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Natural resource, education and russian economic growth

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ABSTRACT

This paper investigates the relationship among resource abundance, education and economic growth, and show that an increase in resource income frustrates economic growth indirectly by increasing the rewards to unskilled labor. So it provides a mechanism interpretation of the phenomenon of resource curse, namely the crowding-out effect of natural resource exploitation towards education. Then it conducts empirical test by virtue of relevant Russian data and accordingly put forward specific policy suggestion.

KEYWORDS

Natural resource;
Education;
Economic growth.

INTRODUCTION

According to many early development economists, abundant natural resources would be an important pillar to facilitate economic growth. However,a number of recent empirical evidence and theoretical work has presented a rather puzzling fact: on average, countries with rich natural resources appear to grow more slowly than countries with relatively poor resources. Later, this fact evolved into a very famous paradox in the field of economics: resource curse, that is, natural resources tend to hinder rather than boost economic growth (Auty,1994; Sachs and Warner,1995, 1997,1999).

Why are natural resources indeed harmful for economic growth? Economists have developed many theories in order to explain the paradox of resource curse. The main focus of these analysis lies in the crowding-out effects of resource wealth, that is, natural resources indirectly impede economic growth by crowding-out some of its important determinants. The scope of this paper is on a crowding out effect of resource abundance: the crowding out of education or human capital. Based on relevant model, this paper attempts to test the relationship among Russian natural resources, education and its economic growth by empirical analysis of relevant Russian data.

The rest of this paper proceeds as follows. Section 2 briefly introduces the theoretical model developed by Asea & Lahiri (1999). Section 3 presents the results of empirical test while the lase section concludes with some policy suggestions.

THE THEORETICAL MODEL

The model set up in Asea & Lahiri (1999) illustrates the inner mechanism through which abundant resources crowds out education by increasing the rewards to unskilled labor. The main content of this model is as follows:

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Consider a small open economy which consumes and produces two goods, x and y. The representative agent is infinitely lived and maximizes the present discounted value of her lifetime utility given by

$$V = \int_{t=0}^{\infty} \exp(-\rho t) u(c_t^x, c_t^y) dt \quad (1)$$

Where ρ denotes the subjective rate of time preference. It is also assumed that u is homothetic and belongs the family of constant relative risk aversion (CRRA) functions. Hence, $\mu(c_t^x, c_t^y) = c^{1-\sigma}/1-\sigma$ where p is a positive constant.

The competitive solution

The agent chooses paths for c_t^x, c_t^y, n_t and s_t to maximize lifetime utility given by Eq. (1)

The first-order conditions for utility maximization are

$$\mu_x(c^x, c^y) = p\mu_y(c^x, c^y) \quad (2)$$

$$p\mu_y(c^x, c^y) f_n(k^x, n, \bar{e}) = \mu e \quad (3)$$

$$\dot{\mu} = \left[\rho + n - 1 - \frac{e g_e(k^y, e, \bar{e})}{p f_n(k^x, n, \bar{e})}\right]\mu \quad (4)$$

$$\lim_{t\to\infty} \exp(-\rho t)\mu_t e_t = 0 \quad (5)$$

From the above conditions we obtain:

$$\rho - (1-\sigma)(1-\hat{n}) = \frac{e}{p}\frac{g_e(k^y, e, \bar{e})}{f_n(k^x, \hat{n}, \bar{e})} \quad (6)$$

Comparative statics

The primary interest in this subsection is to study the effect of a change in the natural resource endowment on the growth rate. Totally differentiating equation (6) gives

$$\frac{\partial \hat{n}}{\partial k^x} = \frac{e g_e f_{nk}}{-f_n \Delta}; \frac{\partial \hat{n}}{\partial k^y} = \frac{e g_{ek}}{\Delta}; \frac{\partial \hat{n}}{\partial p} = \frac{-e g_e}{p\Delta} \quad (7)$$

Eq. (7) says that the steady-state labor supply rises with an increase in the sector x specific capital and falls with an increase in the sector y specific capital. Further, an increase in the relative price of good x induces the steady-state labor supply to increase. These results are collected in the following proposition:

Proposition. $\sigma \geq 1$ is a sufficient condition for the steady state growth rate of the economy to be: (i) decreasing in the sector x specific capital, k^x;(ii) increasing in the sector y specific capital, k^y;and (iii) decreasing in the relative price of good x.

