Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.5, No.21, 2014

Natural Resources, Human Capital and Economic Development in Nigeria: Tracing the Linkages

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Abstract
The proposition that natural resource abundance tends to slow down economic growth through its deleterious impact on human capital accumulation is studied in the Nigerian context. Three main channels of transmission from natural resource abundance to stunted economic growth are discussed. They include: (a) the voracity effect, (b) the Dutch disease and (c) the neglect or crowding out effect. Estimating a system of seemingly unrelated regressions (SUR), we find evidence that natural resource abundance through its adverse effects on institutional quality, crowds-out human capital and affects economic growth negatively. The policy implication of our result makes the case for increased funding and participation in education, since more and better education tends to shift comparative advantage away from natural resource production towards manufacturing and services provision which accelerates learning by doing and guarantees economic development that is sustainable.

1. Introduction

Nigeria is often regarded as an oil-rich country. It is widely observed in the literature that natural resource abundance tends to slow down economic growth in countries that possess and exploit them, which is the paradox of resource-abundance turning to resource-curse. This may happen through its crowding-out effect on human and physical capital accumulation. This claim deserves careful scrutiny because of its potential implications for raw materials research, education and development policy Nigeria.

Recent studies of the linkages between these three variables reflect a consistent pattern of relationships, though with a few exceptions. For example, Gylfason (2001) studied 65 natural resource–rich countries (including Nigeria) and observed that only four countries managed to attain long-term investments exceeding 25% of Gross Domestic Product and per capita income growth exceeding 4 percent per annum on average between 1970 and 1998. These countries are Botswana, Indonesia, Malaysia and Thailand.

The other 61 countries failed to attain these levels because they built the base of their economies around their natural capital, that is the exploitation of their natural resource endowments, thereby completely neglecting, or devoting inadequate attention to, investment in the development of other economic resources. By concentrating in exploitation of their natural resource endowments and allocating less than sufficient expenditure to the development of other resources, especially human capital, whose linkage effects on growth and development would be positive, nations which are richly endowed in natural capital tend to remain poor and undeveloped. According to Gylfason (2001), "their natural wealth blinded them to the need for educating their children".

The purpose of this paper is to shed new light on the nature of the linkages between natural resources, human capital accumulation and economic growth in the Nigerian context. We attempt an empirical analysis of the relationship between these variables by specifying an econometric model, which sought to provide answer to the following questions: (1) Does natural resource abundance tend to engender faster or slower economic growth? (2) Does natural resource abundance tend to accumulate more or less human capital? And (3) what is the direct, indirect and total impact of natural resource abundance on economic growth?

The rest of the paper is organized as follows. Section 2 describes the linkage of natural resources, human capital accumulation and economic growth in economic literature. Section presents the methodology adopted to achieve the objectives of the paper, while Section 4 presents the results from our model estimation with the econometric interpretation. Finally, in Section 5, we discuss the policy implications of the results and end with a conclusion.

2. Literature review: Linking natural resources, human capital and economic development

2.1 Literature review

Mainstream neoclassical economists assume that economic growth is primarily and positively linked with capital accumulation, labour productivity and the level of technological advancement in an economy. Hence, conventional growth models like the Cobb-Douglas and the Harrod- Domar models seek to explain growth dynamics as a function of only these three factors. Recent research has however shown that two additional factors play significant roles in explaining the differences in economic performance among countries. These

factors are: (1) the variations in the stock of natural capital (Sachs and Warner, 1995, 1999) and the stock of social capital, which includes education (Acemoglu, *et al*., 2002; Auty, 2007). Gylfason (2011:10) broke down capital into six categories – real capital, human capital, foreign capital, social capital, financial capital and natural capital – their relative comparison will consider issues such as tangibility, replenishability, cross-effect on the stock of other capital, and economic growth-effect of set of capital. In this study human capital is regarded as a part of social capital due to the effect of education on economic growth process.

Two stylized facts models explain how natural resources and social capital (education) can be linked with economic development. These are the low-rent competitive industrialization model and the high-rent staple trap model (Auty, 2007).

The low-rent competitive industrialization model opines that countries with low rents from natural resources are encouraged to promote alternative economic activities that have high potential for wealth creation by providing public goods and maintaining incentives for efficient investments in economic and social infrastructure. The development of these alternative economic activities propels the manufacturing sector with high potential for technological innovations and enhanced services that necessarily increases the tax base of the economy, thereby boosting government revenue.

