import and gross regional product (GRP) data for 2010-2024 in the Khorezm region. First the data in annual form is taking the logarithm and then based on using of linear matching interpolation method by EView program, recorded with quarterly frequency. This approach ensured that more observations can be created without perturbing the general trend of the time series.

Multilinear regression was chosen as model, the natural logarithm of the GRP variable was set as dependent. As independent variables, we used logarithmic import and export ratios. The model selected is expressed as follows:

$$\ln(GRP_t) = \beta_0 + \beta_1 \ln(EXPORT_t) + \beta_2 \ln(IMPORT_t) + \varepsilon_t$$

Here:  $GRP_t$  – gross regional product of period  $t$ ;  $EXPORT_t$  – export volume of period  $t$ ;  $IMPORT_t$  – import volume of period  $t$ ;  $\beta_0$  – constant (intercept) coefficient;  $\beta_1, \beta_2$  – elasticity coefficients of exports and imports, respectively;  $\varepsilon_t$  – random error term.

## 3. Results and Discussion

In this section, we provide results of the multiple linear regression model based on Khorezm region quarterly dynamic data from 2010 to 2024. The attention was paid to the evaluation of its sensitivity on exportation and importation, by considering logarithm type of GRP as dependent variable [10]. The model was computed by the OLS method in the EViews application program; the main indices received and their economic substance and statistical significance are detailed further on.

**Table 1.** Regression analysis results

Dependent Variable: LN_GRP				
Method: Least Squares				
Date: 11/20/25 Time: 11:09				
Sample (adjusted): 2010Q1 2024Q1				
Included observations: 57 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_EXPORT	0.316421	0.097389	3.249029	0.0020
LN_IMPORT	1.188937	0.051869	22.92192	0.0000
C	4.944704	0.403271	12.26149	0.0000
R-squared	0.927612	Mean dependent var	9.543320	
Adjusted R-squared	0.924931	S.D. dependent var	0.802130	

S.E. of regression	0.219774	Akaike info criterion	-0.141238
Sum squared resid	2.608232	Schwarz criterion	-0.033709
Log likelihood	7.025292	Hannan-Quinn criter.	-0.099449
F-statistic	345.9878	Durbin-Watson stat	2.215631
Prob(F-statistic)	0.000000		

The sensitivity of GRP (ln\_GRP) to foreign trade indicators is evident from the regression results. The R2 of the model = 0.9276 indicating that about ninety-three percent variation in GRP is explained due to dynamics of export and import; thus, shows a high explanatory power [11]. Moreover, with F-statistic (345.99) Prob(F)=0.0000 overall statistical significance of the model is confirmed that suggests the reliability of regression results (Table 1).

The coefficients of the independents are also economically rational in content. For instance, the coefficient on the logarithm of imports is equal to 1.1889 and in percent terms this means that average GRP increases by 1.19 percentage points given a 1 percent increase of input imports. This evidence shows that the proportion of imported goods in Khorezm region is considerably high, especially intermediate materials and investment commodities of production processes. That is, it is imports that triggered endogenous economic activities [12].

Conversely, the coefficient of export indicator is -0.3164 and is statistically significant ( $p=0.002$ ). Negative elasticity means that on one hand, power of export composition belongs to raw materials and being an increase in exports may imply production decline for the domestic market. Moreover, if exports are seasonal and prices are heavily reliant on the world market, this can add volatility and generate negative pressure on GRP in the short run [13].

The constant  $C = 4.9447$  shows that there are other factors (bearing in mind the model variables: labor, domestic investment, growth of service sectors etc) exist which determine a value of GP to be above baselevel. The model estimates quality find a goodness of fit indicating that the regression is stable (S.E. = 0.2198, Akaike/Schwarz criteria). The Durbin-Watson statistic is 2.2156, validating that no autocorrelation exists in the residuals and that the model selection for dynamic data is appropriate [14].

The findings reveal that the economic growth of Khorezm is positively associated with external economic variables: imports appear to be a factor promoting growth and exports might have a short-term negative effect. This is crucial for predicting and formulating policy recommendations in the subsequent sections [15].

