

Determinants of trade openness and its impact on regional economic growth in Kazakhstan: a panel data analysis

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Abstract

Globalization and the fragmentation of production have significantly strengthened the role of international trade as a mechanism for integrating economies into global value chains. Under current conditions, the emphasis is shifting away from the mere expansion of trade volumes toward the quality of integration, particularly in terms of value-added creation and movement toward more technologically advanced stages of production. This paper investigates the determinants of trade openness and its impact on regional economic development. The empirical analysis is based on a balanced panel dataset covering 16 regions over the period 2014–2024 ($n = 176$), constructed from official national statistics. Descriptive statistics reveal pronounced interregional disparities: gross regional product ranges from 79,551 to 31,294,467 million tenge, with an average of 4,405,129 million tenge. Export values vary from 30,769 to 14,992,642 million tenge, while imports range from 27,775 to 11,704,095 million tenge, indicating a high concentration of external economic activity. To test the proposed hypotheses, a two-stage panel approach is employed. In the first model (TradeOpenness), employment is identified as a statistically significant factor: a 1 % increase in $\ln_Employment$ is associated with an approximate 0.23 % decrease in trade openness ($\beta \approx -0.228$; $p < 0.01$), whereas investment and cargo turnover are not statistically significant. In the second model (\ln_GRP), gross fixed capital formation exerts a strong positive effect ($\beta \approx 0.857$; $p < 0.001$), while trade openness itself does not show statistical significance ($p \approx 0.212$). The findings indicate the dominant role of internal growth drivers and the limited direct impact of trade openness, highlighting the need for policies focused on improving export quality and increasing domestic value added.

Keywords: trade openness; regional growth; investment; panel data; Kazakhstan; global value chains.

Introduction

The deepening of globalization and the fragmentation of production have reinforced the role of international trade not only as a channel for expanding market access, but also as a mechanism for integrating economies into the global division of labor through global value chains (GVCs). Under current conditions, the key issue is no longer the expansion of gross export-import flows, but rather the quality of integration, including the ability to increase domestic value added, utilize imported intermediate inputs for subsequent export, and move toward more technologically advanced stages of production. This logic underpins the conclusions and policy recommendations of international organizations, which emphasize that participation in GVCs can accelerate growth, although its impact depends on export structure, institutional quality, and upgrading strategies within value chains (World Bank, 2020).

For Kazakhstan, this issue is particularly relevant, as its external trade remains largely concentrated in raw materials and semi-processed goods. In this context, the benefits from trade are often determined not by the scale of gross exports, but by the growth of domestic value added (DVA) and the depth of technological linkages. Analytical reports by the World Bank on trade competitiveness highlight the dominance of extractive and metallurgical industries in export value added, along with relatively weak backward integration, reflected in the low share of foreign value added in exports. This limits technological spillovers and reduces export diversification (UNCTAD, 2013). As a result, these structural features may weaken the likelihood that trade openness alone will translate into sustained regional economic growth without parallel processes of diversification and investment upgrading (World Bank, 2020).

Against this background, the central research question emerges: which factors determine differences in trade openness across regions, and whether higher openness is associated with improved economic performance at the regional level. Existing empirical evidence on the openness–growth relationship is largely based on cross-country analyses, where results are sensitive to how openness is measured, the endogeneity of trade flows, and model specification. The regional (subnational) dimension has received far less attention,

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although it allows for identifying heterogeneous effects of trade shaped by differences in industrial specialization, transport connectivity, and the size of the domestic market (Topalova, 2010). In the case of Kazakhstan, this gap is particularly pronounced: despite the availability of studies on trade aggregates and export structure at the national level, systematic panel-based evidence on the determinants of regional trade openness and its contribution to regional output remains limited.

The aim of this study is to assess structural shifts in the foreign trade of Kazakhstan's regions, identify the key factors determining the level of trade openness, and examine the impact of external trade activity on regional economic development.

To achieve this objective, the study addresses the following tasks: 1) to analyze the dynamics of foreign trade activity across regions of Kazakhstan; 2) to evaluate the influence of investment and transport activity on trade openness; 3) to assess the effect of trade openness on regional economic development.

The study tests the following hypotheses:

H1: Investment in fixed capital has a positive effect on regional trade openness.

H2: The development of transport activity increases the degree of regional trade integration.

H3: Trade openness has a positive impact on regional economic development.

