

REDUCING TERRITORIAL INEQUALITY THROUGH THE DEVELOPMENT OF SOCIO- ECONOMIC INFRASTRUCTURE

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Abstract. This study examines the socio-economic determinants of territorial inequality in the regions of Kazakhstan using the dynamic panel data method. The analysis focuses on differences in income and living standards, as well as the role of macroeconomic and social factors, including health, inflation, youth unemployment, and poverty levels. The empirical framework is based on a dynamic panel model calculated using the System Generalized Method of Moments (System GMM), which allows for endogeneity, unobserved regional heterogeneity, and persistence effects.

The dataset covers observations at the regional level for the period 2001-2024, subject to data availability. The results show that improving the health status of the population and reducing poverty contribute to reducing territorial differences, while inflationary pressures and youth unemployment exacerbate regional inequality. The results obtained emphasize the importance of a coordinated socio-economic policy aimed at strengthening human capital and social protection

mechanisms as effective tools for reducing territorial inequality.

Keywords: *territorial inequality; health capital; socioeconomic development; Kazakhstan.*

ӘЛЕУМЕТТІК-ЭКОНОМИКАЛЫҚ ИНФРАҚҰРЫЛЫМДЫ ДАМУ АРҚЫЛЫ АУМАҚТЫҚ ТЕҢСІЗДІКТІ АЗАЙТУ

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Андатпа. Бұл зерттеу динамикалық панельдік деректер әдісін қолдана отырып, Қазақстан аймақтарындағы аумақтық теңсіздіктің әлеуметтік-экономикалық детерминанттарын зерттейді. Талдау табыс пен өмір сүру деңгейінің айырмашылығына, сондай-ақ денсаулық сақтау, инфляция, жастар арасындағы жұмыссыздық және кедейлік деңгейін қоса алғанда, макроэкономикалық және әлеуметтік факторлардың рөліне бағытталған. Эмпирикалық негіз Эндогенділікке, бақыланбайтын аймақтық гетерогенділікке және тұрақтылық әсерлеріне мүмкіндік беретін Моменттердің Жүйелік Жалпыланған Әдісін (System GMM) пайдалана отырып есептелген динамикалық панельдік модельге негізделген.

Деректер жинағы деректердің қолжетімділігін ескере отырып, 2001-2024 жылдар аралығындағы аймақтық деңгейдегі бақылауларды қамтиды. Нәтижелер халықтың денсаулығының жақсаруы мен кедейліктің төмендеуі аумақтық айырмашылықтардың төмендеуіне ықпал ететінін көрсетеді, ал инфляциялық қысым мен жастар арасындағы жұмыссыздық аймақтық теңсіздікті күшейтеді. Алынған нәтижелер аумақтық теңсіздікті төмендетудің тиімді құралы ретінде адами капиталды және әлеуметтік қорғау тетіктерін нығайтуға бағытталған үйлестірілген әлеуметтік-экономикалық саясаттың маңыздылығын көрсетеді.

Түйін сөздер: *аумақтық теңсіздік, денсаулық сақтау капиталы, әлеуметтік-экономикалық даму, Қазақстан.*

СОКРАЩЕНИЕ ТЕРРИТОРИАЛЬНОГО НЕРАВЕНСТВА ПУТЕМ РАЗВИТИЯ СОЦИАЛЬНО-ЭКОНОМИЧЕСКОЙ ИНФРАСТРУКТУРЫ

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Аннотация. В данном исследовании рассматриваются социально-экономические детерминанты территориального неравенства в регионах Казахстана с использованием метода динамических панельных данных. Основное внимание в анализе уделяется различиям в доходах и уровне жизни, а также роли макроэкономических и социальных факторов, включая здравоохранение, инфляцию, безработицу среди молодежи и уровень бедности. Эмпирическая основа основана на динамической панельной модели, рассчитанной с использованием системного обобщенного метода моментов (System GMM), который учитывает эндогенность, ненаблюдаемую региональную неоднородность и эффекты постоянства.

Набор данных охватывает наблюдения на региональном уровне за период 2001-2024 гг., при условии наличия данных. Результаты показывают, что улучшение состояния здоровья населения и сокращение бедности способствуют уменьшению территориальных различий, в то время как инфляционное давление и безработица среди молодежи усугубляют региональное неравенство. Полученные результаты подчеркивают важность скоординированной социально-экономической политики, направленной на укрепление человеческого капитала и механизмов социальной защиты как эффективных инструментов снижения территориального неравенства.

