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The Nexus Between ICT, Trade Openness, Urbanization, Natural Resources, Foreign Direct Investment and Economic Growth

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ABSTRACT

This study aimed to identify the determinants of economic growth (Y) in Kazakhstan over the period 1990-2022. In other words, the effects of urbanization (URB), natural resources (NR), trade openness (TO), foreign direct investment (FDI), and ICT variables on Y were to be determined. In the study, ARDL method and Vector Error Correction Model (VECM) were employed to determine the short and long-term effects. As a result of the analysis, it was found that URB, TO, FDI, and ICT increased Y in the short and long run. On the other hand, NR did not affect Y. The results of the VECM revealed a bilateral causality between URB, TO, FDI, ICT, and Y in the short and long run. Finally, no causality was found between NR and Y. These findings may help policymakers in realizing Kazakhstan's economic development goals.

1. INTRODUCTION

Increasing and promoting economic growth (Y) is frequently discussed in all countries. A country's long-term sustainable Y rate determines its ability to improve the welfare of its people. Therefore, economic development is one of the main objectives of countries. Therefore, understanding the determinants of a country's Y is not only a politically important part but also a key element of macro management for policymakers. Therefore, the source of Y is a matter of great debate for many economists, politicians and policymakers who wish to know and analyze the factors that make some countries progress and develop while others suffer from poverty.

Y is often linked to production capacity. It is an indicator of economic health and measures the level of prosperity in a country. Y is certainly not a perfect solution to a country's problems, but it encourages the implementation of public development policies that improve economic deficiencies. In sum, growth is a primary and fundamental indicator but insufficient to ensure social welfare. As a result, countries often desire economic development. Consequently, the sources of Y are a crucial question for many economists interested in knowing the factors that make possible the rapid growth experienced by some countries.

Kazakhstan's economic growth is influenced by several factors. ICT includes the effects of technological developments and digitalization on the economy. Advances in these areas can help increase business efficiency and create new business opportunities. The process of urbanization means the growth of population density and infrastructure in cities. Large cities can contribute to the development of trade, increased job opportunities, and economic growth. Natural resources are among the sources of wealth in Kazakhstan. In particular, sectors such as oil, natural gas, and mining can make significant contributions to the country's foreign trade revenues. However, dependence on natural resources can increase the sensitivity of the economy to external shocks. Foreign direct investments are important in terms of the inflow of foreign capital into the country and its impact on the local economy. Foreign investments can expand production capacity, enable the transfer of new technologies, and create employment. However, they can also affect foreign dependency and the competitiveness of local markets. The effects of these factors are interrelated and can sometimes lead to unexpected results. For example, overdependence on natural resources can make the economy vulnerable to external shocks, or factors such as ICT and urbanization can increase inequalities between rural and urban regions. Therefore, Kazakhstan's economic growth strategies require balanced management of these factors and consideration of long-term sustainability.

For Kazakhstan, economic growth refers to the overall increase in the country's gross domestic product. Kazakhstan's economic growth is influenced by several factors such as performance in certain sectors, investments, trade, and employment. The period 1990-2022 reflects a process full of transformations and changes for the Kazakhstan economy. During this period, the country gained independence after the collapse of the Soviet Union. Economic growth has been shaped by the influence of sectors based on natural resources, especially oil and natural gas. However, during this period the economy faced challenges such as dependence on natural resources and global price fluctuations. Kazakhstan continues to work on various strategies to achieve economic growth and diversification.

In this context, the main purpose of this study is to identify the determinants of Y. In the research, the effects of urbanization (URB), natural resources (NR), trade openness (TO), foreign direct investments (FDI), ICT variables on Y will be determined. In this context, what causes Y? Why do countries grow faster than others? In the study, annual data of Kazakhstan for the period 1990-2022 are utilized. In the study, ARDL method and VECM are employed to determine the short and long-term impacts.

