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RESEARCH ARTICLE
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The Role of Education in Reducing Income Inequality: A Regional Analysis of Kazakhstan

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ABSTRACT

In the context of increasing social stratification, the assessment of factors affecting income inequality is becoming particularly important. This article examines the influence of socioeconomic factors, including access to education and human capital development, on Kazakhstan's income inequality level. The Fixed Effects Model is used as an empirical approach, allowing for consistent regional characteristics and minimizing unexplained data variability. The methodological base is built on panel data for 16 regions, covering the period from 2001 to 2022, comprising 352 observations. The regression model estimates obtained showed statistically significant correlations between the analyzed factors and the level of income inequality. In particular, an increase in the level of education and an increase in the subsistence level contribute to a decrease in the Gini coefficient (coefficient for the subsistence level = -3.32e-06; $p < 0.01$). On the contrary, an increase in the proportion of the population with incomes below the subsistence level (coefficient = 0.000766; $p < 0.01$), unemployment (coefficient = 0.010659; $p < 0.01$), as well as inflation (coefficient = 0.000851; $p < 0.01$) lead to an increase in income inequality. The results indicate that regions with higher educational opportunities and investment in human capital exhibit lower levels of inequality. The findings underscore the need to develop policies that expand access to quality education and reduce regional disparities, thereby mitigating social and economic inequality. Further research should focus on analyzing the role of educational institutions at the micro level and examining the nonlinear effects of regional education policies.

KEYWORDS: Economy, Regional Economy, Economic Development, Economic Inequality, Human Capital, Knowledge Economy, Higher Education, Unemployment

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JEL Code: I24, O15, R11

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1. INTRODUCTION

In Kazakhstan, a student's ability to obtain higher education primarily depends on his or her family's financial well-being. People from low-income families often face significant challenges, including limited access to quality primary education, limited awareness of available scholarships, and the economic burden of tuition fees. These factors significantly reduce their chances of enrolling in the country's leading universities. A vicious circle of inequality is reproduced: limited access to education constrains social mobility, increasing the income gap. Meanwhile, improving the availability and quality of higher education can become a powerful lever in the fight against inequality. Education expands people's economic opportunities, increasing their chances of getting a well-paid and stable job and forming a more conscious attitude to social justice, civic responsibility and involvement in public life. Investments in education are the driving force not only of personal achievements but also of the foundation of sustainable socioeconomic development. In this regard, the study of regional differences in the availability of education and its impact on income distribution is of key importance. Spatial inequality is widely recognized in modern economic science as a significant barrier to balanced regional development, especially in countries with significant socioeconomic diversity. With its significant regional differences in income, employment and infrastructure development, Kazakhstan is a vivid example of the need for a comprehensive analysis of these processes. In the modern world, the study of spatial inequality is considered one of the urgent tasks of regional economics and economic geography. At the same time, differences in the levels of development of regions can be as significant as those between individual states. The high level of socioeconomic inequality in the regions of Kazakhstan, as well as its negative consequences for the country's economic growth and the development of human capital, are alarming. In recent years, growing scholarly attention has been devoted to exploring the influence of investment in innovation and human capital on regional economic growth. This encompasses spending on research and development (R&D), technological advancement, healthcare, education, broader socioeconomic conditions within regions, and the transmission of knowledge and financial flows across them. A significant body of literature examines how such expenditures affect regional development, particularly in regions across Europe and the United States.

While much of this research focuses on intra-country dynamics, such as the movement of innovation and human capital across domestic regions, interregional spillovers between neighbouring countries are also plausible, primarily when strong economic and cultural linkages exist. Numerous studies address mutual regional influences on economic performance. However, when multiple countries are analysed collectively, researchers often treat them as a single macro-region and examine how all other regions jointly affect each region – an approach seen in Rodríguez-Pose and Crescenzi (2003), who analysed 15 European countries.

Despite this, there is limited insight into which specific regions and through which indicators exert the most significant influence on regional growth. Various methodological frameworks have been proposed to investigate the drivers of regional development. The study adopts a methodological approach similar to those applied in other countries and post-Soviet regions. These studies assess the cumulative effect of innovation and human capital spillovers from all other regions. The distinctive contribution of our work lies in disaggregating these effects, separately evaluating the impact of spillovers originating from other domestic regions and those in neighbouring countries.

2. LITERATURE REVIEW

Contemporary research on the role of endogenous factors in national economic growth can be traced back to foundational theoretical contributions from the 1950s and

1960s. Within this framework, economic growth is commonly attributed to two core components: capital accumulation and labour input, both underpinned by knowledge as a key driver. The transmission of knowledge from scientific domains to society occurs primarily through the education system. At the same time, its application to enhance societal welfare depends on effective collaboration between the scientific and business communities. At the national scale, human capital is a comprehensive category encompassing the intellectual dimension of labour resources.

Jaffe et al. (1993) highlighted the critical importance of R&D investments, emphasizing the positive impact of the geographical concentration of public and private research institutions on regional economic performance. Earlier, Aghion and Howitt (1992) introduced a three-sector endogenous growth model comprising intermediate goods production, technological innovation, and research activity. Their study also explores a U-shaped relationship between competition and innovation intensity, interpreting "knowledge" as a socially embedded phenomenon arising from individual interactions (Checchi, 2003). Using a dynamic panel model, German-Soto et al. (2021) tested the hypothesis that innovation is a principal engine of regional growth. Evidence from Mexican regions confirms this positive relationship, albeit with notable heterogeneity across territories and sectors.

