International Journal of Social Science and Humanities Research-MIYR
2026, Volume 6, Issue 1, pp.10~27
https://doi.org/10.53468/mifyr.2026.6.1.10

Regional economic growth and convergence in Eastern Mongolia: A panel data–based empirical analysis

Tegshjargal Sodnomdavaa[1], Tsolmon Sodnomdavaa[2*] Battuvshin Gurbazar[3]

[1,3]Mongolian University of Science and Technology, Ulaanbaatar, Mongolia
[2*]Mandakh University, Ulaanbaatar, Mongolia
*Corresponding author: Tsolmon Sodnomdavaa, tsolmon@mandakh.edu.mn

CITATION

Tegshjargal Sodnomdavaa, Tsolmon Sodnomdavaa, Battuvshin Gurbazar. Regional economic growth and convergence in Eastern Mongolia: A panel data-based empirical analysis. International Journal of Social Science and Humanities Research-MIYR
2026, 6(1), 10~27.
https://doi.org/10.53468/mifyr.2026.6.1.10

ARTICLE INFO

Received: 26 Jan 2026
Revised: 29 Jan 2026
Accepted: 03 March 2026
Available online: 30 March 2026

Abstarct Uneven regional economic growth and persistent income disparities remain major challenges for sustainable development in many developing economies. These issues are particularly evident in resource-dependent countries with concentrated sectoral structures, where the benefits of economic expansion are unevenly distributed across regions. This study examines regional economic growth, income convergence, and interregional spillover effects in Mongolia's eastern provinces using panel data from 2000 to 2024. The empirical analysis estimates both absolute and conditional β-convergence models using panel regression techniques. In addition, the study investigates spillover effects to assess how economic growth in the eastern region is interconnected with economic dynamics in other regions of Mongolia. The econometric framework incorporates key determinants of regional growth, including human capital development, industrial structure, financial conditions, and settlement characteristics. The results provide evidence of both absolute and conditional β-convergence within the eastern region, indicating that provinces with lower initial income levels tend to grow faster. However, convergence dynamics appear to be influenced more strongly by national macroeconomic conditions and sectoral cycles than by province-specific characteristics. Human development and industrial activity positively affect regional growth, whereas financial pressures, educational constraints, and weaknesses in settlement structures limit growth performance. The findings highlight the importance of targeted regional policies that strengthen human capital, support economic diversification, and account for spatial interdependencies across regions.

Keywords- Regional economic growth; β-convergence; Human capital; Spatial spillover effects; Panel data

1. INTRODUCTION

Recent empirical research further demonstrates that regional economic growth is shaped not only by internal regional characteristics but also by strong interdependencies with the economic dynamics of other regions. Economic activity generated in regional growth hubs can be transmitted to neighboring and more remote areas through channels such as investment flows, labor mobility, and market accessibility, producing both positive and negative spillover effects [1]. Consequently, regional economic development can no longer be adequately analyzed within isolated spatial boundaries; instead, it increasingly requires a systemic perspective that explicitly accounts for interregional linkages and mutual dependence. This spatial perspective has become a central component of modern regional growth analysis, particularly in economies where economic activity is geographically concentrated and regional disparities are persistent.

In Mongolia, economic growth has remained heavily concentrated in the mining sector and highly sensitive to fluctuations in international commodity prices, creating structural conditions that have reinforced regional development disparities. In economies with such structural characteristics, income growth tends to be spatially concentrated, while the benefits of development fail to diffuse evenly across regions. A growing body of research shows that under these conditions, regional income gaps

are unlikely to narrow in the short term and may even widen during certain phases of the economic cycle [2; 3]. This pattern is particularly relevant for resource-dependent economies, where sectoral concentration and external commodity price shocks may disrupt the convergence mechanisms predicted by traditional neoclassical growth theory.

In recent years, studies on regional economic growth have increasingly emphasized the role of human capital, industrial diversification, and institutional quality. These factors are widely recognized as key determinants of regional economic resilience and the capacity to absorb external shocks, thereby shaping divergent long-term development trajectories across regions. Empirical evidence suggests that regions with stronger human capital bases and more diversified economic structures tend to exhibit greater adaptability and more устойчив growth paths over time [4; 5]. Consequently, contemporary analyses of regional growth increasingly underscore the need to incorporate qualitative dimensions of economic structure. In particular, variables reflecting human capital accumulation, industrial capacity, financial conditions, and settlement structure are frequently incorporated into empirical growth models to capture the structural determinants of regional development.

Despite these advances, empirical evidence for Mongolia's eastern provinces remains limited. In particular, there is a lack of systematic, long-term analyses that jointly examine regional economic growth, income convergence, structural determinants, and interregional linkages within a unified empirical framework. Little is known about whether economic growth in the eastern provinces is converging toward the national average conditional on initial income levels, or how this process is interconnected with the economic dynamics of other regions in Mongolia. Furthermore, previous studies have rarely incorporated spatial interaction mechanisms or examined the role of interregional spillover effects in shaping regional growth dynamics within the Mongolian context.

Accordingly, this study seeks to address this gap in the regional development literature by empirically examining economic growth, absolute and conditional income convergence, and interregional spillover effects in Mongolia's eastern provinces using econometric methods based on long-term panel data. By combining convergence analysis with structural determinants of growth and interregional interaction effects, the study provides new empirical evidence on the mechanisms underlying regional development disparities in Mongolia. Specifically, the paper contributes to the literature in three main ways. First, it constructs a long-term provincial panel dataset spanning 2000–2024 to analyze regional growth dynamics in Mongolia. Second, it evaluates both absolute and conditional β-convergence using panel regression models that incorporate key structural determinants of economic growth. Third, it examines interregional spillover effects to assess how economic dynamics in major growth centers influence economic performance in the eastern provinces. Overall, the findings of this study contribute to a better understanding of how structural characteristics, spatial interdependencies, and national macroeconomic dynamics jointly shape regional economic development in resource-dependent economies.

2. THEORETICAL FRAMEWORK AND REVIEW OF PREVIOUS STUDIES

The theoretical foundations for explaining the long-term dynamics of regional economic growth and income disparities originate from neoclassical growth theory. The Solow [6] growth model predicts that diminishing returns to capital generate faster growth in regions with lower initial levels of income. Under this framework, regions are expected to gradually converge toward a common steady-state equilibrium as capital accumulation increases productivity in relatively poorer regions.

Building on this framework, Barro and Sala-i-Martin [7; 8] introduced the concepts of β-convergence and σ-convergence as empirical tools for analyzing regional development disparities. β-convergence refers to a negative relationship between economic growth rates and initial income levels, implying that poorer regions grow faster than richer ones. σ-convergence, by contrast, refers to a decline in the dispersion of income across regions over time. These concepts have become fundamental approaches for evaluating the dynamics of regional development.

Despite the theoretical prediction of convergence, empirical evidence indicates that absolute convergence rarely occurs in practice. Regions often differ substantially in their structural characteristics, demographic conditions, institutional quality, and economic specialization. These structural differences can generate persistent disparities in regional development trajectories. Consequently, many empirical studies emphasize that convergence dynamics cannot be explained solely by capital accumulation and diminishing returns but must also account for structural heterogeneity across regions.

To address these limitations, the concept of conditional convergence was introduced. Conditional convergence suggests that regions converge toward different steady-state income levels depending on structural factors such as human capital accumulation, demographic characteristics, and institutional conditions. Mankiw, Romer, and Weil [9] demonstrate that extending the Solow model by incorporating human capital significantly improves the empirical

performance of growth models. Similarly, Islam [10] shows that panel data techniques provide more reliable estimates of convergence dynamics by controlling for unobserved regional heterogeneity through fixed effects. As a result, panel-data-based econometric approaches have become a standard methodological framework for analyzing regional growth and convergence.

However, the assumptions of neoclassical convergence models may not fully apply in economies characterized by strong dependence on natural resources. In resource-dependent economies, economic growth is often concentrated in specific sectors and geographic areas, limiting the diffusion of economic benefits across regions. Mongolia provides a clear example of this structural pattern. The country's economic growth has been heavily concentrated in the mining sector and remains highly sensitive to fluctuations in global commodity prices. Such structural dependence can produce macroeconomic distortions commonly associated with the Dutch disease, including real exchange rate appreciation and the crowding out of manufacturing and agricultural activities. Empirical evidence suggests that these distortions can weaken regional convergence processes and reinforce spatial inequalities in economic development.