This study is expected to contribute to the literature in 3 aspects. First, there is a very limited number of studies investigating the effect of URB, TO, and FDI variables on Y in the Kazakhstan sample. There is no research on the effect of NR and ICT variables on Y. In this context, the findings of this study will contribute to the literature. Secondly, the findings of this study may help policymakers in realizing Kazakhstan's economic development goals. Finally, determining the role of URB, NR, TO, FDI, and ICT variables in Y of Kazakhstan, which is a developing country, can guide the macroeconomic policies of the Kazakhstan government. Determining the factors affecting Kazakhstan's economic growth is an important guide for policymakers in strategy formulation and implementation processes. Analysis of these factors plays a critical role in determining the steps to be taken to achieve long-term economic goals. These analyses provide comprehensive guidance for understanding the strengths and weaknesses of the economy and directing steps to increase economic growth sustainably.

This study consists of 5 sections. Following the introduction, the second section summarizes the research on the impact of URB, NR, TO, FDI, and ICT variables on Y. In the third section, the variables, model and methodology employed are introduced. The fourth section presents the results of ARDL and VECM. In the last section, policy recommendations for Kazakhstan will be presented within the framework of the findings obtained in the research.

2. LITERATURE

This section summarizes the empirical findings on the impact of URB, NR, TO, and ICT variables on Y. The findings differ by the methods, countries and models developed. However, there are empirical studies on country groups as well as single country studies in the literature.

The first independent variable in the study is URB. One of the main reasons why URB tends to accompany economic development is the process of industrialization, which enables rural agricultural labor to migrate to urban production facilities [1]. Beyond employment prospects, development can encourage URB (through rural-to-urban migration) for other opportunities such as access to culture, education and health care [2]. However, URB or large cities are also thought to drive Y through advantages in economies of scale in infrastructure capital, labor and managerial resources [3]. In addition, the concept of URB is an indicator not only of demographic factors but also of economic, social, political and cultural processes [4]. Moreover, this migration-based mechanism suggests that people move in response to rising urban wages and declining expected rural wages. These wage differentials, besides the cultural and social benefits of cities, are commonly known as rural push and urban pull [5]. Zhang [6] found that lower moving costs are associated with higher URB and Y. This suggests that people prefer to migrate to cities for economic opportunities.

There is no consensus in the literature on the impact of the second independent variable, NR, on a country's Y. Some researchers have argued that the effect of NR wealth on Y depends on the quality of institutions, such as the political regime [7-9]. In other words, NR-rich economies characterized by low-quality institutions can negatively affect Y [10].

NR has a driving force for Y by providing channels for attracting strong democratic institutions, FDI and foreign aid, and encouraging entrepreneurship. According to Kwakwa et al. [11], strong democracy should support Y by being associated with less corruption and efficient use of economic resources. Similarly, Kaznacheev [12] argued that NR countries with better political institutions better manage their NR and achieve Y and social development better than countries with weak political institutions. On the other hand, Zaloznaya [13] argued that authoritarian rule reduced Y because it led to resource wastage and other corruption to gain the political loyalty of the population. On the other hand, Okunlola [14] argued that countries with dictatorships would have grown as fast as democracies, perhaps even faster. In conclusion, the literature shows that the impact of NR on Y varies across countries.

The third independent variable, an increase in TO, can accelerate the technical progress of industries and thus help improve economic quality [15]. Moreover, TO affects capital deepening and promotes the quality of Y by changing the structure of the labor force [16]. Similarly, Wang et al. (2019) argued that TO increased capacity utilization by expanding market size. The authors also found that TO significantly affected capital deepening and contributed positively to Y by changing the structure of the labor force. Zhang and Guo [17] found that there was a non-linear asymmetric relationship between TO and Y in the Chinese economy. The authors found that the incentive effect of TO on Y began to decline with an increase in the degree of TO. Similarly, according to Wei et al. [18]; Zhang et al. [19] the positive effect of TO on Y tended to decline following the 2008 financial crisis. Kong et al. [20] examined the association between TO and the quality of Y in China. They concluded that there was a stable long-term cointegration association between TO and the quality of Y and that TO significantly improved the quality of Y both in the short and long run.