Russian scholars note the limited future contribution of labour to growth under a business-as-usual scenario, projecting a negative impact until 2035 (Akindinova et al., 2017). They introduce a refined approach to growth accounting by employing a modified human capital index, which differentiates between structural and cyclical components. This framework integrates educational and health outcomes into GDP dynamics. Assuming continued investment activity and stable labour productivity trends within a moderate external environment, Russia's long-term growth rate is expected to hover around 1%. An article by Sulaiman et al. (2017) examined the long-term relationship between income inequality and economic growth in Malaysia, utilizing ARDL modelling on data spanning 1970–2014. The authors confirm the Kuznets hypothesis, which states that inequality increases in the initial stages of per capita GDP growth but declines in the long run. Education and foreign direct investment contribute to reducing inequality, whereas trade openness, on the contrary, tends to increase it. The study is notable for its use of a long time series and a focus on policy recommendations to support the bottom 40% of the income population. Ramos et al. (2012) examined the effect of overeducation on regional economic growth in the European Union. Using panel data and micro-level information from IPUMS-I, the authors show that the overall level of education and the mismatch between education and employment significantly affect growth. Both formal education indicators and the presence of "overeducated" workers have a positive effect, especially at the regional level. The work emphasizes the importance of considering the qualitative aspects of human capital when developing regional economic policy. In addition to the costs of innovation, the region's human capital factors and socioeconomic conditions are essential for economic growth. In this direction, the results of Ashirbekova et al. (2023) are interesting, as they study the dynamics and differentiation of incomes among the population of Kazakhstan using statistical and factor forecasting methods. A survey of 7475 respondents revealed significant inequality: more than half of the respondents experience difficulties even with basic expenses. The constructed regression model significantly impacted income from factors such as minimum wage, pension, and subsistence minimum. The Gini coefficient calculated based on the survey data (0.735) differs significantly from the official one (0.281), indicating a deep level of subjective polarization. The work emphasizes revising social standards and developing policies to reduce inequality.

Contemporary research demonstrates a robust link between educational characteristics

and levels of social inequality (Yang & Chan, 2017). One of the most comprehensive studies is the meta-regression analysis by Abdullah et al. (2015), which, based on data from 44 countries, shows that improvements in educational indicators, including enrollment and years of schooling, lead to a decrease in the Gini coefficient. Chicchi (2003) analyzed the relationship between income inequality and access to education, using data from 108 countries from 1960-1995. The results show that high-income inequality limits access to education, especially at the secondary level, with gender differences pointing to the impact of financial constraints on families. Coady and Disioli (2017) also emphasized the need to consider differences across age groups and countries, indicating that the impact of education on inequality is more substantial in developing countries. Sylwester (2003) found a small but inverse effect of college attendance on income inequality. A cross-national study by Jeng et al. (2019) showed a similar picture: higher levels of education are associated with lower inequality, although the effect varies by region and economic situation. The study by Agranovich and Dreneva (2021), based on data from OECD countries and Russia, adds an international perspective. The authors found a negative relationship between educational attainment, enrollment, education financing, and the Gini coefficient. The relationship between years of schooling (r=-0.64), education financing, and inequality was robust. A positive correlation was also found between inequality and class size and the proportion of students with low PISA scores. This emphasizes the role of educational coverage and the quality of the educational environment. The evidence confirms that access to education, as well as the structure, organization, and financing of the education system, significantly impact the level of social inequality. These effects vary depending on the stage of development and the country's institutional structure.

Education is considered one of the key mechanisms for reducing income inequality, especially in developing and transition economies (Gylfason & Zoega,2003). Mauro and Carmeci (2003) analyzed data from 19 OECD countries and demonstrated that investment in education contributes to economic growth. However, its effectiveness decreases when unemployment rates are high. This confirms the importance of considering the labour context when formulating education policy. Verbic et al. (2009) provided evidence from Slovenia that increasing public expenditure on education, combined with tax reductions, can foster GDP growth while contributing to a more equitable income distribution. In a related context, Sapkota and Bastola (2015) demonstrate that periods of economic recession in the United States are associated with rising college enrollment rates, which, over time, support a reduction in income disparities. However, the relationship between education and labour market outcomes is more complex in countries facing elevated youth unemployment. For example, Alçin et al. (2021) find that expanding access to tertiary education does not necessarily reduce youth unemployment, especially when there is a structural mismatch between the qualifications the education system provides and the actual labour market demands.

Social and family factors also play an important role. Lehti et al. (2019) and Coelli (2009) show that parental job loss significantly reduces young people's chances of continuing education, which can perpetuate intergenerational inequalities. These studies highlight the importance of providing targeted social support to students and adopting a comprehensive approach to education policy.

Thus, it can be concluded that theoretical and practical views on economic growth and inequality, considered in the literature, highlight the important role of human capital, education and innovation as internal driving forces of sustainable development. In light of the increasing socioeconomic stratification in the regions of Kazakhstan, studying how access to education and its level can affect income inequality is particularly relevant. Research confirms that investments in education and health care, and forming a favourable

institutional environment, serve as the foundation for inclusive and equitable development. However, there is also a reverse perspective. Without a targeted and regionally balanced educational policy, an increase in educational level may not significantly affect combating inequality or may even exacerbate it under unequal access to opportunities.

3. RESEARCH METHODS

This paper uses a quantitative approach using econometric modeling based on assessing the key determinants (factors) affecting the development of domestic tourism in Kazakhstan. In addition, for the reliability of the analysis, other methods were used, including SWOT analysis, to assess the strengths and weaknesses, opportunities and threats shaping the tourism industry.

This study uses an econometric model to analyse the impact of key macroeconomic factors on the level of income inequality in Kazakhstan, measured using the Gini coefficient (GINI). The panel data method with fixed effects was used to estimate the parameters, which allows for considering the unchanging regional characteristics that affect inequality. The Gini coefficient is regarded as a dependent variable, and indicators such as consumption income, inflation, subsistence minimum, the share of the population below the subsistence minimum, and the unemployment rate are considered explanatory variables. Panel data combines time series and data on several subjects (individuals, companies, countries, etc.).

Panel data models:

- Fixed Effects (FE) model - considers the individual characteristics of each object that do not change over time.

- Random Effects (RE) model - assumes that the individual characteristics of the objects are random and uncorrelated with the explanatory variables. The Hausman Test chooses between fixed effects (FE) and random effects (RE) models.

Test hypotheses:

H0 (null hypothesis): there is no difference between the FE and RE estimates, and random effects are consistent.