The contribution of this paper is threefold. First, it extends the openness–growth discussion to the regional level by employing a balanced panel dataset (2014–2024; $n = 176$), which allows for separating cross-regional differences from temporal dynamics. Second, trade openness is treated not only as a driver of growth but also as an endogenous outcome shaped by regional characteristics, implemented through a two-stage framework consisting of two interconnected panel models. Third, the findings offer policy-relevant implications: if trade openness does not translate into higher output, policy priorities should shift toward investment, structural diversification, and the expansion of domestic value added, in line with the logic of participation in global value chains (World Bank, 2020; UNCTAD, 2013).

Literature review

The relationship between trade openness and economic growth occupies a central position in the economic literature. Within the framework of classical open economy theory, greater integration into international trade is expected to promote economic growth through expanded market access, improved resource allocation efficiency, and access to advanced technologies. However, empirical evidence accumulated over recent decades suggests that this relationship is far more complex and less conclusive than initially assumed.

A number of studies support the existence of a positive relationship between trade openness and economic growth, particularly in the long run. For example, evidence from Côte d'Ivoire indicates that trade openness has a statistically significant positive effect on economic growth in the long term, although short-term effects appear less stable (Keho, 2017). These findings are consistent with the traditional view of trade as a key driver of economic development.

Nevertheless, a broader set of empirical studies based on panel data challenges the universality of this relationship. Ulaşan (2015) demonstrates that the positive impact of trade openness is not robust, with results varying significantly depending on the country sample and model specification. Similar conclusions are drawn by Jalil and Rauf (2021), who emphasize that empirical estimates are highly sensitive to the econometric methodology employed and the treatment of endogeneity. This suggests that the openness–growth relationship is not stable and may change under more rigorous modeling frameworks.

Further evidence highlighting this ambiguity is provided by Idris, Yusop, and Habibullah (2017), who, using panel causality analysis, show that the relationship between trade openness and economic growth may be bidirectional or even absent. This instability in causal direction complicates the interpretation of empirical findings.

A significant contribution to explaining these inconsistencies comes from approaches that emphasize the conditional nature of the openness effect. Tahir and Azid (2015) argue that in developing economies, the impact of trade openness depends on institutional quality, human capital, and investment activity. Similarly, Ramzan et al. (2019) identify total factor productivity (TFP) as a key transmission channel: when TFP levels are low, the positive effects of trade may not materialize. This highlights the indirect nature of the openness effect, which operates through internal structural factors.

Another important issue concerns the measurement of trade openness. Huchet-Bourdon, Le Mouél, and Vijil (2018) note that conventional aggregate indicators, such as the ratio of exports and imports to GDP, fail to capture the structure of trade and may therefore distort the actual effects. Their findings suggest that posi-

tive growth effects are primarily associated with economies that have more diversified and technologically sophisticated export structures, whereas in resource-dependent economies these effects remain limited.

Moreover, recent studies point to heterogeneity in the impact of trade openness even among relatively homogeneous groups of countries. In particular, evidence from OECD countries shows that the effect of openness may vary depending on the level of economic development and income distribution, and in some cases may even be negative. This further supports the conclusion that no universal relationship between openness and growth exists.

Overall, the international literature converges on the view that the impact of trade openness on economic growth is ambiguous, context-dependent, and mediated by a range of internal factors. This conclusion is crucial for interpreting the findings of the present study. The empirical results indicate that TradeOpenness does not have a statistically significant effect on gross regional product, which is consistent with the argument that the openness–growth relationship is neither stable nor unconditional. Furthermore, the identified central role of investment as a driver of economic growth aligns with the view that the benefits of trade are realized through internal channels, including capital accumulation and productivity improvements. This suggests that, for Kazakhstan’s regions, trade openness alone is not a sufficient condition for economic growth and requires supportive structural and institutional conditions to unlock its potential.

Additional studies focusing on countries with comparable institutional and structural characteristics provide deeper insight into the relationship between trade openness and economic growth. In particular, for Central Asian countries, a common pattern emerges in which formal economic openness does not necessarily translate into effective integration into the global trading system. As noted by Mazhikeyev, Edwards, and Rizov (2015), despite the liberalization of trade regimes, these countries retain elements of economic isolation, and their participation in international trade remains limited in terms of efficiency and depth of integration. This suggests that an increase in trade openness alone does not guarantee higher economic returns from external economic activity.

