IMPACT OF THE MINING AND AGRICULTURE SECTOR ON THE MONGOLIAN ECONOMY

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Abstract: *Increasing the use of natural resources can improve the country's wealth, but it has adverse effects caused by improper usage, and it is non-renewable. The depletion of natural resources is a global environmental issue that threatens the livelihoods of billions of people. Moreover, not all resource-rich countries are highly developed. Mongolia is one of the natural resources-rich countries in the world. The agricultural sector is Mongolia's traditional economic sector, and it still plays an essential role in the country's economy. This paper investigated the interrelation between the agriculture and the mining sectors and their impact on Mongolia's economic growth. A multiple-stage regression model was used to analyse the selected variables' time series data over 20 years of Mongolia. In addition to the model's sectoral data per capita wealth, other control variables are added to explain economic convergences, human capital impact, and government size. Result proves that the mining sector has a substantial impact on the economic growth of Mongolia. However, agricultural sector growth does not depend on the mining sector. The high dependency from one sector, particularly the extractive sector, warns against the sustainable development of the country's economy. Therefore, it is essential to support agriculture and other secondary sectors based on renewable natural resources and agriculture.*

Keywords: Natural resources, sustainability, mining, agriculture, economic growth, Mongolia.

JEL classification: O41, O53, Q32

1. Introduction

The sustainability of renewable and non-renewable natural resource usage is a global issue since resources are the source of every life globally. The pressure on global natural resources will continue to grow in the coming years. The world population is continuously growing and is expected to reach 9.7 billion by 2050 (United Nations, 2019). Understandably, people aspire for a better lifestyle, leading to higher consumption levels, although some variations in low and middle-income countries are comparable to high-income countries (Food and Agricultural Organization, 2017). The increasing higher consumption levels of the

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world population lead to the further depletion of natural resources. About 3.5 billion people live in oil-, gas- and mineral-rich countries. However, these resources have become a source of conflict rather than an opportunity all too often. Many of these resource-rich countries also suffer from poverty, corruption, and conflict stemming due to weak governance (World Bank, 2021b). An abundance of natural resources is not directly related to economic growth. However, natural resources underpin the functioning of the worldwide economy and the quality of life (Bouwman et al., 2012).

Natural resources, including land, water, forests, fisheries, animals, mineral ores and energy sources, are considered valuable in their relatively unmodified form. The problem starts when the regrowth and regeneration of renewable resources are not as fast as the consumption rate. Soil degradation has affected 1.9 billion hectares already (Young, Orsini and Ian, 2015), and 45% of total Gross Domestic Product (GDP) ($63 trillion) will be at risk due to water stress by 2050 globally (Growing Blue, n.d.). Compared to 16 million hectares of deforestation annually in the 1990s, the number decreased between 2015 and 2020 to 10 million ha per year (FAO and UNEP, 2020).

Non-renewable resources tend to be an essential source of economic growth and energy in many countries. Schröder and Zwichel (2015) designed a model showing what will be left of earth's non-renewable resources. The projection shows that the world will have 11 years of gold, 30 years of copper, 77 years of phosphorus and 117 years of coal resources by 2020.

The agriculture sector is crucial to economic growth. By 2018, sector share accounted for 4% of the global gross domestic product (GDP). In some developing countries, agriculture shares are more than 25% of GDP. Agriculture can help reduce poverty, raise incomes and improve food security for 80% of the world's poor. Agriculture sector growth is 2-4 times more effective out of the poverty than other sectors. 65% of the poor engaged in agriculture (World Bank, 2021a).

The extractive industries sector plays a decisive economic role in 63 countries facing resource dependency and weak governance (World Bank, 2021b). By Ericsson & Lof (2018) research on mining's contribution to the economic development of low- and middle-income countries (for the years 1996–2014), in some nations, mining accounts for a dominant share of the national wealth, with more than 50 percent of exports and around 10–20 per cent of GDP.

