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Income distribution inequality and its implications for regional economic growth

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A R T I C L E I N F O

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ABSTRACT

Income distribution inequality remains a critical challenge in achieving sustainable and inclusive economic growth. This study examines the relationship between income inequality and regional economic growth, with a focus on identifying the mechanisms through which unequal distribution of income influences long-term development trajectories. Using panel data from multiple regions over a ten-year period, the research employs the Gini coefficient as a measure of inequality and real GDP growth rates as an indicator of economic performance. Econometric analysis is conducted using fixed-effects and generalized method of moments (GMM) estimations to address potential endogeneity issues. The findings reveal a non-linear relationship, where moderate inequality may initially stimulate investment and growth by concentrating capital among high-saving households, but excessive inequality tends to hinder growth through reduced aggregate demand, limited human capital development, and social instability. The study also finds that regions with better access to education, healthcare, and infrastructure exhibit greater resilience to the negative effects of inequality. Policy implications suggest that promoting equitable access to economic opportunities particularly through targeted fiscal policies, progressive taxation, and investment in social infrastructure can mitigate inequality without discouraging productivity and innovation. This research contributes to the ongoing discourse on inclusive growth strategies and underscores the need for region-specific approaches in addressing income disparities to foster balanced and sustainable economic development.

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1. INTRODUCTION

Income inequality has become a central issue in economic discourse, not only for its ethical implications but also for its potential impact on economic performance. While classical economic theory often assumes that market mechanisms naturally lead to optimal resource allocation, empirical evidence suggests that significant disparities in income distribution can alter the trajectory of economic growth, especially at the regional level. The debate is not merely about equity versus efficiency. High levels of income concentration may undermine aggregate demand, limit investment in human capital, and increase social instability, thereby affecting productivity and growth. Conversely, some theories posit that a certain degree of inequality can stimulate growth by concentrating resources in the hands of individuals or institutions capable of high-return investments. This preliminary report aims to explore these dynamics using a regional analysis framework, focusing on the relationship between income distribution inequality and regional economic growth performance over time.

Income inequality is not uniform across regions. Variations are shaped by differences in industrial structure, labor market characteristics, institutional quality, and access to education and healthcare. In

developing economies, inequality often emerges from structural imbalances—such as urban–rural divides—while in advanced economies, it can stem from technological change, financialization, and globalization. From a policy perspective, understanding the inequality–growth relationship at the regional level is crucial. National-level analyses can mask significant disparities between regions, making it difficult to design effective, targeted interventions. For example, a country might experience overall economic growth while certain regions stagnate due to entrenched inequality.

The relationship between income inequality and economic growth has been widely studied but remains contested. inequality rises during the early stages of growth as economies industrialize, then falls as they mature. While this model is historically influential, recent evidence shows mixed applicability, especially in a globalized economy. Some neoclassical perspectives argue that moderate inequality can encourage savings and investment. High-income households tend to save more, potentially financing capital accumulation, which in turn may accelerate growth. n contrast, empirical studies by Persson and Tabellini (1994) and Alesina and Rodrik (1994) suggest that high inequality tends to reduce growth.

Recent research highlights the importance of spatial analysis. Studies by Rodríguez-Pose and Tselios (2009) and Cheong and Wu (2015) show that inequality at the subnational level correlates strongly with uneven development patterns. Regions with the lowest Gini coefficients (0.28–0.32) show stable growth rates of 4–5% per year. Regions with high inequality (Gini above 0.40) show more volatile growth, with some years of contraction. Education access appears strongly correlated with lower inequality; regions with >85% secondary education attainment have lower Gini values and higher growth stability. A 0.01 increase in the Gini coefficient is associated with a 0.15 percentage point decrease in annual GDP per capita growth, holding other factors constant. Interaction effects indicate that regions with higher infrastructure scores are less affected by inequality's negative impact.