H1 (alternative hypothesis): random effects are correlated with explanatory variables. Therefore, the fixed effects model is preferable.

The FE model is more suitable if individual effects are not random and depend on explanatory variables. The RE model is more efficient if individual differences are random and uncorrelated with independent variables.

The model uses data from 2001 to 2022 and covers 16 regions of Kazakhstan, with 352 observations in total. The Gini index was calculated using the following functional relationship according to formula (1):

$$Gini = f\left(\begin{matrix}\text{CONSINC,INFL,PRMIN,}\\ \text{UNDERPRMIN,UNEMPL}\end{matrix}\right) \quad (1)$$

where:

CONSINC – average consumption income (in tenge);

INFL – inflation rate (in percentage);

PRMIN – poverty relief minimum (in tenge);

UNDERPRMIN – proportion of population with income below the poverty relief minimum (in percent);

UNEMPL – unemployment rate (in percent).

4. RESULTS AND DISCUSSION

The study involved constructing an econometric model to identify and quantify the key factors influencing the number of domestic tourists. The model was estimated using the ordinary least squares (OLS) method based on data from 2013–2024. The econometric analysis included an estimate of the regression coefficients (Table 1), an analysis of their statistical significance, and a test of the model for autocorrelation (Table 2). Additionally, graphs were constructed to demonstrate the trends of the variables under study (Figure 2) and time series (Figure 3).

In Table 1, there are results for least squares model.

TABLE 1. Least squares model, observations from 2013-2024

Predictor	Coefficient	St. error	Statistics	P-value
Const	-4.98584e+06	1.96140e+06	-2.542	0.0440
GDP	0.0508075	0.0117957	4.307	0.0051
Share_of_tourism_GDP	447484	170463	2.625	0.0393
Organizations	637.838	277.987	2.294	0.0616
Accommodation_Revenue	-0.00481190	0.00592297	-0.8124	0.4476
Hotel_Occupancy	115301	69385.9	1.662	0.1476

Note: compiled by authors

This section presents the main empirical results of the study and their interpretation in terms of the influence of socioeconomic factors on the level of income inequality in the regions of Kazakhstan. Based on the constructed econometric model of panel data, a quantitative analysis of the relationship between the Gini coefficient and several explanatory variables was carried out, including consumption income, inflation, subsistence minimum, unemployment rate and share of the population living below the subsistence minimum. The coefficients obtained allow us to estimate the direction and strength of the impact of each factor on income inequality.

The analysis covers the period from 2001 to 2022 and reflects both long-term trends and short-term fluctuations at the regional level. Additionally, graphic materials illustrate the dynamics of key indicators by regions and cities of national significance. This allows for a deeper understanding of territorial differences and identification of patterns characteristic of individual regions. The discussion of the results is carried out considering the current context of the country's economic development, including structural reforms, regional programs and educational policy. This approach provides a comprehensive understanding of the mechanisms by which inequality is formed and can serve as a basis for recommendations for reducing it. Consumer income growth is observed in almost all regions of the country (see Figure 1).

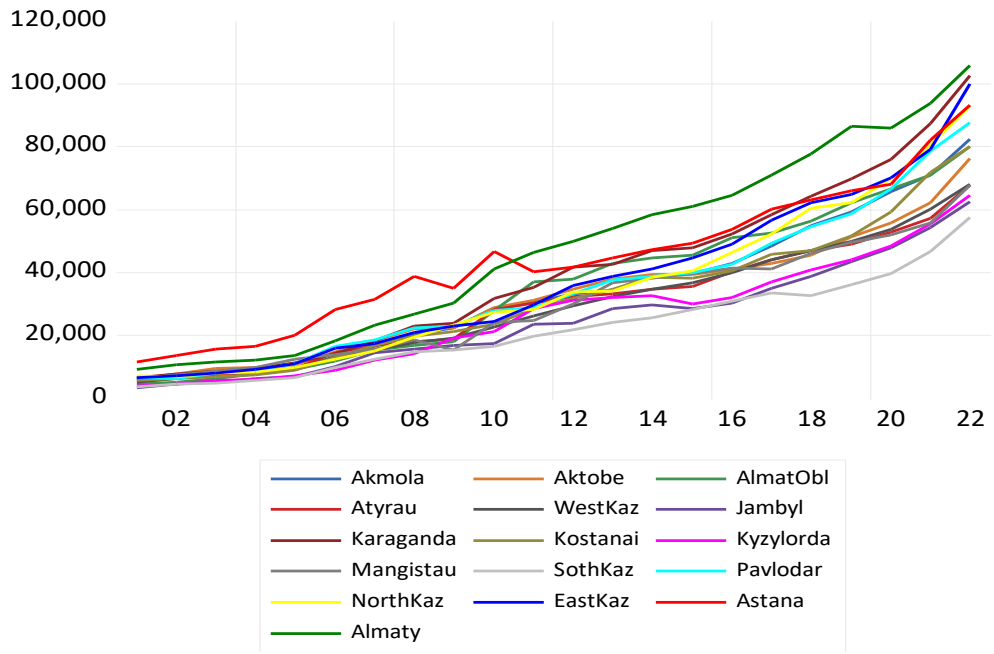

FIGURE 1. Dynamics of consumption income by regions of Kazakhstan for 2000-2022

Figure 1 shows the dynamics of consumption income for different regions of Kazakhstan from 2000 to 2022. The graph shows the trajectory of consumption income for each region, which generally differs in the growth trend, but the nature of the growth is not uniform. For example, Almaty's income dynamics have been growing steadily over time, showing an increase in income. At the same time, the indicators for Astana also show growth but with sharper fluctuations. The graph shows that most regions show an upward trend, indicating that consumption income in most regions increased in the period under review. Some lines intersect, which means a change in the rank of regions by income level at different points in time, and it is essential to understand how this affects inequality in general.

Figure 2 shows the dynamics of the funds ratio for different regions and cities of national significance.