Mongolia is ranked as the highest level of mining dependency and the highest per capita value of resource reserves among the lower-middle-income countries. Mongolia is ranked 4th in mining sector contribution to the economy after DRC, Chile and Australia (Ericsson and Lof, 2018). Mongolia is one of the leading producers of mineral commodities such as coal (the world's 13th largest producer in 2017) and copper and one of the countries highly dependent on a commodity (Li, Gupta and Yu, 2017; Ericsson and Lof, 2018). In addition to coal and copper, Mongolia produces and exports 15 mineral and petroleum commodities, including gold, iron ore, zinc, molybdenum, fluorspar, tungsten, silver, tin, gypsum, zeolite, lead and clinker (The Extractive Industries Transparency Initiative, 2021).

Economists do not have a common agreement on the interrelationship between natural resources and the country's economic development and have not yet reached a standard agreement (Li, Deng and Cheng, 2013; Sachs and Andrew, 2001). The study of the Mongolian case has a similar phenomenon in terms of mineral resources depletion and economic development (Ge and Kinnucan, 2017; Avralt-od et al., 2012; Tserendorj and Purevjav, 2012; Khan and Gottschalk, 2017; Lkhagva, Wang and Liu, 2019; Dagys et al., 2020; Davaakhuu, Sharma and Oczkowski, 2015; Li, Gupta and Yu, 2017; Locatelli, 2019). Studies of Ge & Kinnucan (2017), Avralt-od, et al. (2012) and Tserendorj & Purevjav (2016) concluded that there is no negative direct effect from the mining boom on other economic sectors. Nevertheless, Khan & Gottschalk (2017), Lkhagva, et al. (2019), Locatelli (2019) and Dagys, et al. (2020) summarised that resource curse exists in Mongolia. These

researchers highlighted the mining sector as a vital driver of the Mongolian economy and paid less attention to its non-renewable resource usage and sustainability issues.
Therefore, the research aims to investigate the perspective of natural resource use in Mongolia and its impact on economic growth by checking the following hypothesis i) mining sector growth supports other sectors growth, ii) natural resource using sector growth increases per capita GDP growth in Mongolia, and iii) agriculture sector growth does not depend on the mining industry.
The second section introduces the theoretical background of economic growth and natural resources and the Mongolian perspective on natural resource use. The third section discusses research methodology, variable selection based on the literature, data analysis and model setting and descriptive statistics of the variables. The fourth section presents results and discussion based on data analyses, and the paper ends with a conclusion, including the study's limitations.

2. Depletion of natural resources and economic growth

A major policy challenge facing developing countries with abundant natural resources is achieving and sustaining rapid economic growth that will help reduce poverty while being socially inclusive and environmentally sustainable (Almas, 2018). The concern about resource depletion does not stand in isolation and is central to sustainable development where social and economic aspects are also interlinked with environmental resources (Ayadi, Ayadi and Ashiomanedu, 2008; Dominati et al., 2014). Consequently, governments need to engage in regulations and decisions on utilising natural resources proactively, and thus environment, society and economy go hand in hand (Pearce and Moran, 1994; Ayadi, Ayadi and Ashiomanedu, 2008). It is crucial to understand the role of natural resources in the economy to grow an economy that is sensitive to how it utilises and protects natural resources (Barbier, 2003; Organisation for economic co-operation and development, 2011). Some empirical studies showed that countries with abundant natural resources, particularly non-renewable, fared both much more poorly than they should have compared to less well-endowed countries at similar stages of development. The notion that countries well endowed with natural resources have experienced relatively slow growth is called the "curse of natural resources" and the "Dutch disease". The Dutch disease research focuses on resource-dependent countries' challenges, such as democratisation, rent-seeking, corruption, bribery, and conflict (Organisation for economic co-operation and development, 2011; Sachs and Andrew, 2001; McMahon and Moreira, 2014). For instance, in the Gulf countries, Nigeria, Mexico and Venezuela, Oil States have not reached sustainable economic growth (Sachs and Andrew, 2001). However, there are other examples of highly developed or developed countries with abundant natural resources. Examples include the United States, Venezuela, Australia, Norway, Chile, Peru, Brazil, and Botswana (Avralt-od et al., 2012; McMahon and Moreira, 2014). Thus, the optimum exploitation of natural resources is more critical than their availability. Furthermore, they are implying that there is a necessity to understand the root of the curse of natural resources.