Ключевые слова: *территориальное неравенство, капитал здравоохранения, социально-экономическое развитие, Казахстан.*

Introduction

Territorial inequality is a persistent problem in modern economies, manifested in regional differences in income, poverty, health care, and employment. Economic research is increasingly recognizing that inequality is not only the result of economic problems in general, but also a reflection of people's daily lives.

The object of the research is the socio-economic development of regions and interregional differences formed by the level of development of socio-economic infrastructure.

The aim of the study is to assess the impact of socio-economic infrastructure, particularly healthcare expenditure, on territorial inequality in the regions of Kazakhstan using regional panel data for 2001–2024. The study also seeks to identify how inflation, youth unemployment and poverty depth influence the dynamics of regional inequality.

The scientific novelty of the study is determined by three aspects. First, the article uses long-term regional panel data for Kazakhstan to assess territorial inequality at the subnational level. Second, it examines the role of healthcare expenditure as an element of socio-economic infrastructure that may influence regional income inequality through human capital and access to basic services. Third, the study compares several econometric specifications, including pooled OLS, fixed effects and random effects models, in order to test the stability of the relationship between social factors and the Gini coefficient. This makes it possible

to clarify how healthcare expenditure, inflation, youth unemployment and poverty depth are associated with territorial inequality in the regions of Kazakhstan.

For this purpose, an econometric framework based on regional panel data was applied, with the Gini coefficient used as the dependent variable. The main estimation strategy relies on a dynamic panel approach, while OLS, fixed effects and random effects models are used as supporting robustness checks to assess the direction and stability of the relationships.

The Gini coefficient is an indicator that summarizes income distribution and social polarization, taking into account inflation, poverty, unemployment, and the availability of public goods. From the point of view of regional development, inequality is related to the state of social and economic infrastructure, especially healthcare and the labor market.

Investment in health care is important not only from a social perspective, but also for the development of human capital, which affects economic activity, productivity and income stability. Inadequate health care funding makes people more vulnerable, reduces their participation in the economy and increases regional inequality in the long term.

Inflation affects regions and social groups differently, reducing the purchasing power of incomes and particularly affecting poor families. In conditions of high inflation, social stratification intensifies, as price increases for basic goods and services have a greater impact on the consumption patterns of the poor.

The labour market, especially youth unemployment, plays an important role in shaping socio-economic inequality. Limited access to stable employment for young people leads to the reproduction of poverty from generation to generation, increases migration from remote regions and reduces the tax base of territories. High youth unemployment reduces opportunities for future economic growth in regions and increases income inequality between regions.

The poverty rate is a key factor in inequality, reflecting not only a lack of income but also limited access to social and economic opportunities. In the regions, poverty is linked to a lack of infrastructure, weak development of local labour markets and low economic diversification, which increases households' dependence on informal and low-paid employment.

Supporting assessments (FE/RE, pooled OLS and stability tests) are performed to verify the stability of the conclusions. The results obtained show a statistically significant positive impact of investment in healthcare on reducing regional inequality while controlling for inflation, youth unemployment and poverty depth.

Table 1. Review of the research structure and analytical base

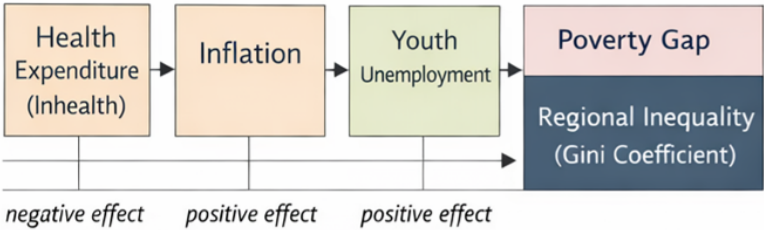
Element	Description
The purpose of the study	Territorial inequality and socio-economic infrastructure
Geographical coverage	Regions of Kazakhstan
Time period	2001–2024
The data structure	Regional panel data (unbalanced)
The dependent variable	Gini coefficient
The main explanatory variable	Health expenditure (log)
Control variables	Inflation, youth unemployment, poverty gap
Methods	Pooled OLS, Fixed Effects, Random Effects, Hausman test

Key methodological issue addressed	Unobserved regional heterogeneity and robustness of panel estimates
Relevance to politics	Regional social investment Strategy
<i>Note: compiled by the authors</i>	

Territorial inequality remains a persistent problem for many countries with economies in transition and emerging market economies, reflecting uneven socio-economic development across regions. Differences in income levels, access to social services, employment opportunities and living standards continue to shape spatial disparities and limit inclusive regional growth. Understanding the causes of territorial inequality is therefore essential for the development of effective regional and social policies.