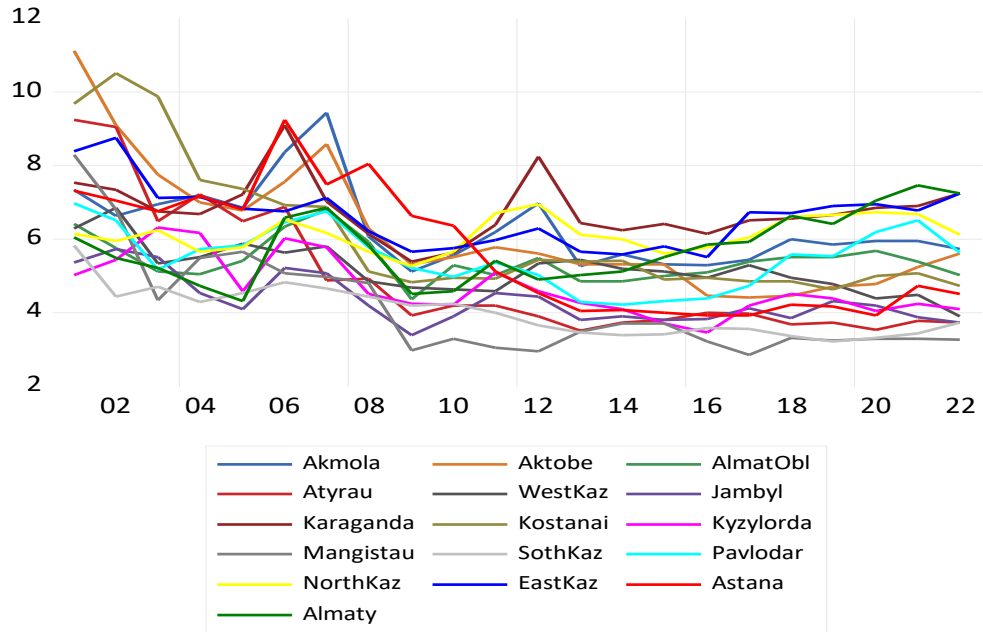

FIGURE 2. Dynamics of the fund coefficient by regions and cities of republican significance in Kazakhstan for 2000-2022

The fund's ratio reflects the ratio of investment volume to the size of the economy or income, which indicates investment activity or capitalization in the country for more than twenty years. The data show fluctuations in the fund's ratio over time for each region, with some sharp ups and downs, which may reflect changes in investment policy, economic climate or other external factors affecting the stock market or investment activity.

Overall, the trajectories of the lines exhibit considerable volatility, reflecting the variability of the fund ratio across different regions during the analyzed periods. The average value of fluctuations in the fund ratio across all regions and years is approximately –0.101, indicating a slight downward trend over time. The following cases are among the most notable changes in the coefficient of funds. In Akmola region (2008), the coefficient decreased by 3.3662, falling from 9.4318 in 2007 to 6.0656. In Atyrau region (2003), a significant decline of 2.5543 was recorded. A similar reduction occurred in Mangistau region (2003), amounting to 2.4715, and in Aktobe region (2008), where the coefficient declined by 2.2938. Conversely, substantial growth was observed in Astana city (2006), with an

increase of 2.4225, and in Almaty city (2006), where the increase reached 2.2683. These fluctuations suggest that, over the past two decades, major investment flows and income growth have been predominantly concentrated in the two major urban centers (Astana and Almaty), rather than in the peripheral regions.

Particular attention should be paid to changes in the Gini coefficient, which vary by region and year (see Figure 3).

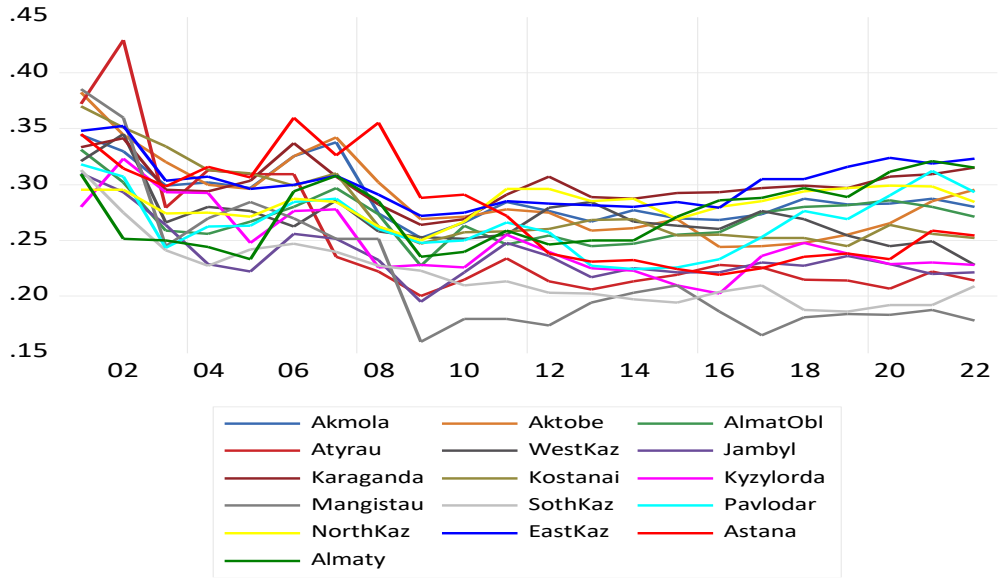

FIGURE 3. Dynamics of the Gini coefficient by regions and cities of republican significance of Kazakhstan for 2000-2022

The Gini coefficient ranges from 0 to 1, where 0 indicates perfect equality (everyone in society has the same income) and 1 indicates perfect inequality (one person gets all the income and everyone else gets nothing). The average Gini coefficient, about 0.267, measures a society's degree of income inequality (see Table 1).

