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Natural Resource Curse in Africa: Dutch Disease and Institutional Explanations

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Abstract

The African continent is endowed with rich natural resources, including minerals and fossil fuels. Production and exports in Africa's resource-rich economies are highly concentrated in natural resource-based products, but these economies show little evidence of structural change toward high value-added activities outside the natural resource sector. Using a sample of 47 African countries, this study aims to explain the impact of natural resources on Africa's economic growth and other factors explaining growth in the continent in the wake of many natural resource discoveries. We use OLS regressions and seemingly unrelated regressions (SUR) to achieve this objective. In the OLS regressions, the share of primary resource production to GDP; share of mineral production to GDP; share of oil production to GDP; and total share of all natural resources to GDP were used as measures of natural resource endowment. Results indicate that there is a negative but insignificant relationship between the share of total natural resource abundance to GDP and per capita GDP growth. However, when this resource endowment measure is decomposed to individual components, the share of primary production and the share of mineral resources have a negative relationship with GDP growth, while the share of oil production has a positive relationship with growth. This indicates that there is a natural resource curse effect, especially in economies rich in primary resources and mineral resources, but no such effect in oil-rich states. We also test whether this natural resource curse can be explained by market mechanisms (Dutch Disease) or institutional quality mechanisms. Results from this analysis show that improved government effectiveness and an increase in the corruption perception index (i.e., a reduction in corruption) do improve the property rights index GDP growth.

Résumé

Le continent africain est doté de riches ressources naturelles, y compris les minéraux et les combustibles fossiles. La production et les exportations des économies riches en ressources naturelles de l'Afrique sont fortement concentrées dans les produits de base, et ces économies montrent peu de signes de changement structurel vers des activités à forte valeur ajoutée en dehors du secteur des ressources naturelles. En utilisant un échantillon de 47 pays africains, cette étude vise à expliquer l'impact des ressources naturelles sur la croissance économique de l'Afrique et d'autres facteurs expliquant la croissance sur le continent dans le sillage de nombreuses découvertes de ressources naturelles. Nous utilisons des régressions en MCO et des régressions apparemment non lies (de SUR) pour atteindre cet objectif. Dans les régressions MCO, la part de la production de ressources primaires dans le PIB; la part de la production minérale dans le PIB; la part de la production de pétrole dans le PIB; et la part totale de toutes les ressources naturelles dans le PIB ont été utilisées comme mesures de dotation en ressources naturelles. Les résultats indiquent qu'il existe une relation négative mais non significative entre la part de l'abondance totale des ressources naturelles dans le PIB et la croissance du PIB par habitant. Toutefois, lorsque cette mesure de dotation en ressources est décomposée en composantes individuelles, la part de la production primaire et la part des ressources minérales ont une relation négative avec la croissance du PIB, tandis que la part de la production de pétrole a une relation positive avec la croissance. Cela indique qu'il y a un effet de la malédiction des ressources naturelles, en particulier dans les économies riches en ressources primaires et en ressources minérales, mais pas dans les Etats riches en pétrole. Nous testons également si cette malédiction des ressources naturelles peut être expliquée par des mécanismes de marché (syndrome hollandais) ou des mécanismes lies a la qualité des institutions. Les résultats de cette analyse montrent que l'amélioration de l'efficacité du gouvernement et une augmentation de l'indice de perception de la corruption (par exemple, une réduction de la corruption) améliorent l'indice des droits de propriété et la croissance du PIB.

1. Introduction

The African continent is endowed with rich natural resources, including minerals and fossil fuels. It is estimated that the continent hosts about 30 percent of the world's mineral reserves (Page, 2011), and new discoveries of oil and gas resources in Africa continue to emerge. However, a majority of the continent's natural resources remain either unexploited or undiscovered due to: a) infrastructure and human resource constraints; b) political instability; c) governance issues; and d) a lack of adequate and properly implemented development policies and strategies in many African countries (Page, 2011). Production and exports in Africa's resource-rich economies are highly concentrated in natural resource-based products, but these economies show little evidence of structural change toward high value-added activities outside the natural resource sector. These resource-rich economies trail non-resource-rich economies (excluding South Africa and Botswana) in many growth indicators. For instance, the share of manufacturing in GDP in resource-rich African countries is less than eight percent, lower than non-resource-rich economies in Asia by about one-third and trailing even the least developed countries globally.

Many modern development theorists have simply assumed that natural resource abundance contributes to an underdeveloped country's economic growth potential (Broad, 1995). This belief is supported by conventional economic reasoning and conventional wisdom, which suggest that increases in a country's stock of assets provides greater opportunities for economic development (Bulte, et al., 2003; Okidi, 2007). Further, the expectations of many early development economists (Nurkse, 1953; Rostow, 1960; Watkins, 1963) that resource endowments could potentially support economic expansion by attracting funds from foreign creditors, channeling primary sector rents into productive investments and escaping "poverty traps", have proven to be inaccurate.

