“Assessing the differences in the levels and dynamics of economic development of Kazakhstani regions”

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ASSESSING THE DIFFERENCES IN THE LEVELS AND DYNAMICS OF ECONOMIC DEVELOPMENT OF KAZAKHSTANI REGIONS

Abstract

This study aims to analyze the level of differences based on effectiveness, statistical dependence, and mutual influence of economic indicators for ranking the regions of Kazakhstan. In the paper, a systematic algorithm of actions is used, ensuring the interconnectedness, the sequence of work, and the validity of the methods used. Several model specifications were formulated to identify interregional differences in economic development indicators: the operating data environment analysis model (DEA) and the random effects regression model (RE). The information database of the Bureau of National Statistics of the Republic of Kazakhstan for 2010–2020 was used. The construction of the RE model was carried out in the SPSS program. A regression model with fixed and random effects in panel data was employed to determine the impact of the selected indicators on gross regional product produced (GRP). Based on the results, the influence of the physical volume of industrial products on GRP per capita in the regions of Kazakhstan for 11 years was revealed in both models with a high significance of coefficients. The study results can be used by public administration bodies that carry out effective strategic management by smoothing interregional differences. Moreover, they can determine the prospects for studying other parameters based on efficiency, statistical dependence, and mutual influence of economic indicators for ranking regions.

Keywords regional development, management policy, efficiency, statistical dependence, economic growth, growth factors, Kazakhstan

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INTRODUCTION

Today, the economic growth of any economy has a broad impact on specific regions, cities, and even individual settlements. Therefore, economic growth, as a rule, is the ultimate goal of any country, and that is why the economic policy of the administration of any state should be aimed at achieving this goal. This is because only in conditions of sustainable economic growth can social needs be met and the well-being of the population be improved. As a result, for the state, this means a reduction in poverty, an increase in average per capita income, and an improvement in the quality of life.

Until now, it has been assumed that the successful development of the regions depends entirely on their social well-being, location on highways, the availability of natural resources on their territory, and the competitiveness of enterprises. However, there is a problem with managing regional policy in developing countries, such as Kazakhstan, with well-established principles and stereotypes. Therefore, effective regional management requires smoothing interregional differences, identifying the potential, and improving the quality of life of each re-

gion. In addition, interregional differentiation by the level of economic development is predetermined, on the one hand, by various factors and conditions, uneven distribution of resource potential, differences in labor productivity, and demographic indicators. On the other hand, modernization and transformational transformations carried out in recent decades within the framework of regional management policy have led to the underutilization of the economic potential of individual regions, an increase in asymmetry in the quality of life of the population, and a reduction in production efficiency.

In the modern understanding, economic growth is a long-term path of development of a country, occurring both due to qualitative indicators in the economy and due to quantitative changes, that is, their synergistic process. Thus, the problem of economic growth and its impact is widely discussed in the scientific literature (Hausmann, 2001; Cabus & Vanhaverbeke, 2003; Lichter & Brown, 2011). Each economic growth model has several factors that affect the development of any region (Gallup et al., 2003; Fingleton & Lopez-Bazo, 2006). At the same time, it is necessary to identify factors influencing economic growth for a country or region to have economic growth. Some econometric studies pay special attention to endogenous factors (Barro, 1997; Rodrik, 1998). In other scientific works, key characteristics and indicators of the effectiveness of decision-making are highlighted by comparing various indicators (Banker et al., 2010; Chemak et al., 2010).

However, insufficient attention has been paid to the issue of the impact of economic growth on the effectiveness of regions, particularly in developing countries like Kazakhstan, although this area is of high importance in the development strategy.

1. LITERATURE REVIEW

Today, the development of the economy of any country is determined by the state and potential of its regions. The economic condition of the regions, first of all, depends on the available resources and their location on the country's territory. At the same time, the economic growth of territories, the sustainability of social development, the quality of life of the population, and the level of production are due to an increase in the efficiency of individual regions. The main reason is the amount of differentiation, which indicates an unequal contribution to the distribution of resources, the level of competitiveness, and the uneven economic development of the regions. In this regard, each region of a country can be competitive only in those areas of its development for which it has the necessary economic potential.

The importance of production, resources, institutions, capital, goods, and services in the long-term economic development of any country is widely discussed in scientific literature. In addition, the regions of one country are affected by government policy, environmental problems, global epidemics, external shocks, exchange rate dynamics, etc. Analyzing the scientific literature, general trends in the evolution of theories and concepts of regional development can be stated; there is an active transition in regional research from statics to dynamics, and several factors affect economic growth.