The economic intuition behind the proposition is simple. An increase in the endowment of the sector x specific capital causes an increase in labor supply to that sector since the two inputs are complements in the production of good x. The rise in the return to labor in sector x causes the opportunity cost of schooling to rise and, hence, reduces schooling time and causes the steady state growth rate to fall. Similarly, an increase inincreases the return to human capital in sector y, and hence, increases schooling and growth. An improvement in the terms of trade facing sector x, on the other hand, causes labor wage in sector x to rise. The consequent increase in the opportunity cost of schooling causes a fall in steady-state schooling.

Conclusion of the model

The model developed in this paper is one where the engine of growth is human capital. However, the variable which determines investment in human capital is the reward to skilled labor relative to unskilled labor. Assuming that unskilled labor and natural resources are more complementary in production than are skilled labor and natural resources, the primary prediction of the model is that a larger endowment of resources should increase unskilled wages and, thereby, reduce human capital investment and growth.

EMPIRICAL TEST FOR RUSSIA

Preliminary empirical observation

Preliminary statistical observation will be conducted in this part by virtue of empirical data in 7 Russian federal districts1, i.e.,Central District(CT), Northwest District(NW), Southern District(SO), Volga District(VL), Ural District(UR), Siberia District(SB) and Far East District(FE), so as to know about the approximate relationship between Russian natural resources and its education level.

It is always very hard to measure the abundance of

natural resources. In view of the huge economic rent embodied in energy resources and its strategic status in the process of industrialization, and the significant influence of Russian abundant petroleum and natural gas in international market of energy, this paper constructs resource abundance index (simplified as RAI)represented by energy, measuring the regional disparity of natural resource endowment mainly by the relative ratio of the production of three mineral resource, i.e., coal, petroleum and natural gas in each federal district to the national total production. According to data published by BP, the proportion of total production and consumption in primary Russian energy is about: coal 13%, petroleum 30%, natural gas 48%, based on which this paper designates the relative weight to three resources, respectively. The specific formula to calculate RAI is as follows:

$$AI = \frac{coal_i}{coal} \times 13 + \frac{oil_i}{oil} \times 30 + \frac{gas_i}{gas} \times 48$$

In which, coali, oili, gasi are the production of coal, petroleum and natural gas in i federal district, respectively; coal, oil, gas are the total national production of coal, petroleum and natural gas, respectively.

Education level is represented by the number of full-time students (unit: person)in each district's 1000 population. The scatter diagram between education and RAI is depicted in Figure 1, with the vertical axis measuring each district's average education level from 1997-2013, and the horizontal axis measuring each district's resource abundance index.

It is obvious from the diagram that the fitted curve is downward-sloping, which indicates the education level in districts with abundant resources is on average lower than that in districts with poor resources in recent years, and there is a negative relationship between resource abundance and education level. Natural resources maybe crowd-out Russian education according to the preliminary district-level empirical observation.

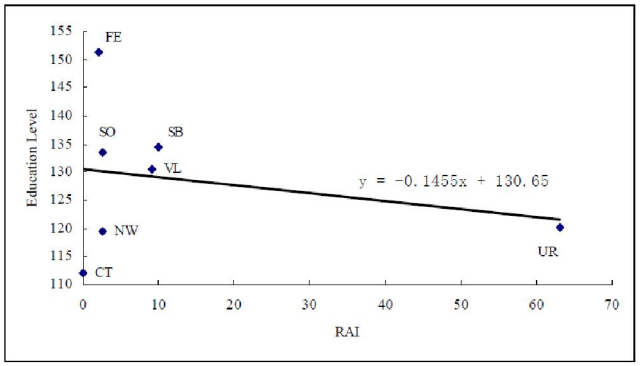

Figure 1 : Russian natural resources abundance and its education level

Empirical test of the crowding-out effect of resources on Russian education

Setting model and picking up variables

Next, this paper will test whether or not natural resources crowd out Russian education level, i.e., model (8) will be estimated:

$$Eduit=\alpha 0+\alpha 1\ LnYi0+\alpha 2\ NRit+\varepsilon it \quad (8)$$

In which, i corresponds to each district, t represents year, α0 on the right side of the equation represents the vector of constant term, Yi0 represents the initial economic level of various district, Edu represents the education level of various district, α1 and α2 are the vector of coefficient, εit is stochastic disturbance term.

Due to the availability of data, this paper collects the data of 7 Russian federal districts from 1997-2013. The final panel data includes time series data of 7 sectional unis within 17 years, and 119 sample observations.Data of GDP have been deflated by GDP deflator so as to get rid of the influence of price fluctuation. Data is derived from Российский сталистический ежегодник, 1997-2014 and Регионы россии, 1996-2014.

Since there exists disparity in total such as level of economic development, scale of population and land area in various Russian districts, indicators in absolute value are unsuitable for horizontal comparison within districts. Therefore, values of all variables in the regression equation are all in relative value. The meanings of various variables in the equation are as follows:

LnYi0is the natural logarithm of district i 's real per capita GDP in 1997;

Eduit is the education level of district i in period t represented by the number of full-time students in each district's 1000 population so as to reflect the effect of human capital level in various district on its economy;

NRit is district i's input level of natural resources in

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TABLE 1 : The result of econometric analysis of the crowding-out effect of natural resources on Russian education

Variable	LnYi0	NRit	Constant term	Estimation method	R2	Sample size
Eduit	0.0109786 (8.97) ***	-0.0001543 (-11.96) ***	0.0803141 (2.96) **	FE	0.6076	119

Note: 1. The value in parenthesis is t-statistics, 2. ***00* represent the significance in the level of 1%05%010%, respectively**

period t represented by the resource abundance index {RAI} mentioned above.

Based on a series of tests such as Hausman test in software Stata10.0, this model should be estimated by fixed effect model. Meanwhile, since there exist heteroscedasticity and interdependency in the model, it should be estimated by command xtscc in Stata10.0. The result is in TABLE 1.

It is obvious from TABLE 1 that the coefficient of natural resources is negative, and passes through the test of significance in the level of 1%, which indicates natural resources markedly crowd-out Russian education level.

Empirical test of the fact that resources improve the rewards to unskilled worker, thereby crowding out Russian education

Because data of wages in various districts is unavailable, this paper attempts to set up a model of vector auto regression(VAR) based on national Russian time series data, and analyze the dynamic relationship between Russian natural resources and the rewards to unskilled workers, and between rewards and Russian education with impulse response function in VAR.

Empirical test of the relationship between natural resources and the rewards of unskilled Russian workers

Sources of data and treatment

This paper collects yearly output data of Russian coal, crude oil and natural gas. There is conversion formula published by Chinese Academy of Sciences as follows: output of energy= output of crude coal×0. 714 t/ t + output of crude oil×1. 43 t/ t +output of natural gas ×1. 33 t/ 1000m3. In which,t is ton, m3 is Cubic meter. By converting the three important energy, i.e., coal, crude oil and natural gas, into standard coal and adding them up, we get the yearly output of Russian energy and designate it as the abundance of natural resources; and designate the rewards of untrained workers as those of unskilled workers.Due to the availability of data, this paper collects Russian time series data from 1995-2013, in which, data of rewards is derived from Российский сталистический ежегодник, 1997-2014; data of output of coal, crude oil and natural gas is derived from Регионы россии, 1996-2014。