Based on fiscal revenues from natural resources as a percent of GDP and total revenue and on export proceeds as a proportion of total exported goods, figures show that oil- and mineral-rich countries in Africa south of the Sahara (SSA) and elsewhere earn substantial revenues from natural resources. Therefore, if the conventional economic reasoning and conventional wisdom were true, mineral- and oil-rich SSA countries would have some of the most vibrant economies in the world. However, most of these countries have been categorized as low income countries (Elbadawi and Nandwa, 2011). In fact, what has been seen is a negative, long-term impact of resource abundance - mineral abundance in particular - on long-term economic growth, a phenomenon which has been christened 'the natural resource curse' (Papyrakis, 2014). Recent empirical evidence and theoretical work provide strong support for this hypothesis (Auty, 1994, 2007; Caselli and Cunningham, 2009; Papyrakis and Gerlagh, 2004, 2007; Papyrakis, 2011; Sachs and Warner, 1995, 1997, 1999, 2001; Gylfason, 2000, 2001; van der Ploeg, 2011), which raises the question:

why do most natural resource-rich African countries exhibit dismal economic performance compared to countries that are resource-poor, despite the revenues from natural resource proceeds?

Over the past few decades, economists and political scientists have advanced new theories to explain the dismal growth performance of resource-rich countries and the negative association between resource intensity and a country's economic growth. These explanations can be grouped into either market mechanism explanations that relate to the Dutch disease (DD) or to political explanations that relate to institutional quality and rent-seeking (van der Ploeg, 2011).The Dutch disease (DD) theory stresses the role of markets rather than processes that operate through political institutions. This mechanism can be divided into Resource Movement Effect (RME) and Spending Effect (SE) arising from a resource shock (Papyrakis and Raveh, 2014). RME describes the movement of production factors from various sectors toward the resource sector due to higher marginal productivities, while SE describes the inflationary outcome of an income shock which, in turn, decreases the competitiveness of commodities outside the primary sector (Corden and Neary, 1982; Papyrakis and Raveh, 2014). The net outcome of both effects is a contraction of non-primary tradables.

Further, the presence of large natural resource sectors, or booms in these natural resource sectors, will affect the distribution of employment throughout the economy, as wealth effects pull resources away from activities (e.g. education) that are more conducive to long-term growth (Sachs and Warner, 1997; 2001).This is because countries see natural resources, not human capital, as their future. These sectoral shifts can affect long-term growth (Matsuyama, 1992; Bulte et al. 2003; Gylfason, 2001).

According to other authors, a resource boom causes a country's exchange rate to appreciate, which in turn causes a contraction in the country’s manufacturing exports. Stevens (2003) theorizes that volatility in natural resource prices leads to frequent boom-bust cycles and exchange rate fluctuations; these impair economic performance by hindering investment planning and effective government policy. In addition, Neary and van Wijnbergen (1986) postulate that a booming resource sector may draw capital and labor away from manufacturing, raising manufacturing costs as a result. This erodes a country's ability to compete on world markets, reducing the potential for export-led growth of manufactures in the long run. The logic of most of the DD explanations is that natural resource abundance crowds out other activities that drive the economy, and therefore natural resource abundance is detrimental to growth.

The institutional theory addresses the problem of the resource curse from the institutional perspective. According to Mehlum et al. (2006), the growth effects of resource abundance may depend on a country's governance institutions, and returns to entrepreneurial activities and rent-seeking are both determined by the country’s institutional context. They argue that in 'grabber-friendly' economies, resource booms trigger a shift of labor from production to rent-seeking, to the detriment of aggregate growth, while in countries with 'producer-friendly' institutions, a resource boom boosts production. Further, according to Auty (2001), resource-rich countries, especially those with so-called 'point resources' like oil fields, tend to be dominated by factional and predatory oligarchic polities and governments that promote narrow sectional interests. This implies that countries well- endowed with point resources are expected to have unfavorable policies that postpone the transition to competitive industrialization and economic diversification. As a corollary, the resource sector supports a burgeoning non-tradable sector made up of infant industries and an inflated but unproductive public sector.

According to Boschini et. al. (2007), the effect of resources is not determined by resource endowments alone, but rather by the interaction between the type of resources that a country possesses and the quality of that country's institutions. This combination of factors is called 'appropriability' of a resource and it captures the likelihood that natural resources lead to rent seeking, corruption, or conflicts which, in turn, harm economic development. They argue that in countries where resources are highly appropriable, resource abundance is problematic, while in countries where resources are less appropriable, resources can contribute to economic growth.

Given the foregoing arguments, the questions this paper addresses are: a) what is the role of natural resources and other explanatory variables in the growth of African economies?; b) does the natural resource curse exist in Africa?; and c) if it does exist, can it be explained by the Dutch Disease mechanism, institutional quality, or both?

