Does Natural Resources Lead to a Curse on Educational Spending in Northeast China?

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Abstract: With increasing interest in exploring natural resources to boost economic development, governing body investment and expenditure play a valued role in regional economic growth. This article addresses a significant blind spot in our perception of the "Natural resource Curse" by evaluating the way the natural resource extractive industry impacts government priorities and investment budgets. Using a set of panel data from 3 provinces in North-east China covering the period from 2004 to 2023, this paper finds a prominent negative influence of the natural gas and oil extraction industry on a public educational investment relative to GDP, which is robust in controlling for the other supplementary variations. These findings and outcomes are important, especially for the exploitation and extraction of natural resources fortune in less developing countries, since they could invest revenue generated by natural resources in public departments such as education to achieve especially high payback. Nevertheless, this article also emphasizes the significance of the role of administration duty, pointing out that policy is vital to regional development. In addition, this paper also suggests how to adjust policy to boost the economies better and shrink the inequality development between regions.

Keywords: economic development, education, resource curse, public spending.

1. Introduction

There has been a debate about a paradox, which mainly indicates that while those who have profuse natural resources such as minerals, natural gas, timber, and land experienced much lower economic growth and much worse performance than those with limited land, natural resources areas such as Hong Kong, Singapore, Norway. This seems to betray the principle of economic development, which states that those with adequate resources should be more developed and advanced. This phenomenon has attracted many scholars to research it, and solving this problem will contribute to mitigating regional imbalance and inequality. And thus, the discussion about "natural resources" has remained controversial and far from settled.

Most studies regarding the "natural curse" focus on African and Middle Eastern countries, where these regions suffer from serious economic problems and lagging development. More importantly, in these regions, the natural resources are the most abundant, such as fuel and oil in the Middle East, and timber in Africa. Nonetheless, much less study focuses on other naturally abundant countries and even regions such as states and provinces, resulting in some basis and tendentious opinions about other areas. China has been developing fast in recent decades, mainly due to its policies and

population, however, China also has serious imbalance development in regions such as the Northeast and the west of China, where both show low economic growth and development, while having large amounts of natural resources such as natural gas, coal, fossil fuel, minerals. Some Chinese scholars have been researching these topics, Huang Yue. indicated that the northeast of China suffered from a "natural curse", which is also connected to human capital investment and government policies[1]. Some other scholars Gylfason, also pointed out that there is a squeezing-out impact on human capital in those resource-abundant areas, in the process of resource development, it will hinder economic growth by crowding out physical capital and human capital[2].

Respecting the connection between Natural resources and Human capital, there is much less research on this aspect, especially about education. Since education is almost the most significant indicator of human capital, without sufficient educational investment in the region, less high-quality labor will flow into the industries, and thus, the local industrial development will stagnate, and eventually the whole region will languish and backward. As an illustrative case, the African continent demonstrates significant challenges regarding adult education and literacy rates. The adult population in many African countries often faces a pronounced lack of educational opportunities, resulting in alarmingly high rates of adult illiteracy. With an extremely low proportion of school attendance as well as high education finalization. In advanced countries such as the US, the number of people with higher education levels was much higher than that in Africa. In addition, in the Middle East, the areas have been riddled with wars, conflicts, political incidents, turmoil, and constantly occurring regional wars, mostly due to natural resources. The whole area also performed well below the world's average education level, and thus this reason could contribute to the backward economic development and the burst of wars[3].

Based on theoretical and empirical research evidence as reviewed above, it seems necessary to investigate the connection between Natural resources and education expenditure, which would probably solve the question of regional imbalance, such as in the northeast of China. Thus, the aims of this paper are as follows: whether there are correlation between Natural resources and educational expenditure in the northeast of China, and what the government policies should stipulate when a "Natural Curse" actually occurs. Understanding the relationship behind them will contribute to boosting regional economics and shrinking inequality.