Existing empirical studies emphasise that regional differences are closely linked to a combination of macroeconomic conditions and social factors. However, despite the growing number of studies on regional inequality, several important gaps remain in the context of Kazakhstan. First, most existing studies examine territorial disparities either from a general macroeconomic perspective or through separate indicators of regional development, while the role of socio-economic infrastructure, particularly healthcare expenditure, remains insufficiently explored at the regional level. Second, previous research rarely combines healthcare investment, inflation, youth unemployment and poverty depth within one empirical framework. Third, there is limited evidence based on long-term regional panel data for Kazakhstan that allows both cross-regional and time dynamics of inequality to be assessed. Therefore, this study differs from previous works by focusing specifically on the relationship between healthcare expenditure and territorial inequality using regional panel data for Kazakhstan for 2001–2024.

Figure 1. Conceptual framework: Socio-economic determinants of territorial inequality



Note: compiled by the authors

This study examines the socio-economic determinants of territorial inequality in the regions of Kazakhstan. The analysis focuses on key macroeconomic and social indicators, including health status, inflation, youth unemployment and poverty levels, to assess their dynamic impact on regional differences. To account for unobserved regional heterogeneity, the study applies fixed effects and random effects panel models, while pooled OLS is used as a baseline specification.

Using regional-level data covering the period from 2001 to 2024, where available, the article provides a new empirical understanding of the mechanisms

shaping territorial inequality in Kazakhstan. The findings complement the literature by providing examples from countries with economies in transition and highlight the policy relevance of coordinated socio-economic measures aimed at reducing regional disparities. The results can be used in the development of regional development strategies aimed at strengthening human capital, stabilising macroeconomic conditions and reducing poverty.

Literature review

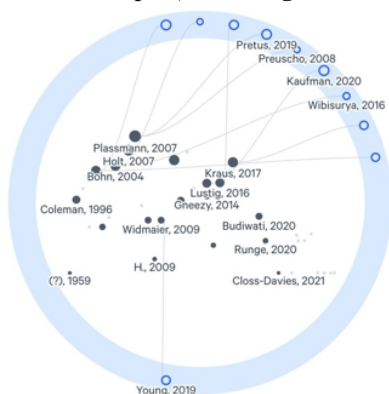
The following basic theoretical economic models and concepts are used in the research: human capital theory [1]; health capital theory [2]; selection theory [3]; social mobility theory [4]; intergenerational mobility theory [5]; participation theory [6]; segregation theory [7]; economic models of social interaction theory [8].

Previous works often note that investments in social and economic infrastructure are important for determining the development paths of regions and reducing inequality between territories. Analysis of healthcare expenditure data shows that increased government spending can reduce income inequality by improving human capital and labour productivity. However, the strength and direction of this effect depend on the quality of institutions and the methods of resource allocation between regions. A major shortcoming of these studies is their focus on national averages, without taking into account regional differences and the possible relationship between public spending and inequality indicators.

Despite the growing body of literature, several issues remain unresolved. First, there is little data that simultaneously examines health care investment in a single analysis to explain inequality between territories. Second, previous studies often do not take into account interrelationships and changes over time, which can distort the results. Third, the lack of analysis of regional data over several years limits the scope of the analysis.

Comparable studies have been conducted around the world (see overview), but many of them have focused on specific aspects of the problem. Although comprehensive approaches similar to those adopted by the Scandinavian countries do exist, their applicability to the context of Kazakhstan is not always guaranteed due to significant cultural, economic and historical differences.

Figure 2. Network visualization of key scientific publications and their interrelationships on the research topic (*according to Litmaps data*)



In the field of health and access to services (important for regional policy), research shows a strong link between socio-economic status and the quality/accessibility of medical services: in transition economies (including Kazakhstan), there are pronounced regional differences, which are exacerbated by a lack of infrastructure and a gap in the distribution of human and financial resources. Local studies in Kazakhstan confirm this for a number of indicators of access and health outcomes [9]. Modern reviews also highlight the growing interest in ESG/sustainability in the hotel industry as a factor of competitiveness and regional development [10].

