Re-examining the Natural Resource Curse in African Countries: Resource dependence or abundance?

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Abstract

The natural resource curse has been a dominant theme in the past 20 years in discussions about the economic performance of developing countries. While many studies have adopted the approach popularized by Sachs and Warner (1995) and found significant negative effects of natural resources on economic growth, referred to as the resource curse, there have been a number of recent studies that have questioned the conclusions concerning natural resources being a curse. These studies have largely faulted the resource curse conclusions based on variables measurement – whether resource dependence or resource abundance. This paper conducted a re-examination of the resource curse hypothesis for African countries. A simple cross-section growth regression using 2 measures of resource dependence and 4 measures of resource abundance was conducted. The estimations showed the negative effects of resource dependence on growth, while resource abundance had positive effects on growth. These conflicting results highlight the differing experiences of developing and advanced countries with regard to natural resources. African countries that are resource rich should learn from advanced resource-rich countries and adopt suitable policies which will

optimize the use of their natural resources and foster technological progress and advancement in other sectors of the economy.

Keywords: Resource curse, Resource dependence, Economic growth, Developing countries

Introduction

The natural resource curse has been a dominant theme in the past 20 years in discussions about the economic performance of developing countries. Simply put, the highpoint of the resource curse theory is that natural resource endowments have been responsible for the slow growth rates reported by countries endowed with natural resources. Auty (1993) is credited with coining the term 'resource curse' while Sachs and Warner (1995) initiated empirical research into this issue.

The channels through which natural resources contribute to slow growth rates have been broadly classified into two: economic and political factors (Badeeb et al., 2017; Frankel, 2012; Moradbeigi and Law, 2017). Economic factors include the Dutch disease, commodity price volatility, and economic mismanagement. The political factors include weak institutions, rent seeking, corruption and democracy (van der Ploeg, 2011; Frankel, 2012; Badeeb et al., 2017). These factors have been identified as regular features in empirical studies examining the determinants of economic growth (Durlauf et al., 2005).

Following the seminal paper by Sachs and Warner (1995), there has been an explosion of interest in the resource curse from both policy makers and academics, with mixed results. Empirical investigations of the resource curse have progressed in 3 main directions (Badeeb et al., 2017). The first line of research involves cross-country studies of the effects of natural resources on economic growth according to Sachs and Warner (1995, 2001). The results from these studies generally support the proposition that natural resources have had a negative effect on economic growth (Gylfason, 2001; Nili and Rastad, 2007; Mehrara, 2009; Arezki and Nabli, 2012). The second group of studies examine the effects of natural resources on variables that are usually used as proxies for economic growth, such as human capital, savings, institutional quality, openness, and fiscal policy (Badeeb et al., 2017). These studies report a negative relationship between resource dependence and

such proxies for economic growth (Gylfason and Zoega, 2006; Mehlum et al., 2006; Papyrakis and Gerlagh, 2007). The third line of research comprises studies that offer contrasting views on the natural resource curse. These studies cite weaknesses in the resource curse hypothesis related to measurement of the resource variable, endogeneity issues, and sensitivity to the time period chosen (Stijns, 2005; Brunnschweiler and Bulte, 2008; Alexeev and Conrad, 2009).

This paper falls in the third category of papers. Sachs and Warner (1995) defined natural resources as the ratio of resource-based exports to GDP. Following their paper, many studies have used different variants of the resource abundance measure, with mixed results, suggesting that the consistency and robustness of the resource curse is shaky (Brunnschweiler and Bulte, 2008). Brunnschweiler and Bulte (2008) have questioned this measure, claiming it is more a measure of resource dependence than a measure of resource abundance. Also, since the denominator of this variable captures the whole economy, it will ultimately be affected by other policies, institutions and government actions, implying potential endogeneity problems (Brunnschweiler and Bulte, 2008: 249). Wright and Czelusta (2004) noted that the ratio of resource exports to GDP does not capture resource abundance but indicates the comparative advantage in resources. Following similar lines, Badeeb et al. (2017) identified 4 different measures of resource dependence that have been used in empirical studies: primary exports as a ratio of GDP; rents from natural resources as a share of GDP; share of natural capital in national wealth; and the ratio of mineral exports to total exports. In addition, Badeeb et al. (2017) identified 2 popular measures of resource abundance: total natural capital and mineral resource assets per capita; and subsoil wealth.