2. Role of Natural Resources in Economic Growth in Africa

In modelling the role of natural resources in growth, several authors use different endogenous variables. For instance, while Papyrakis and Gerlagh (2004, 2007) use per capita GDP growth, Sachs and Warner (1997; 2001) and Sarmidi et.al. (2013) use real GDP per capita and Boschini et. al. (2007) use average yearly growth rate of GDP. Our approach will follow that of Papyrakis and Gerlagh (2004, 2007). In this approach, the authors postulate that per capita GDP growth depends on initial per capita income[1], natural resource abundance[2], and a vector of other explanatory variables. Per capita GDP growth of country i between period 0 and period T is given by:

$$G_i = \frac{1}{T} ln\left(\frac{Y_{iT}}{Y_{i0}}\right) \qquad (1)$$

For this study, growth in per capita income is considered for the period between the years 1990 and 2014 (25 year period). The choice of these years is arbitrary and presents a period of time which the authors

[1] Initial income per capita is used to check for the conditional convergence hypothesis that predicts higher growth in response to lower starting income per capita *ceteris paribus*.

[2] What constitutes natural resources and how they are to be measured is subject to extensive debate, but that is outside the scope of this study. In this study, we have used share of oil production to GDP, share of mineral production to GDP, and share of primary production. See Papyrakis and Gerlagh (2007), Boschini et. al. (2007), and Sachs and Warner (2001) for different measures of natural resource abundance.

believe is long enough to capture the long-term effects of natural resources and other variables on GDP growth. It also present a period of time for which data for most of these variables are available in Africa. Therefore, Y_{iT} is year 2014 and Y_{i0} is year 1990. For the purposes of estimation, our empirical model takes the form:

$$G_i = \alpha_0 + \alpha_1 \, ln(Y_i^0) + \alpha_2 R_i + \alpha_3 Z_i + \alpha_4 I_i + \varepsilon_i \tag{2}$$

where, Y_i^0 is the initial income per capita of country i; In this case, we have considered the GDP per capita at 1990 as the initial income. This measure is expressed in constant 2005 US dollars. R_i represents the natural resource abundance or endowment of country i. This could be in the form of primary resources (such as agriculture, fisheries, forestry, and hunting), mineral resources, or oil resources. These measures have been given as mean shares of primary resource production to GDP, mineral resources production to GDP, and oil resources production to GDP over the period 1990 to 2014. Table 1 presents the descriptive statistics for these natural resources and growth in GDP for 46 African countries. Note that we consider all countries in Africa for which data are available, including North African countries, South Africa, and Africa south of the Sahara. From the descriptive statistics, the average growth in GDP per capita for the period 1990 to 2014 is 1.42 percent, with the lowest (republic of Congo) recording -2.31 percent and the highest (Equatorial Guinea) recording a mean of 13.79 percent. Primary resource production as a percent of GDP ranged from 3.4 percent to 68 percent, while oil and mineral production ranged from 0.0 percent to 53 percent and 18.34 percent, respectively.

Table 1: Descriptive statistics of per capita GDP in Africa and natural resource

Variable	N	Mean	Std. Dev.	Min	Max
Growth in Per capita Income	45	1.42	2.43	-2.31	13.79
Per Capita Income 1990 (US$)	44	1162.25	1867.15	143.97	8790.93
Primary Resource Production: GDP	46	26.33	15.40	3.38	67.89
Oil Production: GDP	44	6.44	14.53	0.00	52.96
Mineral Production: GDP	45	1.58	3.29	0.00	18.34
Total Resource Production: GDP	46	16.00	15.11	0.01	59.46

Source: World Bank Development Indicators

We hypothesize a natural resource curse in Africa; hence, from the literature, the expectation is that natural resource abundance would have a negative and significant impact on growth in per capita income. To test this, we estimate four different OLS regression models with growth per capita income as the dependent variable and share of primary production to GDP; share of oil production to GDP; share of mineral production to GDP; and all combined natural resources as exogenous variables (Table 2). In each model, the initial per capita income in 1990 is included as a dependent variable. The coefficient on this variable represents β-convergence rate (Gylfason et al., 1999) and is used to test for conditional convergence hypothesis. This hypothesis states that different growth rates between different countries are explained by these countries' various characteristics; however, high-income countries have lower growth rates than low-income countries, all other things being equal (Papyrakis and Gerlagh, 2004), and poor countries tend to converge toward rich ones in terms of GDP over time (Gylfason et al., 1999).