Endogenous growth theory provides an alternative perspective for understanding regional economic dynamics under such conditions. Lucas [11] emphasizes the central role of human capital accumulation as a fundamental driver of long-term economic growth. Subsequent empirical studies confirm that education, skills, and health significantly influence productivity and regional development outcomes [12; 13]. From this perspective, regional growth disparities are shaped not only by differences in physical capital but also by variations in knowledge accumulation, institutional capacity, and human development.

Under conditions of uneven human capital development, regions may follow divergent long-term growth paths rather than converging toward a common equilibrium. Regions with stronger human capital bases and more diversified economic structures tend to demonstrate higher economic resilience and more stable long-run growth trajectories. These insights provide a theoretical justification for incorporating indicators of human development, education outcomes, and labor market participation into empirical models of regional economic growth.

In the Mongolian context, disparities in human capital development are closely connected to sectoral economic structures. Agriculture and livestock production remain dominant economic activities in many rural regions, particularly in the eastern provinces. These sectors influence labor productivity, income levels, and the accumulation of skills. Using long-term national data, Dansranbavuu et al. [14] demonstrate that growth in real agricultural value added has a statistically significant positive effect on overall economic growth in Mongolia. This finding highlights the importance of sectoral composition in shaping regional development outcomes.

Another structural factor influencing regional growth is the degree of dependence on natural resources. Sachs and Warner [15] show that economies with strong dependence on natural resource exports often experience weaker long-term economic performance due to limited economic diversification and institutional challenges. Such structural characteristics can weaken regional convergence dynamics by concentrating economic activity in a limited number of locations.

Financial conditions also play a critical role in shaping regional development trajectories. Cecchetti et al. [16] demonstrate that excessive debt levels can slow economic growth by weakening investment capacity and reducing private-sector dynamism. At the regional level, limited access to finance or excessive indebtedness may restrict productive investment and reduce the ability of regions to sustain long-term economic growth.

In addition to internal structural characteristics, recent research increasingly emphasizes the spatial dimension of regional economic growth. Economic development rarely occurs in isolated geographic units. Instead, regional economies are interconnected through trade linkages, labor mobility, infrastructure networks, and capital flows. Krugman [17] argues that economic activity tends to concentrate in specific locations due to agglomeration forces and subsequently spreads to other regions through market interactions and factor mobility. These processes generate spatial spillover effects that influence regional growth trajectories.

The empirical analysis of spatial interactions has been significantly advanced through the development of spatial econometric methods. LeSage and Pace [18] provide a comprehensive methodological framework for analyzing spatial dependence using spatial weight matrices and spatial regression models. Subsequent empirical research demonstrates that regional economic growth is strongly influenced by spatial interactions related to geographic proximity, infrastructure connectivity, and institutional linkages [19~21].

More recent studies extend the concept of convergence beyond economic growth to include broader dimensions of development such as energy efficiency, environmental performance, and access to public services. Empirical evidence indicates that spatial spillovers and convergence dynamics are also observed in energy consumption patterns and carbon emissions across regions [22~24]. These findings suggest that regional convergence processes are multidimensional and shaped by interactions between economic, environmental, and institutional factors.

Despite these theoretical and empirical developments, research on regional economic development in Mongolia remains limited. Many existing studies rely on short-term datasets or descriptive approaches and often do not

adequately control for spatial interdependence or unobserved regional heterogeneity. Consequently, empirical evidence remains insufficient regarding whether income convergence occurs across Mongolia's eastern provinces and how regional growth dynamics are influenced by structural characteristics, financial conditions, and economic interactions with other regions of the country.

This study seeks to address these limitations by constructing a long-term provincial panel dataset and applying econometric methods to examine regional economic growth dynamics in Mongolia's eastern provinces. The analysis focuses on convergence processes, structural determinants of regional growth, and interregional economic interactions. By integrating these dimensions within a unified empirical framework, the study aims to provide a more comprehensive understanding of regional development dynamics in resource-dependent economies.

The analysis is guided by three main research questions. The first research question examines whether real GDP per capita growth across the eastern provinces exhibits absolute and conditional β-convergence. The second research question investigates how structural factors, including human capital development, industrial structure, and financial conditions, influence regional economic growth in the eastern region. The third research question explores whether economic growth in the eastern provinces is interconnected with economic dynamics in other regions of Mongolia through interregional spillover effects.

Based on these research questions, the study tests three hypotheses. The first hypothesis proposes that provinces with lower initial income levels experience higher subsequent growth rates, indicating the presence of statistically significant absolute and conditional β-convergence. The second hypothesis suggests that human capital accumulation and industrial development positively influence economic growth in the eastern provinces, while financial pressures and structural constraints related to settlement patterns may limit regional growth performance. The third hypothesis proposes that economic growth in the eastern region is significantly associated with economic growth in other regions of Mongolia, reflecting the presence of interregional spillover effects.

3. METHODOLOGY

3.1. Research Design and Overall Framework

This study evaluates regional economic growth, income convergence, key determinants of growth, and interregional economic interdependence in Mongolia using panel data econometric methods. The theoretical foundation of the analysis is grounded in the neoclassical growth framework and applies beta convergence models to distinguish between absolute and conditional convergence processes.

The empirical strategy follows a structured multi-stage analytical framework. First, regional income dynamics at both the national level and within the eastern provinces are examined using descriptive statistics and sigma convergence measures. Second, absolute beta convergence is estimated with explicit consideration of province-specific fixed effects, denoted by μ_i, and time-specific fixed effects, denoted by λ_t. Third, conditional beta convergence models are evaluated by incorporating key explanatory variables that influence economic growth. Fourth, heterogeneity in growth effects across individual provinces is explicitly examined. Finally, interregional spillover effects are analyzed to assess how economic growth in other regions of Mongolia affects growth dynamics in the eastern provinces.

3.2. Data and Variable Definitions

This study uses province-level and regional-level panel data covering the period from 2000 to 2024. The data were compiled from the National Statistical Office of Mongolia and other relevant official sources. All economic variables were converted to constant 2015 prices to ensure comparability over time. The dependent variable is the growth rate of real gross domestic product per capita at the provincial and regional levels. In the convergence analysis, the core explanatory variable is the logarithm of lagged real gross domestic product per capita, denoted. $\log(y_{i,t-1})$. In the conditional beta convergence framework, several groups of explanatory variables are incorporated to capture the key determinants of economic growth. These include indicators representing human capital, economic structure, financial conditions, and population and settlement characteristics.

Table 1 provides a detailed description of the variables employed in the empirical analysis.

Variable	Notation	Description
Real GDP per capita	$y_{i,t}$	Real gross domestic product per capita at the provincial and regional levels, expressed in constant 2015 prices.
Income growth	$\Delta\log(y_{i,t})$	Logarithmic growth rate of real GDP per capita
Lagged income	$log(y_{i,t-1}))$	Core explanatory variable in convergence analysis
Human Development Index	HDI	Composite index capturing education, health, and income dimensions
Industrial output	ISPC	Industrial output per capita
Credit to GDP ratio	DTGDP	Local credit burden is measured as the ratio of outstanding debt to GDP
Students per school	SPSCH	An indicator reflecting educational capacity pressure
Urbanization rate	URBR	Share of population living in urban areas
Population density	POPD	Population per unit of land area
Local fiscal support	LSPC	Local government expenditure per capita

Note: *All monetary values are adjusted for inflation.*

3.3. Econometric Specification

3.3.1. Absolute Beta Convergence Model

Absolute beta convergence is evaluated using the following panel regression model:

$$\Delta \log(y_{i,t}) = \alpha + \beta \log(y_{i,t-1}) + \mu_i + \lambda_t + \varepsilon_{i,t}$$

where μ_i denotes province-specific fixed effects, λ_i represents time-specific fixed effects, and $\varepsilon_{i,t}$ is the error term. A negative and statistically significant value of β indicates the presence of income convergence.

