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Can the mining industry improve social welfare? Evidence from Mongolian provinces

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ABSTRACT

The mining industry plays a crucial role in the economies of many resource-rich countries, including Mongolia. While mining is widely recognized for driving economic growth, its implications for social welfare remain debated. This study investigates the relationship between the mining sector's contribution to gross domestic product (GDP) and the Human Development Index (HDI) across Mongolian provinces over the period 2004–2023. Using a balanced panel dataset and a two-way fixed effects regression model, we examine how changes in mining activity influence key dimensions of human development, such as education, health, and living standards. Our findings reveal a positive and statistically significant association between the mining share of GDP and provincial HDI scores. The results suggest that mining-driven economic activity not only generates fiscal revenues and employment but also indirectly fosters improvements in public services and infrastructure, thereby enhancing social welfare. We also observe that the positive effects are more pronounced in urbanized provinces with better institutional capacity, suggesting that local governance plays a mediating role. To further test the robustness of the results, we conduct several sensitivity checks, including alternative model specifications and lagged variables. The study contributes to the literature by providing empirical evidence from a developing, resource-dependent country context and underscores the potential for the mining sector to serve as a driver of inclusive development. The findings offer policy insights for balancing economic extraction with long-term welfare enhancement in mineral-rich regions.

KEYWORDS

Mining industry, Human development index, Social welfare, Mongolia

1.INTRODUCTION

Mining is one of the key industries in Mongolia's economy and plays a significant role in improving both national and local welfare. The country is rich in mineral resources, especially copper, coal, and gold. The development of these resources has not only driven economic growth but also provided substantial fiscal revenue and job opportunities for local governments. However, it remains important to explore how mining can truly translate into improvements in social welfare, particularly in areas such as education, health, and income distribution [1].

Previous studies have examined the relationship between natural resource development and socioeconomic indicators, with mixed results. Some scholars have found that resource extraction contributes to improvements in the Human Development Index (HDI) by fostering infrastructure development and increasing government revenue that can be invested in public services. Others argue that resource dependence may exacerbate inequality and weaken institutional quality, limiting long-term welfare gains. In the context of Mongolia, few empirical studies have systematically assessed how mining affects HDI at the subnational level, creating a gap in the literature.

This study aims to explore how mining activities contribute to the improvement of social welfare in Mongolian provinces, using the Human Development Index (HDI) as a comprehensive measure. The HDI includes factors such as health, education, and income, making it a suitable tool for assessing changes in welfare. By analyzing the relationship between mining development and social welfare, this study will show how mining has enhanced people's living standards through job creation, higher incomes, and better infrastructure.

As mining continues to grow in Mongolia, its positive impact on local economies is increasingly evident. Especially in remote areas, the development of mining has not only boosted economic growth but has also directly improved living standards through taxes, social security, and public services. Therefore, this study argues that mining is not only a driver of economic growth but also plays a key role in enhancing social welfare [2].

Through empirical analysis of the relationship between mining development and social welfare across Mongolian provinces, this study aims to provide valuable insights for policymakers. It seeks to highlight how mining can contribute to both economic growth and the improvement of social welfare, paving the way for sustainable development [3].

By offering new empirical evidence from a resource-dependent developing country, this study contributes to a better understanding of how mining can serve not only as an engine of economic growth but also as a potential driver of social welfare. The findings provide actionable insights for policymakers seeking to align mineral development with broader development goals.

2. RESEARCH METHODS

2.1. Model Specification

This study employs a Two-Way Fixed Effects Model to analyze the impact of the mining industry on social welfare, specifically how the mining sector's contribution to GDP affects the Human Development Index (HDI) in Mongolian provinces.

The fixed effects approach controls for both province-specific characteristics (such as geography, culture, and historical factors) and time-specific shocks (such as national economic policies) that could influence both mining development and HDI. By focusing on the within-province variation over time, this model allows for an assessment of how changes in the mining sector's GDP share impact HDI, independent of unobserved heterogeneity.

2.2. Data and variables

This study uses panel data from Mongolian provinces over the period of 2004 to 2023. The data is sourced from national statistical agencies, provincial economic reports, and international databases, including the Mongolian National Statistical Office (NSO).

The key variables in this study are as follows:

Dependent Variable:

HDI (Human Development Index): The Human Development Index is a composite index that measures three key dimensions of human development:

Health: Life expectancy at birth.