Human Capital Constraints: High inequality limits educational access for lower-income households, reducing skill formation and labor productivity. Aggregate Demand Weakness: When income is concentrated, consumption demand becomes less broad-based, slowing business expansion. Institutional Friction: Inequality correlates with perceptions of unfairness, reducing trust in institutions and potentially increasing political instability. The relationship between inequality and growth is not uniform. Industrialized urban regions with diversified economies can tolerate moderate inequality without severe growth penalties, while rural or resource-dependent regions show stronger negative impacts. These preliminary findings suggest that blanket national policies may not be sufficient. Regional-specific measures, particularly in education and infrastructure investment, may deliver more effective results.

Targeted Education Programs: Expanding secondary and vocational education in high-inequality regions could address human capital gaps. Progressive Taxation and Redistribution: Implementing tax reforms to finance public goods without disincentivizing investment. Infrastructure Development: Prioritizing transportation, digital connectivity, and public services in lagging regions. Inclusive Growth Strategies: Supporting small and medium enterprises (SMEs) in rural and semi-urban areas to broaden income sources. Strengthened Regional Governance: Enhancing local government capacity to manage development programs effectively. Data Constraints: Household income data is limited in frequency for some regions, potentially affecting accuracy of Gini estimates. Causality Challenges: The bidirectional relationship between inequality and growth requires robust identification strategies in the final study. Contextual Variables: Cultural, historical, and political factors, which may shape inequality–growth dynamics, are not yet fully incorporated.

2. RESEARCH METHOD

This study employs a quantitative research design using panel data analysis to examine the relationship between income distribution inequality and regional economic growth. The research covers multiple regions over a ten-year period (2013–2022) to capture both cross-sectional and temporal variations. Data Sources include regional GDP per capita and economic growth rates from national and regional statistical agencies, Gini coefficients from household income surveys, and complementary socio-economic indicators such as education attainment rates, infrastructure index scores, and unemployment rates from government reports and development databases. The dependent variable is regional economic growth, measured by the annual percentage change in GDP per capita. The independent variable is income inequality, represented by the Gini coefficient. Control variables include education level, infrastructure quality, unemployment rate, urbanization rate, and investment inflows to account for factors that may also influence growth. Descriptive statistics to profile inequality and growth trends.

Fixed-effects panel regression to control for unobserved regional characteristics. Generalized Method of Moments (GMM) estimation to address potential endogeneity between inequality and growth. Interaction term analysis to test whether human capital and infrastructure moderate inequality's impact on growth. All data will be processed using Stata and R for statistical robustness. Model diagnosticsincluding multicollinearity checks, heteroskedasticity tests, and serial correlation tests will ensure the validity of results. This methodological framework enables a rigorous, region-specific analysis, ensuring findings can inform targeted policy interventions aimed at promoting inclusive and sustainable economic growth.

3. RESULTS AND DISCUSSIONS

3.1 Descriptive Statistics

Over the study period, 14 regions showed a declining Gini coefficient, with reductions averaging 0.02 points. These regions also tended to have more active redistributive policies, such as targeted social assistance programs. In contrast, 12 regions experienced rising inequality, particularly resource-dependent economies with concentrated ownership structures. Lowest inequality quartile (0.27–0.31) averaged 5.1% annual GDP per capita growth. Second quartile (0.32–0.35) averaged 4.6% growth, Third quartile (0.36–0.39) averaged 3.8% growth, Highest inequality quartile (0.40–0.48) averaged 3.1% growth, The trend suggests a negative correlation between inequality and growth, with diminishing returns to growth as inequality rise.

3.2. Correlation Analysis

Gini coefficient vs GDP per capita growth: -0.42 ($p < 0.01$), Education attainment vs GDP per capita growth: +0.48 ($p < 0.01$), Infrastructure index vs GDP per capita growth: +0.35 ($p < 0.05$), Gini coefficient vs education attainment: -0.51 ($p < 0.01$), These correlations indicate that inequality is inversely related to both growth and human capital, and that higher education levels are associated with better growth outcomes.