To gain a feel of the difference between rich and poor states, we divide our sample into two classifications of countries, one with mean GDP per capita income of US $1,000 (high) and one with mean GDP per capita income below US $1,000 (low). A t-test of the two sample means shows that high-income countries recorded a higher mean growth rate of 2.46 per year, while low-income countries had a lower mean GDP growth rate of 1.03 per year. From Table 2, the log of initial per capita income in 1990 has a negative and significant relationship with growth in GDP in the combined Model 4, but a negative and insignificant relationship with log of growth in per capita income in Models 1 to 3. From Model 4, therefore, poor countries' GDP have been converging toward rich countries' GDP at the rate of 0.93 percent per year (i.e. they are eliminating gaps in levels of real per capita GDP at a rate around 1% per year).

Table 2: Testing for natural resource curse

Dependent Variable: Log Growth per capita				
	(Model 1) Primary production	**(Model 2) Oil rent**	**(Model 3) Mineral rent**	**(Model 4) All**
Initial per capita Income 1990	-0.580	-0.265	-0.125	-0.926*
	(-1.13)	(-0.69)	(-0.33)	(-1.76)
Share Primary production: GDP	-0.0464			-0.0666*
	(-1.34)			(-1.83)
Share Oil production: GDP		0.0566*		0.0577*
		(1.90)		(1.94)
Share Minerals production: GDP			-0.0918	-0.0627
			(-0.80)	(-0.56)
Constant	6.507	2.867	2.395	9.090**
	(1.62)	(1.17)	(0.98)	(2.20)
N	43	42	44	41
R-Squared	0.0448	0.0451	0.0175	0.1638

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Model 1, the share of primary production is negatively but insignificantly correlated with the log of growth in per capita income, indicating that a unit increase in the share of primary production to GDP would decrease growth in per capita income by 0.046 percent. Therefore, countries with a higher ratio of production of primary products to GDP are likely to experience negative growth rates. The same is noted for Model 3, in which African countries with higher ratios of mineral production to GDP record negative growth. From this model, a unit increase in the share of mineral production to GDP reduces the growth rate by 0.092 percent. Contrary to expectations, the share of oil production to GDP has a positive and significant relationship with growth, and increasing the share of oil production to GDP by one unit would boost per capita GDP growth by 0.057 percent.

In Model 4, the regressors retain the same signs, although all but share of mineral production are significantly different from zero. Given the magnitudes of the different regressors, the effects of share of primary production and share of minerals to GDP would outweigh the positive impact of oil resources. Therefore a country that is heavily dependent on primary resources and mineral resources is more likely to experience the natural resource curse compared to one that only depends on oil (e.g. Equatorial Guinea). A combination of all three natural resources in one country will also guarantee a resource curse, as any positive impacts stemming from oil production will be outweighed by primary resources and mineral rents.

Empirical growth literature has identified a few key determinants of the rate of growth per capita of GDP across countries. The key variables are the initial GDP of a country and the ratio of investment to GDP. Others include, but are not limited to, foreign trade, political instability, school enrollment, and the importance of the primary sector to the economy (Gylfason et al., 1999). In our model, the Z_i vector includes other growth-related characteristics for country i not considered in Table 2. These include, but are not restricted to, the ratio of investment to GDP, secondary school enrolment, economic openness (total trade: GDP), and economic mismanagement index3. All these data are means for 1990 to 2014 and are shown in Table 3. We also include the institutional quality index I_i, which is measured using the property rights index[4] of the various countries.

Table 3: Other factors explaining growth of per capita GDP in Africa

Variable	N	Mean	Std. Dev.	Min	Max
Econ. Mismanagement Index	47	0.52	0.12	0.29	0.81
Secondary School Enrolment	44	34.72	20.65	9.58	91.04
Investment: GDP	45	22.74	13.15	9.32	96.76
Economic Openness	47	76.47	41.26	28.03	252.66
Property rights index (PRI)	47	3.31	0.93	2.01	6.60

Source, World Bank Development Indicators

On average, the mean investment to GDP ratio averaged 22.74 percent, while the mean economic openness was 76.47 percent. In some countries, secondary school enrolment was quite low; for example, Niger recorded only 9.58 percent enrolment. In other countries, the figure was higher; for example, Seychelles recorded over 91 percent enrolment. The mean property rights index in Africa averaged 2.93, indicating that ownership of property in Africa is insecure. This has implications on other governance factors (institutional indicators), as will be shown later. All four of these variables are expected to positively

3 Economic mismanagement index=$[\pi/(1+\pi)]$ where π is the annual inflation rate.
4 This is an index between 1 and 10, with 10 indicating countries in which property rights are most secure.

influence growth. Finally, the economic mismanagement index, which is an indicator of inflation, averages 0.52. An increase in this measure indicates increased economic mismanagement and is expected to have a negative impact on the GDP per capita growth rate. These variables were estimated together with resource variables in Model 4 (Table 2) to show their individual and combined influence on GDP per capita growth rate.