Similar conclusions are observed in studies of resource-dependent economies. Evidence from Azerbaijan indicates that trade openness does not exert a stable positive effect on economic growth, whereas internal development factors, including investment and economic structure, play a decisive role (Seyfullayev, 2022). This finding is particularly relevant for Kazakhstan, where extractive industries dominate and dependence on external markets remains high.

Studies specifically focused on Kazakhstan are also of particular importance. Khan et al. (2018) identify the existence of a long-term relationship between trade openness and economic growth, but emphasize the ambiguity of causal linkages. This indicates that the impact of openness on economic development is not direct and may be mediated by other macroeconomic factors. Thus, even at the national level, there is no clear empirical evidence supporting the dominant role of trade as a driver of growth.

Recent research increasingly highlights the conditional nature of the impact of trade openness. Nguyen and Nguyen (2025) demonstrate that the effect of openness on economic growth depends significantly on institutional and structural characteristics, including governance quality, the level of information and communication technologies, human capital, and resource endowment. In the absence of these conditions, the impact of trade may be limited or statistically insignificant.

This perspective is consistent with other empirical studies emphasizing the role of internal factors as key transmission channels of the openness effect. In particular, the impact of trade on economic growth may operate through improvements in total factor productivity, human capital accumulation, and technological development (Ramzan et al., 2019; Fatima et al., 2020). In developing economies, where these channels are insufficiently developed, the positive effects of openness may not fully materialize.

Furthermore, evidence from Central Asian countries suggests that economic growth is driven primarily by internal factors, including technological progress and digitalization, which reduces the role of trade openness as an independent growth driver (Kurmanov et al., 2025). This reinforces the argument that in transition and resource-based economies, structural transformation and investment activity are of primary importance.

Taken together, these studies provide a theoretical and empirical foundation for interpreting the results of the present research. Contrary to the classical view of a direct and positive relationship between trade openness and economic growth, contemporary evidence points to a more complex, mediated, and context-dependent relationship. This helps explain the finding of this study that trade openness does not have a statistically significant impact on gross regional product.

Thus, it can be concluded that, for the regions of Kazakhstan, trade openness alone is not a sufficient condition for economic growth. Its effects are realized through a system of internal factors, including in-

vestment, technological development, and structural characteristics of the economy, highlighting the need to shift economic policy from the quantitative expansion of trade toward improving its quality and deepening integration into global value chains.

Data and Methodology

This study employs an econometric approach to analyze the factors determining trade openness across the regions of the Republic of Kazakhstan, as well as to assess the impact of external trade activity on their economic development. The methodological framework is based on panel data analysis, which allows for capturing both cross-regional heterogeneity and temporal dynamics of the indicators.

The empirical basis consists of panel data covering 16 regions of the Republic of Kazakhstan over the period 2014–2024 (176 observations). The selected time frame is determined by the availability of consistent and comparable regional statistics on foreign trade.

The data are sourced from the Bureau of National Statistics of the Republic of Kazakhstan. To ensure the comparability of the panel dataset, several regions were excluded from the analysis due to limited data availability for earlier years. Specifically, the regions of Zhetysu, South Kazakhstan, Ulytau, Abai, as well as the city of Shymkent, were not included, as their statistical records are available only from 2018 onward, which prevents the construction of a balanced panel for the full study period.

In addition, due to administrative-territorial changes in the Republic of Kazakhstan, statistical data for the South Kazakhstan and Turkestan regions were aggregated and treated as a single territorial unit. This adjustment was necessary to maintain consistency in time series and preserve the integrity of the panel structure. To ensure comparability, export and import values originally reported in foreign currency were converted into tenge using the average annual official exchange rate.

Within the study, the following dependent variables are defined: $\ln(\text{GRP})$, the natural logarithm of gross regional product, used as an indicator of regional economic development, and $\text{TradeOpenness}_{it}$, a measure of trade openness calculated as the ratio of total exports and imports to gross regional product:

$$\text{TradeOpenness}_{it} = \frac{\text{Export}_{it} + \text{Import}_{it}}{\text{GRP}_{it}} \quad (1)$$

The independent variables are specified as logarithmic transformations of the following macroeconomic indicators: \ln_GFCF , the logarithm of gross fixed capital formation; \ln_Cargo , the logarithm of cargo turnover; and $\ln_Employment$, the logarithm of employment.