In consequence, the low-rent competitive industrialization mechanism encourages early competitive industrialization which is labour-intensive and entails high level education with frontier extending innovativeness. This process triggers a virtuous economic cycle with positive feedbacks that can foster rapid social and economic capital accumulation and high GDP growth rates that are sustainable (Auty, 2006; Hamilton, 2001).

Conversely, the high-rent staple trap model demonstrates that high natural resource-rents relative to GDP can have two adverse effects on the political economy. First, high natural resource exports usually tend to result in exchange rate appreciation of the country's currency vis-a vis the trading partners' currency, with the effect that export of manufactures are competitively stifled. This is the process which is referred to as Dutch Disease problem (Gylfason, 2011). Second, high rents dampen the incentives of governments away from promoting alternative economic sectors to rent redistribution which has a higher potential for scoring and obtaining greater and immediate political points and rewards. Besides, the development trajectory of resource rich countries tends to procrastinate the continued reliance on resource exports and fails to absorb surplus labour, thereby exacerbating income inequalities.

Rent-rich governments frequently respond to disequilibria in the labour market by using rents to provide jobs, thereby over expanding the civil service and protecting infant industries that hardly ever mature (Gleb, 1998; Auty, 2007). This process results in a vicious cycle of underdevelopment. This vicious cycle evolves from low human and physical capital accumulation to stunted growth (Auty and Kiisk, 2001; Birdsall et al., 2001; Barro, 2001; Woolcock et al., 2001). It is this dependence on primary exports with declining viability and its resultant adverse effects on physical capital accumulation, human capital accumulation and economic growth that is referred to as the staple trap linkage. There is also some theoretical allusion to the fact that agency problem, in the form of rent-seeking behaviour and corruption generally intensifies in countries that are natural resource rich. This is attributed to existence of weak institutions that predates the discovery of the natural capital and neglect of education and other growth-intensifying factors in the process of time (Gylfason, 2011).

The empirical literature dealing with the nexus between natural resources, human capital accumulation and economic growth has generally been consistent across countries (see for e.g. Adawo, 2008; Gylfason, 2001; Barro, 1997, 2001; Stijns, 2005, 2006; Auty, 2007). Overall, three kinds of relationships have been observed: (a) economic growth varies inversely with natural resource abundance, (b) human capital accumulation measured by educational inputs, outcomes and/or participation are all inversely related to natural capital, and (c) economic growth varies directly with education.

Human capital accumulation is a crucial driver of economic development in any country. Abundant natural resources may however undermine human capital thereby slowing down the progress of economic development. According to Gylfason (2001), nations that are confident that their natural resources are their most important assets may inadvertently and perhaps even deliberately neglect the development of their other resources by devoting inadequate attention and expenditure to human capital through education.

The reason is that, in resource abundant countries with enormous foreign exchange earnings, there is no incentive for the political elite to promote technologically creative skills so as to export the manufactured products needed to pay for imports. Rather, the resource owning elite have a tendency in this circumstance to use the countries resources to invest in highly skilled labour, particularly for their own children (Stijns, 2006).

Barro (2001) and Stijns (2006) argue that it is adequate attention to human capital development especially at the secondary and tertiary levels that facilitates the absorption of superior technologies from leading countries. This technology-absorption effect is what brings about growth in the manufacturing sector and hence economic development.

The observed relationships between these three economic variables (abundant natural resources, human capital accumulation and economic growth) only seem to be in the data, while the understanding of the channels of transmission has been a difficult task. In the theoretical literature, three channels of causation from natural resource abundance to low human capital accumulation to low growth have been identified.

First, natural resources generate rents which lead to rapacious rent seeking. This tendency is referred to as the "voracity effect", and it manifests in the political economy of the country with corruption and institutional fragility (as hallmarks) which adversely affects long-run growth. Sala-i-Martin and Subramanian (2003) refer to these effects more broadly as the institutional impact of natural resource abundance.

Second, natural resource abundance often results in an overvaluation of the national currency. This is referred to as the *Dutch disease* syndrome: a situation where a natural resource boom accompanied by an increase in the resource export drives up the real exchange rate, thereby making other exports unattractive. Also, recurrent booms and busts tend to increase exchange rate volatility (Gylfason, *et al*., 1999). This effect reduces total exports and skews the composition of exports away from the manufacturing and service sectors, which are particularly essential for sustainable economic growth (Frankel and Romer, 1999).