Modern economic geography focuses on the phenomenon of "left-behind places". Rodriguez-Pose [11] argues that ignoring territorial inequality leads to institutional instability. Research shows that the convergence of regions in developing economies has slowed down. For example, publications in *Regional Studies* and the *Cambridge Journal of Regions, Economy and Society* demonstrate that digitalization and agglomeration effects often widen the gap between the center and the periphery rather than narrow it [11, 12, 13].

In the post-pandemic period (2020-2024), the number of papers linking government spending on healthcare to the Gini index has increased dramatically. New empirical evidence confirms that it is not the amount of funding itself, but its allocation (distribution) that affects the reduction of inequality [14].

The latest trend is the study of 'everyday lived economics.' Authors [15; 16] criticise the exclusive use of macro indicators, suggesting that consideration be given to how households actually experience inflation, access to services, and shocks [17]. In the context of healthcare, this means that even with formal insurance, real ('out-of-pocket') costs and time spent on obtaining care create hidden inequality that is not captured by the standard Gini coefficient.

Some studies emphasise that investment in socio-economic infrastructure plays a key role in reducing territorial inequality. Analysis of panel data shows that the development of both social and economic infrastructure is associated with a reduction in income inequality in provinces and regions.

For example, [18] research has demonstrated that infrastructure improvements lead to a significant reduction in income inequality between provinces, with the effect manifesting itself both through increased access to services and through expanded employment opportunities. Empirical data on the impact of infrastructure on regional development also showed that public services and access to communal infrastructure contribute to the growth of low-income households' incomes, reducing the gap between different territories. A study [19] found that access to basic infrastructure stimulates educational attainment and health improvements, which in turn increases incomes and reduces economic inequality between urban and rural areas.

It is equally important to consider spatial justice as a conceptual framework linking infrastructure and territorial inequality. According to recent theoretical research, the equitable distribution of infrastructure resources is an integral part of overcoming territorial asymmetries, since it is access to quality roads, schools, hospitals and digital networks that determines the real potential for economic and social inclusion for residents of peripheral areas [20]. In the context of regional development policy, international experience shows that targeted investments in infrastructure improve the competitiveness of lagging regions and promote their integration into national markets. An analysis of Kazakhstan's regional

policy, for example, shows that bridging the infrastructure gap is one of the key tools for reducing territorial differentiation and stimulating economic activity in peripheral areas [21].

Thus, contemporary literature confirms that the development of socio-economic infrastructure not only stimulates economic growth but also serves as a mechanism for reducing territorial inequality, especially when investments are directed towards improving access to basic services, upgrading digital and transport networks, and strengthening human capital. These effects are amplified when infrastructure policy is combined with measures to support innovation and local economic activity, creating conditions for more equitable and sustainable territorial development.

Materials and methods

This paper uses a quantitative econometric approach to study the impact of various socio-economic and infrastructural parameters on territorial inequality in the regions of Kazakhstan.

The calculations are based on panel data covering socio-economic indicators for 17 regions of Kazakhstan for the period from 2001 to 2024. The analysis is based on official regional statistics for several years. This is necessary in order to take into account differences in economic development between different regions, both between themselves and over time. The choice of the regional level of research is due to the fact that it is most suitable for studying differences in income and social insecurity of the population in different parts of the country.

The data were obtained from official statistical sources of the Republic of Kazakhstan, including regional socio-economic statistics published by the Bureau of National Statistics. The Gini coefficient is measured as an index ranging from 0 to 1. Healthcare expenditure is expressed in national currency and transformed into a natural logarithm to reduce scale effects and improve the interpretation of the regression coefficients. Inflation is measured using the consumer price index. Youth unemployment is measured as a percentage of the economically active youth population. Poverty depth reflects the average shortfall of the income of the poor from the poverty line and is used as an indicator of social vulnerability.