2. Literature review

2.1. Studies on natural resources curse

"Natural resource Curse" has gained a lot of scholars' notice in the studies presently available. Nonetheless, the "Natural resource Curse" is constantly indicating a controversial question since some prefer it, others oppose it. Prebisch indicated that there was an inverse correlation between abundant natural resources and economic development, the primary reason is that developing countries rely too much on exporting natural resource products and importing industrial manufactured goods, while developed countries will eventually reduce their dependence on natural resources due to the existence of more advanced technological progress, and thus deepening the terms of trade in those developing countries, leading to a slowing progress of economic development[4]. Chen Lin et al. discovered that natural resource abundance and GDP per capita have a remarkable negative relationship, and demonstrated that a "Natural resource Curse" exists in Chinese provinces.[5] However, other scholars Gerelmaa and Kotani indicated that the extension of the manufacturing department in resource-abundant countries has a positive impact on financial and economic development[6]. Erum and Hussain pointed out that technological progress is generally conducive to countries[7]. Nawaz discovered that the exploitation of Natural resources in the country such as Pakistan favors the country, more importantly, there is a strong correlation between Natural resources

and economic development, regarding different income groups. Janus T showed that the rent-seeking behaviors of the government and the declining institutional quality caused by abundant resources are important transmission mechanisms of the resource curse[8]. The sudden growth in income levels caused by the exploitation of natural resources can lead to a decline in lazy, shrewd management, social inequality, and weak institutions. Additionally, natural resources will lead to talent outflow and thus lead to economic backwardness.

2.2. Studies on human capital and natural resources

Some researchers have discovered that natural resources will hurt human capital, and will squeeze out human capital, Chen, and Liu pointed out that educational input and the economic linkage effect of the "resource curse" is negative, that is, educational investment weakens the hindering effect of resource endowment on economic growth, which means that educational input dampens the "Natural resources Curse"[9]. Hao Xiaowei, Yang Xi, and Min Weifang introduced that the "Resource Curse" not only exists in areas of China but also produces a serious "crowding out" of education investment, and regions that escape the "resource curse" through their development tend to have higher investment in education[10]. Cheng Wenling also discussed the effect of natural resources on the human capital of advanced education at the city level in China[11]. The results show that there is also a crowding-out impact of natural resources on human capital at the city level in China, but the market level is conducive to weakening the crowding-out effect. Gemicioğlu, S., Soyhan, S. and Mollavelioğlu, M.Ş. introduced that when human capital was at a low level, the function of restraint was obvious, resulting in the occurrence of a "Natural Curse", on the contrary, when human capital was increasing, its function of constraint constantly reduced, which indicated that "Natural resources Curse" will probably inverse to "Natural Blessing"[12]. Gregorio, J.D. and Lee, J. concluded that on average, in Pennsylvania's Marcellus Shale region, districts experiencing gas exploitation had lower per capita revenue, lower funding for local schools, per capita income, and per capita property wealth than similar districts that did not exploit[13]. Li, K.et al.showed that African individuals who owned gold mines in their districts when they were in their teens, had expressively lower educational accomplishments as adults[14]. Vander Ploeg, F., and Venables, A.J. indicated that Natural resources influence the stimulants to invest in educational departments and the rent-seeking behavior, in turn affecting economic development[15]. The inequality of education and political participation determine whether natural resources will stimulate growth or lead to a poverty trap. Ali et al.confirmed the significance of inferior institutional quality and insufficient investment in human capital when a resource curse happens, natural abundance may have an adverse influence on economic growth when considered solely but have a beneficial effect on economic growth when other explanatory variables, such as human capital, policy quality are considered[16].

3. Data and methodology

3.1. Data

This paper uses a set of data from three provinces in northeast China, Heilongjiang, Jilin, and Liaoning, including the years 2004-2023 to investigate the connection between natural resource abundance and educational spending. Data for natural resources are measured by the proportion of oil and natural gas extraction industry in total industrial output; educational spending is measured by government investment in education as a share of GDP; total imports and exports of enterprises with foreign direct investment are measured by billion; R&D internal expenditure is measured by billion; contribution rate of tertiary industry is measured in% of GDP(see Table 1). The natural resources data educational spending and other data are gathered from China's National Bureau of Statistics. Accurate estimations are given by converting variables into their natural logarithmic forms.