Third, natural resource abundance may imbue people with a false sense of financial security and lead governments to lose sight of good and growth-friendly economic management including human capital development, natural resource management and institutional quality (Sachs and Warner, 1999). This false confidence reposed on the natural resource asset, makes governments to neglect other economic assets such as human capital. A situation we can refer to as the crowding-out effect. This is true especially when we consider the evidence reported by Gylfason (2001) where the average secondary school enrolment rate and share of education expenditure in GDP in OPEC countries was 57 and 4 percent respectively, compared with 64 and 5 percent for the rest of the world in 1997.

2.2 Theoretical framework

The empirical investigation of this paper is based on three theoretical underpinnings. The first is the assumption that technological progress based on human capital accumulated through education is the major source of economic growth (Lucas, 1988; Douangngeune, *et al*, 2005). This is the underlying assumption in conventional growth models and has been useful in explaining the trajectory of economic growth in many East Asian countries.

The second is the induced innovations hypothesis developed by Hayami and Ruttan (1971). According to this hypothesis, countries with abundant natural resources can easily increase output by increasing the exploitation of its natural resources, such as aggressive exploration for oil deposits as was the case of Nigeria in the 1970s. This tendency inhibits the tendency for such countries to develop new technologies for other economic activities through education and research.

The third concept is the vent-for-surplus development theory by Hla Myint (1965, 1971). According to this theory, a resource abundant country's participation in international trade based on the sale of natural resources cannot lead to sustainable development, unless natural resource rents are effectively mobilized for physical and institutional infrastructure including education. In fact, effective use of natural resource rents have been identified as the bases for the successful shift in the economic growth momentum of Canada and the United States from exploitation to agricultural intensification and industrialization (Douangngeune, *et al*, 2005).

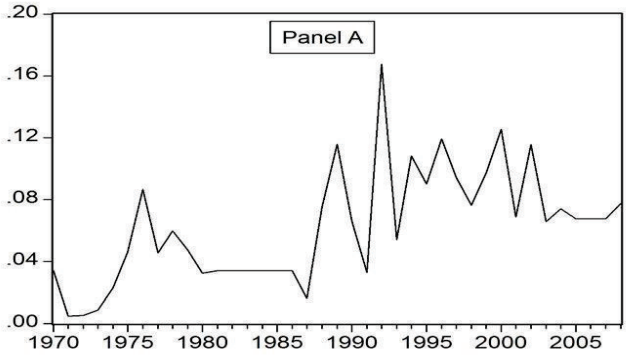
It seems reasonable to hypothesize that Nigeria's lag in educational development relative to other resource abundant countries like Malaysia and Botswana, represents a failure of the government to effectively utilize the enormous resource rents generated from the vent-for-surplus development process to create an enabling environment for sustainable modern development.

2.3 Pictorial view in human capital accumulation and natural resource production

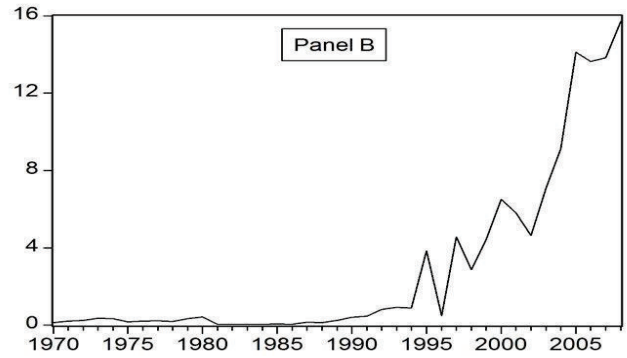
In Nigeria, the effect of natural resource exploitation on human capital accumulation could be captured by the trend of public expenditure on education, while the level of contribution the natural resource sector to national output is measured by the share of natural resource in GDP. These trends are represented in Figure 1 below.

In particular, the graphs in Figure 1 depicts the trend in public expenditure on education as a share of total public expenditure, and the trend of natural capital share in GDP measured by primary export intensity. Panel A shows that the share of public expenditure on education in total public expenditure peaked in the early 1990s with a maximum of 16.7 % in 1992. Since then, the ratio has been on a downward trend. As at 2008, the share of public expenditure on education as a percentage of total public expenditure was 7.7%, about 19 percentage points short of the UNESCO recommended benchmark of 26%. On the other hand, Panel B shows that the share of natural capital in GDP has been on the steady rise since 1970. A clear indication that natural resources have been the economic base of the Nigerian economy and continues to intensify its hold as the base.