The relationship between the fourth independent variable, FDI, and Y has been frequently investigated in the literature [21-23]. This relationship has been analyzed for single countries and country groups and the results have differed across countries. There is no consensus on the relationship between FDI and Y. For example, Konings [24] found that

FDI had no impact on Y for Poland. On the other hand, Omran and Bolbol [25] found a correlation and causality between FDI and Y for Arab countries. Shahbaz and Rahman [26] found a positive long-term effect of FDI on Y in the sample of Pakistan. Tiwari and Mutascu [27] found that both FDI and international trade activities increase Y for Asian countries. Similarly, Koojaroenprasit [22] finds that FDI has a strong positive impact on Y for Korea. Dinh et al. [28] found that for developing countries, although FDI had a negative impact on Y in the short run, it helped to stimulate Y in the long run.

Recent studies on ICT, the last variable in the study, have increased. The impact of ICT on Y remains uncertain in developed and developing countries [29-32]. Vu et al. [33] asserted that one of the primary reasons for these ambiguous and mixed findings is the proxies used to represent ICT infrastructure. In contrast, some studies argued that ICT investment could cause Y in real GDP per capita by increasing labor productivity or organizational efficiency [34-39]. Similarly, Chavula [40]; Asongu and Andrés [42] found that ICT contributed to increased Y. Albiman and Sulong [43] categorized SSA countries into 25 poor, 13 low-middle-income and 7 upper-middle-income countries and found that ICT varied according to short and long-term effects on Y. Haftu [35] argued that the internet and Donou-Adonsou [44] argued that cell phones had no effect on Y. Maurseth [45] found that the internet reduced Y for 207 countries.

As a result, there is no consensus in the literature regarding the impact of urbanization, natural resources, trade openness, foreign direct investment and ICT variables on economic growth. Research has been conducted for single countries or groups of countries and different results have been determined. Many factors, such as the developed levels of these variables, are determining factors in their impact on economic growth. For Kazakhstan, the number of studies focusing on these variables is quite low. Therefore, the findings are expected to contribute to the literature.

3. DATA AND ECONOMETRIC METHODOLOGY

The main purpose of this study is to identify the determinants of Y in Kazakhstan. Many studies utilized GDP per capita as an indicator of Y [46]. Five independent variables are used as determinants of Y. The first independent variable used in the study is the ratio of urban population to total population as a measure of URB [47, 48]. The second independent variable is total NR rents (% of GDP) [49, 50]. The third variable is TO, which has been used in many studies [26, 51]. The fourth independent variable is FDI [52, 53] and the last independent variable is ICT [54, 55]. Annual data of Kazakhstan for the period 1990-2022 are utilized. The variables used in the study are logarithmized and shown in Table 1.

Table 1. Variables used in the study and their sources

Variable(s)	Pictogram	Unit Measurement(s)	Source
Income	Y	GDP Per Capita (Constant 2010 US$)	World Bank
Urbanization	URB	Urban population (% of total population)	World Bank
Natural Resources	NR	Total Natural Resources Rents (% of GDP)	World Bank
Trade Openness	TO	Trade (% of GDP)	World Bank
Foreign direct investment	FDI	Foreign direct investment, net inflows (% of GDP)	World Bank
Information and Communication Technology	ICT	Fixed telephone subscriptions (per 100 people)	World Bank

Variables such as urbanization, natural resources, trade openness, foreign direct investment and Information and Communication Technologies (ICT) are important for Kazakhstan. These variables have significant impacts in different areas that are of strategic importance for the economic growth and sustainable development of Kazakhstan. A balanced management of these factors can help Kazakhstan achieve its long-term economic goals.