This study tests the validity of the resource curse hypothesis in African countries. Alternative measures of resource dependence and resource abundance were used to verify if measurement of these variables affects the conclusions regarding resource curse. However, due to limited data observations, only simple 3-variable regressions could be undertaken. Thus, other control variables in the estimations could not be included and neither was instrumental variable estimation undertaken to account for endogeneity. However, the results provide the basis for further discussions on the resource curse hypothesis in African countries.

Understanding the natural resource-growth link for African countries is important for a number of reasons. First, many African countries have regularly been characterized as exhibiting the classic features of the natural resource curse (Sachs and Warner, 1995; Sala-i-Martin and Subermanian, 2003; Mehlum et al., 2006; van der Ploeg, 2011; Frankel, 2012; Badeeb et al., 2017). Thus, obtaining a deeper understanding of this relationship using only African countries in the analysis can help policy makers in formulating strategies for addressing the resource curse in Africa. Second, recent studies have questioned the empirical validity of past studies on the resource curse based on the measure of resource abundance (Wright and Czelusta, 2004; Brunnschweiler and Bulte, 2008; Bruckner, 2010). These studies have proposed new ways of capturing the natural resource variable in empirical models and have drawn a distinction between measures of resource dependence and measures of resource abundance.

Data

This study utilised data for a cross-section of African countries over the period 1970 to 2015. Specifically, data for 52 African countries were employed in the study.[1] The countries were selected based on data availability.

A number of variables to measure natural resources were used. First, following Brunnschweiler and Bulte (2008), resource dependence was defined using 2 variables: ratio of natural resource exports to GDP (RESEXP) and ratio of mineral resource exports to GDP (MINEXP). These variables, originally used by Sachs and Warner, are the most frequently used variables in the empirical studies of the resource curse hypothesis. Second, following Brunnschweiler and Bulte (2008), resource abundance was defined using 2 variables: log of subsoil assets/mineral resource assets per capita for 1994 and 2000 (SUBSOIL1994, SUBSOIL2000). Furthermore, both Brunnschweiler and Bulte (2008) and van der Ploeg and Poelhekke (2010) acknowledged that

[1]The countries are: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cape Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Democratic Republic, Congo Republic, Cote d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe.

the resource abundance measures might still suffer from endogeneity problems. Following these studies, two additional measures of resource abundance were used: log of per capita reserves of 1970 values of 35 fuel and non-fuel mineral resources (MINRES); and the ratio of oil production value to GDP (OILP).

Results and Discussion

Scatter diagrams

We first examined the simple relationship between natural resources and economic growth using scatter diagrams. The scatter diagrams are presented in Figures 1 to 6. Figures 1 and 2 show a negative relationship between economic growth and natural resources, which is in consonance with the resource curse hypothesis. On the other hand, Figures 3 to 5 show a positive relationship. Figure 6 does not indicate a discernible relationship between economic growth and natural resources.

Interestingly, the variables used to depict natural resources in Figures 1 and 2 are the common variables used in earlier studies following Sachs and Warner (1995, 2001). These studies have been questioned by Brunnschweiler and Bulte (2008) who noted that these variables indicate resource dependence rather than resource abundance. The variables which they had identified as adequately capturing resource abundance are used in Figures 3 to 6. Figures 3 to 5 depict a positive relationship between economic growth and natural resources.