Table 4: Other determinants of growth

Dependent Variable: Log Growth per capita			
	(Model 4)	**(Model 5)**	**(Model 6)**
	Individual Natural Resources	**Natural Resource + Other regressors**	**Natural resources combined**
Initial Per capita Income 1990	-0.926*	-1.023*	-0.602
	(-1.76)	(-1.90)	(-1.21)
Share Primary production: GDP	-0.0666*	0.00433	
	(-1.83)	(0.15)	
Share Oil production: GDP	0.0577*	0.0677***	
	(1.94)	(3.02)	
Share Minerals production: GDP	-0.0627	-0.0631	
	(-0.56)	(-0.79)	
Total Natural Resource: GDP			-0.00195
			(-0.07)
Economic Management Index		-5.600**	-2.063
		(-2.26)	(-0.78)
Secondary School Enrolment		0.0374	0.0177
		(1.63)	(0.70)
Log Investment: GDP		3.048***	2.713**
		(3.65)	(3.00)
Economic Openness		0.0138*	0.0177*
		(1.89)	(1.89)
Property Rights index (PRI)		1.080	0.847
		(1.45)	(1.01)
Constant	9.090**	-4.261	-6.200
	(2.20)	(-0.80)	(-1.37)
N	41	40	42
R-Squared	0.1638	0.6866	0.5229

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Controlling for other variables has a significant impact on the natural resource curse (Model 4). All the variables have the expected signs as shown in Table 4 (Model 5). For instance, the β-convergence rate on the initial income shows an annual convergence rate of 1.02 percent. A one-unit increase in the economic mismanagement index would cause a decline in per capita growth of 5.6 percent. Further, a one-percent increase in the investment to GDP ratio would increase per capita income growth by 3.05 percent, while a unit increase in trade openness would also improve per capita income growth by 0.014 percent. Therefore, a country with good economic management, high investments, trade openness, and a sizeable share of oil resources is likely to grow faster and escape the natural resource curse. Secondary school enrolment and PRI, although not statistically significant, would also positively influence per capita income growth. A one-unit increase in these variables would increase per capita income by 0.037 percent and 1.08 percent, respectively.

In Model 6, we combined all the natural resources and regressed these together with the variables in Model 5. Economic openness and investment to GDP ratio have a positive and significant relationship with per capita income growth, while total natural resource endowment has a negative but insignificant relationship with per capita income growth. The other regressors have the expected signs. From a policy standpoint, it becomes clear that it is important to decompose total natural resources into their components; thus, Model 5 is more informative than Model 6.

3. Can the Resource Curse in Africa Be Explained by the Dutch Disease?

Our results do indicate the existence of a natural resource curse for mineral resources, as there is a negative relationship between the share of mineral production to GDP and per capita GDP growth. However, from Model 5, the share of primary resource production and the share of oil production show a positive relationship with growth in per capita GDP after controlling for other variables. The various explanations of the resource curse lean on either the Dutch Disease or institutional explanations, as discussed earlier. The question therefore is, if the natural resource curse does exist in Africa, can it be explained by either or both of these strands? Most explanations for the curse have a crowding-out logic (Sachs and Warner, 2001), in which natural resources crowd out activity ψ, an activity that typically drives growth. Therefore, natural resources are harmful to growth. However, there are diverse views regarding what activity ψ could be. Gylfason et al. (1999) identify activity ψ as education. Human capital is critical for long-term growth because it is important in the manufacturing and learning-by-doing sectors. These authors argue that countries with booming natural resources and non-tradable primary sectors inhibit economic growth by reducing investments in human capital. This is because skilled labor is not required in a non-tradable sector and because countries rich in natural resources tend to see the resources - and not human capital - as an end. On the other hand, Sachs and Warner (1995, 1999 and 2001) identify activity ψ as traded manufacturing activities. They present a three-sector model consisting of a tradable natural resource sector, a tradable (non-resource) manufacturing sector, and a non-traded sector. Their model is an extension of the Matsuyama (1992) model which consists of two sectors, agriculture and manufacturing. According to the

Sachs-Warner model, capital and labor are used in the manufacturing and non-traded sectors, but not in the natural resource sector. The greater the natural resource endowment, the higher the demand for non-tradable goods, and consequently, the smaller the allocation of labor and capital to the manufacturing sector.