Natural resource use and economic growth in Mongolia

The Gross Domestic Product of Mongolia is relatively growing steady except for 2008-2009 and 2014-2016 during the selected period (Figure 1). The global economic crises of 2008-2009 impacted the Mongolian economy. The steady growing economic growth of Mongolia had declined to 1.2% in 2016 (USD11147) from 7.9% in 2014 (USD12224), due to the economic difficulties after mineral exuberance, as a result of unprecedented terms-of-trade and foreign direct investment shocks, and a lack of fiscal policy adjustments indicated by rapid and unsustainable debt accumulation (Asian Development Bank, 2020). Mongolia's

economic performance improved from 1.2% in 2016 to 7.2% in 2018. The Strong growth between 2016 and 2018 was accomplished without excessive inflationary pressures. Strong growth momentum was supported by steady commodity exports (coal and copper), a recovery in Foreign Direct Investment, and improved business sentiments, as well as a practical implementation of an economic adjustment program by the government (Nganou et al., 2018).

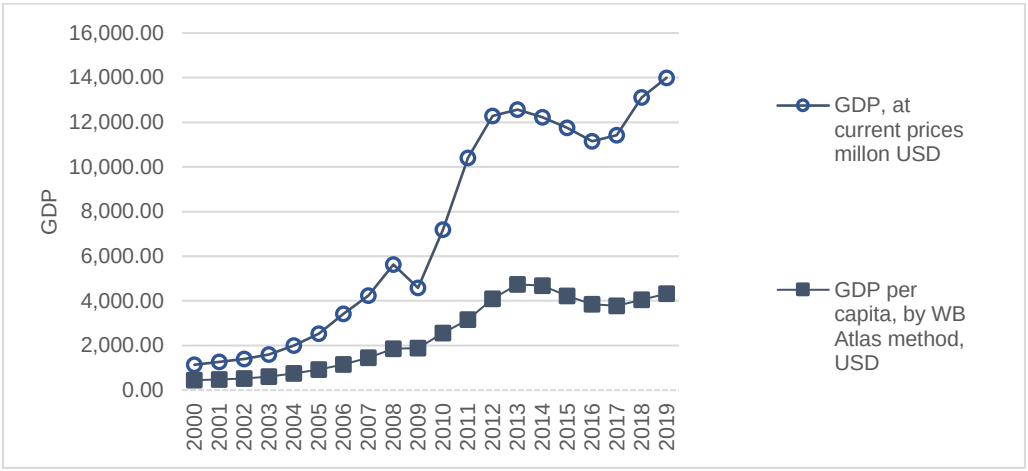

Figure 1. Nominal GDP growth and per capita GDP growth in Mongolia, USD
Source: Authors processing based on the data from the National Statistical Office of Mongolia, 2000-2019.

Since agricultural production depends entirely on renewable resources such as land, water, and forest, these resources' use and future perspectives will directly impact the development of the Mongolian economic sectors. Besides, the rapid development of mining in Mongolia over the last 20 years has greatly affected these renewable resources. Land of 118.4 million ha (75%) of the total area of Mongolia (156.5 million ha) is suitable for agriculture production and pastoral livestock production (National Statistics Office of Mongolia, 2020).
The agriculture sector had been a dominant sector of the Mongolian economy. The mining sector has gained momentum; agriculture has been ranked second to third in the GDP last two decades. In 2005, large national and foreign-invested mining companies began their operations, and in 2006 the Minerals Law was renewed. As a result, the mining sector alone accounted for more than 30% of budget revenues and more than 90% of total export earnings (National Statistics Office of Mongolia, 2020). Figure 2 provides agriculture sector share (ShareAG) and mining sector shares (ShareMINING) in GDP. By 2005, the share of the agriculture sector had declined, and the share of mining had increased. A slowdown in the agricultural sector is due to privatisation, structural changes and animal loss from the very harsh winter in 2000 and 2010. The agricultural sector's maximum (27.4) and minimum (10.1) shares happened in 2000 and 2017. A very harsh winter hit the agriculture sector in 2010; while a big mining site started its operation, the agricultural sector share declined. In general, as the share of the mining sector in GDP increases, the share of the agricultural sector in GDP decreases- Figure 2.