Figure 1 Education and natural resource abundance in Nigeria



Public expenditure on education (% of total public expenditure)



Share of natural resource in GDP (primary export/GDP)

3. Methodology

The aim of this section is to specify the econometric model linking up with theoretical framework above, and to identify data for the implementation of the empirical analysis. This section has two sub-sections: the econometric model and the treatment of variables and data.

3.1 The econometric model

Building on Gylfason (2001, 2011) and Barro (2001), we specify a system of two seemingly unrelated regressions (SUR) equations: (a) the resource-growth equation and the resource-human capital equation respectively. Thus,

$$GDPG = \beta_0 + \beta_1 NRA + \beta_2 TENR + \beta_3 INV + \beta_4 PCI + \varepsilon_t \quad (1)$$

$$TENR = \beta_0 + \beta_1 NRA + \beta_2 PCI + \varepsilon_t \quad (2)$$

Where *GDPG* is the growth rate of gross domestic product, *NRA* is a measure of natural resource abundance, *TENR* is tertiary enrollment, *INV* is gross domestic investment and *PCI* is per capita income.

Equation (1) implies that economic growth depends on the stock of natural capital, school enrollment, gross investments in the economy and per capita income. Equation (2) suggests that human capital accumulation measured by participation in tertiary education depends on the stock of natural capital and the per capita income in the economy. The recursive nature of the system and the conceivable correlation of the error terms in the two equations makes SUR an appropriate estimation procedure (see Maddala, 1998; Zellner, 1962; Lahiri and Schmidt, 1978 for an explanation).

3.2 Variables description and Data sources

We collect data for the selected variables from 1970 to 2008. We proxy natural resource abundance using primary export intensity as proposed by Sachs and Warner (1995). Hence resource abundance is defined as primary exports divided by GDP. Where primary exports include: agricultural, mineral and oil exports. The data is collected from the World Trade Dataset (2008).

We use tertiary enrollment to capture human capital accumulation. It is defined as the number of students who enrolled for a University, Polytechnic and College of Science and Education programmes within the period under review. The data is obtained from the National Bureau of Statistics (NBS) *Abstract of Statistics* (various issues) and is supplemented with data from UNESCO via the World Bank's *World Development Indicators* (WDI) database.

Gross domestic investment is total value of investments in the economy by indigenous and foreign investors. The dataset is obtained from the Central Bank of Nigeria's (CBN) (2009) *Statistical Bulletin*. Data on per capita income is obtained from the World Bank's WDI database and is defined as national income divided by the total population. We use the computations of the World Bank in WDI to capture the trend of economic growth in Nigeria.

4. Results and discussion

The results of the empirical estimation of the model are presented in Table 1. These parametric estimates represent empirical evidence on the relationship between natural resource abundance, human capital accumulation and economic growth in Nigeria. The coefficient for resource abundance in the resource-growth equation indicates that there is an inverse relationship between natural resource abundance and economic growth in Nigeria. The evidence is strong because it is both statistically and econometrically an important negative influence on growth process since its coefficient is significant at 1% level of confidence. This means that a one percentage increase in earnings accruing from exploitation of natural resource (petroleum oil mineral), will result retardation of economic growth directly by 1.55%.

Table 1. Regression results

Dependent Variable	Constant	Natural Capital	Human Capital Accumulation	Investment	Per Capita Income	R^2
Economic Growth	30.55	-1.55	4.19	4.29	6.46	0.71
	(0.75)	(-3.12)***	(0.72)	(1.1)	(2.71)**	
Human Capital Accumulation	15.08	-0.29			0.59	0.53
	(6.32)***	(-6.46)***			(1.43)	

t-statistics are shown within parentheses.
*** and ** indicates significance at the 1% and 5% levels respectively

The direct impact of natural capital on economic growth is -1.55, while the indirect effect through its impact on education is $-0.29 \times 4.19 \approx -1.22$. Hence, the total effect of natural resource abundance on economic growth is -2.77 (the direct effect plus the indirect effect). The indirect effect of natural capital accumulation on the economy, working through its impact on human capital accumulation, requires some more attention. At first sight (in economic growth equation in Row 1, Table 1), the coefficient of human capital is positive (4.19) but not statistically significant – meaning that the relationship tends to zero under statistical consideration. By regressing the natural capital on human capital accumulation, however, the estimated coefficient for natural resource exploitation clearly unveiled its negative effects on human capital accumulation. This negative effect is statistically significant at 1% level.