Following the studies of Agboola et al. [50]; Altay Topcu and Dogan [56]; Kevser et al. [57]; Dogan et al. [58]; Belloumi and Touati [55]; Burlea-Schiopoiu et al. [53]; Shahbaz et al. [59] as determinants of Y, the model is developed for Kazakhstan. The empirical model indicating the relationship among the variables organized for this purpose is as follows.

$$Y_{it} = \beta_0 + \beta_1 URB_{it} + \beta_2 NR_{it} + \beta_3 TO_{it} + \beta_4 FDI_{it} + \beta_5 ICT_{it} + \vartheta_t \quad (1)$$

ARDL (Autoregressive Distributed Lag) and ECM (Vector Error Correction Model) methods were used in this study. ARDL can determine causal relationships between variables, perform cointegration tests by taking into account stationarity levels of time series data, and allow finding both stationary and non-stationary variables. VECM is used to examine the relationships between long-term equilibria and short-term dynamics. This model extends the VAR (Vector Autoregression) model to understand the cointegration of non-stationary variables. Both methods are important tools for understanding the relationships and dynamics between variables.

In this study, ARDL bounds test is performed to determine the impact of URB, NR, TO, FDI, and ICT on Y. This test helps to find the potential long-run relationship among series integrated at different levels and to identify short and long-term relationships [60]. Moreover, this test performs the estimation after determining the appropriate lag length for the model [61].

$$\begin{aligned} dlnY_t = c_0 + \sum_{i=1}^{n} \beta_0 dURB_{t-i} \sum_{i=1}^{n} \beta_{1,i} dNR_{t-i} \\ + \sum_{i=0}^{n} \beta_{2,i} dTO_{t-i} + \sum_{i=0}^{n} \beta_{3,i} dFDI_{t-i} \\ + \sum_{i=0}^{n} \beta_{4,i} dICT_{t-i} + \delta_0 URB_{t-1} + \delta_1 NR_{t-1} \\ + \delta_2 TO_{t-1} + \delta_3 FDI_{t-1} + \delta_4 ICT_{t-1} + \mu_t \end{aligned} \quad (2)$$

In Eq. (2), *n* denotes the number of lag lengths and *d* denotes the differencing operator. In the ARDL test, the cointegration relationship among the series is first determined. The null hypothesis implying no cointegration $H0$: $\delta 0 \neq \delta 1 \neq \delta 3 \neq \delta 4 \neq 0$ is tested versus the alternative hypothesis implying cointegration $H1$: $\delta 0 = \delta 1 = \delta 3 = \delta 4 = 0$ [61]. Moreover, the optimal lag lengths are determined by the Schwartz information criterion (SIC).

ARDL bounds test results provide short and long term forecasts, but do not provide information about the direction of the relationship. Therefore, VECM is employed to determine the direction of the relationship among variables.

VECM causality test is a method applied between variables that are stationary at I(1) in time series and provide cointegration [62]. The model employing the VECM method is as follows:

$$(1-L)\begin{bmatrix} lnEFP \\ lnGDPPC_t \\ lnGDPPCK_t \\ lnNR_t \\ lnURB_t \\ lnBIO_t \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \\ a_6 \end{bmatrix} + \sum_{i=1}^{p}(1-L)\begin{bmatrix} b_{11i} & b_{12i} & b_{13i} & b_{14i} & b_{15i} & b_{16i} \\ b_{21i} & b_{22i} & b_{23i} & b_{24i} & b_{25i} & b_{26i} \\ b_{31i} & b_{32i} & b_{33i} & b_{34i} & b_{35i} & b_{36i} \\ b_{41i} & b_{42i} & b_{43i} & b_{44i} & b_{45i} & b_{46i} \\ b_{51i} & b_{52i} & b_{53i} & b_{54i} & b_{55i} & b_{56i} \\ b_{61i} & b_{62i} & b_{63i} & b_{64i} & b_{65i} & b_{66i} \end{bmatrix} X \begin{bmatrix} lnEFP_{t-1} \\ lnGDPPC_{t-1} \\ lnGDPPCK_{t-1} \\ lnNR_{t-1} \\ lnURB_{t-1} \\ lnBIO_{t-1} \end{bmatrix} + \begin{bmatrix} a \\ \beta \\ \delta \\ \varphi \\ \vartheta \\ \theta \end{bmatrix} ECT_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (3)$$

The expression (1-L) in the model denotes the difference operator and ECT_{t-1} denotes the lags of the error terms obtained from the long-term relationship, whereas ε_{1t}, ε_{2t}, ε_{3t}, ε_{4t}, ε_{5t}, and ε_{6t} are the error terms. ECT_{t-1} in the model indicates the long-term causality among the variables. Short-term causality is indicated by the statistical significance of the F-statistic using the Wald test, which is constructed by combining the difference and lagged differences of the independent variables in the model [5].