TABLE 1. Descriptive characteristics of variables

Parameter	Gini	Income used for consumption	Inflation	Minimum subsistence level	Proportion of population living below the subsistence level	Unemployment rate
Mean	0.266901	33395.85	108.4000	17474.02	13.20521	6.394483
Median	0.268500	30483.50	107.3000	15865.00	5.300000	5.400000
Max	0.429000	105896.1	127.1000	52367.00	70.70000	13.90000
Min	0.159000	3421.500	103.2000	3685.000	0.400000	4.400000
Standard Error	0.041906	22545.75	4.054662	10855.40	15.85969	1.946484
Skewness	0.179925	0.737149	2.139501	0.783766	1.630829	1.277307
Kurtosis	3.316653	2.965032	7.268138	2.910611	4.612429	4.016619

Note: calculated by the authors in the Eviews program

The value of 0.267 indicates a moderate level of inequality in income distribution across regions of Kazakhstan. This is a relatively low value of the Gini coefficient, which may indicate a more equal income distribution in society compared to other countries where the Gini coefficient may be higher.

In the context of economic policy, countries strive to reduce the Gini coefficient through various social and economic measures such as

taxation, social payments and economic growth in poor regions to reduce economic inequality and improve the social well-being of the population.

Significant changes in the Gini coefficient over the specified period were observed in several regions. In Atyrau region in 2003, the most notable drop in the Gini coefficient was recorded, with a decrease of 0.150 compared to the previous year, indicating a sharp decline in inequality. In Mangistau region in 2003, the coefficient decreased by 0.115, reflecting a substantial reduction in income disparity. Another significant decrease was registered in Mangistau in 2009, amounting to 0.092. In East Kazakhstan in 2003, the Gini coefficient fell by 0.079, while in Atyrau in 2007 the decline was 0.074.

These significant changes likely reflect the impact of economic strategy, income redistribution, or other socioeconomic factors that have caused changes in inequality in these areas. During the period under review, the Gini coefficient changed 73 times, indicating instability of this indicator across the country. One of the key indicators is the cost of living, fluctuations of which directly affect the level of social well-being (see Figure 4).

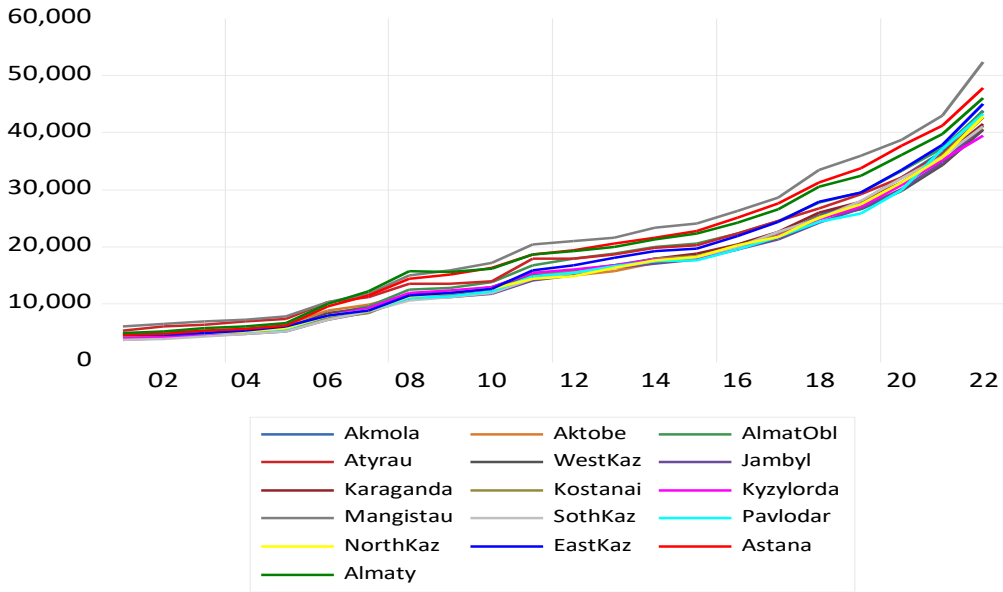

FIGURE 4. Changes in the subsistence minimum indicator by regions and cities of republican significance of Kazakhstan for 2000-2022

To analyze the dynamics of the subsistence minimum in Kazakhstan, key indicators and deviations from average values are considered. The subsistence minimum is commonly used as a criterion for determining the minimum income required to meet basic human needs, and changes in this indicator can significantly impact the economic well-being of the population. The average cost of living for the period under review was 17,474.02, which shows the basic cost of living in different areas. The highest cost of living was 52.367, which may indicate periods of economic growth or inflation. The lowest was 3.685, which may indicate economic crises or a significant drop in living costs in specific periods. The standard deviation of the cost of living was 10.855.4, which indicates significant fluctuations in this indicator over the years.

Analysis of the dynamics shows significant fluctuations in the cost of living in different regions and periods. The most considerable deviations can be associated with economic factors, such as changes in the state's economic policy, inflation, or the influence of international economic conditions. Particularly

noticeable changes in the cost of living can be observed during periods of economic crises, which can accompany an increase in the number of people below the poverty line.

An increase in the proportion of the population living below the subsistence level indicates an increase in poverty and inequality (see Figure 5).