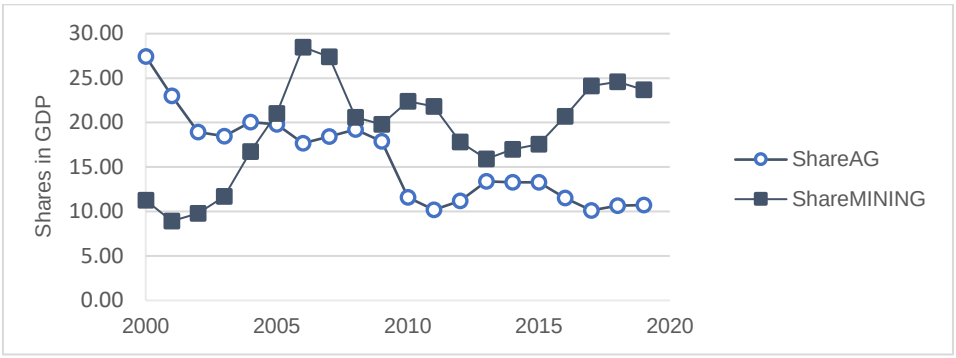

Figure 2. Share of agriculture and mining sector in GDP of Mongolia
Source: Authors processing based on the data from the National Statistical Office of Mongolia, 2000-2019.

3. Materials and methods

3.1 The model and data

The study adopted the most commonly used methodology of estimating the growth model (Sachs and Andrew, 2001; Ronald, 2006). This growth model has become the standard for investigating the determinants of growth across countries. We have developed a three-step economic growth model (Y1, Y2 and Y3) to investigate the sectoral effect on economic growth. Y1 model has three sub-models (Y1-1, Y1-2 and Y1-3) that excludes control variables.
The variable selection has been made based on the previous review of scholarly studies.

Table 1. The variable description and references

Variables	Impact*	Variable explanation	References
Dependent variable:			
Economic growth rate GDP		The annual growth rate of GDP in logarithm	(Ronald, 2006; Sachs and Andrew, 2001)
Experimental variables:			
Log GDP per capita	+	GDP per capita, by WorldBank Atlas method, USD	(Ronald, 2006; Sachs and Andrew, 2001)
ShareMINING	+	Share of the mining sector in GDP in percent	(Barro, 2016; Ronald, 2006; Sala-i-Martin, Doppelhofer and Miller, 2004; Sachs and Andrew, 2001)
ShareAG	+	Share of agriculture sector in GDP in percent	(Barro, 2016; Ronald, 2006; Sachs and Andrew, 2001; Sala-i-Martin, Doppelhofer and Miller, 2004)
Control variables:			
Education	+	Gross enrollment ratio	(Sachs and Andrew, 2001; Iponga et al., 2018; Sala-i-Martin, Doppelhofer and Miller, 2004; Barro, 2016)
ShareNetTax	-	Income tax contribution in the GDP	(Ronald, 2006)
ShareGov	-	Share of Government expenditure in the GDP	(Barro, 1997; Ronald, 2006; Sala-i-Martin, Doppelhofer and Miller, 2004)

Note: * + positive impact; - negative impact;
Source: Authors processing based on the scholarly articles

Table 1 shows the main variables that affect economic growth and their explanations. These variables were used to determine the extent to which natural resources affect economic growth and whether there is a resource curse.
The following general equation shows a model form explaining relationships between dependent and independent variables. The dependent variable is estimated in three different forms:
Thus:

$$Y_t = \alpha + \beta logPC_t + \gamma X_{i_t} + e \quad (1)$$

where: i: share mining, share agriculture, gross enrollment rate (Education) and share tax of net tax

$$Y_t = \frac{LogGDP_t - LogGDP_{t-1}}{LogGDP_{t-1}} \quad \text{where t=}\{0; 20\} \quad (2)$$