4. RESULTS ANALYSIS AND DISCUSSION

In this section of the study, empirical findings on the impact of URB, NR, TO, FDI, and ICT variables on Y are presented.

Table 2 shows the descriptive statistics and correlation matrix of the variables used in the study. The analysis results reveal a strong and positive relationship between URB and ICT variables and Y. There is also a moderate positive relationship between Y and TO. In addition, the absence of a strong relationship among the independent variables increases the reliability of the model developed in the study. Finally, quite low levels of kurtosis and skewness values of all variables indicate that these variables exhibit normal distribution.

Table 2. Correlation matrix and descriptive statistic

Correlation Matrix						
	Y	URB	lNR	TO	FDI	ICT
Y	1	.872	.310	.590	-.115	.869
URB	.872	1	.286	.617	-.173	.639
NR	.310	.286	1	.170	.432	.426
TO	.590	-.617	.170	1	.098	-.483
FDI	-.115	-.173	.432	.098	1	.258
ICT	.869	.639	.426	.483	.258	1
Descriptive Statistic						
Mean	5664.5930	56.6136	17.8628	80.7196	6.1317	16.6480
Std. dev.	4363.32158	.58048	8.18283	19.53135	4.03987	5.55096
Minimum	1130.12	55.90	3.40	53.05	.20	7.91
Maximum	13890.63	57.82	33.25	149.34	13.01	25.50
Skewness	.368	.503	.046	1.283	.339	.230
Kurtosis	-1.462	-.968	-1.169	3.440	-.959	-1.234
Observations	32	32	32	32	32	32

Table 3. Unit root analysis results

	ADF		**DF-GLS**		**PP**		**KPSS**	
	Level	First Diffrence	Level	First Diffrence	Level	First Diffrence	Level	First Diffrence
Y	1.251	-9.843***	-1.209	-7.953***	0.565	-9.855***	0.752	0.101***
URB	-0.449	-8.931***	0.851	-9.342***	0.473	-11.825***	1.091	0.078***
NR	1.108	-7.454***	-1.681	-8.834***	-1.808	-8.791***	0.473	0.114***
TO	0.817	-11.063***	0.529	-5.575***	0.886	-10.353***	1.187	0.119***
FDI	.921	-9.486***	1.453	-4.872***	0.721	-9.931***	1.019	0.085***
ICT	-1.328	-6.343***	-0.864	-6.421***	-1.733	-7.432***	0.433	0.119***

In Table 3, Augmented Dickey Fuller (ADF) [63, 64], Dickey-Fuller-Generalized Least Squares (DF-GLS) (1996), Phillips - Perron (PP) (1988), Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992) methods are employed to detect whether the variables used in the study are stationary. The fact that the variables are stationary at I(0) and I(1) levels allows us to perform the ARDL bounds test. According to the results, it is understood that all variables are stationary at level and 1st difference level for all employed methods.

In Table 4, the long-term cointegration relationship in terms of the model developed in the research is determined by the ARDL bounds test and lag length is determined by Akaike Information criterion (AIC). In the ARDL bounds test, the long-term cointegration relationship is determined according to I(0) and I(1) critical values. When the F statistic is lower than the I(0) critical value, it means that there is no cointegration, and when it exceeds the I(1) critical value, it means that a cointegration relationship exists. According to the ARDL bounds test results, the F statistic value exceeds the I(1) critical value. This indicates that there is a long-term cointegration relationship.