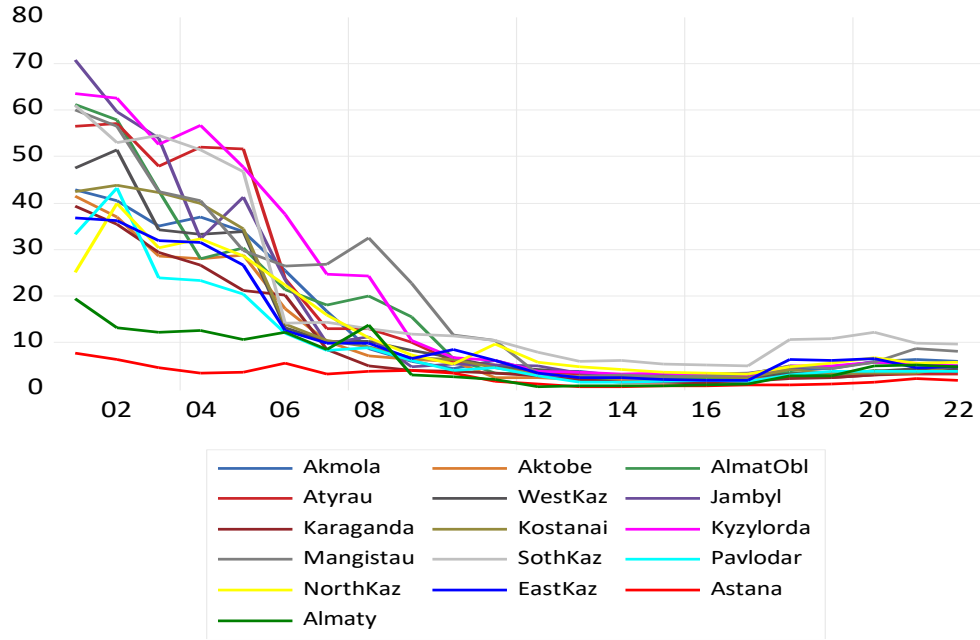

FIGURE 5. Change in the number of people with incomes below the subsistence level by regions and cities of republican significance of Kazakhstan for 2000-2022

The diagram shows the indicator's dynamics characterising the population's share below the poverty line, directly affecting the Gini coefficient. This means that the growth in the number of poor people increases economic inequality. The overall picture of the dynamics of the share of the population living below the poverty line indicates uneven distribution by region. Impact on the Gini coefficient: The growth of this indicator indicates an increase in income inequality, which is important for developing social policy and measures to combat poverty. The indicator demonstrates a statistically significant impact on income inequality, as confirmed by t-test results and the corresponding p-values. Fluctuations in the share of individuals with incomes below the subsistence level may reflect broader economic downturns or shifts in state social policy. These dynamics require detailed examination to uncover their root causes and inform the development of effective policy countermeasures. A sustained increase in the proportion of the population living below the poverty line can exacerbate social tensions and have detrimental effects on public health and general societal well-being.

The unemployment rate, as one of the important economic factors, also has an impact on inequality (see Figure 6).

The graph illustrates the dynamics of the unemployment rate, which is one of the key factors influencing the Gini coefficient and has a strong positive correlation with economic inequality. The average unemployment rate across the observed regions and periods is 6.394%, with fluctuations ranging from a minimum of 4.4% to a maximum of 13.9%, indicating a high degree of variability depending on macroeconomic conditions and regional characteristics. The standard deviation of the indicator is 1.946, which suggests a considerable level of instability in unemployment levels across different areas.

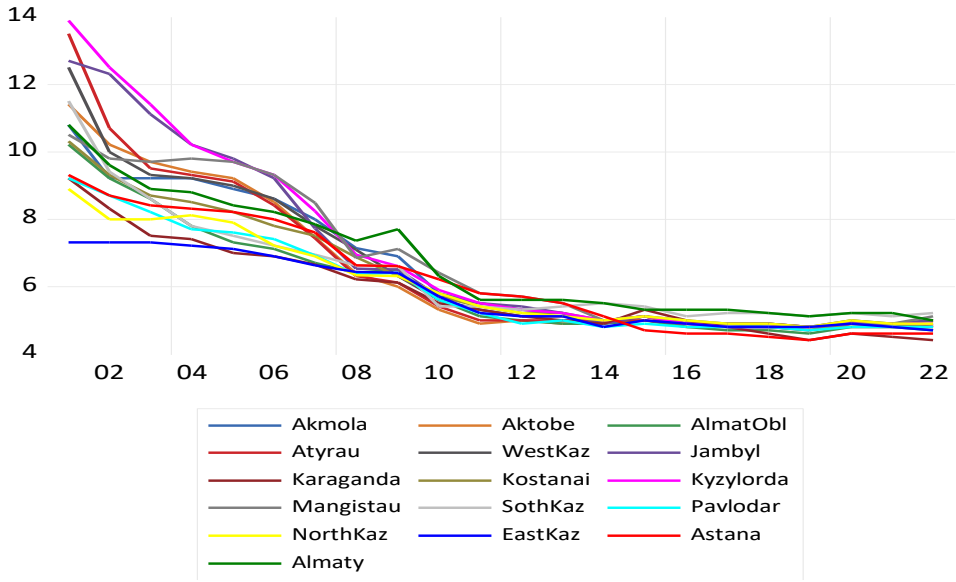

FIGURE 6. Changes in unemployment rates by regions and cities of republican significance in Kazakhstan for 2000-2022

Notably, the maximum value of 13.9% likely reflects periods of economic downturn or structural transformation in the regional labor markets. In contrast, the lowest value of 4.4% may correspond to phases of relative financial stability or the effectiveness of targeted employment policies.

In addition, a correlation matrix was constructed to assess interrelationships among the variables included in the model. The analysis of correlation coefficients revealed both expected and potentially ambiguous associations, requiring further interpretation in the context of regional and temporal specifics.

Futhermore, correlation analysis confirmed the link between poverty, unemployment and the level of inequality (see Figure 7).