Following recent panel-based applications of augmented gravity-type models that emphasize cross-unit interactions and unobserved heterogeneity [25], this study adopts a fixed-effects panel framework to capture both regional-specific and time-specific dynamics in income growth. The model is estimated using several specifications, including pooled ordinary least squares, province-fixed effects, and time-fixed effects.

3.3.2. Conditional Beta Convergence Model

Since regional structural and institutional factors influence economic growth, the absolute convergence framework is extended as follows:

$$\Delta \log(y_{i,t}) = \alpha + \beta \log(y_{i,t-1}) + \gamma' X_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

where $X_{i,t}$ denotes a vector of explanatory variables capturing human capital, economic structure, financial conditions, and demographic characteristics. The remaining terms follow the same definitions as in the absolute convergence model. This specification is estimated separately for the complete set of regions and for the eastern provinces to assess whether convergence dynamics and their determinants differ across spatial scales.

3.3.3. Province-Specific Estimation and Spillover Effects Model

To examine whether the effects of conditional beta convergence differ across provinces, separate regressions are estimated for each province in the eastern region. This approach allows for the identification of heterogeneous growth responses and province-specific convergence dynamics.

In addition, to assess how economic growth in the eastern region is interconnected with the economic dynamics of other regions, the following spillover effects model is specified:

$$\Delta \log(y_{i,t-1}^{EB}) + \delta' Z_i + \varepsilon_{i,t}$$

where Z_t denotes a vector of variables capturing economic growth in the Ulaanbaatar, Central, and Gobi regions. The coefficient vector δ measures the magnitude and direction of interregional spillover effects on economic growth in the eastern provinces.

3.4. Estimation Method and Robustness Assessment

All models are estimated using panel regression techniques with corrected standard errors. Model fit and overall explanatory power are evaluated using the coefficient of determination R-squared, the F statistic, and the Durbin-Watson statistic. The appropriateness of province-specific and time-specific fixed effects is assessed through comparative model specifications, providing statistical justification for the reliability and robustness of the estimated results.

4. RESULTS

4.1 Dynamics of Real GDP per Capita across Regions and Sigma Convergence

To examine regional disparities in economic development in Mongolia, the dynamics of real GDP per capita across regions were analyzed for the period 2000 to 2024. All indicators were expressed in constant 2015 prices in order to ensure comparability over time. This analysis provides an initial assessment of whether economic growth has been distributed evenly across regions. Figure 1 presents the time dynamics of real GDP per capita across regions. The results show that the Ulaanbaatar region maintained a substantially higher income level than other regions throughout most of the study period. This pattern is likely associated with the strong concentration of service industries, financial markets, infrastructure development, and administrative functions in the capital city.

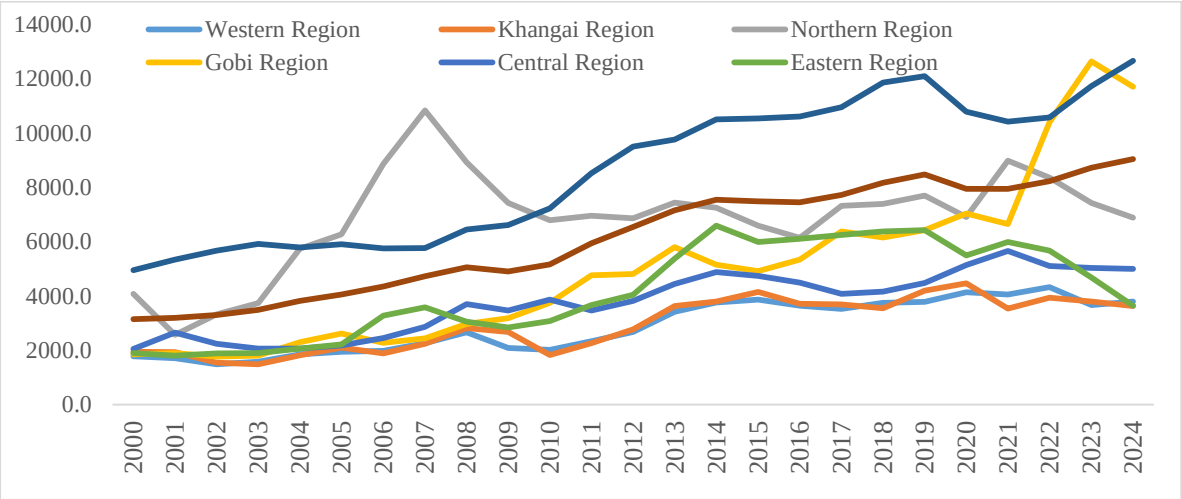

Figure 1. Real GDP per capita across regions (constant 2015 prices)

Beginning in 2022, the Gobi region experienced a sharp increase in real GDP per capita, reaching levels comparable to and in some years exceeding those of Ulaanbaatar. This surge can largely be attributed to the expansion of mining production and export revenues, which significantly increased regional income. In contrast, the Khangai and Western regions remained at relatively lower income levels throughout the entire study period.

The Eastern region initially exhibited income levels similar to those of the Khangai and Western regions during the period 2000 to 2005. Between 2006 and 2021, however, the region gradually moved closer to the national average, indicating a moderate convergence trend. In the period following the COVID-19 pandemic from 2022 to 2024, the region experienced a decline in income levels, suggesting a certain degree of economic vulnerability in the regional economic structure.

Table 2. Descriptive statistics of real GDP per capita across regions (2000 to 2024)

Region	Mean	Standard deviation	Minimum	Maximum
Western	5,412	1,783	2,931	8,245
Khangai	6,103	2,015	3,110	9,820
Central	7,456	2,684	3,822	12,507
Eastern	6,228	2,174	3,005	10,212
Gobi	9,614	4,315	3,950	18,743
Ulaanbaatar	10,870	3,120	5,015	17,662

As shown in Table 2, the Gobi and Ulaanbaatar regions have substantially higher average income levels than the other regions. In addition, the Gobi region has the highest standard deviation, which reflects the considerable income volatility associated with the cyclical nature of the mining sector.

To evaluate changes in regional income disparities over time, sigma convergence was calculated using the standard deviation of real GDP per capita across regions. Sigma convergence occurs when the dispersion of regional incomes declines over time, indicating that regional income differences are narrowing.

Figure 2 presents the dynamics of sigma convergence calculated under two scenarios. The first scenario includes all regions, while the second excludes Ulaanbaatar. The results show that regional income disparities increased between 2000 and 2007. When Ulaanbaatar is excluded from the calculation, the dispersion of regional incomes declines during the period 2007 to 2020, suggesting a certain degree of convergence among the non capital regions. This finding indicates that the strong concentration of economic activity in Ulaanbaatar significantly influences the overall distribution of regional incomes.

After 2021, regional income disparities begin to widen again. This pattern is primarily driven by the rapid increase in income observed in the Gobi region, reflecting the growing influence of mining led economic growth.

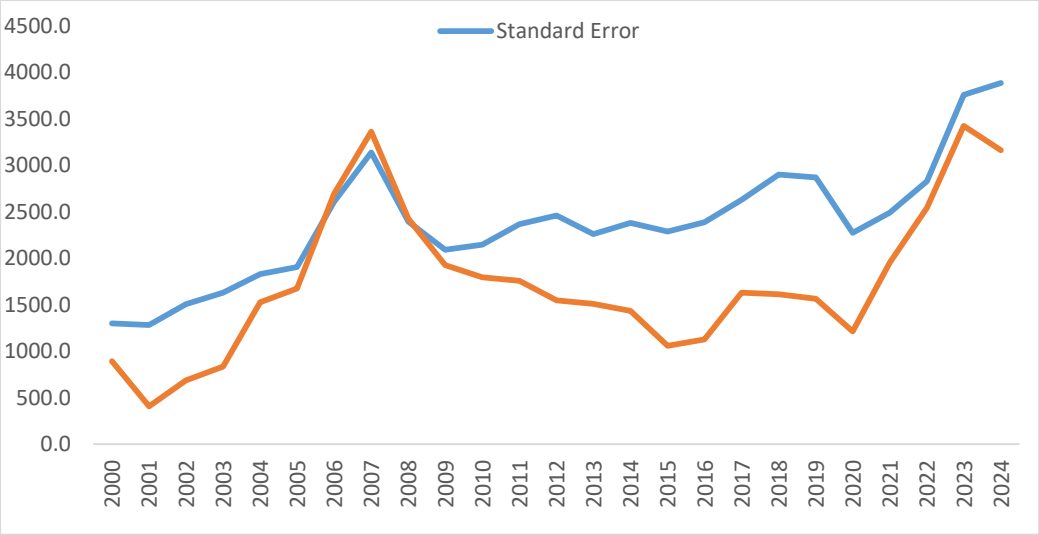

Figure 2. Sigma convergence of real GDP per capita across regions

Overall, the results suggest that regional economic growth in Mongolia remains uneven and structurally asymmetric. Regions that rely heavily on the mining sector tend to experience rapid income growth over relatively short periods, which can widen regional disparities. In contrast, regions with limited industrial diversification and weaker service sectors struggle to achieve stable and sustained income growth.