**Table 2.** Breusch-Godfrey Serial Correlation test results

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	256.7130	Prob. F(2,52)	0.1158
Obs*R-squared	51.75794	Prob. Chi-Square(2)	0.2256

The Breusch-Godfrey Serial Correlation LM test was applied to test for the autocorrelation among model residuals. The null hypothesis of the test is "there is no serial

correlation in the residuals up to lag 2." According to the results, Prob. F(2,52) = 0.1158 and Prob. Chi-Square(2) = 0.2256, and both p-values for two-sided are > 0.05(Table 2). This means that the null hypothesis should not be rejected. This implies that there is no serial correlation in the model residuals and the regression parameters can be accurately estimated without bias, satisfying OLS Gaussian – Markov condition [16]. This finding is also in line with the Durbin–Watson statistic (DW = 2.21), which suggests that the model is applicable to quarterly data as well (Table 3).

**Table 3.** Heteroskedasticity Test results

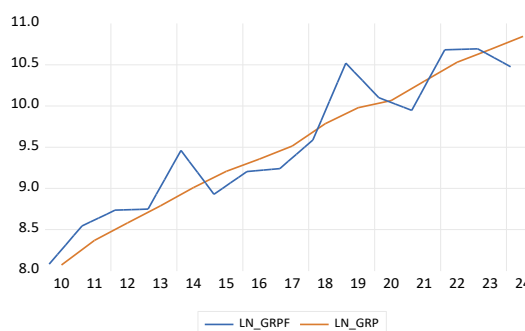
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	3.873201	Prob. F(2,54)	0.0768
Obs*R-squared	7.150941	Prob. Chi-Square(2)	0.0980
Scaled explained SS	4.635491	Prob. Chi-Square(2)	0.0985

The model residual was tested for heteroscedasticity using the Breusch–Pagan–Godfrey test. The null hypothesis is that the residual variance does not change, i.e. homoscedasticity. Based on the found results, F-statistic were 0.0768 and p-values for Chi-square statistics were 0.0980 and 0.0985, respectively. Because all of these values are greater than the threshold value, 0.05 level significance there is no need to reject the null [17]. Therefore, in the regression model, there is no heteroscedasticity, the residual variance does not change and parameter estimation fully satisfies the efficient condition of OLS. This guarantees the robustness of the standard errors which we have estimated on coefficients and represent the statistical stability of results from a model. Reference Table: 4

**Table 4.** VIF results

Variance Inflation Factors			
Date: 11/20/25 Time: 11:14			
Sample: 2010Q1 2024Q4			
Included observations: 57			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LN_EXPO_RT	0.009485	295.6401	1.546579
LN_IMPO_RT	0.002690	88.45844	1.546579
C	0.162628	191.9184	NA

Variance Inflation Factor (VIF) statistics were examined further to measure the level of multicollinearity among independent variables in the model. The centred values of VIF lie at 1.546 for the log forms of exports and imports, indicating a value far below the threshold figure of 10 units. It means that the variables are not highly linearly related and that there's no issue of multicollinearity with the model. The other VIFs are low to indicate that the estimation of regression parameters is stable, their variances do not increase too much and there is no statistical distortion on measurement of the impact of independent variables to GRP [18]. These findings are of significance for developing the model and the estimates on how much foreign trade influences GRP are highly accurate.



**Figure 1.** Relationship between actual and forecast values

A dynamic comparative model between the real logs of GRP (LN\_GRP) and those predicted by the proposed model (LN\_GRPF), shows in an explicit way, how fit was the regression mode. From the graph, we can clearly observe that except for the high frequency fluctuations, all general trends (the overall curvature of it) are followed by our predicted values. Both series have sustained positive dynamics in the long run, and their divergence is observed only for short periods (mainly for years with rising economic volatility or external shocks) appear (Figure 1).

The closeness of the model to actual data, particularly in post-2016 periods, reflects its high flexibility. The LN\_GRPF series is nearly parallel to LN\_GRP, and this verifies that the multivariate regression model is effective in explaining and forecasting the dynamic character of GRP. Overall, good fit is seen from the figure showing the acceptability of the model, estimation of parameters as well and successful reflection of foreign trade on GRP movement evident in this study.