It is necessary to highlight the theoretical block of concepts, approaches, and scientific directions aimed at the study of economic dynamics, in particular, the cyclical development of territories. Thus, in the economic development theory, the main approaches to regional development management are distinguished: territorial-problematic, systemic, systemic-institutional, process, program-target, resource, situational, reflexive, cluster, typological, marketing, value-oriented, etc. The cyclical nature of the development of regions reflects the theory of growth poles, according to which the centers of economic space, on the territory where enterprises of leading industries are located, become attraction poles for production factors since they provide the most efficient use of them (Friedman, 1966; Boudeville, 1970).

In recent decades, many studies have appeared on the role of geography in economic development. For example, geographical features of countries and regions began to be considered in econometric studies,

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in cross-country comparisons, as exogenous growth factors (Hausmann, 2001; Gallup et al., 2003). In other studies, new economic geography models have become widespread, indicating the presence of agglomeration effects and spatial heterogeneity (Krugman, 1991; Fujita et al., 1999; Fingleton & Lopez-Bazo, 2006). In specific papers, under the new economic geography, it is recognized that urban and rural economies are becoming increasingly interdependent on several localization factors that are an integral part of economic growth (Cabus & Vanhaverbeke, 2003; Lichter & Brown, 2011).

Separate works are devoted to analyzing various factors, including endogenous factors (Barro, 1997; Rodrik, 1998; Acemoglu et al., 2005). For example, Barro (1997) demonstrated the statistical significance of many economic growth determinants to explain development levels. Rodrik (1998) argued that internal social conflicts and institutions are the keys to understanding the continuing pace of economic growth. He also considered foreign trade, institutions, and geography (a completely exogenous factor) as deep determinants. Further, three possible factors determining institutions were identified: rules established by people, geography, and culture (Acemoglu et al., 2005).

Furthermore, special attention was paid to the interaction between regions through the movement of people, goods, or information in various flows (Boukebbab & Boulahlib, 2015). Thus, interactions between regions indicate economic growth, depending on geographical space. Thus, the region's economic growth will be primarily ensured by the development of the adjacent territory, especially with the involvement of production factors from the adjoining territory (Heryanti et al., 2014).

In some scientific studies, the flow of production factors coming from other regions shows the dependence between regions. For example, Soares et al. (2017) analyzed and explained the differences, interactions, and optimal regional spatial structure using variable infrastructures from different areas. Of interest are scientific works on the systematization of interterritorial effects induced by the proximity of production facilities, economic structures, the availability of local resources, and the capital of the regional economy (Morrissey, 2016; Araújo et al., 2019).

It is particularly worth focusing on scientific research that analyzes decision-making effectiveness by comparing various indicators. Thus, multiple models have been proposed to compare the relative efficiency of decision-making units with various inputs and multiple outputs (Banker et al., 2010). However, standard models for evaluating the effectiveness of management decisions are mainly used to assess the effectiveness of scale and technical distributional efficiency (Chemak et al., 2010).

Further, the effective management system of regions depends on information flows, and regional management is perceived as a system of differentiated centers (Piekkari et al., 2010). Bagautdinova (2013) proposed an integral indicator of the region's economic policy's effectiveness as a primary indicator for evaluating decisions to implement regional development management policy. Further, Czaplewski and Klóska (2020) analyzed the interdependence of processes occurring at the national and regional levels based on methods of multidimensional comparative analysis.

Kazakhstan's regional development management practice has demonstrated that many approaches and tools show low efficiency, including special factors related to doing business in regions (Orazymbetova, 2014; Nurlanova et al., 2018; Satpayeva et al., 2020; Ibragimova et al., 2021). At the same time, the issue of transition to a sustainable development path remains relevant in Kazakhstan and many developing countries. Therefore, a specific approach to developing an effective regional environment is necessary to achieve this goal. This is manifested when the formulated goals, long-term goals, and priorities of regional development management do not correspond to the current level of economic development of the region, its production potential, the peculiarities of the state of the legal framework, the requirements of the main participants and stakeholders in the process of managing the region.

Based on the literature review, it is clear that many scientific works have studied economic development. The main determinants affecting regional economic growth are productivity, human capital, investments, information flows, institutions, and other resources. At the same time, the emphasis on the analysis of one factor differed depend-

ing on the potential of each region. However, in Kazakhstan, such studies focused on representative samples, including data analysis mainly for large cities or agglomerations. Moreover, very few scientific studies assess the level of economic development by achieving specific values of performance indicators, statistical dependence, and mutual influence of economic parameters.

Based on the existing literature, this study considered the availability of data on each Kazakh region's economic development level. In this paper, the critical task is not to choose a unique methodology but to use a set of methodological approaches by structuring the available data based on the operating data environment analysis model (DEA) and the random effects regression model (RE). Therefore, this study will focus on assessing interregional differences in Kazakhstan's economic development indicators, making it possible to form an effective territorial development policy. Thus, the primary purpose of this study is to analyze the level of differences based on efficiency, statistical dependence, and mutual influence of economic indicators for ranking regions of Kazakhstan.