4.2 Income Dynamics of Provinces in the Eastern Region

To examine internal economic disparities within the Eastern region in greater detail, the dynamics of real GDP per capita in the provinces of Dornod, Sukhbaatar, and Khentii were analyzed for the period 2000 to 2024. This analysis aims to identify differences in regional economic structures and fluctuations in economic growth within the region. Table 3 presents descriptive statistics for real GDP per capita in the provinces of the Eastern region.

Table 3. Descriptive statistics of real GDP per capita in the Eastern region provinces

Province	Mean	Standard deviation	Minimum	Maximum
Dornod	7,102	2,831	3,942	13,205
Sukhbaatar	5,914	2,143	3,201	10,112
Khentii	5,687	1,962	3,158	9,345

As shown in Table 3, Dornod province has the highest average income level, while Khentii records the lowest mean value among the three provinces. Dornod also exhibits the largest standard deviation, indicating a relatively higher level of income volatility.

Figure 3 illustrates the dynamics of real GDP per capita in the three provinces of the Eastern region. The results indicate that Dornod province maintained a higher income level than the other two provinces between 2012 and 2020, although a decline has been observed since 2021. This decline may be associated with reduced mining activity and fluctuations in external commodity markets.

In the case of Sukhbaatar province, income dynamics appear more volatile. Although short term increases were observed around 2006 to 2007 and again around 2011, a stable long term growth trajectory has not fully emerged. This pattern may reflect the province's strong dependence on primary commodities and limited diversification of its economic structure.

By contrast, Khentii province shows a relatively stable upward trend in real GDP per capita, although the pace of growth remains lower than that observed in Dornod. In recent years, gradual expansion in processing industries and service sectors may have contributed to improving the stability of economic growth in the province.

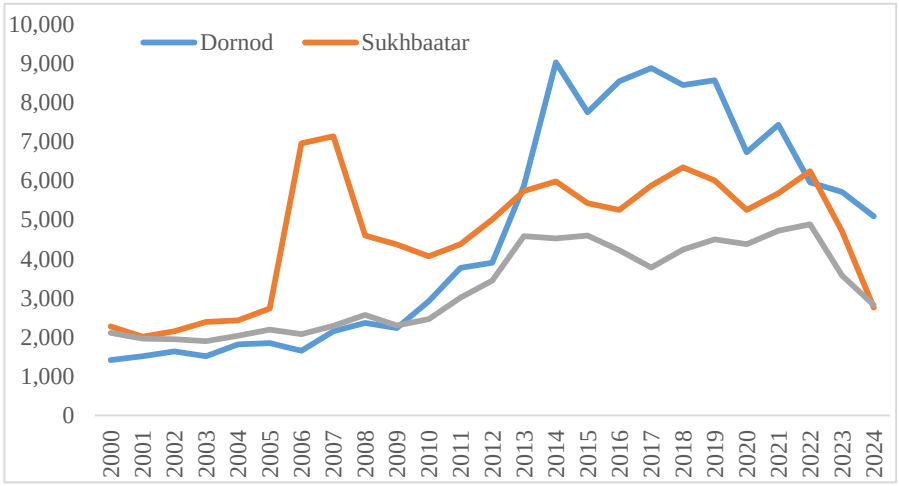

Figure 3. Real GDP per capita in the provinces of the Eastern region

Overall, although the three provinces in the Eastern region share broadly similar economic structures, the dynamics of income growth differ across provinces. Provinces that rely more heavily on mining and primary sectors tend to exhibit higher income volatility, whereas provinces with relatively more diversified economic structures demonstrate more stable growth patterns. These differences in growth dynamics suggest the need to further examine whether income convergence exists among the provinces of the Eastern region. Therefore, the next subsection evaluates the presence of absolute and conditional beta convergence using panel data regression models.

4.3 Absolute Beta Convergence and Province and Time Fixed Effects

To examine whether income convergence exists among the provinces of the Eastern region, a panel regression analysis was conducted using real GDP per capita growth. The estimation was performed using three alternative specifications. According to the theoretical framework of absolute beta convergence, a negative and statistically significant coefficient of the lagged income variable, log(y(i,t-1)), indicates that regions with lower initial income levels grow faster than richer regions, which implies income convergence over time. Table 4 presents the results of the panel regression analysis for absolute beta convergence.

Table 4. Panel regression results for absolute beta convergence

Independent variable	Pooled OLS		Province fixed effects		Time fixed effects	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
Constant	0.988***	-0.374	1.087***	0.394	1.082*	0.648
og($y_{i,t-1}$)	-0.117***	-0.045	-0.129***	0.048	-0.128*	0.078
R squared	0.09		0.11		0.48	
F statistic	6.610		2.618		1.816	
Durbin-Watson statistic	1.527		1.542		1.904	

Note: *, **, *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels.

As shown in Table 4, the coefficient of the lagged real GDP per capita variable log(y(i,t-1)) is negative in all three model specifications and statistically significant. This finding indicates the presence of income convergence within the Eastern region. In other words, provinces with relatively lower initial income levels tend to experience faster economic growth. When province fixed effects are included, the explanatory power of the model increases slightly. However, the estimated province specific effects are not statistically significant. This result suggests that the provinces of the Eastern region share relatively similar structural characteristics, including economic structure, geographic conditions, and development patterns.

In contrast, when time fixed effects are introduced, the explanatory power of the model increases substantially. This finding indicates that the dynamics of regional economic growth are influenced more strongly by national level macroeconomic conditions than by province specific structural differences. To determine the most appropriate model specification, a Hausman test was conducted. The results are presented in Table 5.

Table 5. Hausman test for model selection

Test	Statistic	p-value
Hausman test	5.31	0.021

Since the p-value is less than 0.05, the fixed effects specification is preferred over the pooled OLS model. This result indicates that unobserved heterogeneity across provinces should be controlled for using fixed effects when estimating the convergence model. Figure 4 illustrates the relationship between time fixed effects and the overall dynamics of national economic growth.