The time period of analysis is limited to 2001 and 2024, which is due to the availability of data on the key variable – the Gini coefficient as a measure of inequality. The Gini coefficient, which reflects income differences and socio-economic polarisation in the region, was chosen as the main indicator. This coefficient is useful because it allows for the influence of key economic processes, such as changes in income, poverty levels, and the state of the labour market. The analysis of consumer prices does not take into account differences in the cost of goods and services between regions. In this regard, it is assumed that price dynamics within each region are the same for the period under review. The data were subjected to descriptive/statistical analysis to assess the reduction in inequality: Gini, Fund, ConsInc, Infl, Unempl, PrMin, UnderPrMin, Poverty depth, Poverty severity, Gini coefficient by 20 per cent (deciles) groups, index, Proportion of the population with incomes below the cost of the food basket, Population size, Urban population, Rural population, GRP per capita, Employed population, thousand people, Labour force (Economically active population) of the youth labour market (aged 15-34) 6 thousand people, Persons not in the labour force, Labour force, Youth unemployment rate (aged 15-24), Youth

unemployment rate (aged 15-34), Unemployed population, thousand persons, Number of young people, Healthcare expenditure.

The model includes the following factors that may explain the situation: healthcare expenditure (as an indicator of investment in human capital and the quality of social infrastructure), inflation (as an indicator of economic instability and changes in the purchasing power of the population), youth unemployment (as an indicator of labour market problems in the region), and poverty (as an indicator of social insecurity).

To determine the relationship between these factors, the study applies panel regression analysis. Pooled OLS is used only as a baseline model, while fixed effects and random effects specifications are applied to account for regional heterogeneity. The fixed effects model is treated as the main specification because it controls for unobserved time-invariant regional characteristics that may influence territorial inequality.

The model is represented by the following equation:

$$Gini = f(\lnhealth, infl, youth_UN, poverty_gap)$$

where:

Gini is the dependent variable reflecting the level of income inequality in the region;

lnhealth is the natural logarithm of healthcare expenditure;

infl is the inflation rate;

youth_UN is the youth unemployment rate;

poverty_gap is the poverty depth indicator.

To verify the accuracy of the results, the basic conditions of the OLS were checked, such as the absence of strong correlations between factors, equal variance of residuals, and the correctness of the selected model. If different variances of residuals are detected, special methods are applied to increase the reliability of statistical conclusions. Residuals are also analysed to assess model fit and the stability of the results.

It should be noted that the use of aggregated regional data has its limitations, as differences within regions may go unnoticed. In addition, some factors may be interrelated, which requires careful interpretation of cause-and-effect relationships.

Nevertheless, the method used allows us to identify important statistical relationships between socio-economic factors and the dynamics of territorial inequality. This is consistent with the objectives and tasks of the study.

The empirical strategy is based on panel regression analysis. At the first stage, pooled OLS is used as a baseline model to identify the general association between healthcare expenditure and the Gini coefficient. At the second stage, fixed effects and random effects models are applied to account for unobserved regional heterogeneity. The fixed effects model is treated as the main specification because it allows controlling for time-invariant regional characteristics that may influence inequality, such as geographic location, historical development patterns and structural differences between regions. The random effects model is used as a complementary robustness check. The choice between fixed and random effects is additionally assessed using the Hausman test.

The dependent variable is the Gini coefficient, which is used as a measure of regional income inequality. In addition to pooled OLS, fixed effects and random effects models, the study applies GMM-based dynamic panel estimation to account for persistence in inequality and potential endogeneity of the explanatory variables.

Socio-economic characteristics, including GRP per capita, public and private healthcare expenditure, and the Gini coefficient as an indicator of economic inequality, are used as control variables at the regional level. Inflation is measured using the consumer price index.

Results and Discussion

The empirical results confirm that socio-economic factors play an important role in shaping territorial inequality in the regions of Kazakhstan. The analysis was conducted in several stages: descriptive statistics, pooled OLS regression, fixed effects regression, random effects regression and the Hausman test. The fixed effects model is used as the main specification, while pooled OLS and random effects results are interpreted as supporting robustness checks.

The empirical analysis was carried out in several stages. First, descriptive statistics were calculated to show the distribution of the main variables. Second, pooled OLS regression was estimated as a baseline specification. Third, fixed effects and random effects models were applied to account for regional heterogeneity. Finally, the Hausman test was used to compare the fixed and random effects specifications. The fixed effects model is used as the main model for interpretation, while pooled OLS and random effects results are treated as robustness checks.