The resource-human capital equation results (row 2 in Table 1) reveal that natural resource abundance is inversely related to human capital accumulation in Nigeria. This implies that the higher the share of natural capital in national income, the more is the likelihood for government to focus on its natural resource assets, thereby neglecting other assets like human capital. Overall, our results indicate that a 2.77 percentage point increase in the share of natural capital in GDP is associated with an average decrease of one percent in economic growth. Weak accumulation of human capital has very severe growth-retarding effect because labour is not just a factor of production but a living one. Its poor quality when combined with other factor inputs has the strong productivity diminishing potential on the inanimate inputs. This negative effect of low quality of human capital on total output can as well be explained by O-ring theory in production by which the dysfunction of a factor (even when such a factor is considered relatively unimportant) could result in systemic dysfunctionality. The productive inefficiency effects of the low human capital accumulation and employment is thus made manifest as slow process of economic growth in natural resource-rich economy as is the case in Nigeria.

This is most likely to happen through the crowding-out (neglect) effect of natural resource abundance earlier discussed in Section 2 above. The nature of the relationship obtained in our resource-growth equation is consistent with the resource curse hypothesis and similar to the results obtained by Sachs and Warner (1995), Sala-i-Martins and Subramanian (2003), Gylfason (2001; 2011) and Stijns (2005).

5. Implications for policy and conclusion

5.1 Policy implications

It is important that policy makers and stakeholders do not point accusing fingers at natural resource abundance as the culprit for stunted economic growth in Nigeria, but to realize that it is the failure of public authorities to

properly manage the rents that accrue that seems to be the problem. Natural resource abundance can turn a hitherto underdeveloped economy into a very prosperous one. Norway, Chile, Malaysia, Indonesia and Botswana are typical examples.

What are the new insights from our results? First, natural resource based development is less high-skill labour intensive and sometimes, also less high-tech capital intensive than other industries and so generates relatively weak forward and backward linkages with other industries (Chuku, 2007; Wood, 1999). This conclusion has some exceptions in modern agriculture and high-tech oil-drilling operations. In the long-run, as long as high-tech labour and high-tech capital are less common in natural resource production activities than elsewhere, then, majoring in natural resource production and primary exports will impede learning by doing, technological advancement, human capital development and eventually, economic growth. The policy implication of these relations is that Nigerian government at every tier should consciously embark on policies that will enhance human capital formation so as to deepen the developmental effect of natural capital accumulation.

The nature of these linkages reinforces the case for increased investments in education and training as an engine for growth. The rational is that more inputs (in form of investments) and participation in education increases the outcome of human capital in the form of creative innovativeness which catalyzes economic development.

In an attempt to achieve sustainable economic development and higher human capital accumulation, Nigerian authorities should establish a known rule for the allocation of natural resource wealth. A substantial percentage (say 40%) should be invested in foreign securities in other to divide the rents fairly between present and future generations as well as to shield the domestic economy from the syndrome of too much money too quickly and the neglect of other sectors. The remains should be allocated to social expenditure in priority sectors, especially education. Others include: health, infrastructure, rural development and environment.

There should concerted policy effort to stem the problem corruption, which is intensifying underdevelopment through diversion of public funds accruing natural resource exploitation to undue private advantage. This could be achieved through development of institutions, promotion of good governance and entrenchment of transparency in the conduct of nature resource transactions in the country. This will free resources currently abused in corruption and misappropriation for human capital accumulation.

5.2 Conclusion

Natural resource abundance and human capital accumulation are two vital elements that affect economic development. Natural resources can be linked with economic development through the low-rent competitive industrialization model and the high-rent staple trap model.

In this paper, we trace the linkages between natural resource abundance, human capital development and economic growth in Nigeria. Our results show that natural resource intensity has a negative impact on growth and human capital accumulation. This leads us to the conclusion that the high-rent rent staple trap model is applicable to Nigeria.

Natural resources and the rents that accrue from them can be better managed if optimal intertemporal and intersectoral mechanisms for rent redistribution are put in place. The basic insight from the paper is that more and better inputs (investments) and participation (enrollments) in education can shift comparative advantage away from natural resource (primary) production to manufacturing (intermediate) and services (tertiary) provision, thus accelerating the process of economic growth in a sustainable manner.

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