2. METHODOLOGY

In this study, a methodical algorithm of actions is used, ensuring the interconnectedness, the sequence of work, and the validity of the methods used. Thus, several specifications of the models were formulated to identify interregional differences in economic development indicators.

First, for the data environment analysis (DEA) model, the idea is mainly to consider a decision-making unit as an integrated system with multiple inputs and multiple outputs and determine the relative effectiveness of various decision-making units by comparing the output-to-input ratio between different systems. In the practical process of regional economic research, there are many ways to quantify the effectiveness and efficiency of regional economic development. Therefore, many studies proposed complex and diverse assessment methods for this, especially in terms of multiple inputs and multiple results (Banker et al., 2010; Chemak et al., 2000; Fried et al., 2002). As a result, the DEA model is such an effective assessment method that corresponds to the actual economic development situation.

In the practical process of these economic development efficiency assessments, the advantages and reliability of data envelope analysis in assessing the effectiveness of economic development have been well explained and verified. That is, technical and economic development efficiency can be better obtained, providing a benchmark for improving economic growth. Moreover, the research model for comparing relative efficiency allows this paper to estimate the efficiency boundary based on all input and output information obtained from the region (Rogers, 1998).

The DEA method is an alternative to regression models since it allows work with multiple input and output variables. Moreover, it does not require model variables to collect unique statistical characteristics since this method measures the effectiveness of each region on other regions in the sample, providing greater flexibility in selecting variables according to different indicators. The basic structure of the CCR model in the DEA model is presented by:

$$\begin{cases} \min\left[\theta-\varepsilon\left(\hat{e}^T s^- + e^T s^+\right)\right] \\ st.\sum_{j=1}^{n}\lambda_j x_j + s^- = \theta x_0 \\ \sum_{j=1}^{n}\lambda_j y_j - s^+ = y_0 \\ \lambda_j \geq 0, j = 1...n \\ s^+ \geq 0, s^- \geq 0 \end{cases} \quad (1)$$

where ε – a non-archimedean infinitesimal quantity; s^- – a vector consisting of relaxation variables corresponding to the input; s^+ – a vector consisting of the remaining variables corresponding to the output; λ – a coefficient of a linear combination of decision-making units; θ – a coefficient of an input signal reduction ratio and optimal solution; θ* – effective overall DMU efficiency situation.

Furthermore, the results of the study can be analyzed as follows:

1) DEA efficiency. If equal to $\theta^* = 1$, and $s^- = s^+ = 0$, DMU is generally effective for DEA. With $\theta^* = 1$, and $s^- \neq 0$, $s^+ \neq 0$, the DMU is weakly

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effective for DEA. When $\theta^* < 1$, DMU is valid for non-DEA.

2) Advantages of scale. If equal to

$$\sum_{j=1}^{n} \lambda_j = 1, \quad (2)$$

the DMA's large-scale revenue remains unchanged. If equal to

$$\sum_{j=1}^{n} \lambda_j > 1, \quad (3)$$

the return on the DMU scale decreases. If equal to

$$\sum_{j=1}^{n} \lambda_j < 1, \quad (4)$$

the DMU scale increases revenue.

3) Improved projection. For the DMU scale that is invalid for DEA, it can be improved with a "projection theorem" to make it valid for DEA:

$$\overset{\frown}{x} = \theta^* x - s^-, \quad \overset{\frown}{y} = y - s^+. \quad (5)$$

Improved value:

$$\Delta x = x - \overset{\frown}{x} \geq 0, \quad \Delta y = y - \overset{\frown}{y} \geq 0. \quad (6)$$

As an input indicator, only one is used – a unified input indicator. Its use is explained by the fact that all the indicators selected for use at this stage have a "positive" orientation, i.e., their higher values correspond to a more stable situation in the region. Therefore, it is logical to define them as output indicators. However, the specifics of the DEA method require at least one input indicator. In this case, a conditional input indicator can be used, which is assigned a value of 1 for all the objects under study.

Second, for the random effects regression model (RE), the idea is to build a model based on regression analysis of selected indicators that establishes links between various factors and assesses the stability and degree of their mutual influence. The regression method extends the mean regression to other variables (Pedroni, 1999; Aneiros-Pérez & Vieu, 2006). Regression refers to the relationship between the independent variable and the conditional mathematical expectation of the dependent variable, which is built to model and predict the average value. In fact, the RE algorithm is an essential tool for data modeling and analysis.