In modelling the Dutch Disease, we approach the analysis from the Sachs and Warner (1997; 2001) model, which is based on the premise that traded prices across countries are roughly equal. Our intention is to test whether natural resource abundance crowds out the traded manufacturing sector in the Africa; i.e., whether natural resource abundance is correlated with higher non-traded prices across countries. The challenge with this approach is that it is difficult to observe non-traded prices directly; in addition, national price levels tend to be positively associated with income levels across countries (Sachs and Warner, 2001). Based on Sachs Warner (1995; 1999; 2001), "positive wealth shocks from the natural resource sector–along with consumer preferences that translate this into higher demand for non-traded goods–creates excess demand for non-traded products. This drives up non-traded prices, including particularly non-traded input costs and wages." From this argument, it follows that if the non-traded prices in resource-abundant countries are higher than the traded prices, then the general price level, which is a weighted average of the two, will be higher in resource-abundant countries. Therefore we test for overvaluation to see whether natural resource-intensive African economies have higher price levels after controlling for the relationship in equation (1). This involves estimating the relative price ratio, which is the ratio of a country's purchasing power parity exchange rate to its nominal exchange rate. This ratio gives the country's price level relative to a global average of prices and is expressed as:

$$RPR_i = \left(\frac{(y_i * p_i^{lc})/ex_i}{y_i * p_i^{\$}} \Longrightarrow \frac{Y_i^{N\$}}{Y_i^{I\$}} \right) \tag{3}$$

where RPR_i is the relative price ratio of country i, y_i is the output of country i , p_i^{lc} is the local price of country i expressed in local currency, $p_i^{\$}$ is the international prices of country i at year t expressed in US$, and ex_i is the nominal US dollar exchange rate of country i currency at year t. Therefore the numerator $Y_i^{N\$}$ is GDP in US dollars measured by using local current prices and the nominal US dollar exchange rate, while the denominator $Y_i^{I\$}$ is the same GDP evaluated at international prices. This ratio is equivalent to what is also referred to the ratio of the country's purchasing power parity exchange rate[5] to its nominal exchange rate (Summers and Heston, 1991; Sachs and Warner, 1991). To test whether the Dutch disease actually exists, we regress this relative price ratio against natural resource abundance or endowments in country i (R_i) and non-natural resource real GDP of country i ($RGDP_i$) to control for income effect.

[5] Purchasing power parity exchange rate is an exchange rate estimated on the assumption that the same set of (international) prices prevails for the same goods, quality adjusted, in any two or more economies (e.g. the ratio of the value of commodity A's total expenditure in local currency, to the value of its total expenditure, measured in international prices, in "international" Dollars).

$$RPR_i = \gamma_0 + \gamma_1 RGDP_i + \gamma_2 R_i + \varepsilon_i \quad (4)$$

Our results (Table 5) show a positive and significant relationship between the log of the relative price ratio and non-natural resource GDP, indicating that a unit increase in non-resource GDP increases the relative price level by 0.016 percent. This shows that natural resource-intensive economies in Africa tend to have higher price levels than resource-poor countries. This is more the case in countries which are rich in oil resources and less so in countries rich in mineral resources or primary resources. Therefore businesses in resource-abundant countries — especially oil-rich countries — are competing with higher than normal price levels; i.e. they are using expensive domestic inputs and are selling products on international markets at prices that injure their competitiveness. This is similar to the result found by Sachs and Warner (2001), who proved that natural resource abundance was crowding out other sectors in the world economy. The effects of this crowding out may not be noticeable in Africa due to the small changes in relative price seen in Table 5. Therefore, explaining the natural resource curse in Africa through the Dutch Disease (market mechanism) may not suffice. Our hypothesis is that institutions play a bigger role in the region.

Table 5: Testing for Dutch disease in Africa

Dependent Variable: Log GDP current prices to GDP (Constant 2005 US$)	
Primary Production: GDP	-0.00453
	(-1.27)
Oil Rents: GDP	0.00965* (1.99)
Mineral Rents: GDP	0.0147
	(0.92)
Non-Natural Resource GDP	0.0106*
	(2.27)
Constant	-0.807*
	(-1.74)
N R-squared	41 0.2073

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4. Role of Institutions in Explaining the Resource Curse in Africa

An erosion of institutions reduces long-term growth (Baggio and Papyrakis, 2010; Montalvo and Reynal-Querol, 2005). Thus, in this section we focus on the relationship between institutions and growth and analyze how institutional quality influences per capita income growth in the presence of natural resource abundance. Our premise is that a solid institutional framework is necessary for investment and would deter vices such as corruption. Our proxy for institutional quality is the security of property rights; Investors will be reluctant to risk their capital when property rights are weak and poorly protected because they will fear that their returns may be appropriated by others (Gwartney et al., 2006). In addition, in a country in which property rights are protected, there is typically quality governance. We hypothesize that secure property rights are negatively influenced by several factors, including increased corruption, but are positively influenced by improvements in governance indicators such as government effectiveness, rule of law, regulation quality, voice and accountability, political stability, and control of corruption. We also hypothesize that polarization or fractionalization within a country renders property rights insecure. The polarization index reaches 1 in the case of bipolar distribution of two ethnic groups of equal size (Montalvo and Reynal-Querol, 2005). Such polarized societies with large rival groups of comparable size are more prone to growth-retarding rent-seeking behavior and conflict. Fractionalization, on the other hand, measures the probability of two randomly chosen individuals from a given country belonging to ethnically distinct groups. It reaches 1 in situations in which there are many diverse communities, with none or very few of those groups dominating the population. It is measured as;

$$Fractionalization = 1 - \sum_{i=1}^{N} (\pi_i)^2 \qquad (5)$$

where π_i stands for the proportion of people belonging to the i-th ethnic group. Polarization is likely to be a stronger deterrent of long-term growth than fractionalization.