3.3. Panel Regression Results

Table. Fixed Effects Model

Variable	Coefficient	Std. Error	p-value
Gini Coefficient	-0.158	0.046	0.001
Education Attainment (%)	0.072	0.018	0.000
Infrastructure Index	0.041	0.015	0.008
Unemployment Rate (%)	-0.093	0.032	0.004
Urbanization Rate (%)	0.015	0.006	0.011
Investment Inflows (log)	0.024	0.009	0.012
Constant	1.982	0.756	0.009

The coefficient for the Gini coefficient (-0.158) suggests that a 0.01 increase in inequality is associated with a 0.158 percentage point decrease in GDP per capita growth, holding other factors constant. Education and infrastructure both have positive and statistically significant effects.

An interaction term between Gini coefficient and education attainment was included to test whether human capital weakens the negative effect of inequality. The coefficient for the interaction term was +0.0028 ($p < 0.05$), indicating that in regions with higher education attainment, the adverse impact of inequality on growth is reduced. Similarly, the interaction between Gini coefficient and infrastructure index yielded +0.0019 ($p < 0.05$). This suggests that infrastructure development also mitigates the negative growth effects of inequality, although the effect size is slightly smaller than for education.

Alternative inequality measure: Using the Theil index instead of the Gini coefficient produced similar negative effects on growth (-0.146, $p < 0.01$). Lagged inequality variable: Including a one-year lag of the Gini coefficient confirmed the persistence of its negative impact (-0.127, $p < 0.05$). Subsample analysis: Dividing regions into urbanized (>60% urban population) and less urbanized groups showed that inequality had a stronger negative impact in less urbanized regions (-0.182 vs -0.124). Region A maintained a Gini coefficient around 0.29 over the decade, coupled with robust education programs and

diversified industries. Average growth reached 5.4%, even during periods of national slowdown. Region F's Gini coefficient rose from 0.39 to 0.45, primarily due to concentration in mining sector revenues and limited reinvestment into local infrastructure. Growth averaged only 2.7%, with significant volatility tied to commodity price fluctuations.

Region K had a Gini coefficient averaging 0.35 but implemented extensive vocational training and SME support programs. Despite moderate inequality, growth averaged 4.9%, illustrating that targeted policies can buffer inequality's negative effects. Negative Impact of Inequality: Income inequality has a statistically significant and economically meaningful negative effect on regional economic growth. The magnitude is such that a 0.05 increase in the Gini coefficient can reduce growth by approximately 0.79 percentage points annually. Importance of Human Capital: Education attainment consistently shows a strong positive association with growth and moderates the harmful effects of inequality. Infrastructure as an Equalizer: Infrastructure investment both directly supports growth and reduces the growth penalty associated with inequality. Differential Regional Sensitivity: Less urbanized and resource-dependent regions are more vulnerable to the growth-reducing effects of inequality. Policy-Driven Resilience: Regions that proactively address inequality through education, infrastructure, and SME support tend to achieve more stable and higher growth rates, even with moderate inequality.

The results align with the hypothesis that while some level of inequality might be inevitable in a growing economy, excessive income concentration hinders sustainable regional growth. The mechanisms are both demand-side (weaker aggregate demand from lower-income households) and supply-side (restricted human capital formation). The moderating effects of education and infrastructure are particularly noteworthy. In regions where a high proportion of the population has access to quality education and reliable infrastructure, inequality's negative impact is significantly reduced. This suggests that public investment in these areas serves as a form of "growth insurance" against the destabilizing effects of income concentration. Moreover, the stronger effect in less urbanized regions implies that rural economies are more sensitive to inequality due to limited diversification and weaker institutional capacity. This finding supports the case for differentiated regional policy design rather than one-size-fits-all national measures.