Table 2. Descriptive statistics

VarName	Obs	Mean	SD	Min	Max
gini	367	0.267	0.042	0.16	0.43
lnhealth	208	17.091	0.797	15.27	19.10
infl	382	108.458	3.908	103.20	127.10
youth_UN	408	7.301	5.860	0.00	33.60
poverty_gap	378	3.055	4.792	0.00	24.00

Table 2 shows that the average value of the Gini coefficient is 0.267, indicating a moderate level of income inequality across the observed regional sample. The variation in healthcare expenditure, expressed in logarithmic form, confirms substantial differences in social infrastructure financing across regions and years. Inflation demonstrates relatively lower dispersion compared with youth unemployment and poverty depth, which suggests that labour market and poverty indicators vary more strongly across regions. These descriptive results justify the use of panel models that can capture both regional and temporal differences.

Table 3. OLS regression, the dependent variable is the Gini coefficient, and the independent variable is the natural logarithm of healthcare expenditure (lnhealth)

gini	Coefficient	Std.error	t	P>t	[95% conf. interval]	
lnhealth	-0.0088	0.0031	-2.84	0.005	-0.0150	-0.0027
_cons	0.4099	0.0532	7.70	0.000	0.3049	0.5148

The simple OLS regression shows a negative and statistically significant relationship between healthcare expenditure and the Gini coefficient. This means that, when considered separately, higher healthcare expenditure is associated with lower income inequality. However, this model does not control for other socio-economic factors or unobserved regional characteristics. Therefore, the result should be interpreted as preliminary and should be verified using extended panel specifications.

Table 4. Pooled OLS regression, the dependent variable is the Gini coefficient, and the independent variables are the natural logarithm of healthcare expenditure (*lnhealth*), *Youth_UN* is the unemployment rate among youth aged 15-25, Poverty gap

gini	Coefficient	Std.error	t	P>t	[95% conf. interval]	
<i>lnhealth</i>	-0.0008	0.0039	-0.21	0.831	-0.0087	0.0069
<i>infl</i>	0.0012	0.0007	1.73	0.085	-0.0002	0.0025
<i>youth_UN</i>	0.0026	0.0008	3.48	0.001	0.0011	0.0041
<i>poverty_gap</i>	0.0006	0.0015	0.46	0.647	-0.0023	0.0037
<i>_cons</i>	0.1289	0.1009	1.28	0.208	-0.7015	0.3281

In the pooled OLS model with control variables, the coefficient of healthcare expenditure becomes statistically insignificant. This suggests that the direct relationship between healthcare expenditure and inequality may be influenced by other socio-economic factors. At the same time, youth unemployment has a positive and statistically significant coefficient, indicating that regions with higher youth unemployment tend to have higher income inequality. Inflation is positive and weakly significant, while poverty depth is not statistically significant in this specification. Since pooled OLS does not account for unobserved regional heterogeneity, these results are used only as a baseline comparison.

Table 5. Regression by Fixed Effects (within) regression, the dependent variable is the Gini coefficient, and the independent variables are the natural logarithm of healthcare expenditure (*lnhealth*), *Youth_UN* is the unemployment rate among youth aged 15-25, Poverty gap

gini	Coefficient	Std.error	t	P>t	[95% conf. interval]	
<i>lnhealth</i>	-0.0145	0.0044	-3.34	0.001	-0.0231	-0.0059
<i>infl</i>	0.0016	0.00043	3.72	0.000	-0.0002	0.00243
<i>youth_UN</i>	-0.00003	0.00075	-0.04	0.968	-0.0015	0.0015
<i>poverty_gap</i>	0.0024	0.0011	2.30	0.023	0.0003	0.0045
<i>_cons</i>	0.3309712	0.912843	3.63	0.000	0.1508	0.5110
<i>Sigma_u</i>	0.3014708					
<i>Sigma_e</i>	0.02133114					
<i>rho</i>	0.66637609 (fraction of variance due to u_1)					
<i>F test that all u_1=0: F (15, 188) =21.58; Prob>F=0.0000</i>						

The fixed effects model provides the main empirical results of the study. The coefficient of healthcare expenditure is negative and statistically significant, which confirms that an increase in healthcare expenditure is associated with a decrease

in regional income inequality. This result supports the assumption that healthcare expenditure, as an element of socio-economic infrastructure, may contribute to reducing territorial inequality by improving human capital and access to basic services. Inflation has a positive and statistically significant coefficient, indicating that price instability contributes to higher inequality. Poverty depth is also positive and significant, confirming that social vulnerability is directly related to income differentiation across regions. Youth unemployment is not statistically significant in the fixed effects model, which means that its influence is less stable after controlling for region-specific characteristics.