Data set $t_0 = 2000$ and $t_{20} = 2019$.
$logPC_i$ is the initial level of Per Capita GDP in logarithm
Here, the dependent variable Y is the annualised growth rate for Mongolia.
Model Y1 -annual growth of GDP; It has three different forms regarding the number of independent variables.
$Y_t^1 = \alpha + \beta logPC_t + \gamma X_{i_t} + e$;

$$\text{where } Y_t^1 = \frac{LogGDP_t - LogGDP_{t-1}}{LogGDP_{t-1}} \quad (3)$$

model Y2- annual growth of GDP less the contribution of the agriculture sector; and
$Y_t^2 = \alpha + \beta logPC_t + \gamma X_{i_t} + e$;

$$\text{where } Y_t^2 = \frac{Log(GDP_t - GAP_t) - Log(GDP_{t-1} - GAP_{t-1})}{Log(GDP_{t-1} - GAP_{t-1})} \quad (4)$$

model Y3-annual growth of GDP less the contribution of agriculture, and resource extraction sector.
$Y_t^3 = \alpha + \beta logPC_t + \gamma X_{i_t} + e$;

$$\text{where} \quad Y_t^3 = \frac{Log(GDP_t - GAP_t) - Log(GDP_{t-1} - GAP_{t-1} - GMP_{t-1})}{Log(GDP_{t-1} - GAP_{t-1} - GMP_{t-1})} \quad (5)$$

These different forms aim to investigate the sectoral effects on economic growth. Variables as GDP per capita, Agriculture sector share (ShareAg), Mining sector share (ShareMining) are experimental variables. Moreover, variables such as Education (Education) and Net taxes (ShareNetTax) are selected as control variables. The selected independent variables denoted X_i are the share of selected variables in GDP except for the gross enrollment ratio (Education) representing human capital.
Ronald (2006) took the share of college and university-educated people in the total population as variable Education. Unfortunately, this type of data was unavailable in Mongolia's statistical information; therefore, we use the gross enrollment ratio. Theoretically, initial levels of human capital, usually measured in terms of schooling years, positively affect economic growth, and expenditures on education and school enrollment are negatively correlated with the share of natural capital in national wealth (Ronald, 2006; Barro, 1997). Several debates are taking place in the literature on development economics regarding the role of human capital in economic growth. Some of the debates on the lack of standardised

indicators to measure human capital stock and investments as different authors have used different measures of human capital indicators (health and education expenditure, school enrolments, adult literacy rates, average years of schooling, mortality, life expectancy and adult survival rates). Another issue is related to the econometric problem of simultaneity. There is maybe a reciprocal relationship between human capital and economic growth (Almas, 2018).

4. Results and discussions

4.1 Growth model - 1

The three steps explain the growth model Y1 annual growth of GDP (2000-2019). In the first steps, the model estimated only two independent variables: the share of agriculture and mining (Model Y1-1). Furthermore, the second and third steps added control variables one by one (Y1-2 and Y1-3). The regression results of the first type of growth model are presented in Table 2.

Table 1. Regression of annual growth of GDP (2000-2019) on agriculture and natural resources intensity and other controlling variables

Variable	Growth model 1-Y1		
	Model Y1-1	**Model Y1-2**	**Model Y1-3**
	no control variables	**with education**	**with education & tax**
Log GDP per capita	-0.014 (-1.65*)	-0.015 (-1.61*)	-0.005 (-0.576)
ShareAG	-0.061 (-0.85)	-0.072 (-0.81)	0.002 (0.022)
ShareMINING	0.055 (1.88**)	0.057 (1.81*)	0.73 (2.49**)
Education		0.00 (-0.22)	0.00 (0.233)
ShareNetTax			0.269 (2.088**)
Constant	0.057 (1.5*)	0.072 (0.943)	0.026 (-0.31)
R-squared	0.266	0.268	0.452
Adj R-squared	0.119	0.059	0.241
Durbin Watson	1.91	1.92	2.3

Note: t- statistics in parentheses;
*, ** *indicates that significant at 10 and 5 % level respectively.*
Source: Authors analysis based on regression analysis

The log GDP per capita coefficient interprets a conditional rate of convergence. This coefficient is statistically significant in two regression models, i.e. Y1-1 and Y1-2. The estimated coefficient of -0.014 and -0.015 implies a convergence rate of these two cases, respectively (Peter et al., 2005). The variable Share of agriculture on GDP is negative but not significant in all forms. The ShareMINING variable is positive and highly significant, indicating that Mongolia's economic growth depends on the mining sector contribution. The variable Education is insignificant. Thus, this variable has no impact on GDP growth. Variables such as years of schooling and school enrolment, which do not reflect the quality

of education, have weak relation with economic growth (Barro, 2016). The variable ShareNetTax is highly significant and positively related to the growth of GDP. This result implies that an increase in tax income supports economic growth. Government tax has a high portion of natural resources income and extraction.