The use of logarithmic transformation is motivated by the need to reduce the variability of the data and to allow the estimated coefficients to be interpreted in terms of elasticities.

To achieve the research objectives and test the proposed hypotheses, a two-stage econometric framework is employed, based on the estimation of two interconnected panel models. This approach enables a sequential analysis of both the determinants of regional trade structure and its impact on economic development.

The first model is designed to identify the factors determining the level of trade openness across regions. In this specification, trade openness is treated as an outcome of internal economic conditions, including investment activity, the development of transport infrastructure, and the scale of employment. Accordingly, the first model addresses the question of which factors explain differences in trade integration across regions of Kazakhstan. The econometric specification of the model is as follows:

$$\text{TradeOpenness}_{it} = \beta_0 + \beta_1 \ln(\text{GFCF}_{it}) + \beta_2 \ln(\text{Cargo}_{it}) + \beta_3 \ln(\text{Employment}_{it}) + \mu_i + \varepsilon_{it} \quad (2)$$

where:

$\text{TradeOpenness}_{it}$ denotes the level of trade openness of region i at time t ;

GFCF_{it} represents investment in fixed capital;

Cargo_{it} refers to cargo turnover;

Employment_{it} indicates employment;

μ_i captures region-specific fixed effects reflecting time-invariant characteristics;

ε_{it} is the error term.

The selection of explanatory variables is grounded in the economic logic of trade activity formation. Investment in fixed capital reflects the production capacity of a region and creates conditions for expanding

external economic activity. Cargo turnover is used as a proxy for the level of development of transport and logistics infrastructure, which directly affects the intensity of trade flows. Employment characterizes the scale of economic activity and the size of the domestic market, which may either stimulate or reduce reliance on external trade.

The second model aims to assess the impact of trade openness on regional economic development. In this specification, trade openness is treated as an explanatory variable, allowing its contribution to gross regional product to be evaluated. Accordingly, the second model addresses whether the level of trade openness influences the economic development of Kazakhstan’s regions. The econometric specification of the model is as follows:

$$\ln(\text{GRP}_{it}) = \beta_0 + \beta_1 \text{TradeOpenness}_{it} + \beta_2 \ln(\text{GFCF}_{it}) + \beta_3 \ln(\text{Employment}_{it}) + \mu_i + \varepsilon_{it} \quad (3)$$

where:

GRP_{it} denotes the gross regional product, while the remaining variables correspond to those defined in the previous model.

The inclusion of the trade openness variable allows testing the hypothesis regarding its effect on economic growth. According to open economy theory, a higher degree of integration into international trade should promote growth through expanded market access, improved efficiency, and access to advanced technologies. At the same time, investment serves as a key driver of economic growth, reflecting capital accumulation and the expansion of productive capacity, while employment is included as a control variable capturing the scale of regional economic activity.

For clarity, the sequence of methods and stages of the empirical analysis is illustrated in Figure 1.



Figure 1. Conceptual framework of the empirical analysis

The established methodological framework provides a basis for proceeding to the interpretation of the empirical results obtained from the estimated models.

Results and Discussion

The study employs a balanced panel dataset covering 16 regions of the Republic of Kazakhstan over the period 2014–2024. The constructed dataset allows for capturing both cross-regional differences and the temporal dynamics of key economic indicators, which is essential for analyzing processes of trade integration. Table 1 presents the descriptive statistics of the variables used, enabling an assessment of their distribution, variability, and general patterns of regional development.

Table 1 –Descriptive statistics of variables

Indicator	GRP (mln tenge)	GFCF (mln tenge)	Cargo (mln t-km)	Employment (thousand persons)	Export (mln tenge)	Import (mln tenge)
Mean	4 405 129	693 810	24 937	511	1 390 781	919 799
Median	3 051 730	508 124	24 042	424	798 446	396 967
Standard deviation	4 236 935	645 403	10 854	214	2 184 817	1 704 927
Minimum	79 551	116 943	5 646	249	30 769	27 775
Maximum	31 294 467	4 328 236	53 698	1 083	14 992 642	11 704 095
Observations	176	176	176	176	176	176

Note: compiled and calculated by the authors using RStudio based on the original dataset

The average value of gross regional product (GRP) amounts to 4,405,129 million tenge, with a median of 3,051,730 million tenge, indicating a pronounced right-skewed distribution. The gap between the minimum (79,551 million tenge) and maximum values (31,294,467 million tenge) confirms a very high level of interregional disparity in economic development.