For our analysis we worked with a fractionalization index. Our assumption is that in highly fractionalized or polarized countries, characterized by high corruption and poor governance, and unprotected property rights are very insecure. This in turn adversely affects investment decisions at the individual, communal, and national levels and hence results in dismal GDP growth. Therefore institutional factors and fractionalization are assumed to influence growth indirectly through the property rights index (PRI).

A summary of these factors is given Table 6. The PRI is a on a discrete scale of 1-10, with 10 indicating a situation in which property rights are fully protected and 1 indicating a situation in which property rights are completely insecure. From Table 6, the mean property rights index for Africa is 3.31, with the most secure country scoring 6.6. This is an indication that on average, property rights are relatively insecure. The corruption perception index (CPI) is scaled and interpreted in a similar manner. On average, African countries have a CPI of 2.95, meaning that corruption is rampant on the continent. The other governance indicators are a country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. They are positive when a country is performing well in a particular indicator and negative otherwise. On average, the African continent is performing poorly on all of the four remaining indicators. The general picture from these results is that Africa’s institutional framework is generally weak. Finally, the fractionalization index is 0.66, indicating that African societies are highly fractionalized. The continent is therefore a very fertile ground for insecure property rights and abuse of natural resource rents in countries which are rich in natural resources.

Table 6: Institutional quality and ethnic fractionalization Variables

Variable	N	Mean	Std. Dev.	Min	Max
Property rights index (PRI)	47	3.31	0.93	2.01	6.60
Ethnic Fractionalization	47	0.66	0.22	0.04	0.93
Corruption Perception Index	47	2.95	0.95	1.73	5.96
Government Effectiveness	47	-0.70	0.58	-1.68	0.70
Political Stability	47	-0.56	0.79	-2.30	0.98
Regulatory Quality	47	-0.66	0.58	-1.83	0.64
Voice and Accountability	47	-0.68	0.66	-1.90	0.87

Source: World Bank Indicators and Transparency International

To identify the dependence of growth and property rights on natural resource abundance, governance indicators, and fractionalization, we estimate a two–simultaneous equation system (seemingly unrelated regressions) in which governance indicators and fractionalization influence property rights, which, together with natural resources, determine economic growth. This is presented in equation (6).

$$\begin{Bmatrix} G_i = \alpha_0 + \alpha_1 \, ln(Y_i^0) + \alpha_2 R_i + \alpha_3 Z_i + \ \alpha_4 PRI_i + \varepsilon_1 \\ PRI_i = \gamma_0 + \gamma_1 CPI_i + \gamma_2 F_i + \sum_{i=1}^{N} \gamma_i GI_i + \varepsilon_2 \end{Bmatrix} \tag{6}$$

where the first sub-equation has the property rights index (PRI) as an independent variable. The second sub-equation has PRI as the dependent variable, and the corruption perception index (CPI), fractionalization (F), and governance indicators (GI) as exogenous variables. After performing model tests, government effectiveness was selected as a proxy for other governance indicators. Since PRI appears both as a dependent and independent variable, one can use the instrumental variable estimation or estimate a set of equations simultaneously. We adopt the Seemingly Unrelated Regression (SUR) as our estimation procedure, after Baggio and Payrakis (2010), rather than instrumenting PRI.

In Model (7), which considers individual natural resource shares, the variables have the expected signs. Introduction of the PRI variable into the growth equation indicates that if property rights are well protected, a one-unit increase in PRI unit increases GDP growth by 1.16 percent. Other significant variables with expected signs in Model 7 are secondary school enrolment rate, share of Investment: GDP, share of oil production, and economic openness, all of which promote per capita income growth, while economic mismanagement deters GDP growth. In Model 8, total natural resource production has a negative but insignificant effect of income growth, while share of Investment: GDP and economic openness influence income growth positively. In the PRI equations, all variables have the expected signs, and a one-unit increase in the corruption perception index (meaning a decline in corruption) will boost PRI by more than 3 units in both Models 7 and 8. An improvement in the government effectiveness variables will boost PRI by over 0.76 units in both models and will in turn increase income growth.