4.2 Growth model – 2 and Growth model – 3

The second type of regression analysis excluded a contribution of the agriculture and mining sector in the GDP growth step by step from dependent variables. Model Y2 estimated the exclusion of agriculture share in per capita GDP, and model Y3 ran without considering both agriculture and mining sectors' share in GDP growth in the dependent variable. Table 3 provides the regression results of these two models.

Table 2. Regression of annual growth of GDP less the contribution of agriculture and resource extraction sector (2000-2019) on natural resources intensity and other controlling variables

Variable	**Y2 (exclude agriculture)**	**Y3 (exclude both sectors)**
Log GDP per capita	-0.012 (-1.185)	0.001 (0.081)
ShareAG	-0.044 (-0.457)	0.035 (0.311)
ShareMINING	0.071 (2.186**)	0.058 (1.51*)
Education	8.819 (0.128)	0.00 (0.16)
ShareNetTax	0.248 (1.74*)	0.389 (2.32**)
Constant	1.012 (11.1***)	0.941 (8.73***)
R-squared	0.45	0.367
Adj R-squared	0.239	0.124
Durbin Watson	2.36	2.19

Source: Authors analysis based on regression analysis
Note: t- statistics in parentheses;
*, **, *** *indicate that significant at 10, 5 and 1 % level respectively.*

The estimation results are pretty similar to the growth model 1. The log GDP per capita's coefficient indicates a conditional rate of convergence is no longer significant in these two cases. While the coefficients of ShareMINING and ShareNetTax are positive and remain highly significant. All other variables are insignificant. In the two models, the contribution of the agriculture and mining sector in economic growth has not affected the mining sector's importance in economic growth. The result supports the other researchers that Mongolia is overdependence on mineral resources (Li, Gupta and Yu, 2017; Lkhagva, Wang and Liu, 2019; Dagys et al., 2020; Locatelli, 2019). The coefficients on the control variables are very close to the first regression model's result in table 2. Therefore, the evidence does not support the notion that resource richness hampers other sectors' growth in Mongolia. This result is similar to the Avralt-od et al. (2012), and Ge and Kinnucan (2017) concluded that the resource curse is not detected in Mongolia.

5. Conclusion

The importance of natural resource use increases year to year due to the increasing demand of the world population and the resources' availability. High usage or depletion of renewable and non-renewable resources causes biodiversity, environmental degradation and many other side effects.

From an economic point of view, natural resources are an essential source of the nation's economic growth and wealth. The study results prove that Mongolia's economic growth is positive and highly dependent on mining. Likewise, the net tax share in GDP is highly significant and positively related to the per capita growth GDP. The result implies that an increase in tax income supports economic growth, explaining the comparatively high Government tax on a portion of natural resources income and extraction. The evidence does not support that resource richness hampers other sectors' growth in Mongolia. The log GDP per capita coefficient interprets a conditional rate of convergence. Thus, the research endowment of Mongolia is not supporting reducing poverty. The Mongolian agriculture sector is highly dependent on weather conditions and does not depend on the mining sector. According to the historical data, the agriculture sector can grow because Mongolia has vast pasture land, and the manufacturing sector is based on renewable agricultural resources. Mongolia should support the agriculture sector's growth and other sectors with growth potential, quickly adopt new and advanced technological innovation and increase productivity to diversify economic performance.

The study's main limitation is the lack of some data on control variables. For instance, variable Education (gross enrollment ratio) should be replaced by the share of highly educated people or expenditures on higher education. Similarly, other experimental and control variables need to extend the regression model where significant pooled data is available. Therefore, the follow-up study should consider appropriate data gathering from different means through primary and secondary sources.

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