A similar pattern is observed for gross fixed capital formation: while the mean is 693,810 million tenge, the median is considerably lower at 508,124 million tenge, and the range spans from 116,943 to 4,328,236 million tenge. This suggests a strong concentration of investment activity in a limited number of regions. External trade indicators exhibit even greater heterogeneity: average exports amount to 1,390,781 million tenge, with a maximum of 14,992,642 million tenge, while imports range from 27,775 to 11,704,095 million tenge.

The high standard deviation values—4,236,935 million tenge for GRP, 2,184,817 million tenge for exports, and 1,704,927 million tenge for imports—indicate substantial variability and further confirm significant regional disparities. In contrast, employment shows a relatively narrower dispersion (with an average of 511 thousand persons and a range from 249 to 1,083 thousand), reflecting greater stability of demographic factors compared to economic indicators.

Overall, the quantitative characteristics of the dataset clearly point to structural heterogeneity in Kazakhstan's regional economy, a high concentration of economic activity, and considerable differences in investment and trade performance across regions. These features justify the application of panel data models that account for region-specific effects.

Table 2 — Variables and their economic justification

Variable	Description	Justification
TradeOpenness	Ratio of exports and imports to GRP	Captures the degree of regional integration into international trade and external markets
ln(GRP)	Natural logarithm of gross regional product	Serves as an indicator of regional economic development
ln(GFCF)	Natural logarithm of gross fixed capital formation	Reflects investment activity and capital accumulation as key drivers of growth
ln(Cargo)	Natural logarithm of cargo turnover	Acts as a proxy for the development of transport and logistics infrastructure
ln(Employment)	Natural logarithm of employment	Controls for the scale of economic activity and labor resources

The key indicator in this study is trade openness (TradeOpenness), which reflects the degree of regional integration into international trade. This measure is calculated as the ratio of total exports and imports to gross regional product (Equation 1), ensuring comparability across regions with different economic scales. Figures 2 and 3 illustrate the average level and distribution of TradeOpenness across regions, allowing for the identification of key trends and differences in external trade activity.

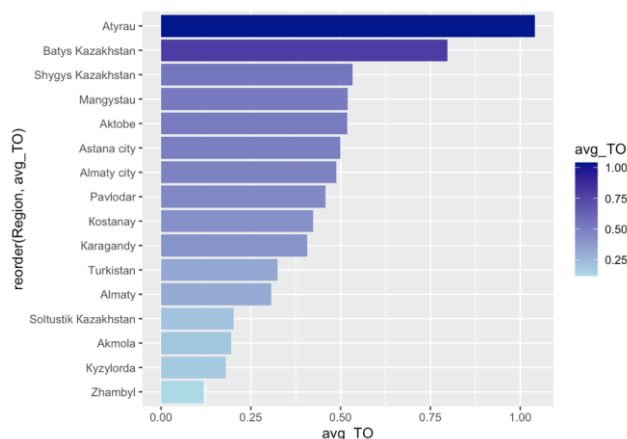


Figure 1. Average level of trade openness across regions

Note: compiled by the authors using RStudio based on data from the Bureau of National Statistics of the Republic of Kazakhstan.

The results presented in Figures 1 and 2 indicate a pronounced interregional disparity in the level of trade openness across Kazakhstan. In particular, resource-oriented regions such as Atyrau and West Kazakhstan occupy leading positions, with values significantly exceeding the regional average. This is consistent with their strong involvement in export-oriented activities, primarily in the extractive sectors of the economy.

At the same time, several regions, including Zhambyl, Kyzylorda, and Akmola, exhibit considerably lower levels of TradeOpenness, indicating a stronger orientation toward the domestic market and limited participation in external economic activities. Overall, these patterns point to a persistent structural heterogeneity within the regional economy.