RE model is often used to analyze economic development, especially in the regional context. An essential advantage of the model is the large number of factors affecting the practical feature, which causes the inclusion of only a few variables in the regression model. Using the results of a comprehensive analysis of the regions, a multiple regression model will be constructed describing the relationship between the dynamics of several economic indicators and the physical volume of the gross regional product produced (GRP). Based on the use of the RE model, the forecast values of GRP growth rates will be calculated, and the practical application of the model for managerial decision-making will be shown. This is one of the essential tasks of ongoing analysis.

General regression model RE (random effects) and fixed model FE (fixed effects) are defined by:

$$\begin{aligned} \ln GRPpercapita = \beta_0 + \beta_1 \ln ALE + \\ + \beta_2 \ln Indvol + \beta_3 \ln Invest + \\ + \beta_4 \ln Empl + \beta_5 \ln Export + \varepsilon, \end{aligned} \quad (7)$$

where ln*ALE* – the natural logarithm of the number of active legal entities; ln*Indvol* – the natural logarithm of the index of the physical volume of industrial products; ln*Invest* – natural logarithm of fixed capital investment; ln*Empl* – the natural logarithm of the employed population; ln*Export* – natural logarithm of export of Kazakhstan regions, ε – random error of the model.

The construction of the RE model was carried out in the statistical package of the specialized SPSS program. In order to determine the impact of the selected indicators on GRP, a regression model with fixed and random effects on panel data for the period 2010–2020 was applied. As a result, the RE panel model will provide more information and data, which gives a new look at how these factors affect economic growth. Moreover, it will help management decision-makers to implement more effective policies in the field of regional development.

Table 1. Description of the selected factors

Source: Compiled by the authors.

No.	Description	Parameter	Unit measurements
1	GRP	Gross Regional Product indicator	in a million KZT
2	GRP per capita	Gross Regional Product on per capita	in thousand KZT
3	lnALE	Number of active legal entities	units
4	lnIndvol	Physical volume of industrial products	as a percentage
5	lnInvest	Investment in fixed assets	in a million KZT
6	lnEmpl	Employed population	in thousand people
7	lnExport	Export of Kazakhstan regions	in a million US dollars

The focus is on 17 regions of Kazakhstan, including three cities of republican significance. The data sample shows that since 2018, the South Kazakhstan region has been divided into the Turkestan region and Shymkent city. The information base of the study was made up of data from the annual statistical collections of the Bureau of National Statistics of the Republic of Kazakhstan. Factors (variables) acting as prerequisites for growth are selected for empirical research. Explanatory variables, conditionally divided into basic and control, are presented in Table 1.

The choice of variables is based on the analysis of previous studies, as is the case with the inclusion of GRP, GRP per capita, and other control variables. In addition, the selected variables make it possible to rank the regions of Kazakhstan based on efficiency, statistical dependence, and mutual influence of economic indicators.

3. RESULTS

3.1. Analysis and results of the DEA model

A distinctive feature of this paper is the evaluation of efficiency by the region's relative development level. Since the evaluation of the effectiveness of its development can be measured from various points of view, under normal circumstances, the number of elements in the benchmark (standard metric) set should be at least two times greater than the total number of input and output indicators. There cannot be a strong correlation between input and output indicators, and indicators cannot be proportional. Thus, the DEA model used for this study is result-oriented, given that this study aims to identify interregional differences in Kazakhstan's economic development indicators.

The DEA model consists of two stages; for this purpose, two tests were conducted for 2010 and 2020 on the efficiency level based on the region ranking. The results of constructing a model for analyzing the functioning environment and grouping regions are shown in Table 2.

Based on the results obtained using the DEA model, regions were ranked for 2010 and 2020 by the level of relative development and setting goals for effective/inefficient regions. In addition, modal regions were selected based on comprehensive accounting of economic indicators. A benchmarkable region is a region that is a model of sustainable development and effective management in which the available resources are used most effectively. Based on the given interval boundaries, each region is assigned a place (rank) depending on the indicator's value. The analysis of the resulting groups of regions indicates the possibility of their logical interpretation. Thus, according to the presented results for 2010, five regions received high indicators and entered the group of effective regions: Akmola region, Atyrau region, South Kazakhstan region, Nur-Sultan city, and Almaty city. For comparison, in 2020, the grouping of effective regions has changed slightly, including only four regions – Almaty region, Atyrau region, Kostanay region, and Almaty city.

An interesting fact is that for all regions of Kazakhstan, the reference set will be two regions that have been included in the group of effective regions twice – Almaty city and the Atyrau region. At the same time, it should be noted that the weight coefficients attributed to the reference regions mean the amount of the "contribution" of this reference region

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Table 2. Performance evaluation result and benchmarkable regions for 2010 and 2020

Source: Bureau of National Statistics (n.d.).