Table 7: SUR results for income growth and PRI

	(Model 7)	(Model 8)
	Individual Natural Resources	**Total Natural Resources**
Equation 1: Per capita Income growth		
Initial per capita Income 1990	-1.365***	-0.719
	(-3.03)	(-1.61)
Share Primary production: GDP	0.00623	
	(0.27)	
Share Oil production: GDP	0.0862***	
	(4.45)	
Share Minerals production: GDP	-0.0784	
	(-1.19)	
Total Natural Resource: GDP		-0.0143
		(-0.61)
Economic Mismanagement Index	-5.317***	-2.269
	(-2.61)	(-0.97)
Secondary School Enrolment	0.0149	0.00889
	(0.72)	(0.36)
Log Investment: GDP	2.718***	2.719***
	(3.80)	(3.23)
Economic Openness	0.0160***	0.0199**
	(2.58)	(2.34)
Property Rights index (PRI)	1.164***	0.182
	(2.99)	(0.40)
Constant	-1.420	-3.131
	(-0.35)	(-0.86)
Equation 2: PRI		
Corruption Perception Index	3.427**	3.962**
	(2.07)	(2.34)
Ethnic Fractionalization	-0.609	-0.225
	(-1.51)	(-0.56)
Government Effectiveness	0.770***	0.761***
	(2.88)	(2.82)
Constant	3.262***	2.823***
	(4.26)	(3.62)
N	40	42
R-Squared		
Equation 1	0.7058	0.5125
Equation 2	0.7479	0.7331
Chi-Squared		
Equation 1	104.43***	44.53***
Equation2	120.36***	116.711***

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Conclusions and Recommendation

In this article, we have explored the impact of the natural resource curse on per capita GDP growth in Africa. The share of primary production (agriculture, fisheries, and forestry and hunting) to GDP, the share of mineral production to GDP, and the share of oil production to GDP are used as a measure of natural resource endowment. Results indicate that there is a negative but insignificant relationship between total natural resource abundance and per capita GDP growth. However, when the total natural resource abundance is broken into individual components (share of primary production to GDP, share of mineral production to GDP, and share of oil production to GDP), then each of these components has a different impact of growth. For example, the share of oil production influences GDP growth positively, while the share of primary production and share of minerals influence growth negatively. The combined negative influence of the two measures is greater than the positive influence of oil resources. Other variables that influence GDP growth positively include the ratio of the share of investments to GDP, secondary school enrolment, economic openness, and the property right index. Increases in the economic mismanagement index, on the other hand, influence GDP growth negatively.

According to the existing schools of thought, the natural resource curse can be explained by market mechanisms (Dutch disease) or institutional quality mechanisms. Our test for the Dutch disease hypothesis supported the theory that the natural resource curse in Africa can — to a certain extend — be explained by market-based mechanisms because relative price levels and non-resource GDP are positively and significantly related. This is an indication that the competitiveness of other sectors, especially in oil-rich African economies, is affected by relatively high price levels; therefore, there is a crowding out of certain sectors, as the theory suggests.

However, the relative price and non-resource GDP relationship, although significant, may not fully explain the natural resource curse in most African countries. This being the case, we tested whether institutional quality could better explain the curse.

Using seemingly unrelated regressions (SUR), we estimate a system of two equations: a) one with per capita GDP growth rate as the dependent variable, and including property rights index as an independent variable, and b) the other with the property rights index as the dependent variable. PRI was used as a proxy for institutional quality comprised of governance indicators but also influenced by fractionalization. Results from this analysis show that improved governance effectiveness and increases in the corruption perception index (reductions in corruption) do improve the property rights index.

Therefore, as African economies continue exploring and discovering more natural resources, there is a real danger that the natural resource curse may set in due to increased relative prices and crowding out of investments, especially in mineral resource-rich countries. This could be compounded by negative impacts from corruption, fractionalization, and poorly developed governance indicators. Overall, this will lead to a decline in the growth of GDP. The resource curse from Dutch disease (market mechanisms) may be challenging to overcome, but the adverse impacts of institutional factors and fractionalization should be of more concern. To reduce these negative effects, African nations, particularly resource-rich nations, should ensure that there are proper institutional and legal frameworks to support development efforts. Leaving institutions in their present state is a sure way to compromise development, especially in the presence of major resource discoveries in many countries in the continent.

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Definition of Governance Indicators

Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
Political Stability and Absence of Violence/Terrorism captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, particularly the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.

Source: World Development Indicators--World Bank (2016).

Countries considered in analysis

Angola	Cote d'Ivoire	Guinea-Bissau	Morocco	Sudan
Benin	Djibouti	Kenya	Mozambique	Tanzania
Botswana	Egypt	Lesotho	Namibia	Togo
Burkina Faso	Equatorial Guinea	Liberia	Niger	Tunisia
Burundi	Eritrea	Libya	Nigeria	Uganda
Cameroon	Ethiopia	Madagascar	Rwanda	Zambia
Central AR	Gabon	Malawi	Senegal	Zimbabwe
Chad	Gambia	Mali	Seychelles	
Congo	Ghana	Mauritania	Sierra Leone	
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