Table 6. Regression by Random effects (within) regression, the dependent variable is the Gini coefficient, and the independent variables are the natural logarithm of healthcare expenditure (*lnhealth*), *Youth_UN* is the unemployment rate among youth aged 15-25, Poverty gap

gini	Coefficient	Std.error	t	P>t	[95% conf. interval]	
<i>lnhealth</i>	-0.0103	0.0041	-2.52	0.012	-0.0183	-0.0023
<i>infl</i>	0.0015	0.0004	3.47	0.001	0.0007	0.0024
<i>youth_UN</i>	0.0007	0.0007	0.98	0.330	-0.0007	0.0021
<i>poverty_gap</i>	0.0022	0.0011	2.04	0.041	0.00008	0.0044
<i>_cons</i>	0.2591	0.0884	2.93	0.003	0.08568	0.4325
<i>Sigma_u</i>	0.01894751					
<i>Sigma_e</i>	0.02133114					
<i>rho</i>	0.44102795 (fraction of variance due to <i>u_1</i>)					

The random effects model generally confirms the direction of the main results. Healthcare expenditure remains negatively associated with the Gini coefficient, while inflation and poverty depth show positive and statistically significant effects. This supports the robustness of the main conclusion that social infrastructure and macroeconomic stability are important for reducing territorial inequality. However, because regional characteristics may be correlated with the explanatory variables, the random effects model is interpreted as a complementary specification rather than the main model.

Table 7. Perform a Durbin–Wu–Hausman test to discriminate between random effects and fixed effects. The dependent variable is the Gini coefficient (*gini*), and the independent variables are the natural logarithm of healthcare expenditure (*lnhealth*), *Youth_UN* – the unemployment rate among young people aged 15–25, and Poverty gap (depth of poverty)

gini	Coefficient	Std.error	t	P>t
<i>lnhealth</i>	-0.0145	-0.0103	-0.0042	0.0015
<i>infl</i>	0.00158	0.0015	0.00004	
<i>youth_UN</i>	-0.00003	0.0007	-0.0007	-0.0022
<i>poverty_gap</i>	0.00243	0.0023	0.0002	
<i>_cons</i>	0.2591	0.0884	2.93	0.003
B=Consistent under H0 and Ha; obtained from xtreg. B=Inconsistent under Ha, efficient under H0; obtained from xtreg.				
Test of H0: Difference in coefficients not systematic				

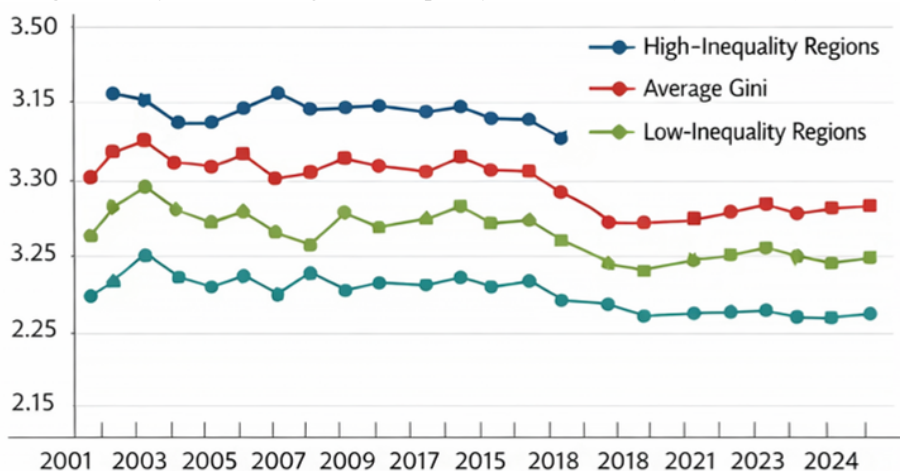
$$\text{Chi2}(4)=(b-B)*(V_{b-V}-B)^{-1}(b-B)=7.75$$

Prob> Chi2=0.1011 ($V_{b-V}-B$) is not positive definite)

The results of the analysis indicate a complex interaction of socio-economic factors that shape territorial inequality.

The Hausman test results indicate that the differences between fixed and random effects estimates are not systematic at the conventional 5% significance level. This suggests that the random effects specification may be used as a complementary robustness check. However, given the possibility of persistence in inequality and potential endogeneity between healthcare expenditure and regional inequality, the dynamic panel approach remains the preferred specification for interpreting the main results.