No.	Region	Indicator of efficiency in 2010	Modal regions (and the coefficients with which they form a hypothetical object) for 2010	Rank	Indicator of efficiency in 2020	Modal regions (and the coefficients with which they form a hypothetical object) for 2020	Rank
1	Akmolinskaya	1	Almaty city	5	0.99468	Almaty city	5
2	Aktobe	0.880501	Almaty city	11	0.966952	Almaty city	9
3	Almaty	0.932042	Almaty city	6	1	Almaty city	3
4	Atyrau	1	Almaty city	2	1	Almaty city	2
5	West Kazakhstan	0.770384	Almaty city	16	0.981606	Almaty city	7
6	Zhambylskaya	0.887438	Almaty city	10	0.956903	Almaty city	11
7	Karaganda	0.880012	Almaty city	12	0.965644	Atyrau region (0.784184) Almaty city (0.181459)	10
8	Kostanay	0.89658	Almaty city	8	1	Almaty city	4
9	Kyzylorda	0.799084	Almaty city	14	0.806595	Almaty city	17
10	Mangystau	0.868824	Almaty city	13	0.885653	Almaty city	16
11	South Kazakhstan	1	Almaty city	4	0.906701	Almaty city	15
12	Pavlodar	0.900811	Almaty city	7	0.94738	Atyrau region (0.810203) Almaty city (0.137177)	13
13	North Kazakhstan	0.776405	Almaty city	15	0.972222	Atyrau region (0.972222)	8
14	East Kazakhstan	0.889347	Almaty city	9	0.953558	Almaty city	12
15	Nur-Sultan city	1	Almaty city	3	0.994148	Almaty city	6
16	Almaty city	1	Almaty city	1	1	Almaty city	1
17	Shymkent city	–	Almaty city	–	0.919399	Almaty city	14

to a hypothetical object, which will be the target region for this inefficient region. At the same time, the weighting factor in 2020, for the Atyrau region more than for Almaty city, means that the structure of the values of the Atyrau region indicators is much closer to the form of the branchmarkable region.

Finally, three regions fell into the group of inefficient regions with low parameters of economic development in 2010: Kyzylorda region (0.799084), West Kazakhstan region (0.770384), and Pavlodar region (0.0521363). In turn, in 2020, the group of inefficient regions with low indicators of economic development included three other regions: South Kazakhstan region (0.90701), Mangystau region (0.885653), and Kyzylorda region (0.806595).

The results of the ranking of Kazakhstani regions allow noting the formation of groups of regions that differ significantly from each other in terms of efficiency and in general economic potential. Accordingly, measures should be developed for inefficient regions to solve the identified problems, considering these differences. In addition, the proposed grouping of regions makes it possible to assess the effectiveness of using available resources by region.

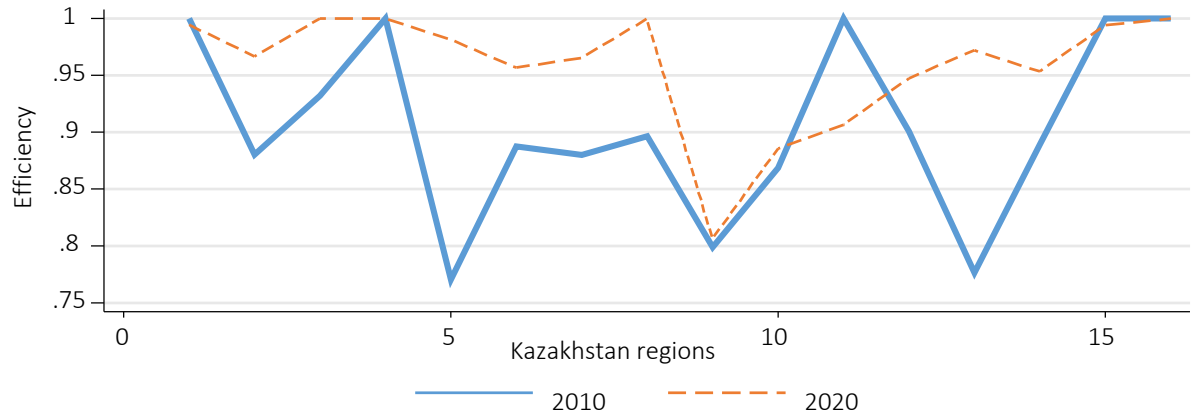

Figure 1. Comparison of the dynamics of Kazakhstan's performance indicator from 2010 to 2020

In addition, the results made it possible to identify effective regions of Kazakhstan in which both the authorities and the companies may be interested simultaneously. Further, Figure 1 shows the difference in performance indicators from 2010 to 2020. Figure 1 shows that in 2010, the indicators were, on average, lower except for three regions. West Kazakhstan region showed the most significant progress in efficiency from 0.770384 (last place in 2010 among the regions) to 0.981606 (7th place in 2020), and the Almaty region became a leader in 2020. On the other hand, the Kyzylorda region does not show significant progress over this period, 0.799084 and 0.806595, respectively. In general, the average value of the efficiency indicator for these 11 years increased by 5.621337%, from 0.905089 to 0.9559671, which demonstrates economic growth in the regions of Kazakhstan.