The empirical results indicate that reducing income inequality should be considered a strategic component of regional growth policy. Expanding access to secondary and tertiary education can directly boost productivity and indirectly offset inequality's harm. Prioritizing infrastructure in lagging regions enhances economic connectivity and access to markets. Supporting SMEs and local entrepreneurship helps distribute income-generating opportunities more evenly. Resource-dependent regions should implement revenue-sharing and local reinvestment mechanisms to prevent excessive income concentration. These findings also underscore the importance of monitoring inequality at the regional level, as national averages may obscure localized problems that undermine overall growth potential.

Discussion

The findings of this study offer significant insights into the complex and often debated relationship between income inequality and regional economic growth. The analysis of 26 administrative regions over a ten-year period reveals that inequality measured by the Gini coefficient has a statistically significant and negative impact on economic growth rates. Moreover, the results demonstrate that human capital development and infrastructure quality can substantially moderate the adverse effects of inequality. This section discusses these results in light of existing literature, economic theory, and policy implications.

The negative coefficient for the Gini coefficient across multiple econometric specifications supports the view that excessive income inequality hinders economic growth at the regional level. This aligns with the arguments advanced by Persson and Tabellini (1994) and Alesina and Rodrik (1994), who highlight the growth-reducing effects of inequality through mechanisms such as limited human capital investment and social instability. From a demand-side perspective, income concentration in higher-income households leads to lower aggregate consumption, since marginal propensities to consume are typically lower among wealthier individuals. In regions with already limited market size,

this reduction in broad-based demand can suppress business expansion and discourage investment in productive sectors serving low- and middle-income consumers. From a supply-side perspective, high inequality constrains access to education, healthcare, and credit for lower-income groups. This reduces labor productivity and entrepreneurial activity, effectively lowering the region's long-term growth potential. The study's correlation analysis supports this mechanism, showing a strong negative correlation between inequality and education attainment rates.

One of the key contributions of this study is the finding that higher levels of education attainment reduce the growth penalty associated with inequality. The positive and significant interaction term between the Gini coefficient and education rates suggests that human capital serves as a buffer, enabling individuals from lower-income backgrounds to participate more effectively in economic activities even in unequal contexts. This finding is consistent with endogenous growth theory, which emphasizes that sustained economic growth depends on the accumulation of knowledge and skills. Education increases labor productivity and adaptability, which in turn enhances competitiveness and innovation potential within regions. Moreover, higher educational attainment may reduce the intergenerational transmission of inequality by providing greater opportunities for upward mobility. Case study evidence from Region K supports this interpretation: despite moderate inequality, targeted investments in vocational training and SME development programs allowed the region to achieve above-average growth rates. This suggests that the presence of strong educational institutions and workforce development initiatives can mitigate some of the detrimental effects of income concentration.

The study also identifies infrastructure development as a significant moderator of inequality's negative impact on growth. Regions with better transportation networks, digital connectivity, and public service accessibility experienced a weaker relationship between high inequality and low growth. Infrastructure acts as an economic equalizer in two ways. First, it reduces transaction costs and improves market access for marginalized communities, enabling them to integrate into broader economic systems. Second, it facilitates spatial mobility, allowing workers from disadvantaged areas to access better employment opportunities. This is particularly critical in less urbanized regions, where economic activity may be geographically concentrated. In line with findings by Calderón and Servén (2010), the data suggest that infrastructure investments not only have direct productivity-enhancing effects but also contribute indirectly to inclusive growth by leveling the playing field between income groups.

These findings contribute to the refinement of the inequality–growth debate, which historically has been framed around the Kuznets hypothesis. While Kuznets (1955) proposed that inequality may rise in early development stages before declining as economies mature, the results here suggest that high inequality even in regions with moderate to high income levels can be detrimental to growth unless counterbalanced by strong human capital and infrastructure. This supports the threshold theory of inequality, which posits that the growth effects of inequality are non-linear: small or moderate inequality may not harm growth, but beyond a certain threshold (estimated here around a Gini coefficient of 0.36–0.38), the negative effects outweigh any potential benefits.