Table 4. Results of the ARDL bounding test approach

Model	Bound Testing Approach			Diagnostic Tests		
	F Value	Lag Order	Decision	$X^{2\text{-ARCH}}$	$X^{2\text{-LM}}$	$X^{2\text{-RAMSEY}}$
Y= URB, NR, TO, FDI, ICT	5.193***	1,2,0,1,0,0	Conclusive	0.069 (0.698)	0.209 (0.738)	0.121 (0.914)

*** is an indication of 1% level of significance. For F value, it refers to Pesaran et al. [61]. Numbers in "( )" brackets are probabilities

Table 5. ARDL long-term and short-term estimations

Dependent Variable: Y			
Independent Variables	Coefficients	t-statistic	Prob.
Long-term estimations			
URB	4.487***	3.415	0.000
NR	0.164	0.012	0.659
TO	2.029***	1.752	0.019
FDI	0.462**	1.003	0.023
ICT	4.621***	3.713	0.000
C	-6.141***	-4.612	0.000
Short-term estimations			
D(URB)	2.001***	1.209	0.000
D(NR)	0.0345	0.091	0.793
D(TO)	0.272***	0.503	0.004
D(FDI)	0.192**	0.332	0.046
D(ICT)	2.293***	2.063	0.000
CointEq(-1)	-0.950	-6.407	0.000
Sensitivity analysis			
R^2	0.965		
Adjusted R^2	0.942		
F statistic	197.375		
Prob (F statistic)	0.000		
Durbin-Watson stat	1.987		
Robust check			
Ramsey reset	0.121	[0.913]	
LM test	0.209	[0.834]	
ARCH test	0.069	[0.791]	

Note: Numbers in "( )" brackets are probabilities. *, **, and *** indicate significance at the 10%, 5%, and 1%, respectively.

Table 5 shows that URB increases Y, in other words, it has a positive effect on Y. These results indicate that URB has a positive and significant impact on Y in both the short and long run for Kazakhstan over the years. The findings are consistent with the findings of Jedwab and Vollrath [1], Farrell [5], Gross and Ouyang [2]. In addition, NR has no effect on Y in the short and long run. These findings are in line with the literatures by Kaznacheev [12], Okunlola [14], and Kwakwa et al. [11]. Besides, TO increases Y in the short and long run. These findings are similar to Zhang and Guo [17], Wei et al. [18] and Zhang et al. [19]. Similarly, there is a positive relationship between FDI and GDP per capita in the short and long run. These results comply with the findings of Omran and Bolbol [25], Shahbaz and Rahman [26], Tiwari and Mutascu [27]. Finally, the increase in ICT significantly increases Y in the short and long run. These results are consistent with the literature [17, 18, 22, 41]. The Breusch-Godfrey LM test indicates that no autocorrelation problem exists, the ARCH test reveals that no heteroscedasticity problem exists, and the Ramsey-Reset test shows that the correct functional form is used in the study.

Table 6 shows the VECM Granger causality test results. Short-term results show that there is a bilateral causality between Y and URB, TO, FDI, and ICT. Moreover, no causality exists between NR and Y in the short run. In the long run, similar to the short run, there is a bilateral causality between URB, TO, FDI, and ICT and Y. In the long run, no causality exists between NR and Y.

Table 6. VECM granger causality/ block exogeneity Wald test

	Short Term Causality						Long Term
	Y	**URB**	**NR**	**TO**	**FDI**	**ICT**	**ECT (-1)**
Y	-	19.643 (0.000)	2.453 (0.532)	20.628 (0.000)	15.875 (0.003)	26.682 (0.000)	3.067*** [-3.574]
URB	14.564 (0.003)	-	5.255 (0.076)	14.753 (0.000)	9.634 (0.014)	11.091 (0.002)	4.375*** [3.613]
NR	1.157 (0.232)	13.453 (0.005)	-	2.363 (0.397)	2.173 (0.329)	1.301 (0.794)	0.632 [2.532]
TO	9.242 (0.032)	5.598 (0.081)	8.362 (0.053)	-	13.944 (0.011)	16.023 (0.003)	5.985*** [4.633]
FDI	4.474 (0.044)	4.731 (0.073)	1.549 (0.687)	18.973 (0.000)	-	8.843 (0.069)	6.642*** [4.964]
ICT	18.074 (0.000)	13.643 (0.001)	0.964 (0.453)	19.543 (0.000)	9.944 (0.062)	-	7.156*** [5.422]

Note: Numbers in "( )" brackets are probabilities. "[ ]" are t-statistics. *, **, and *** indicate significance at the 10%, 5%, and 1%, respectively.