3.2. Analysis and results of the RE model

Regression modeling using the SPSS software product and the global least squares method was carried out to study the factors that form differences in the levels and dynamics of economic development of Kazakhstan's regions. When constructing the spatial model, GRP per capita for 17 regions for 2010–2020 was considered (a dependent variable), and previously selected variables were taken as control factors. The model allows this study to assess the territorial differentiation of economic development under consideration and, based on this, to make adequate management decisions to regulate their growth.

Regression analysis of the data established the optimal type of functional dependence between the studied variables, as well as the presence of multicollinearity – the linear dependence of some of the studied factors. As a result, a nonlinear regression model was constructed, which is presented in Table 3.

Table 3 shows the results of regression models with fixed and random effects on panel data from 2010 to 2020 for 17 regions of Kazakhstan. Almost all coefficients of variables are statistically significant except lnEmpl for the RE model. According to the results of both models, investments in fixed assets negatively affect GRP per capita with coefficients of –0.6837 and –0.5969, respectively. The highest coefficient values are the number of active legal entities (0.7445 and 0.8793), which shows the importance of creating conditions in the regions of Kazakhstan for new enterprises, especially SMEs. The remaining selected indicators have a positive impact on the economic development of the Kazakhstani regions.

4. DISCUSSION

The results of this study are consistent with previous studies that assessed the impact of various factors on economic growth (Hausmann, 2001; Cabus & Vanhaverbeke, 2003; Soares et al., 2017; Araújo et al., 2019). However, due to the lack of research on the impact of economic growth on the effectiveness of Kazakhstan's regions for develop-

Table 3. Regression model of Kazakhstani regions for 2010–2020

Source: Compiled by the authors.

Variable	RE model	FE model
lnALE	0.7445*** (.064)	0.8793*** (.085)
lnInvest	–0.6837*** (.196)	–0.5969*** (.191)
lnIndvol	0.5310*** (.039)	0.4910*** (.045)
lnEmpl	–0.0915 (.096)	0.3742** (.174)
lnExport	0.0522*** (.020)	0.0814*** (.025)
const	4.2005*** (1.121)	–0.0676 (1.471)
R^2 adjusted	0.9140	0.8313
Observations	176	176

Note: * p < .1; ** p < .05; *** p < .01.

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ment strategy, this paper becomes the first in this field. The estimation results imply that the grouping of effective regions has included four regions: Almaty region, Atyrau region, Kostanay region, and Almaty city. However, the benchmarkable regions are Almaty city and the Atyrau region. In addition, Fujita et al. (1999) and Fingleton and Lopez-Bazo (2006) confirmed the presence of agglomeration and spatial heterogeneity effects. However, other similar studies must be conducted to determine the heterogeneity of the development of territories.

As the results show, the export trade, which forms the basis of foreign exchange, is directly and closely related to the economic growth of the regions of Kazakhstan. This determinant also shows a positive effect on GRP per capita both in the model with random effects ($\beta = 0.0522$, $p < .01$) and with fixed effects ($\beta = 0.0814$, $p < .01$). Therefore, it can be noted that exports are an essential source of economic growth of the regional economy in Kazakhstan. Thus, Barro (1997) demonstrated the statistical significance of economic growth determinants in explaining the development levels. It was also argued that foreign trade is a critical determinant of understanding the continuing pace of economic growth (Rodrik, 1998; Chemak et al., 2010; Lichter & Brown, 2011). This study can be supplemented by studying other external factors, such as the import of regions or foreign trade turnover.

Other issues deserve further investigation, including assessing the level of differentiation of regions, their grouping, and ranking. Effective regional governance requires smoothing interregional differences, identifying the potential, and improving the quality of life of each region. The results of this study can be used for further studies to assess the level of heterogeneity and differentiation of regions. Continuing to explore this direction, in subsequent scientific papers, one can consider a wide range of the following grouping by ranking: the difference in the cost of living between large cities of the country compared to small towns and rural areas; the level of internal mobility of citizens; the level of involvement of the rural population in the cultural and economic environment of large cities; individual housing developments that form sparsely populated residential areas; and the level of urbanization of individual regions.