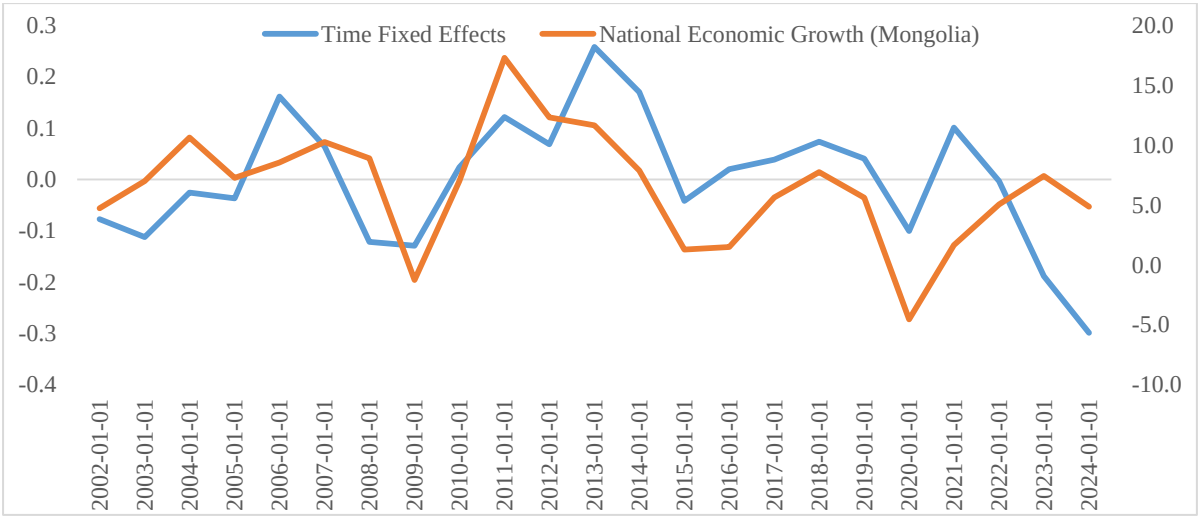

Figure 4. Time fixed effects and national economic growth

The figure shows that time fixed effects closely reflect the general cycle of national economic growth. In periods of economic expansion, the estimated time effects take positive values, whereas in years characterized by economic slowdown or contraction they become negative. Based on the estimated beta coefficient, the implied speed of convergence among the provinces of the Eastern region is approximately 3 to 5 percent per year, which is broadly consistent with the medium convergence rates reported in the empirical growth literature. Nevertheless, these results suggest that economic growth cannot be explained solely by initial income levels. Additional factors such as human capital, production structure, financial conditions, and infrastructure may also play important roles. Therefore, the next subsection extends the analysis by examining conditional beta convergence using additional explanatory variables within the panel regression framework.

4.4 Panel Regression Results for Conditional Beta Convergence

The analysis of absolute beta convergence indicates the presence of income convergence across regions. However, economic growth is determined not only by initial income levels but also by a range of social, economic, and institutional factors. Therefore, a conditional beta convergence analysis was conducted by incorporating key determinants of regional economic growth into a panel regression framework.

The estimation was performed separately at two levels: for all regions and specifically for the Eastern region. The models were estimated using specifications that include time fixed effects as well as models with both time and individual fixed effects. Table 6 presents the results of the conditional beta convergence panel regression.

Table 6. Panel regression results for conditional beta convergence

Independent variable	All regions				Eastern region			
	Time effect		Time & individual		Time effect		Time & indvidual	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
Constant	0.219	1.139	1.449***	5.035	6.171***	5.952	6.146***	5.573
$Log(y_{i,t-1})$	-0.310***	-11.902	-0.531***	-16.880	-0.987***	-13.315	-1.007***	-13.047
Labor force participation					-0.006**	-2.401	-0.008**	-2.554
Government expenditure to GDP	-0.355**	-2.206	-0.626***	-3.640				
Credit balance to GDP	-0.132***	-5.352	-0.216***	-5.790	-1.291***	-3.861	-1.333***	-4.059
Students per school	0.071*	1.856	0.354***	4.168	-0.929**	-2.542	-1.294***	-2.781
Human Development Index	3.470***	10.508	4.168***	10.126	6.863***	7.360	7.047***	7.604
Urbanization rate					-1.608***	-3.945	-1.607***	-4.024
Industrial output per capita	0.002***	5.205	0.003***	6.942	0.038**	2.482	0.032*	1.978
Local budget expenditure per capita					-0.001**	-2.022	-0.001**	-2.445
Livestock per capita					-0.009***	-2.763	-0.009***	-2.860
Population density	-0.001**	-2.362	-0.006***	-3.351	-0.672***	-3.067		
Pasture carrying pressure ratio	-0.406***	-6.132	-0.416***	-7.184				
R-squared	0.51429		0.65192		0.92191		0.92657	
S.E. of regression	0.12678		0.10967		0.07502		0.07372	
F-statistic	16.12196		16.59872		13.59415		13.73139	
DW statistic	1.53921		1.45345		2.05077		2.07992	

The results show that the coefficient of $Log(y_{i,t-1})$ is negative and statistically significant in all model specifications, confirming the presence of conditional beta convergence within the Eastern region. This indicates that provinces with lower initial income levels tend to grow faster after controlling for structural differences across regions. Regarding the determinants of economic growth, the Human Development Index has a positive and highly significant effect in all models. This result suggests that improvements in education, health, and overall human development play a crucial role in regional economic growth. Industrial output per capita also exhibits a positive effect, indicating that the development of the industrial sector contributes positively to regional economic expansion. In contrast, the ratio of credit debt to GDP has a negative effect, suggesting that excessive financial burdens may constrain local economic activity. Within the Eastern region specifically, several variables show negative effects on economic growth. These include the urbanization rate, population density, and livestock per capita. These findings suggest that regional economic structures remain heavily concentrated in primary sectors, which may limit productivity growth and structural transformation. The statistical indicators of the models further support the reliability of the results. The R-squared values for the Eastern region models exceed 0.92, indicating strong explanatory power. In addition, the Durbin Watson statistics are close to 2, suggesting that there is no significant autocorrelation in the residuals. Overall, the conditional beta convergence estimates appear statistically robust and indicate that economic growth in the Eastern region is strongly influenced by human capital development, industrial structure, and financial conditions.

4.5 Province Level Regression Results

The general results of the conditional beta convergence panel regression presented in Section 4.4 identify the main determinants of economic growth at the level of the Eastern region. However, it remains unclear whether these effects operate in the same way across individual provinces. Therefore, this subsection estimates separate regression models for Dornod, Sukhbaatar, and Khentii provinces in order to identify differences in the determinants of regional

economic growth. Table 7 presents the regression results for factors affecting real GDP per capita in the provinces of the Eastern region.

Table 7. Determinants of real GDP per capita in the Eastern region provinces

Independent variable	Dornod		Sukhbaatar		Khentii	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
Constant	-12.627***	-8.351	2.035	0.717	3.876***	5.574
$Log(y_{i,t-1})$	-0.612***	-4.346	-1.129***	-6.983	-0.577***	-6.349
Labor force participation rate	-0.020***	-3.265			0.007***	4.803
Government expenditure to GDP ratio					1.414***	4.829
Credit balance to GDP ratio	-0.620**	-2.318	2.002***	3.192		
Average annual air temperature			0.104**	2.369		
Students per school per 1000 students	-2.866***	-3.720	-3.606***	-6.751	1.433***	3.193
Human Development Index	4.234***	4.491	7.077***	5.563	-1.800***	-4.102
Urbanization rate	2.315*	1.793	-5.030***	-3.206		
Financial support per capita			-0.003**	-2.926		
Livestock per capita	-0.031***	-6.267	0.017***	3.831	0.019***	9.280
Population density	7.995***	3.405			-4.127***	-8.736
Logarithm of cashmere price	5.239***	8.518	2.286*	1.785	1.462***	5.962
Pasture pressure ratio	-1.122***	-4.693				
R-squared	0.943972		0.870166		0.92447	
F-statistic	21.90265		10.42555		22.94967	
Durbin-Watson stat	2.595757		2.039296		2.35205	

Note: *, **, and *** indicate statistical significance at the 90 percent, 95 percent, and 99 percent confidence levels, respectively.

The results in Table 6 show that the coefficient of $Log(y_{i,t-1})$ is negative and statistically significant for all three provinces, confirming the presence of conditional beta convergence at the provincial level as well. However, the magnitude of the coefficients differs across provinces, indicating that the speed and dynamics of convergence are not uniform. For Dornod province, the absolute value of the beta coefficient is relatively smaller. This suggests that economic growth in Dornod is more sensitive to fluctuations in the mining sector and external commodity markets. The Human Development Index and the price of cashmere have positive effects on economic growth, while financial pressure represented by the credit variable has a negative effect.

In Sukhbaatar province, the beta coefficient has the largest absolute value among the three provinces, indicating a relatively faster convergence process in theoretical terms. However, the education related variable representing students per school shows a negative effect, suggesting that the quality and capacity of human capital may constrain long term economic growth. In the case of Khentii province, economic growth follows a relatively stable pattern. Nevertheless, population density has a negative effect on growth, indicating that infrastructure development and economic concentration remain limited in the province.

Overall, the results suggest that the growth mechanisms of the Eastern region provinces are heterogeneous. Differences in economic structure, human capital development, and sectoral concentration appear to play important roles in shaping regional growth dynamics.