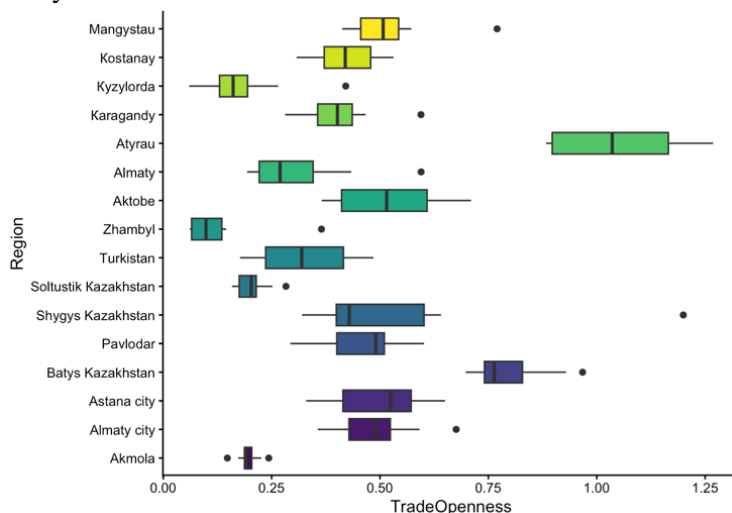


Figure 2. Variability of trade openness across regions

Note: compiled by the authors using RStudio based on data from the Bureau of National Statistics of the Republic of Kazakhstan

Furthermore, the analysis of the distribution of the indicator (Figure 2) shows that differences are observed not only in the levels, but also in the variability of trade activity. In some regions, significant fluctuations and outliers are evident, which are likely associated with dependence on external market conditions and the volatility of export flows.

In the context of the proposed hypotheses, these findings suggest that the level of trade openness is shaped by the structural characteristics of regions, including their sectoral specialization and the presence of export-oriented industries.

Results of the panel regression analysis.

At the first stage of the empirical analysis, the relationships between the key variables of the model are examined. This step allows for a preliminary assessment of the direction and strength of associations, as well as the identification of potential multicollinearity issues that may affect the robustness of subsequent regression estimates.

Given that the study employs two interconnected models, the correlation analysis includes all main variables, covering indicators of economic development, trade openness, and factors reflecting regional production activity (Table 3).

Table 3 — Correlation matrix of variables

Variables	ln_GRP	TradeOpenness	ln_GFCF	ln_Cargo	ln_Employment
ln_GRP	1.000	0.500	0.858	—	0.309
TradeOpenness	0.500	1.000	0.584	0.058	-0.223
ln_GFCF	0.858	0.584	1.000	0.330	0.086
ln_Cargo	—	0.058	0.330	1.000	0.002
ln_Employment	0.309	-0.223	0.086	0.002	1.000

Note: compiled and calculated by the authors using RStudio based on the original dataset

The results of the correlation analysis indicate the presence of economically meaningful relationships among the variables under consideration. The strongest positive correlation is observed between gross regional product and gross fixed capital formation (0.858), confirming the central role of capital accumulation in driving regional economic growth (Figure 3).

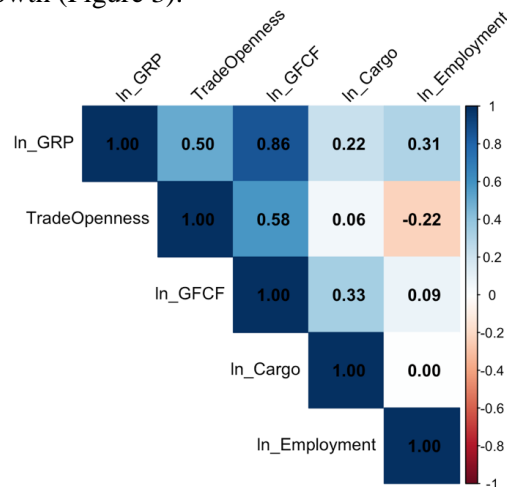


Figure 3. Correlation matrix of variables

Note: compiled by the authors using RStudio

The relationship between trade openness and the level of economic development is moderate (0.5), indicating the importance of external economic activity, but not allowing it to be considered as the sole or dominant driver of growth. This indirectly suggests that the effect of openness operates through more complex channels, including investment and the structural characteristics of regional economies.

Particular attention should be given to the moderate positive correlation between TradeOpenness and investment (0.584), which may reflect a mutually reinforcing relationship: on the one hand, openness facilitates capital inflows, while on the other hand, investment creates the foundation for expanding external trade activity.

At the same time, the relationships among the explanatory variables remain low (with a maximum of 0.33), indicating their relative independence and supporting the validity of including these factors in the regression models.