CONCLUSION

This study assessed the level of differences based on effectiveness, statistical dependence, and mutual influence of economic indicators for ranking the regions in Kazakhstan. The results show that the gap between the level of development of the regions is very noticeable since those regions in the western part of Kazakhstan have vast reserves of hydrocarbons, therefore, have substantial budget revenues. At the same time, based on the results obtained, inefficient regions were identified in the western and southern parts of Kazakhstan, which are associated with a deterioration in economic dynamics. In such regions, of course, additional funding will help solve particular problems. Therefore, it can be assumed that this paper is also crucial for the other regional policy of local authorities to equalize the situation.

According to the results of this study, the megacities of Almaty, Nur-Sultan, and Shymkent, which have high-performance indicators, can become growth centers. Based on the given interval boundaries, each region has assigned a place depending on the indicator's value. In turn, the growth centers will allow the creation of entire clusters in the region that can stimulate the development of interconnected sectors of the economy, and effectively concentrate the limited resources of the regional budget, the sources of the federal center, and private investors in critical areas.

The main feature of this paper is the evaluation of the effectiveness of regional development and the selection of reference regions based on a comprehensive account of the selected variables. Indeed, the problem of smoothing out interregional differences is that excessive differentiation in regions' development levels makes it difficult to form a single economic space. In this regard, there is a need for special state attention to individual regions. The obtained results of the study allow considering each region's

current level of economic development and the determinants that significantly affect it. Effective regional governance requires smoothing out interregional differences, identifying the potential, and improving the quality of life of the region. This study can be valuable and interesting to local executive bodies when forming a strategy for the sustainable development of the regions.

AUTHOR CONTRIBUTIONS

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REFERENCES

1. Acemoglu, D., Johnson, S., & Robinson, J. (2005). *Institutions as the Fundamental Cause of Long-Run Growth* (NBER Working Paper No. 10481). Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/W10481
2. Aneiros-Pérez, G., & Vieu, P. (2006). Semi-functional partial linear regression. *Statistics & Probability Letters, 76*(11), 1102-1110. https://doi.org/10.1016/J.SPL.2005.12.007
3. Araújo, I. F., Goncalves, E., & Almeida, E. (2019). Effects of dynamic and spatial externalities on local growth: Evidence from Brazil. *Papers in Regional Science, 98*(2), 1239-1259. https://doi.org/10.1111/pirs.12402
4. Bagautdinova, N. G., Murtazina, G., Fazlieva, E. P., & Naida, A. M. (2013). Improvement of the Regional Management System Using the Labor Potential Index. *World Applied Sciences Journal, 27*(1), 107-111. Retrieved from https://www.idosi.org/wasj/wasj27(1)13/18.pdf
5. Banker, R. D., Zheng, Z., & Natarajan, R. (2010). DEA-based hypothesis tests for comparing two groups of decision making units. *European Journal of Operational Research, 206*(1), 231-238. https://doi.org/10.1016/j.ejor.2010.01.027
6. Barro, R. J. (1997). *Determinants of Economic Growth: A Cross-Country Empirical Study*. Cambridge, MA: MIT Press.
7. Boudeville, J. R. (1970). *Les espaces economiques*. Paris: Puf. (In French).
8. Boukebbab, S., & Boulahlib, M. S. B. (2015). The Spatial Interactions Using the Gravity Model: Application at the Evaluation of Transport Efficiency at Constantine City, Algeria. *Advances in Intelligent Systems and Computing, 365,* 305-318. http://dx.doi.org/10.1007/978-3-319-19216-1
9. Bureau of National Statistics. (n.d.). *Statistics of national accounts*. (In Kazakh). Retrieved from https://stat.gov.kz/official/industry/11/statistic/6
10. Cabus, P., & Vanhaverbeke, W. (2003). The economics of rural areas in the proximity of urban networks: Evidence from Flanders. *Tijdschrift voor Economische en Sociale Geografie, 94*(2), 230-245. https://doi.org/10.1111/1467-9663.00251
11. Charnes, A., Cooper, W. W., & Rhodes, E. (1976). *Measuring the Efficiency of Decision Making Units with Some New Production Functions and Estimation Methods* (Report ADA049149). Texas university at Austin center for cybernetic studies. Retrieved from https://apps.dtic.mil/sti/citations/ADA049149

http://dx.doi.org/10.21511/ppm.20(3).2022.45

12. Chemak, F., Boussemart, J., & Jacquet, F. (2010). Farming system performance and water use efficiency in the Tunisian semi-arid region: data envelopment analysis approach. *International Transactions in Operational Research, 17*(3), 381-396. https://doi.org/10.1111/J.1475-3995.2009.00736.X