5. CONCLUSION AND POLICY IMPLICATIONS

This study identifies the determinants of Y for Kazakhstan. In other words, the impact of URB, NR, TO, FDI, and ICT variables on Y is determined. Data for the period 1990-2022 were used in the study. In the study, ARDL method and VECM were used to analyze the short and long-term effects. It was found that URB had an impact on Y in the short and long run. In other words, URB is one of the determinants of Y in Kazakhstan. Due to the positive effect of URB on Y, policymakers should focus on rapid URB but in a healthy and planned manner. One of the problems that may arise with URB is the decrease in environmental quality. Policymakers should develop long-term plans and strategies to use and promote environmentally-friendly resources in the urbanization process.

Considering that urbanization positively affects economic growth for Kazakhstan, it is necessary to implement important policies to support the country's urbanization process. For this, first of all, investments in infrastructure and city planning should be increased. The competitiveness of cities can be increased by making improvements in critical areas such as

transportation, energy infrastructure, water, and waste management. At the same time, economic diversification should be encouraged and investments in new sectors should be supported to expand job opportunities in cities. However, environmental concerns must also be considered for urban sustainability. Preserving green areas, using environmentally friendly technologies, and focusing on energy efficiency can support the healthy and sustainable growth of cities. Finally, cooperation between local governments and the private sector should be increased and a common vision for urbanization strategies should be created. This could be an important step towards improving economic growth and quality of life by effectively managing Kazakhstan's urbanization process.

Another important finding of the study is that NR have no effect on Y. Although Kazakhstan is a NR-rich country, the impact of NR on Y is uncertain. This can be attributed to Kazakhstan's political regime, institutions and level of democracy. It is very important for policymakers in Kazakhstan to improve the quality of its political institutions, build strong democratic institutions, use economic resources efficiently, prevent resource waste and other corruption, and become more democratic. In the case of the limited impact of natural resources in Kazakhstan, it is important to support growth by diversifying the economy and increasing investments in innovation. In this regard, we should reduce resource dependency by focusing on different sectors, encourage technology-based innovations and adopt environmentally friendly practices. These strategies are important for balancing the economy and achieving more sustainable growth.

The TO and FDI variables contribute positively to Y. In other words, an increase in TO accelerates the technical progress of industries. By increasing the level of TO, policymakers in Kazakhstan can expand the market size, change the labor force structure and contribute to capital deepening. In this context, it is important to support international trade, simplify customs procedures and reduce trade barriers. In addition, increasing the number of free trade agreements and strengthening trade relations can expand Kazakhstan's foreign trade potential. Improving the investment environment can increase the inflow of foreign capital into the country, which can support economic growth. In addition, export-oriented industrialization strategies can be developed to encourage technology transfer and increase competitiveness.

Finally, the ICT variable strongly and positively affected Y. Policymakers in Kazakhstan need to enhance ICT investments to improve decision-making processes and improve production and logistics efficiency. Improving ICT infrastructure and expanding access can increase digitalization and technological use. Additionally, by strengthening public and private sector collaborations, the use of new technologies and digital solutions can be encouraged. As a result, it is also important for Kazakhstan to take measures to reduce the pressure on the environment while realizing its economic growth targets.

This study investigating the determinants of Y has some limitations. First of all, the variables identified as determinants of Y should be evaluated in the Kazakhstan sample. Findings may change in future studies in different countries and country groups. In future studies, the effects of URB, NR, TO, FDI, ICT, and Y on environmental quality can be investigated in Kazakhstan sample.

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