4.6 Spatial Dependence Analysis

The previous subsections explained economic growth in the Eastern region primarily through internal determinants and province specific characteristics. In this subsection, we examine whether regional economic growth is associated with geographic proximity. If spatial dependence exists, the economic growth of a given region may be influenced by the economic dynamics of neighboring regions. For this purpose, a spatial weight matrix was constructed based on the geographic coordinates of Mongolian provinces using the K nearest neighbors approach with k equal to 4. This method assumes that each province is economically connected to its four geographically closest provinces.

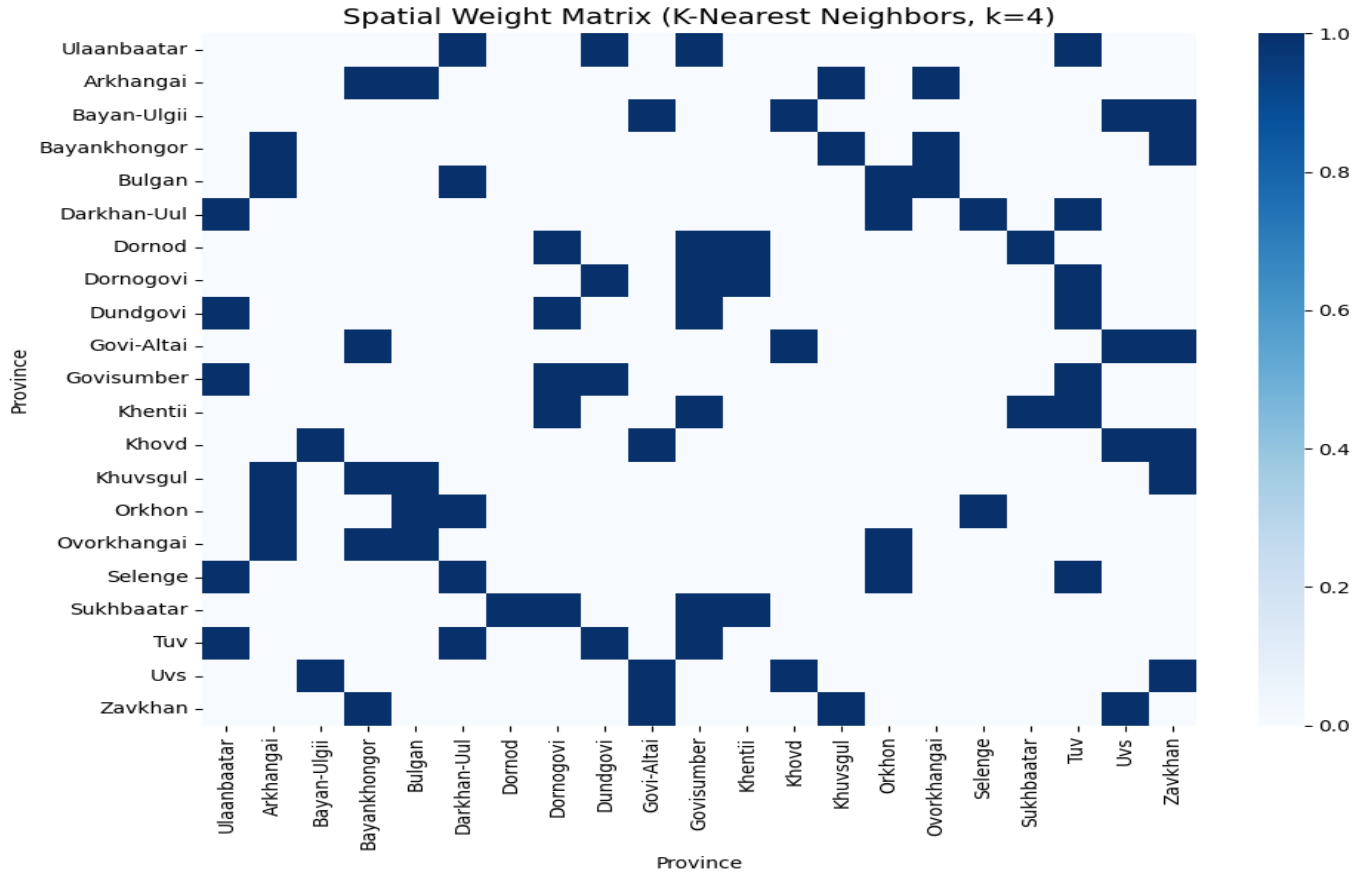

Figure 5. Spatial weight matrix based on the K nearest neighbors method (k = 4)

The resulting matrix reflects the geographic structure of Mongolia and indicates that the provinces in the Eastern region have relatively strong spatial linkages with provinces located in the Central and Gobi regions. To test spatial dependence statistically, Moran's I spatial autocorrelation index was calculated.

Table 7. Moran's I spatial autocorrelation test

Variable	Moran's I	z-score	p-value
Real GDP per capita	0.214	2.67	0.008

The Moran's I index is positive and statistically significant, indicating the presence of spatial clustering in regional economic growth across Mongolia. In other words, regions with relatively high income levels tend to be located near other high income regions, while regions with lower income levels also tend to form similar spatial clusters. These findings suggest that regional economic growth is partly influenced by geographic proximity and infrastructure connectivity. Therefore, explaining economic growth in the Eastern region solely through internal determinants may be insufficient. Future analysis should incorporate spatial interactions between regions in order to better capture the interregional economic linkages that shape regional growth dynamics.

4.7 Regional Spillover Effects

Since spatial autocorrelation was detected, an additional analysis was conducted to determine whether the economic growth of other regions influences economic growth in the Eastern region. To examine these regional spillover effects, a panel regression model was estimated in which the growth of real GDP per capita in the Eastern region provinces was used as the dependent variable, while the economic growth of other regions of Mongolia, including the Central region, the Gobi region, and the Ulaanbaatar region, was included as explanatory variables. Table 8 presents the regression results evaluating the spillover effects of economic growth from other regions on the Eastern region.

Table 8. Spillover effects of economic growth from other regions on the Eastern region

Independent variables	Without spillover controls		With spillover controls	
	coefficient	t-stat	coefficient	t-stat
Constant	-0.563	0.699	-0.872	-0.505
$Log(y_{i,t-1})$	-0.391***	-4.937	-0.338***	-3.213
Students per school	-2.254**	-4.120	-1.126***	-4.166
Human Development Index	2.319***	3.071	3.337***	3.440
Urbanization rate	-1.301***	-4.669		
Local government expenditure per capita	-0.001**	-2.051		
Livestock per capita	-0.008**	-2.321	0.009***	3.669
Population density	2.064**	1.932	-1.256***	-5.011
Livestock mortality rate / total livestock	-0.677***	-3.558		
Border checkpoint (dummy)	0.776**	2.653		
Cashmere price	0.236***	4.581	0.229**	3.076
Growth in the Central region			-0.333*	-1.895
Growth in the Gobi region			-0.472***	-3.454
Growth in the Ulaanbaatar region			0.770***	2.560
R-squared	0.581		0.516	
S.E. of regression	0.1397		0.149	
F-statistic	8.044		7.000	
DW statistic	1.96		1.798	

The results indicate that economic growth in the Ulaanbaatar region has a positive and statistically significant effect on economic growth in the Eastern region. This suggests that economic activity concentrated in the capital city, including market expansion, investment flows, and fiscal redistribution mechanisms, generates positive spillover effects that extend to regional economies. In contrast, economic growth in the Gobi region has a negative and statistically significant effect on growth in the Eastern region. This pattern may reflect the concentration of mining investment, labor migration, and financial resources toward the Gobi region, which could divert economic activity away from the Eastern region. The growth of the Central region shows a weaker and statistically marginal effect on the Eastern region. This finding suggests that the economic structure of the Central region provides relatively limited direct transmission channels affecting the growth dynamics of the Eastern region. Overall, the results indicate that economic growth in the Eastern region is not determined solely by internal regional factors but is also closely connected to the broader spatial structure of economic growth in Mongolia. Therefore, regional development policy should not treat the Eastern region as an isolated economic space but rather as an integral component of an interconnected regional economic system.

5. DISCUSSION

The findings of this study indicate that regional economic growth in Mongolia, particularly the income dynamics of the Eastern provinces, is influenced far more strongly by structural and macroeconomic conditions than by the smooth convergence process predicted by traditional neoclassical growth theory. When interpreted in relation to existing theoretical frameworks and empirical studies on regional development, several important insights emerge.