13. Czaplewski, M., & Klóska, R. (2020). Regional Policy as a Factor in Shaping Regional Development in Poland. *South East European Journal of Economics and Business, 15*(1), 93-104. https://doi.org/10.2478/jeb-2020-0008

14. Fingleton, B., & Lopez-Bazo, E. (2006). Empirical growth models with spatial effects. *Papers in Regional Science, 85*(2), 177-198. https://doi.org/10.1111/J.1435-5957.2006.00074.X

15. Fried, H., Lovell, C., Schmidt, S., & Yaisawarng, S. (2002). Accounting for environmental effects and statistical noise in data envelopment analysis. *Journal of Productivity Analysis, 17,* 157-174. https://doi.org/10.1023/A%3A1013548723393

16. Friedmann, J. (1966). *Regional Development Policy: a Case Study of Venezuela*. Massachusetts: MIT Press.

17. Fujita, M., Krugman, P. R., & Venables, A. J. (1999). *The Spatial Economy: Cities, Regions, and International Trade*. Cambridge: MIT Press.

18. Gallup, J., Gaviria, A., & Lora, E. (2003). *Is Geography Destiny? Lessons from Latin America*. Stanford: Stanford University Press.

19. Hausmann, R. (2001). Prisoners of Geography. *Foreign Policy, 122,* 44-53. https://doi.org/10.2307/3183225

20. Heryanti, Y., Junaidi, J., & Yulmardi, Y. (2014). Interaksi Spasial Perekonomian dan Ketenagakerjaan Antar Kabupaten/Kota di Provinsi Jambi. *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah, 2*(2), 99-106. (In Indonesian). https://doi.org/10.6084/M9.FIGSHARE.1431104.V1

21. Ibragimova, K. I., & Turysbekova, A. B. (2021). Study of Development Trends and Development of Measures to Overcome Depopulation of Strategically Important Regions of Kazakhstan. *Economics: the strategy and practice, 16*(4), 76-89. (In Kazakh). https://doi.org/10.51176/1997-9967-2021-4-76-89

22. Krugman, P. R. (1991). *Geography and Trade*. London: MIT Press.

23. Lichter, D., & Brown, D. (2011). Rural America in an urban society: Changing spatial and social boundaries. *Annual Review of Sociology, 37,* 565-592. https://doi.org/10.1146/annurev-soc-081309-150208

24. Morrissey, K. (2016). A location quotient approach to producing regional production multipliers for the Irish economy. *Papers in Regional Science, 95*(3), 491-506. https://doi.org/10.1111/pirs.12143

25. Nurlanova, N. K., Satybaldin, A. A., Bekturganova, M. A., & Kireyeva, A. (2018). Spatial Distribution of Economic Growth and Inequality: Kazakhstan's Experience. *The Journal of Asian Finance, Economics and Business, 5*(3), 169-178. https://doi.org/10.13106/JAFEB.2018.VOL5.NO3.169

26. Orazymbetova, D. A. (2014). Present-Day Challenges for and Postulates of the Regional Policy of the Republic of Kazakhstan. *European researcher, 79,* 1351-1356. https://doi.org/10.13187/ER.2014.2.1351

27. Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics, 61*, 653-670. Retrieved from https://web.williams.edu/Economics/wp/pedronicriticalvalues.pdf

28. Piekkari, R., Nell, P., & Ghauri, P. (2010). Regional Management as a System – A Longitudinal Case Study. *Management International Review, 50*(4), 513-532. http://dx.doi.org/10.1007/s11575-010-0044-1

29. Rodrik, D. (1998). Where Did All the Growth Go? External Shocks, Social Conflict, and Growth Collapses. *Journal of Economic Growth, 4*(4), 385-412. Retrieved from https://www.jstor.org/stable/40216016

30. Rogers, M. (1998). *The Definition and Measurement of Productivity* (Working Paper No. 9/98). Parksville: Melbourne Institute of Applied Economic and Social Research. Retrieved from https://melbourneinstitute.unimelb.edu.au/downloads/working-paper-series/wp1998n09.pdf

31. Satpayeva, Z. T., Kireyeva, A. A., Kenzhegulova, G., & Yermekbayeva, D. (2020). Gender equality and women business of framework 5Ms in Kazakhstan: Analysis and basic directions. *Journal of Asian Finance, Economics and Business, 7*(3), 253-263.

32. Soares, L., Rustiadi, E., & Mulatsih, S. (2017). Analisis Disparitas dan Interaksi Spasial di Tomor-Leste. *Journal of Regional and Rural Development Planning, 1*(1), 74-86. (In Indonesian). https://doi.org/10.29244/JP2WD.2017.1.1.74-86