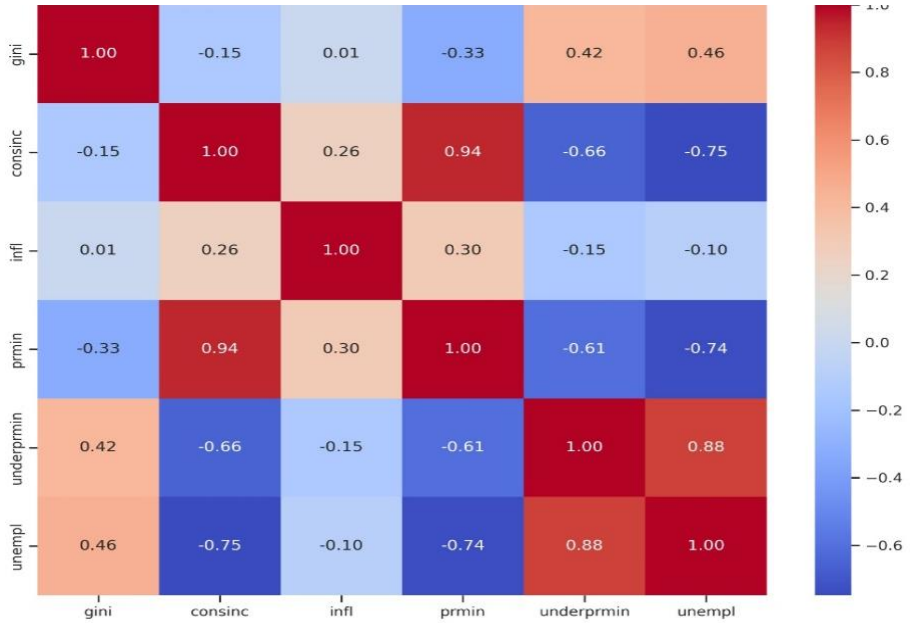

FIGURE 7. Correlation matrix

The most pronounced positive correlation is observed between the Gini coefficient, the unemployment rate (r = 0.46), and the share of the population with incomes below the subsistence level (r = 0.42). This confirms the hypothesis that the growth of unemployment and poverty contributes to increased income inequality. On the contrary, the subsistence level demonstrates a moderately negative correlation with the Gini coefficient (r = -0.33), which may indicate a compensating role of social support in reducing inequality. Of particular interest are the robust correlations observed between certain independent variables, most notably between consumption income and the subsistence minimum (r = 0.94), as well as between the unemployment rate and the proportion of the population living below the poverty line (r = 0.88). Such values indicate the possible presence of multicollinearity, which can distort the regression analysis results. In such cases, additional diagnostics and, if necessary, model adjustments are recommended. In general, the correlation analysis confirms the significance of the selected variables. It allows for a more reasonable interpretation of their impact on the level of income inequality in the regions of Kazakhstan. A matrix of scatter plots was constructed to visually assess the nature of the relationships between the model variables. This tool allows us to see the presence of linear and nonlinear dependencies between variables and identify potential outliers and distribution features. A visual representation of the relationships between the variables of the model is presented in the form of scattering diagrams (see Figure 8).

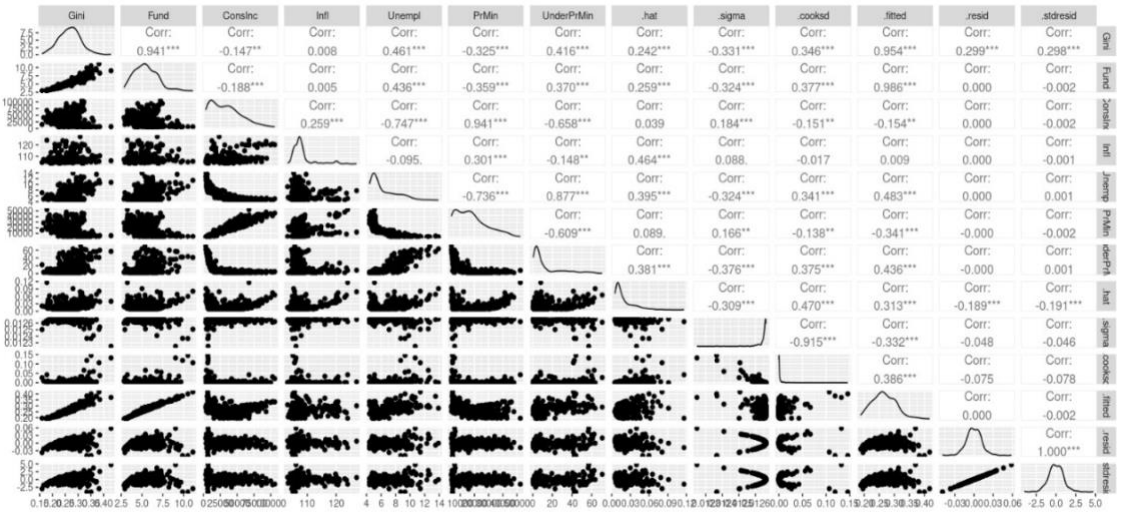

FIGURE 8. Scatterplot Matrix

The graphs clearly show a positive relationship between the variables consinc (consumption income) and prmin (subsistence minimum), which is logical from the point of view of economic content: income growth is accompanied by an increase in the subsistence minimum. Also, one can note the dense clustering of points between unempl (unemployment rate) and underprmin (the share of the population below the poverty line), which indicates a strong relationship between unemployment and poverty in the regions.

Some variables demonstrate curvilinear or weakly expressed relationships. For example, the relationship between gini and infl (inflation) is not visually pronounced, which is confirmed by the low correlation coefficient. However, there is a diagonal trend between gini and underprmin, as well as gini and unempl, indicating a positive relationship.

In addition, the diagonal histograms of the variable distribution indicate the presence of asymmetry and different density of values, which may affect the model's specification. This is

especially noticeable for the variables unempl and underprmin, which are unevenly distributed and have long tails. Thus, visual analysis of scatterplots complements quantitative assessments and allows for a better understanding of the data structure before building a model. A Hausman test was performed to compare fixed and random effects, and the results showed that the fixed effects model was preferable (Table 2).

TABLE 2. Hausman test

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	29.745977	5	0.0000

Note: calculated by authors in the Eviews program

The statistical significance of the explanatory variables and the outcomes of the Hausman test support the robustness and validity of the chosen econometric specification. The findings reveal the directional influence of each factor on income inequality and provide an empirical foundation for shaping targeted socioeconomic policies aimed at its mitigation. A detailed presentation of the model estimations and the interpretation of results is provided in the following sections. Specifically, the model investigates the relationship between the Gini coefficient, used as a proxy for income inequality, and a range of economic indicators and structural conditions.

The resulting regression specification is summarized in Table 3.