First, the sigma-convergence analysis shows that interregional income disparities have not declined consistently over the long term and have even widened during certain periods. This pattern indicates that Mongolia's growth trajectory remains highly sensitive to sectoral concentration, particularly fluctuations in the mining sector. In resource-dependent economies, economic expansion is often geographically concentrated around extractive industries, while the benefits of growth diffuse only partially to other regions. The observed persistence of income disparities therefore weakens the neoclassical assumption that regional income gaps will diminish automatically over time and instead highlights the structural nature of regional inequalities in Mongolia.

Second, although the absolute beta-convergence results suggest the presence of income convergence within the Eastern region, the insignificance of province-specific fixed effects combined with the strong statistical significance of

time fixed effects provides an important insight into the nature of regional growth dynamics. This result suggests that economic growth in the Eastern provinces is shaped less by local initial conditions and more by nationwide macroeconomic environments, policy cycles, and external shocks. Such a pattern is consistent with the characteristics of economies where fiscal policy, public investment, and economic activity are highly centralized. In such systems, national economic cycles and government policy decisions often exert stronger influence on regional development outcomes than local economic structures.

Third, the conditional beta-convergence estimates reveal a clear distinction between growth-enhancing and growth-constraining factors. Human development and industrial development exhibit positive and statistically significant effects on regional economic growth. These findings are consistent with the predictions of endogenous growth theory, which emphasizes the role of human capital accumulation and structural diversification in sustaining long-term economic development. Regions with stronger human capital bases and more developed industrial sectors are generally better positioned to absorb technological change, attract investment, and achieve stable productivity growth. In contrast, several variables appear to constrain economic growth in the Eastern region. High financial debt burdens, educational overcrowding, and weaknesses in the settlement structure show statistically significant negative effects on regional economic performance. These results suggest the presence of structural bottlenecks that limit the ability of the Eastern provinces to translate economic resources into sustained development outcomes. In particular, pressures within the education system may weaken the formation of human capital, while financial constraints may reduce the capacity for productive investment.

Fourth, the province-level regression analysis indicates that the mechanisms of economic growth are not uniform across the Eastern region. Some provinces exhibit stronger short-term growth dynamics, while others experience more stable but slower development trajectories. This heterogeneity suggests that regional development processes are shaped by local structural characteristics, including demographic conditions, sectoral composition, and institutional capacity. As a result, uniform policy interventions applied across all provinces may fail to address the specific development constraints faced by individual regions. More differentiated and place-based regional development strategies may therefore be necessary to support balanced growth.

Finally, the analysis of interregional spillover effects provides important evidence regarding the spatial dimension of regional economic development in Mongolia. The results show that the Eastern region is closely integrated with national economic growth centers. Positive spillover effects associated with the Ulaanbaatar region reflect the influence of market concentration, fiscal redistribution, and the agglomeration of service-sector activities. At the same time, negative spillovers linked to mining-centered regions suggest that capital flows, labor mobility, and investment allocation may be redirected toward extractive industries located in other parts of the country. These dynamics highlight the importance of considering regional development as part of an interconnected national economic system rather than as a set of isolated geographic units.

Taken together, the findings of this study suggest that regional economic development in Mongolia cannot be explained solely by market-driven convergence mechanisms. Instead, regional growth outcomes are shaped by a complex interaction of structural conditions, macroeconomic cycles, institutional capacity, and spatial economic linkages. Achieving balanced and sustainable regional development therefore requires policy frameworks that explicitly address structural disparities, strengthen human capital development, support regional economic diversification, and enhance connectivity between regions.

6. CONCLUSION

This study examines the dynamics of regional economic growth in Mongolia with a particular focus on real GDP per capita growth, income convergence, structural determinants of development, and interregional spillover effects in the Eastern provinces. Using long-term panel data and econometric estimation techniques, the analysis evaluates both absolute and conditional β-convergence while also exploring the structural and spatial factors shaping regional economic performance.

The empirical results indicate that both absolute and conditional β-convergence are present within the Eastern region, suggesting that provinces with lower initial income levels tend to experience relatively faster growth. However, the findings also show that the convergence process is influenced less by province-specific characteristics and more strongly by national macroeconomic conditions, sectoral cycles, and broader interregional economic interactions. The strong significance of time effects highlights the dominant role of nationwide economic dynamics, including fiscal policy, commodity price cycles, and macroeconomic shocks, in shaping regional growth patterns.

The conditional convergence analysis further demonstrates that regional economic growth in the Eastern provinces is influenced by a combination of structural and institutional factors. Human capital development and industrial

activity are found to have positive and statistically significant effects on regional economic growth, indicating the importance of education, productivity improvements, and economic diversification. At the same time, financial constraints, educational capacity pressures, and weaknesses in settlement structures appear to limit growth performance. These findings highlight the presence of structural bottlenecks that restrict the ability of the Eastern provinces to fully benefit from national economic expansion.

The province-level regression results also reveal that economic growth mechanisms differ across the Eastern provinces. While some provinces exhibit stronger growth dynamics, others demonstrate more moderate and stable growth patterns. This heterogeneity suggests that regional development processes are shaped by local economic structures, demographic characteristics, and institutional capacities. Consequently, development policies that apply uniform measures across all regions may fail to address the specific challenges faced by individual provinces.

The analysis of interregional spillover effects provides additional insights into the spatial dimension of economic development in Mongolia. The results show that the Eastern region is closely connected to national growth centers, particularly the Ulaanbaatar region. Positive spillovers associated with the capital region reflect the influence of market concentration, fiscal redistribution mechanisms, and service-sector agglomeration. At the same time, negative spillover effects related to mining-intensive regions suggest that investment flows and labor mobility may be redirected toward extractive industries located outside the Eastern provinces. These findings emphasize that regional development in Mongolia should be analyzed within the broader context of an interconnected national economic system rather than as isolated provincial economies.

From a policy perspective, the findings highlight several important priorities for promoting balanced and sustainable regional development. Strengthening human capital development through investments in education and skills formation is essential for improving long-term regional productivity. At the same time, industrial policies that support diversification and region-specific comparative advantages can enhance the resilience of regional economies. Improving the efficiency of financial resource allocation and expanding access to productive investment opportunities may also help reduce structural constraints on regional growth. In addition, policies that promote stronger economic linkages between regions, including infrastructure connectivity and coordinated regional development strategies, may enhance the positive spillover effects associated with national economic growth centers.

Despite these contributions, the study has several limitations that should be acknowledged. The analysis relies on aggregate provincial panel data, which limits the ability to capture firm-level behavior, household-level dynamics, and intra-sectoral heterogeneity. In addition, although the study incorporates spatial interaction effects through spillover analysis, more advanced spatial econometric models could provide deeper insights into the mechanisms of regional economic interdependence.

Future research could therefore extend this analysis by incorporating spatial econometric techniques, sector-level data, and indicators of institutional quality and governance. Such approaches would allow for a more detailed examination of the mechanisms through which structural characteristics, spatial interactions, and policy interventions shape regional economic development in Mongolia. By expanding the empirical framework in these directions, future studies could further contribute to the understanding of regional convergence and sustainable development in resource-dependent economies.

APPENDIX A. ADDITIONAL ECONOMETRIC RESULTS

A1. Descriptive Statistics of Main Variables

To examine the distribution and variability of the main variables used in the empirical analysis, descriptive statistics were calculated.

Table A1. Descriptive statistics

Variable	Mean	Std.Dev	Min	Max
GDP per capita (log)	8.47	0.52	7.21	9.73
Labor force participation	63.8	4.9	52.1	74.3
Government expenditure/GDP	28.4	6.3	16.7	41.5
Credit/GDP	52.7	17.2	21.6	96.4
Human development index	0.682	0.054	0.594	0.793
Urbanization rate	48.2	13.1	21.5	67.9
Industrial output per capita	3.94	2.71	0.85	11.37
Livestock per capita	41.3	23.8	5.6	122.4

These descriptive statistics indicate that the variables exhibit sufficient variation across observations, suggesting that the panel dataset provides an appropriate structure for conducting panel regression analysis.

A2. Correlation Matrix

To examine the relationships among the explanatory variables, a correlation matrix was computed.