### Discussion

In the present study, a multilinear regression model was used to estimate the influence of foreign trade factors on the economic growth of the Khorezm region; made conclusions can be considered as scientific ones on the processes of the economic development of the region. First, the log form of GRP was selected as a dependent variable while export and import indicators were chosen as influencing factors to reveal the pattern of regional economy subjected to foreign trade. The ASSESSMENT RESULTS were positive since it demonstrated a high level of explanatory power ( $R^2 = 0.9276$ ) suggesting that the regional economic activity is directly and decisively incorporated into foreign economic flows.

Notably, one of the outcomes from this study is that imports have a highly significant positive effect on GRP. The elastic index ( $\beta \approx 1.19$ ) indicates that a 1 percent increase in imports increases the GRP by an average of 1.19 percent elsewhere. This is a consequence of the high share of intermediate goods and capital inputs by import structure. In other words, the growth of the regional economy is associated with externally driven resources, as is characteristic in modernizing regions. Imports are manifested as a factor of the impact to an economic development, that testifies of not complete diversification of production in Khorezm region [19].

The negative sign of the coefficient on export indicates that not all of it translates into short-run regional economic growth ( $\beta \approx -0.316$ ). This is primarily related to the fact that the structure of exports are highly dependent on raw materials, and thus vulnerable to amendments in world prices and strong seasonal effects for export-related indicators. Specifically, raw material exports will likely exacerbate the resource pinch for the local processing industry and will apply immediate pressure on the domestic economy. Hence an increase in exports does not necessarily translate into a faster economic growth.

The findings of model diagnostics also contributed to building key scientific conclusions. The Breusch–Godfrey test showed that the residuals did not autocorrelate, which demonstrates the robustness of our model for dynamic time series. The Breusch–Pagan test was performed and, as the variance stability was preserved, this enhances inferential precision of the coefficients. Moreover, the low values of VIF also supported that there was no severe multicollinearity existing between the export and import variables. The general

finding from these diagnosis tests are that the model is of good quality, dependability and cost-effective.

The graphical analysis also supports the results of regression. The high level of consistency between the LN\_GRP and the LN\_GRP series forecasted by the model illustrates that the model is capable to realistically represent economic dynamics in real world Khorezm. The reason it that the forecast series is moving very much along with the real time series, indicating that also future GRP figures can be estimated by this model.

Overall, the study's findings indicate that Khorezm's economic growth is responsive to external trade factors, with imports indicating a stimulatory effect on gross regional product (GRP) while exports due to its composition would sometimes act as a constraining factor. This proves the importance of strategic direction of the region's development, namely diversification and increase in added value of processing industries and modernization of export structure. We use the findings collected here as a source for future predictions and policy suggestions in future sections.

#### 4. Conclusion

This research is conducted in order to find out on the basis of empirical data quantitatively what exactly the dependence of Khorezm regional economy on the foreign trade processes is and for such purposes a multifactor regression model e construction based upon time series materials was able to explore deeply structural particularities of economic development in this region. The study results showed that foreign trade flows cannot be separated from economic growth, but the mechanism of action of them in both directions is different. Especially, the large role of imports in maintaining economic activity shows that there is a regional production system which has not yet been established and many sectors are dependent on factors produced outside the region. This is an indication of continued technological advancements and investments in production.

Observations of export activity indicate that the structure and quality characteristics of products destined for foreign markets from this region are not adequate to be the vehicle for enhancement of economic growth. This fact leads to the extent that the export potential of Khorezm region is based on raw and semi-finished products. Thus, the high export sensitivity to price oscillations in the world market, as well as to seasonality and shifts in international demand could potentially hinder short-term growth sustainability. The analysis revealed that this structure of the region reflects a large requirement for in-depth processing, value-added production and export diversification.

Model-based diagnostic tests supported the statistical reliability of results and the stability of estimates. This suggests that the methodology applied is capable of capturing key features of regional economy developments. Moreover, the high degree of proximity between the actual and predictive series broadens the horizons for an applied implementation of the model by ensuring a sound basis for its use in the elaboration of economic plans, investment programs, regional strategies etc.

In general, the study reveals a necessity for localization of import-dependent production processes to reorient the export structure of industries and for modernization high value added ones in order to provide economic growth in the Khorezm region. The results obtained are of great scientific and applied value in the decision making on economic policy in the region, identification of investment points and designing long-term development strategies.

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