Analysis of impulse response

Figure 2 is the impulse response of Russian unskilled workers' rewards to natural resources. The horizontal axis represents the number of lagged period of the impact(unit: year), and vertical axis represents the response strength of dependent variable to one standard deviation impact of the disturbance term. The solid line is the impulse response function, and the two dotted lines represent a confidence belt of two standard deviation. It is obvious from the figure that there is no response of the rewards of unskilled Russian workers in the first period after natural resources are given an innovation impact of one positive standard deviation in current period. Then, the response strength gradually increases and reach the positive maximum in the third period, then gradually decreases, thus getting a positive accumulated response strength. This indicates that abundant natural resources will cause the rewards of unskilled Russian workers to increase. Its economic im-

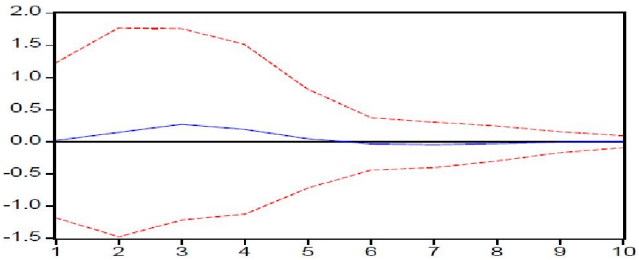

Figure 2 : The impulse response function diagram of Russian unskilled workers' rewards to natural resources

plication is as follows: when it is lucrative in the section of natural resources, this section always absorbs huge amount of labor force with high payment, thus increasing its rewards (including the rewards of unskilled workers).

Empirical test of the relationship between education and the rewards of unskilled Russian workers

In this paper, education level is represented by the number of full-time students (unit: person)in 1000 Russian population, and the reward of unskilled workers is represented by that of untrained workers. Due to the availability of data, this paper collects Russian time series data from 1995-2013, in which, all data is derived from Российский сталистический ежегодник, 1997-2014.

Figure 3 is the impulse response of Russian education level to unskilled workers' rewards. According to analysis similar to that in Figure 2, it is obvious that there always exist a negative response of Russian education level to the impact of unskilled workers' rewards during the whole analysis period, which indicates that the increase of unskilled workers' rewards will lower Russian education level. Its economic implication is as follows: the increase of unskilled workers' rewards will increase the opportunity cost of education, thus lowering the education level. In view of the conclusion in Figure 2, we can conclude that abundant Russian natural resources crowd-out its educational level by increasing unskilled workers' rewards.

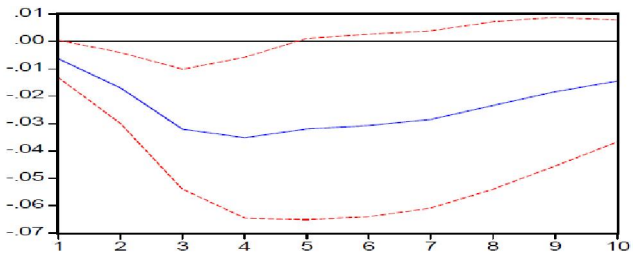

Figure 3 : The impulse response function diagram of Russian education level to unskilled workers' rewards

CONCLUSION

From the above empirical analysis, we can conclude that natural resources indeed crowd-out Russian education, thereby impeding its economic growth. Therefore, Russia should adopt some active countermeasures so as to prevent natural resources from exerting inimical effect on education and growth.

Here are some policy suggestions:

Firstly, safeguard various laws and regulations with regard to education to be earnestly fulfilled. Russia has formulated a number of laws and regulations to facilitate education ever since its independence. However, various national educational policies have nearly been neglected. Therefore, the masses of Russian people should pay more attention to education, and seriously implement national laws and regulations with regard to education.

Secondly, appropriate more money for education. At present, a very striking problem in the filed of Russian education is its short of funds. It is very known that deficiency of funds will undoubtedly impede the development of education. Therefore, Russian government should gradually increase its proportion of educational expenditure in national budget. At the same time, various Russian institutions of education should also try to open up additional sources of revenue so as to make up the deficiency of educational funds.

Finally, strive to build up teaching staff. The question of teachers is the primary question of education. The construction of teaching staff is critical for education. The quality and initiative of teachers determine the level of teaching quality and the success or failure of educational reformation. Therefore, Russia should conduct some new exploration in educational regime.

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