Education: Mean years of schooling and expected years of schooling.

Income: Gross National Income (GNI) per capita.

Core Explanatory Variable:

Mining (Mining Share of GDP): This variable represents the share of provincial GDP that is derived from the mining industry. It is used to capture the economic importance of mining in each province.

Control Variables:

Telephones (Number of Fixed Telephones): A proxy for the level of information and communication technology in each province. Higher access to fixed telephones can enhance education and health outcomes by improving access to information and services.

Libraries (Number of Public Libraries): These variable measures access to educational resources. A higher number of libraries may lead to improved educational attainment, which is a key component of HDI.

Doctors (Number of Doctors): This variable represents the healthcare infrastructure in each province. A greater number of doctors improves healthcare access, which is a crucial factor for improving the health dimension of HDI.

Urbanization (Urbanization Level): This variable measures the proportion of the population living in urban areas. Urbanization is typically associated with better access to education, healthcare, and economic opportunities, which contribute to higher HDI.

3. RESULT AND DISCUSSION

3.1. Descriptive Statistics

To begin the analysis, we present the descriptive statistics for the key variables used in this study. The years 2004, 2010, 2016, and 2023 were selected to represent key points in Mongolia's recent economic and social development. These years provide snapshots approximately every six years, allowing for an examination of medium-term trends in the Human Development Index (HDI) and the mining sector's share of GDP across provinces. The average Human Development Index (HDI) across provinces is relatively low but shows some variation, with urbanized provinces exhibiting higher HDI scores. The mining industry's share of GDP varies significantly across provinces, with some provinces heavily dependent on mining, while others have a more diversified economic base. The control variables, such as the number of fixed telephones, public libraries, and doctors, also show notable variation, reflecting disparities in infrastructure and access to services.

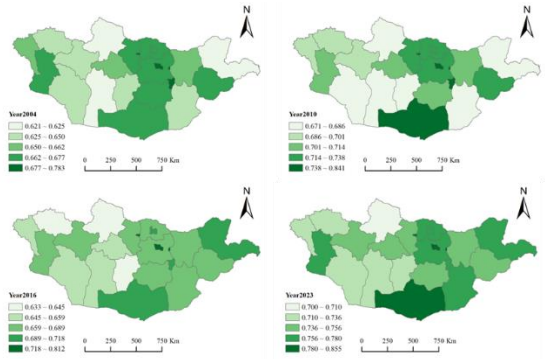

Figure 1. Human Development Index for Mongolian provinces

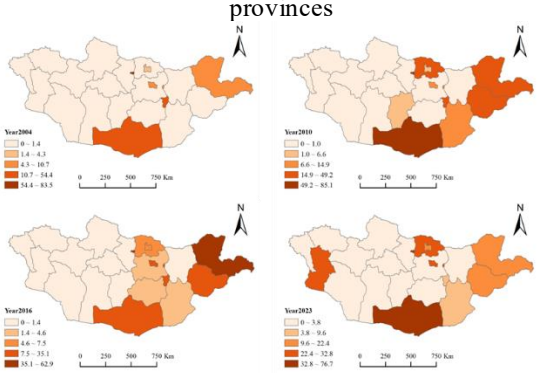

Figure 2. The mining share of GDP for Mongolian provinces

3.2. Regression results

Table 1 presents the results of the Two-Way Fixed Effects regression model. The primary focus is the relationship between the mining share of GDP and the HDI, controlling for other factors such as information technology, healthcare, education resources, and urbanization.

Table 1. Basic regression results.

Variable	(1) HDI	(2) Life	(3) Edu	(4) Eco
mining	0.0854***	0.006	0.0341***	0.206***
	(0.008)	(0.0056)	(0.0119)	(0.0200)
urban	-0.0103	-0.0003	0.0421***	0.0098**
	(0.0226)	(0.0014)	(0.0090)	(0.0041)
tele	0.0172***	-0.0004	0.0192*	-0.0051
	(0.0027)	(0.0012)	(0.0101)	(0.0057)
library	0.0059*	-0.0032	0.0153	0.0561***
	(0.0035)	(0.0048)	(0.0158)	(0.0186)
doctor	0.0259***	0.0177	-0.0783	0.00701
	(0.0074)	(0.0127)	(0.0493)	(0.0424)
_cons	0.410***	0.764***	0.315***	0.226**
	(0.0427)	(0.0259)	(0.108)	(0.0991)
N	440	440	440	440
R^2	0.938	0.983	0.961	0.958

The coefficient of mining is positive and statistically significant at the 1% level, suggesting that an increase in the mining industry's share of GDP is

associated with higher HDI in Mongolian provinces. Specifically, a 1% increase in the mining share of GDP leads to an increase in the HDI by 0.085 points on average. This result indicates that mining has a substantial positive effect on human development outcomes, likely through economic growth, increased employment, and improved infrastructure [4].