Table 2 indicates the variable's descriptive statistics, and the mean of Lnedu, fuel, Lnfor, Lnrd, and service are 6.302,0.092,6.356,123.791,0.453. The variables are skewed positively. Descriptive statistical results for the variables are used in the main analysis and the discussion is summarized in Tables 1 and 2.

3.2. Model

In the existing research, this paper followed the studies of Nawaz, K., Lahiani, A., and Roubaud, D. to confirm the research objectives[17]. Hence, this paper added natural resources, total imports, exports of enterprises with foreign direct investment, R&D internal expenditure, and contribution rate of tertiary industry as determinants of educational spending.

Table 1: Data sources and measurements.

sign	variables	measurement	source
lnedu	educational spending	Government investment in education as a share of GDP	China's national bureau of statistics
fuel	Natural resources	proportion of natural gas and oil extraction industry in total industrial output	China's national bureau of statistics
lnfor	foreign direct investment	total imports and exports of enterprises with foreign direct investment	China's national bureau of statistics
lnrd	R&D	R&D internal expenditure	China's national bureau of statistics
service	tertiary industry	the contribution rate of tertiary industry	China's national bureau of statistics

Table 2: Descriptive statistics.

Variable	Mean	Std. Dev.	Min	Max
year	2013.5	5.815	2004	2023
fuel	.092	.055	.012	.302
edu	.047	.008	.033	.063
lnedu	6.302	.475	5.15	7.035
lnfor	6.356	1.417	4.138	8.288
lnrd	123.791	107.89	1.658	384.067
service	.453	.086	.298	.635

Wherein; education spending, foreign investment, R&D internal expenditure, and contribution rate of tertiary industry. The chosen factors in the model are organized into a log. Variables are transformed into log forms according to the following considerations, for example, using the results of the coefficients to decide the probability of elasticity. In addition, log form can eliminate the time series' sharpness of the data by manipulating the variations of data. As a result, based on the previous studies and research, this research chooses to use the baseline empirical model to examine whether

public educational spending suffers from a "Natural Resource Curse", the following is the econometric form of the model:

$$\text{Educational spending}_{i,t} = a_i + \beta_1 * \text{fuel}_{i,t} + \beta_2 * \text{control}_{i,t} + \mu_{i,t} \tag{1}$$

Where i depicts a country, t indicates time, a_i stands for the country fixed effect, and $\mu_{i,t}$ depicts the error term, respectively.

3.2.1. Public educational spending

To determine the government's contribution to education, this study uses the data from the Bureau of Statistics of China on government education expenditure as a percentage of GDP in Heilongjiang, Jilin, and Liaoning. Public cost on educational activity consists of current and capital expenditures both on public and private departments of educational administrations, institutions, transfers, subsidies, and expenses invested by people from international sources to the local government. Among the 3 provinces, the highest and lowest average spending on education in the years from 2004 to 2023 is 3.3% and 6.3% respectively.

3.2.2. Natural resources

In line with Gylfason, Cockx and Francken, Huang Yue, this study uses a proportion of the oil and natural gas extraction industry in total industrial output as an indicator of natural resources abundance and exploitation[18]. This paper derives the indicator of natural resources from the National Bureau of Statistics of China, which consists of comprehensive data for northeast China for 2004-2023. The highest share of oil and natural gas extraction in total industry output is 30.2%, indicating that natural resource extraction occupies a high proportion of total industrial production.

3.2.3. Additional controls

In line with the discussion of the determining factors of government public expenditure on education, this paper takes into consideration the influence of R&D internal expenditure by containing the logarithm of a dataset. To capture the influence of foreign direct investment, this research includes the influence of total imports and exports of enterprises with foreign direct investment by including the logarithm of data. To determine the effect of the service industry, we use the contribution rate of the tertiary industry as an index.

Table 3: Initial fixed effects regressions on Public Education Expenditures

| | I |
	lnedu
fuel	-0.027*
	(-1.855)
lnfor	-0.000
	(-0.026)
lnrd	0.000
	(1.164)
service	-0.001
	(-0.126)
_cons	0.048***
	(4.508)
N	60
R^2	0.072
F	1.024

Notes:*,**,***denote statistical significance at 10%,5%, and 1% separately.