In the context of the proposed hypotheses, these findings suggest that investment activity serves as a key driver of economic growth, whereas trade openness plays a complementary rather than a decisive role, shaping the conditions for further regional development.

To more rigorously test for multicollinearity, the variance inflation factor (VIF) was calculated for all explanatory variables. Unlike correlation analysis, this measure provides a quantitative assessment of the degree of linear dependence among the factors within the model.

Table 4 — Multicollinearity test (VIF)

Переменные	Model 1	Model 2
ln_GFCF	1.13	1.64
ln_Cargo	1.12	—
ln_Employment	1.01	1.14
TradeOpenness	—	1.71

As shown in Table 4, the calculated VIF values range from 1 to 2, which is well below the commonly accepted critical thresholds (5–10). This indicates the absence of multicollinearity and confirms the correctness of the model specification. Accordingly, the included variables do not duplicate each other and allow for obtaining stable and interpretable regression coefficient estimates. This ensures the reliability of subsequent estimations and enables progression to the key stage of the study, namely the estimation of panel models. It is at this stage that the main research question can be addressed: which factors determine regional trade integration and whether it contributes to economic growth.

Tables 5 and 6 present the results of the panel regression estimations obtained using least squares methods adapted to panel data structures (pooled OLS, fixed effects, and random effects specifications).

Table 5 — Estimation results of Model 1 and Hausman test

Variables	Coefficient	Std. Error	t-statistic	p-value
ln_GFCF	0.025	0.0239	1.0457	0.2973
ln_Cargo	0.026	0.0556	0.4716	0.6379
ln_Employment	-0.228***	0.0857	-2.6617	0.0086
Model statistics	Value	χ^2	p-value	Model choice
R ²	0.053	106.5	<0.001	Fixed Effects
F-statistic	2.919			
Prob (F-stat)	0.0359			

Note: dependent variable — TradeOpenness
 *** indicates statistical significance at the 1 % level.
 Calculated by the authors using RStudio based on the study data.

The econometric specification of the model is as follows:

$$TradeOpenness_{it} = -0.834 + 0.025ln(GFCF_{it}) + 0.026ln(Cargo_{it}) - 0.228ln(Employment_{it}) + \mu_i + \epsilon_{it}$$

The results indicate that employment is the only statistically significant factor in the model. The coefficient on ln_Employment is negative and significant at the 1 % level ($\beta = -0.228$), suggesting that a 1 % increase in employment is associated with an approximate 0.23 % decrease in trade openness.

From an economic perspective, regions with higher levels of employment tend to have more developed domestic markets and a lower dependence on external economic relations. In such regions, economic activity is primarily oriented toward domestic demand, which reduces the relative importance of foreign trade.

At the same time, investment (ln_GFCF) and cargo turnover (ln_Cargo) do not have a statistically significant effect on TradeOpenness. This may indicate that the presence of infrastructure and investment activity alone does not ensure regional integration into international trade in the absence of appropriate export specialization.

The low value of the coefficient of determination ($R^2 = 0.053$) suggests that the model explains only a small share of the variation in trade openness. This implies the presence of additional factors, such as institutional or sectoral characteristics, that are not captured in the model. The results of the Hausman test (p-value < 0.001) support the preference for the fixed effects specification, indicating the presence of unobserved region-specific characteristics affecting trade activity.

As for the results of the second model (Table 6), the estimated coefficients provide further insight into the factors determining regional economic development. The estimated equation is as follows:

$$ln(GRP_{it}) = 1.286 + 0.173TradeOpenness_{it} + 0.857 ln(GFCF_{it}) - 0.003 ln(Employment_{it}) + \mu_i + \epsilon_{it}$$

The results indicate that investment in fixed capital is the key driver of economic growth. The coefficient on ln_GFCF is positive and statistically significant at the 1 % level ($\beta = 0.857$), implying that a 1 % increase in investment is associated with an approximate 0.86 % increase in gross regional product. This finding is fully consistent with economic theory and confirms the role of capital accumulation as a primary engine of growth.

Table 6 — Estimation results of Model 2 and Hausman test

Variables	Coefficient	Std. Error	t-statistic	p-value
TradeOpenness	0.173	0.1377	1.33	0.2120
ln_GFCF	0.857***	0.0385	22.2510	<0.001
ln_Employment	-0.003	0.1467	-0.0195	0.9845
Model statistics	Value	χ^2	p-value	Model choice
R ²	0.764	amp.74	0.192	Random Effects
F-statistic	169.357			
Prob (F-stat)	<0.001			

Note: dependent variable — ln_GRP (regional economic development)
 *** indicates statistical significance at the 1 % level.
 Calculated by the authors using RStudio based on the study data.