The coefficients for the control variables are also consistent with expectations:

Telephones: The number of fixed telephones is positively associated with HDI, highlighting the role of information and communication technology in improving access to education and health services.

Libraries: The number of public libraries is positively correlated with HDI, underscoring the importance of educational resources in fostering human development.

Doctors: The number of doctors has a significant positive impact on HDI, indicating that improved healthcare infrastructure contributes to better health outcomes and, consequently, higher human development.

Urbanization: The relationship between higher levels of urbanization and the Human Development Index (HDI) is not statistically significant, despite the potential advantages of urban living in terms of access to economic, educational, and healthcare opportunities.

3.3. Robustness Checks

To test the robustness of the results, we conducted several diagnostic tests. First, we performed a placebo test by testing the relationship between the mining share of GDP and HDI in provinces with minimal mining activity. The results showed no significant relationship in these provinces, further reinforcing the causal link between mining development and improved HDI in mining-dependent provinces.

Second, we estimated the model with alternative specifications of HDI, including its individual components (health, education, and income). The results showed that the positive effect of mining on HDI is primarily driven by improvements in income and education, which are likely the result of increased economic activity and investment in human capital facilitated by mining revenues [5].

3.4. Discussion

The results of this study provide strong evidence that the mining industry positively impacts social welfare in Mongolia, as measured by the Human Development Index (HDI). Specifically, the significant positive relationship between mining share of GDP and HDI suggests that the economic benefits of mining [5].

One of the primary channels through which mining affects HDI is through economic growth. As mining industries expand, they contribute directly to GDP growth, which can lead to higher incomes and more fiscal resources for public services. [6] These resources can be reinvested in critical areas such as healthcare, education, and infrastructure, which further enhance social welfare. For instance, mining revenues can fund public health programs, improve education facilities, and develop transportation networks, all of which contribute to better quality of life and higher HDI scores.

Another important factor is employment. The mining sector creates direct and indirect job opportunities, raising household incomes and improving access to essential services. Employment in the mining industry often spills over into other sectors, such as retail, construction, and transportation, which further stimulates economic activity and improves social welfare [7].

Moreover, infrastructure development is another key outcome of mining growth. As mining regions grow economically, they attract investments in transportation, healthcare, and education, leading to better access to essential services. For example, roads and public transportation systems built for the mining industry can also benefit local communities, facilitating access to markets, healthcare facilities, and schools.

While the overall findings suggest that mining contributes positively to human development, it is important to note that the impact may vary across provinces depending on the extent of mining activity. The management of mining revenues, and the capacity of provincial governments to channel those resources into social welfare programs. Further research is needed to explore the distributional effects of mining on different segments of the population, especially in terms of income inequality and regional disparities [8].

4. CONCLUSION

The findings of this study have important policy implications for Mongolian policymakers. To maximize the positive impact of mining on social welfare, it is essential for the government to ensure that mining revenues are effectively used to invest in public goods such as healthcare, education, and

infrastructure. Policies should focus on creating a balanced approach where the economic benefits of mining are shared across the population, and the environmental and social costs are managed responsibly.

Investing in education and healthcare: Mining revenues can be directed towards building schools, hospitals, and other public services that contribute to long-term human development.

Promoting sustainable development: Ensuring that mining activities are environmentally and socially sustainable will help protect the welfare of future generations while continuing to generate economic benefits.

Fostering regional development: Mining's benefits should be more evenly distributed across regions, especially to ensure that rural and remote areas also experience improvements in social welfare.

This study provides empirical evidence that the mining industry has a positive impact on social welfare in Mongolia, as measured by the Human Development Index. The expansion of the mining sector contributes to economic growth, job creation, and infrastructure development, all of which are essential for improving human development outcomes. These findings underscore the importance of effective policy and management to ensure that the benefits of mining are fully realized and equitably distributed across Mongolia's provinces.

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