4. Results

4.1. Effect of natural resource exploitation on government educational spending

The results of the baseline regression specification concluded in Table 3 stress the existence of a natural resource curse impact on public educational expenditure. The proportion of the oil and the natural gas extraction industry in overall industrial output has an expressively negative influence on the relationship between public spending on education and GDP. According to the baseline model(columns I and II), from the perspective of core variables, fuel has a significant negative impact on the level of educational spending. The coefficient is 0.027, which is statistically significant at the 10% level, indicating that the educational spending level will decrease by 0.027 percentage points when the proportion of oil and natural gas extraction industry in total industrial output increases by 10 percentage points. It is worth mentioning that worldwide average expenses on education activity were 4.44% of GDP, which depicts a dwindle in government financial support for the educational department. In the following, this paper assesses the role of the various factors that could explain the influence of natural resources: The effect of foreign direct investment, R&D internal expenditure, and service industry, however, lose significance when excluding outliers.

4.2. Robustness checks

To test the robustness of the results, in line with Gylfason et al., Maloney, Bravo-Ortega and De Gregorio, and others, this paper uses the government investment in education Share of GDP to change variables from the origin logarithm form of educational spending to verify the reliability of the empirical results, referring to the practice of using a single indicator in previous studies[19,20]. Passed the F-test and the Hausman test, the individual fixed effect model is still selected for the equation, from table 4 the robustness test results are consistent with the empirical results. The model itself has statistical significance, and the regression coefficients of fuel are -2.939 respectively, which is significant at a 95% confidence level. Therefore, it strengthens the robustness of the core conclusion of this paper.

Table 4: Robustness checks

	I	II
	lnedu	lnedu
fuel	-2.939***	-3.030***
	(-2.951)	(-3.124)
lnfor	0.094	-0.034
	(0.753)	(-0.868)
lnrd	0.003***	0.004***
	(4.210)	(6.794)
service	1.981***	1.540***
	(3.357)	(3.272)
_cons	4.673***	5.573***
	(6.362)	(21.245)
N	60	60
R^2	0.594	
F	19.402	

***p<0.01", "**p<0.05", "*p<0.10

Note:*,**,***denote statistical prominent at 10%,5%, and 1% respectively.

5.   Conclusion and policy suggestion

Education has been an important and indispensable key determinant of economic development growth and human capital development could be beneficial to industrial evolution, especially in resource-abundant countries, nevertheless, some scholars have posited that in resource-abundant countries, natural resource capital could squeeze out human capital. It is true that in resource-rich regions such as the Middle East and Africa, the regional government primarily focuses on natural resources departments while ignoring other significant departments such as public education, which was a policy failure. The principle is that the natural resources revenue is boomed by human capital, and human capital depends on educational systems. Hence, the imbalanced investment of government spending could ultimately lead to counterproductive GDP performance, and eventually lead to the outflow of human capital, which is a vital factor of regional development, and thus the economics deteriorating.

Using three provinces' panel data set including the period from 2004 to 2023, this study finds clear evidence that "Natural resource" has a curse on public educational spending. There is a prominent negative association between natural resource extraction and public educational expenditures relative to GDP, which is robust to controlling for additional variations such as foreign direct investment, R&D internal expenditure, and the contribution rate of tertiary industry. Moreover, Collier concluded that effective and sustainable management of natural resources requires public investment in education, which means that government ignorance of public educational expenditures is a serious policy problem[21].

Our results are of significance for the long-term development of natural resources wealth in developing countries, only if they pay more attention to the educational system and human capital, will the regional economics become better. This paper also raises questions regarding the role of the extractive industry as an important role in regional economies. The oil and natural gas industries could reconsider raising funding for education through mandating corporate social responsibility policies or through other innovative channels of development factors. In sum, the revenue generated by natural resources industries should be allocated more to educational departments, and the distribution of part of the natural resource revenues to a conditional cash transfer program for the construction educational system, potentially with approval from the extractive industries such as oil and natural gas. Eventually, the extractive industries and educational systems could bring out the best in each other and consequently benefit and boost the regional economies, thus shrinking the regional development inequality.

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