TABLE 3. Panel data model for Gini

Variable	**Coefficient**	**Standard Deviation**	**t-statistics**	**Probability**
CONSINC	2.12E-06	2.43E-07	8.710068	0.0000
INFL	0.000851	0.000323	2.636149	0.0088
PRMIN	-3.32E-06	4.91E-07	-6.771422	0.0000
UNDERPRMIN	0.000766	0.000194	3.943869	0.0001
UNEMPL	0.010659	0.001891	5.636876	0.0000
C	0.083823	0.033341	2.514127	0.0124

Note: calculated by authors in the Eviews program

The interpretation of the estimated regression coefficients provides insights into the influence of selected socio-economic indicators on income inequality in Kazakhstan. The positive coefficient for consumption income (2.12E-06) indicates that income inequality tends to increase as average consumer income rises. This may suggest that income growth is unevenly distributed across different social groups, with higher-income households benefiting more from economic expansion. The coefficient for inflation (0.000851) is also positive, implying that higher inflation is associated with greater inequality. Conversely, the negative coefficient for the subsistence minimum (–3.32E-06) suggests that raising the poverty threshold is related to a decrease in inequality, possibly reflecting the effectiveness of social policy interventions aimed at supporting vulnerable populations. Additionally, the positive coefficient for the share of people with income below the subsistence minimum (0.000766) confirms that as poverty deepens, income inequality worsens. Finally, the coefficient for unemployment (0.010659) is also positive, indicating that rising unemployment levels contribute to increasing disparities in income distribution.

The main variables included in the model demonstrate varying effects on the Gini coefficient, reflecting their influence on

income inequality. Consumption income positively impacts the Gini coefficient, suggesting that economic inequality tends to rise as consumer income increases, potentially due to uneven income distribution across population segments. Inflation also shows a positive relationship with the Gini coefficient, indicating that high inflation may disproportionately affect lower-income groups, thereby exacerbating inequality. In contrast, the cost of living negatively impacts the Gini coefficient, which may imply that increases in the subsistence minimum contribute to reducing inequality, possibly through effective social protection mechanisms. The poverty rate positively correlates with the Gini coefficient, suggesting that a higher proportion of the population living below the poverty line correlates with increased inequality. Finally, the unemployment rate significantly positively affects the Gini coefficient, confirming that higher unemployment contributes to growing economic disparities.

The t-test and p-levels confirm the statistical significance of all indicators, indicating the reliability of the results. The model also includes country-fixed effects, considering unaccounted country characteristics that can affect the Gini coefficient. The R-squared of the model is 0.734, indicating that the model explains about 73.4% of the variations in the Gini coefficient. This model provides a deeper understanding of the factors affecting economic inequality in different countries and can be a basis for developing policies to reduce inequality and increase economic welfare.

5. CONCLUSIONS

The model and the information provided give grounds to believe that significant indicators lead to the consequences of the income gap in Kazakhstan. The increase in consumption income and the fluctuations directly depend on the colour, confirming the power of state policy in social support and economic management for the governance gap. The cost of living and unemployment also play a key role in shaping the socioeconomic structure of society and income distribution.

Further in-depth analysis of each region separately, taking into account the specifics of its economic development and social policy, is required for a more detailed analysis and interpretation of the data and for developing specific proposals for improving inequality. Based on the data obtained, the following general recommendations can be formulated based on areas of activity.

Social support: Strengthen social support for the most vulnerable segments of the population, especially in regions with a high proportion of the population with an income below the subsistence minimum.

Economic incentives. The design and implementation of targeted economic incentives to reduce unemployment and foster entrepreneurship can significantly promote a more equitable income distribution—inflation control. Maintaining effective inflation control mechanisms is essential to protecting living standards, particularly in regions experiencing elevated price increase rates, where inflation disproportionately affects low-income households.

Regional development: Promote regional development through investment in infrastructure, education and health care, which can reduce regional disparities and help reduce inequality.

The presented model and analysis allow us to conclude that economic and social factors significantly impact inequality in Kazakhstan. To achieve significant results in the fight against inequality, it is necessary to implement comprehensive measures to improve the population's economic well-being and reduce the social gap between different segments of society and regions of the country. A detailed analysis of each aspect of the model and graphs requires significant work and is beyond the scope of this answer. However, the presented review provides directions for further research and practical actions in the fight against inequality in Kazakhstan.

Several specific recommendations can be proposed based on analysing Kazakhstan's

income inequality model and considering foreign experience in this area. These recommendations include proven approaches and innovative methods that can help reduce inequality.

1. Redistribution of profits through the tax system.

Progressive income tax, as well as wealth and inheritance taxes. This practice is widespread in Scandinavia and helps reduce income gaps without slowing economic growth and introducing or increasing taxes on wealthy citizens while reducing the tax burden on the poor, tightening control over tax payments, and combating tax evasion.

2. Improving access to excellent education

Human capital theory states that investing in education increases productivity and stimulates economic development. Providing equal opportunities for quality education for all groups is critical to reducing inequality and expanding programs to help students from low-income families, including scholarships and subsidies, to improve education quality in rural and remote areas.

3. Developing the labour market and reducing unemployment

Efficient employment policies, including support for job creation, vocational training and retraining, are essential for reducing income gaps. Germany sets a positive example with its dual vocational education and training system, successfully integrating young people into the labour force. Policies should also include measures to stimulate businesses to create jobs, especially in high-tech and environmentally friendly industries. In addition, developing continuing education and advanced training programmes that meet the changing demands of the modern labour market is critical for the flexibility of the workforce.

4. Social support and protection

The concept of the welfare state assumes an active role for governments in providing social protection and reducing poverty. Expanding social support programs, such as unemployment benefits, child benefits, and assistance to the elderly, can mitigate income inequality and protect vulnerable groups. Moreover, introducing social insurance mechanisms helps reduce the risks associated with loss of earnings and increases overall economic stability.

5. Infrastructure and regional development

Renewal of infrastructure and promotion of regional growth to reduce interregional differences, which leads to a more equitable distribution of economic opportunities and a reduction in social stratification. Investments in transport, communications, healthcare and education in less developed regions. Support for small and medium-sized businesses in the regions. These measures require a comprehensive approach and coordination of actions at all levels of government, as well as the active participation of the public and businesses. Foreign experience confirms that reducing inequality is possible with targeted policies and investments in the social sphere and education.

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