At the same time, the TradeOpenness variable does not demonstrate statistical significance (p-value = 0.212), despite having a positive coefficient. This indicates that, during the period under study, trade openness does not have a direct effect on regional economic growth. Its impact is likely indirect and operates through investment or structural transformations of the economy. Employment (ln_Employment) also does not have a significant effect on GRP, which may reflect differences in labor productivity and suggests that quantitative increases in employment do not necessarily translate into higher economic efficiency. The model exhibits strong explanatory power ($R^2 = 0.764$), indicating that the included variables account for a substantial share of the variation in gross regional product. The results of the F-test ($F = 169.357$; p-value < 0.001) confirm the overall statistical significance of the model.

According to the Hausman test results (p-value = 0.192), there are no systematic differences between fixed and random effects estimators, which justifies the use of the random effects specification. Overall, the results of the second model suggest that regional economic growth in Kazakhstan is primarily driven by internal factors, particularly investment activity, while the effect of trade openness remains statistically insignificant.

Based on the econometric findings, the proposed research hypotheses can be evaluated.

The first hypothesis, stating that investment activity has a positive impact on regional economic development, is fully supported. The coefficient on ln_GFCF is positive and statistically significant at a high level, confirming the key role of investment in shaping gross regional product.

The second hypothesis, which assumes a positive effect of trade openness on economic growth, is not supported. Despite the positive sign of the coefficient, the TradeOpenness variable is not statistically significant, indicating the absence of a direct impact of foreign trade on regional economic performance.

The third hypothesis, concerning the influence of production-related factors on trade openness, receives partial support. In particular, employment shows a statistically significant but negative effect on TradeOpenness, while investment and cargo turnover do not exhibit significant effects. This suggests a more complex nature of trade openness formation, driven by the structural characteristics of regional economies.

The results presented in Table 7 summarize the findings of the econometric analysis and provide an overall assessment of the degree to which the proposed hypotheses are supported.

Table 7 — Summary of hypothesis testing results

Hypothesis	Hypothesis description	Result	Interpretation
H1 (Model 2)	Investment (ln_GFCF) has a positive effect on economic development (ln_GRP)	Confirmed	The coefficient is positive and statistically significant, confirming the key role of investment as a driver of economic growth
H2 (Model 2)	Trade openness (TradeOpenness) has a positive effect on economic growth	Not confirmed	Despite the positive sign, the coefficient is statistically insignificant, indicating the absence of a direct effect of foreign trade on economic development
H3 (Model 1)	Production activity factors influence the level of trade openness	Partially confirmed	Employment has a significant negative effect, while investment and cargo turnover do not demonstrate statistical significance

Thus, the findings indicate the ambiguous impact of foreign trade and confirm the dominant role of internal factors, particularly investment activity.

Conclusion

The conducted study has identified key patterns in the formation of trade openness and economic development across the regions of Kazakhstan in the context of their integration into global economic processes.

The results show that the regional economy is characterized by a high degree of heterogeneity, reflected both in the level of trade activity and in the scale of economic development. Trade openness is largely concentrated in resource-oriented regions, which reflects the existing model of Kazakhstan's participation in international trade.

The econometric analysis confirms that investment in fixed capital is the primary driver of economic growth, while the effect of trade openness is statistically insignificant. This finding suggests that participation in foreign trade alone does not ensure sustainable economic growth and requires additional conditions, such as the development of processing industries and the expansion of value added.

At the same time, the analysis of the determinants of trade openness indicates that its formation is driven less by investment and infrastructure and more by the structural characteristics of regional economies, including sectoral specialization and orientation toward domestic or external markets.

From a policy perspective, these findings highlight the need to shift from the quantitative expansion of foreign trade toward improving its qualitative aspects. This involves deeper integration into global value chains, the development of export-oriented processing industries, and the promotion of investments aimed at enhancing the technological level of production.

Overall, the study confirms that sustainable regional economic development in Kazakhstan is primarily driven by internal factors, while trade openness plays a complementary role and requires institutional and structural strengthening to fully realize its potential.

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