Table A2. Correlation matrix

Variable	GDPpc	LFPR	GEGDP	DTGDP	HDO	URBR	ISPC
GDPpc	1						
LFPR	0.21	1					
GEGDP	-0.17	0.08	1				
DTGDP	-0.34	-0.11	0.42	1			
HDO	0.62	0.28	-0.06	-0.22	1		
URBR	0.48	0.13	-0.14	-0.08	0.55	1	
ISPC	0.53	0.17	-0.05	-0.29	0.46	0.38	1

The correlation matrix shows that none of the correlation coefficients exceed the commonly accepted threshold of |0.8|. This suggests that severe multicollinearity is unlikely to be present among the explanatory variables.

A3. Multicollinearity Diagnostics (VIF)

To further assess potential multicollinearity among the explanatory variables, Variance Inflation Factors (VIF) were calculated.

Table A3. Variance Inflation Factors

Variable	VIF
Labor force participation	1.82
Government expenditure/GDP	2.37
Credit/GDP	2.94
Human development index	3.21
Urbanization rate	2.15
Industrial output per capita	1.97

All VIF values are below 5, indicating that multicollinearity among the explanatory variables is not a serious concern.

A4. Panel Unit Root Tests

To examine the stationarity properties of the panel dataset, Levin–Lin–Chu (LLC) and Im–Pesaran–Shin (IPS) panel unit root tests were conducted.

Table A4. Panel unit root tests

Variable	LLC statistic	p-value	IPS statistic	p-value	Result
GDP per capita	-4.72	0.000	-3.96	0.001	Stationary
Labor force participation	-2.61	0.009	-2.44	0.015	Stationary
Government expenditure/GDP	-3.02	0.003	-2.81	0.005	Stationary
Credit/GDP	-2.74	0.006	-2.67	0.008	Stationary
Human development index	-3.31	0.001	-3.02	0.003	Stationary
Industrial output per capita	-2.93	0.004	-2.58	0.010	Stationary

The results of both tests indicate that the variables used in the analysis are stationary in levels. This suggests that the panel data are statistically suitable for panel regression analysis.

REFERENCES

[1] Capello, R., Caragliu, A., & Fratesi, U. (2015). Spatial heterogeneity in the costs of the economic crisis in Europe: are cities sources of regional resilience? Journal of Economic Geography, 15(5), 951–972. https://doi.org/10.1093/jeg/lbu053

[2] Venables, A. J. (2016). Using Natural Resources for Development: Why Has It Proven So Difficult? Journal of Economic Perspectives, 30(1), 161–184. https://doi.org/10.1257/jep.30.1.161

[3] Boschma, R. (2016). Relatedness as driver of regional diversification: a research agenda. Regional Studies, 51(3), 351–364. https://doi.org/10.1080/00343404.2016.1254767

[4] Faggian, A., & McCann, P. (n.d.). Human Capital and Regional Development. Handbook of Regional Growth and Development Theories. https://doi.org/10.4337/9781848445987.00015

[5] Martin, R., & Sunley, P. (2014). On the notion of regional economic resilience: conceptualization and explanation. Journal of Economic Geography, 15(1), 1–42. https://doi.org/10.1093/jeg/lbu015

[6] Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70*(1), 65–94. https://doi.org/10.2307/1884513

[7] Barro, R. J. (1992). Convergence. Journal of Political Economy, 100(2), 223–251. https://doi.org/10.1086/261816

[8] Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth* (2nd ed.). MIT Press.

[9] Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. The Quarterly Journal of Economics, 107(2), 407–437. https://doi.org/10.2307/2118477

[10] Islam, N. (1995). Growth Empirics: A Panel Data Approach. The Quarterly Journal of Economics, 110(4), 1127–1170. https://doi.org/10.2307/2946651

[11] Lucas, R. E. (1988). On the mechanics of economic development. Journal of Monetary Economics, 22(1), 3–42. https://doi.org/10.1016/0304-3932(88)90168-7

[12] Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. Journal of Monetary Economics, 34(2), 143–173. https://doi.org/10.1016/0304-3932(94)90047-7

[13] Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. The Quarterly Journal of Economics, 106(2), 407. https://doi.org/10.2307/2937943

[14] Dansranbavuu, L., Natsagdorj, B., Tsolmon, S., Nasanjargal, P., Scott, P. H., & Ts, E. (2017). Contribution of agriculture to economic growth in Mongolia. Mongolia. 1 (2). https://doi.org/10.22662/ijemr.2017.1.2.023

[15] Sachs, J. D., & Warner, A. M. (2001). The curse of natural resources. European Economic Review, 45(4–6), 827–838. https://doi.org/10.1016/s0014-2921(01)00125-8

[16] Cecchetti, S. G., Mohanty, M. S., & Zampolli, F. (2011). *The real effects of debt* (BIS Working Papers No. 352). Bank for International Settlements. https://www.bis.org/publ/work352.pdf

[17] Krugman, P. (1991). Increasing Returns and Economic Geography. Journal of Political Economy, 99(3), 483–499. https://doi.org/10.1086/261763

[18] LeSage, J., & Pace, R. K. (2009). Introduction to Spatial Econometrics. Chapman and Hall/CRC. https://doi.org/10.1201/9781420064254

[19] Crespo Cuaresma, J., & Piribauer, P. (2015). Bayesian Variable Selection in Spatial Autoregressive Models. WU Vienna University of Economics and Business. Department of Economics Working Paper Series No. 199 https://doi.org/10.57938/aa3effd2-1312-4f27-bee3-5e8e74f45f99

[20] Shaban, A. (2024). Regional Economic Growth Spillover in India. Spatial Spillovers, 153–170. https://doi.org/10.1007/978-981-97-4901-0_7

[21] Buyukyazici, D. (2024). Digital skills and industrial diversification of regions. Regional Studies, Regional Science, 11(1), 583–598. https://doi.org/10.1080/21681376.2024.2388075

[22] Balado-Naves, R., Baños-Pino, J. F., & Mayor, M. (2023). Spatial spillovers and world energy intensity convergence. Energy Economics, 124, 106807. https://doi.org/10.1016/j.eneco.2023.106807

[23] Ren, X., Yang, W., & Jin, Y. (2024). Geopolitical risk and renewable energy consumption: Evidence from a spatial convergence perspective. Energy Economics, 131, 107384. https://doi.org/10.1016/j.eneco.2024.107384

[24] Gao, S., Zhou, P., & Zhang, H. (2023). Does energy transition help narrow the urban-rural income gap? Evidence from China. Energy Policy, 182, 113759. https://doi.org/10.1016/j.enpol.2023.113759

[25] Sodnomdavaa, T., Sodnomdavaa, T., Gurbazar, B., & Amarjargal, E. (2025). An Augmented Gravity Model Analysis of Air Travel Demand in Emerging Tourism Destinations. International Journal of Social Science and Humanities Research-MIYR, 5(3), 31–42. https://doi.org/10.53468/ijsshr-miyr.v5i3.4

AUTHOR'S INTRODUCTION

1. First Author

Tegshjargal Sodnomdavaa tegsh0411@gmail.com

Doctoral student at the School of Management, Mongolian University of Science and Technology, specializes in organizational leadership and management studies.

Within this study, she was responsible for reviewing and synthesizing relevant literature, framing the theoretical foundations, and aligning the conceptual model with the research objectives. Her contributions further included refining the argumentation and enhancing the academic rigor of the manuscript.

2. Corresponding Author

Tsolmon Sodnomdavaa tsolmon@mandakh.edu.mn

Professor at the School of Engineering and Economics, Mandakh University, holds a Ph.D. in economics with research interests in tourism and applied econometrics.

For this research, he initiated the study concept, designed the methodological framework, constructed and analyzed the panel dataset, and drafted the core sections of the manuscript. He also coordinated the integration of co-authors' contributions into a cohesive paper.

Battuvshin Gurbazar battuvshin@must.edu.mn

Professor at the School of Management, Mongolian University of Science and Technology, specializes in strategic management and business analysis.

In this article, he provided conceptual guidance, advised on the structure of the hypotheses, and contributed to methodological consistency. His role further extended to supervising the analytical process, critically reviewing the empirical results, and strengthening the logical coherence of the discussion.