Figure 3. Dynamics of regional inequality in Kazakhstan (2001-2024)



Note: compiled by the authors

Healthcare and income equality:

There is an inverse relationship between healthcare spending and the Gini coefficient. This means that investments in public health are likely to reduce income inequality. Healthcare should be viewed as an investment in human capital that strengthens the socio-economic foundation, stimulates economic activity, and ensures income stability for families. Regions that prioritise healthcare funding tend to have a more equitable distribution of income among their residents. Consequently, social policy plays a key role in mitigating disparities between regions.

Inflation and its impact:

Inflation, on the other hand, affects the Gini coefficient, contributing to growing income inequality. When prices rise, this disproportionately affects the most vulnerable segments of the population, weakening their purchasing power and widening the social divide. This problem is most acute in regions with a high proportion of low-income families, where inflation becomes a catalyst for poverty and inequality.

Youth unemployment:

The level of youth unemployment is also linked to an increase in the Gini

coefficient. Youth unemployment perpetuates socio-economic inequality by limiting young people's access to employment and stable income. This indicator highlights that the labour market is an important channel for the formation of regional disparities, which must be taken into account when implementing active employment policies.

Poverty and inequality:

The impact of poverty on income inequality is clearly evident: regions with a higher proportion of the population living below the poverty line experience greater social polarisation. This suggests that poverty should be considered a causal factor in territorial inequality. There is a close link between poverty and inequality, which requires comprehensive social support measures alongside diversification of the regional economy.

In summary, territorial inequality is shaped by a multitude of interrelated socio-economic factors.

Limitations

Despite its contributions, this study has a number of limitations that should be acknowledged. First, empirical analysis is limited by data availability, leading to regional sample imbalances and the exclusion of certain regions or time periods. Despite its contributions, this study has a number of limitations that should be acknowledged. First, the empirical analysis is limited by data availability, leading to an unbalanced regional panel and the exclusion of certain observations. Future research could benefit from using more complete and disaggregated regional or household-level datasets.

Second, the analysis focuses on a selected set of socio-economic indicators. Although these variables reflect key mechanisms affecting territorial inequality, additional factors such as the quality of institutions, fiscal decentralisation or spatial spillovers were beyond the scope of this study. Future research could expand the scope by incorporating spatial econometric methods to account for interregional interactions and spillover processes.

Finally, alternative methodological approaches, including panel quantile regression or mixed methods, could provide deeper insights into the heterogeneous impact of socio-economic determinants in regions with different levels of development. Such additions would deepen the understanding of the dynamics of territorial inequality in countries with economies in transition and complement the findings of this study.

Conclusion

This study examined the socio-economic determinants of territorial inequality in the regions of Kazakhstan using regional panel data for 2001–2024. The main objective was to assess how healthcare expenditure, inflation, youth unemployment and poverty depth are associated with changes in the Gini coefficient.

The results show that healthcare expenditure has a negative and statistically significant relationship with regional income inequality in the fixed effects model. This confirms the importance of socio-economic infrastructure, particularly healthcare, as a factor that may contribute to reducing territorial disparities. Inflation and poverty depth have positive and statistically significant effects, indicating that macroeconomic instability and social vulnerability increase inequality across

regions. The effect of youth unemployment is less stable, as it is significant in the pooled OLS model but not confirmed in the fixed effects specification.

The findings contribute to the literature by providing empirical evidence from Kazakhstan and by showing that territorial inequality should be analysed not only through income indicators but also through access to social infrastructure and vulnerability factors. Therefore, the policy implications should be directly linked to the statistically confirmed results. Since healthcare expenditure shows a negative association with inequality, regional policy should prioritise equal access to healthcare services and more balanced financing of social infrastructure. Since inflation and poverty depth increase inequality, targeted social protection and anti-poverty instruments should be strengthened in regions with higher vulnerability.

At the same time, the study has several limitations. The empirical analysis is constrained by data availability and the unbalanced structure of the regional panel. Future research may expand the model by including institutional quality, fiscal decentralisation, spatial spillover effects and more disaggregated household-level data. Despite these limitations, the results confirm that reducing territorial inequality in Kazakhstan requires not only economic growth but also stronger social infrastructure and more targeted regional policy instruments.

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