The broader implication of this study is that inclusive growth is not merely a moral imperative but an economic necessity. Regional economic strategies that neglect inequality risk undermining their own growth potential. In an era of increasing globalization and technological change, which tend to create "winners" and "losers" within economies, the capacity to manage and moderate inequality will be a defining factor in regional competitiveness. Moreover, the interplay between inequality, education, and infrastructure underscores the importance of complementary policies. Investment in one area without attention to the others may yield suboptimal results. For instance, building infrastructure without improving educational access may fail to generate inclusive benefits, just as expanding education without adequate infrastructure may limit the ability of graduates to access economic opportunities. Finally, the finding that inequality has more severe consequences in less urbanized regions suggests that spatial inequality the uneven distribution of opportunities across geography is as

important as interpersonal income inequality. Addressing these disparities requires coordinated efforts between national and regional governments, as well as alignment with private sector investment strategies.

This study contributes to the growing body of evidence that high levels of income inequality impede regional economic growth, but that strategic investments in human capital and infrastructure can significantly mitigate these effects. The results challenge overly simplistic narratives that tolerate rising inequality in the name of growth, instead highlighting the need for a balanced approach that integrates equity and efficiency. The policy message is clear: inclusive growth is both possible and economically rational. By ensuring that the benefits of economic expansion are broadly shared through education, infrastructure, and targeted redistribution regions can build resilience, sustain growth, and foster social stability. The inequality–growth relationship is neither fixed nor inevitable; it is shaped by policy choices and institutional capacity. As regions continue to navigate the challenges of economic transformation, climate change, and technological disruption, the lessons from this study suggest that addressing inequality is not a constraint on growth but a foundation for sustainable and equitable development.

4. CONCLUSION

This study set out to examine the relationship between inequality in income distribution and regional economic growth, using panel data from 26 administrative regions over the period 2013–2022. Employing fixed-effects and generalized method of moments (GMM) estimations, the analysis revealed that higher income inequality measured by the Gini coefficient has a statistically significant and negative effect on regional GDP per capita growth. The results remained robust across alternative specifications and measures of inequality, suggesting that the relationship is not merely coincidental but reflects underlying structural mechanisms. The findings confirm that excessive income concentration impedes sustainable regional growth through both demand- and supply-side channels. On the demand side, high inequality suppresses aggregate consumption by limiting purchasing power among lower- and middle-income households. On the supply side, it restricts access to education, healthcare, and credit, reducing labor productivity and innovation potential. Importantly, the study also found that human capital development and infrastructure quality can moderate these adverse effects, indicating that targeted investments in these areas are critical for mitigating inequality's negative impact.

Regional heterogeneity emerged as another important dimension. Less urbanized and resource-dependent regions were found to be more sensitive to inequality, likely due to weaker institutional capacity, limited economic diversification, and inadequate redistributive mechanisms. Conversely, regions with diversified economies, strong educational systems, and robust infrastructure were better able to sustain growth despite moderate inequality levels. From a policy standpoint, the results underscore the necessity of regionally tailored strategies that combine equity and efficiency objectives. Recommended measures include expanding access to quality education, improving infrastructure in lagging regions, supporting small and medium enterprises, implementing progressive taxation, and ensuring equitable resource revenue distribution. Such interventions not only address social justice concerns but also enhance economic resilience and competitiveness. While the study provides strong empirical evidence, it also acknowledges certain limitations, including data availability constraints, potential unobserved variables, and the need for more nuanced measures of inequality. Future research should explore sector-specific effects, governance quality, and possible non-linear thresholds beyond which inequality becomes especially harmful to growth.

In conclusion, this research demonstrates that managing income inequality is not simply a matter of social policy it is a strategic imperative for fostering long-term, balanced, and sustainable regional economic growth. By integrating equity considerations into economic planning, policymakers can create environments where growth is both inclusive and resilient, ensuring that prosperity is broadly shared across all segments of society.

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