Thus, a clear distinction exists between how economic growth is affected by variables indicating resource dependence and resource abundance. This further highlights the importance of the natural resource variable used in the analysis of the resource curse, as variables measuring resource dependence and resource abundance give different results. This has important implications for the resource curse hypothesis. Clearly, the measurement of the natural resource variable plays an important role in whether the natural resource hypothesis is supported or not. However, econometric tests are conducted to further test this relationship to provide scientific evidence for the studied African countries.

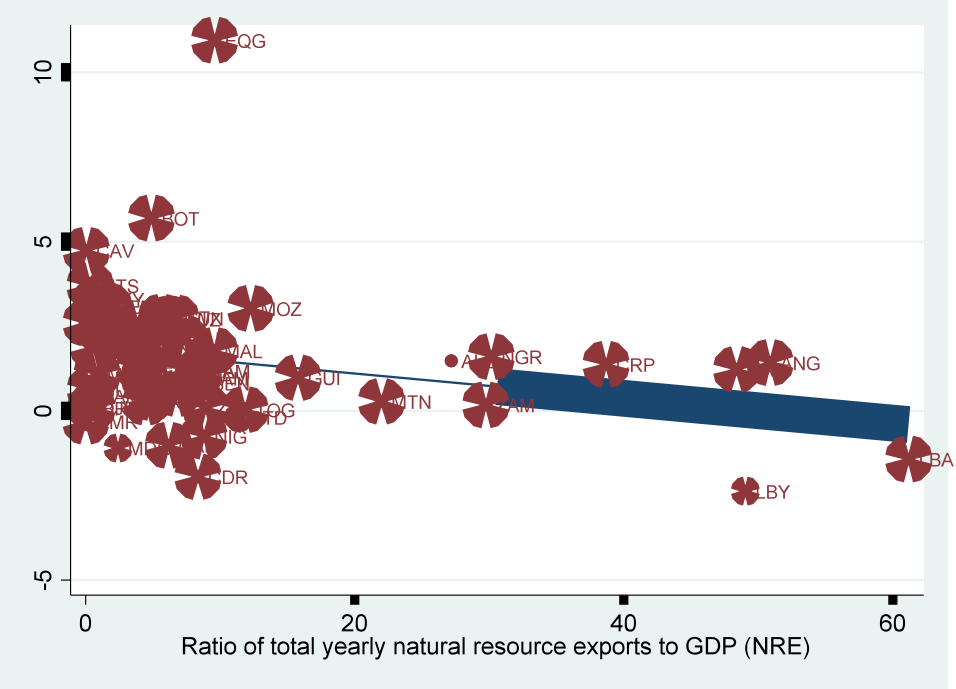

Figure 1: Growth in GDP per capita and natural resource exports (RESEXP)

Notes: ALG is Algeria; ANG is Angola; BEN is Benin; BOT is Botswana; BKF is Burkina Faso; BRD is Burundi; CAV is Cabo Verde; CAM is Cameroon; CAR is Central African Republic; CHD is Chad; CMR is Comoros; CDR is Congo, Democratic Republic, CRP is Congo Republic; CTD is Cote d'Ivoire; DJI is Djibouti; EGT is Egypt; EQG is Equatorial Guinea; ERI is Eritrea; ETH is Ethiopia; GAB is Gabon; GAM is Gambia, The; GHA is Ghana; GUI is Guinea; GUB is Guinea-Bissau; KEN is Kenya; LES is Lesotho; LSA is Liberia; LBY is Libya; MDG is Madagascar; MLW is Malawi; MAL is Mali; MTN is Mauritania; MTS is Mauritius; MRC is Morocco; MOZ is Mozambique; NAM is Namibia; NIG is Niger; NGR is Nigeria; RWD is Rwanda; STP is Sao Tome and Principe; SEN is Senegal; SEY is Seychelles; SRL is Sierra Leona; SA is South Africa; SUD is Sudan; SWZ is Swaziland; TAN is Tanzania; TOG is Togo; TUN is Tunisia; UGA is Uganda; ZAM is Zambia; ZIM is Zimbabwe.

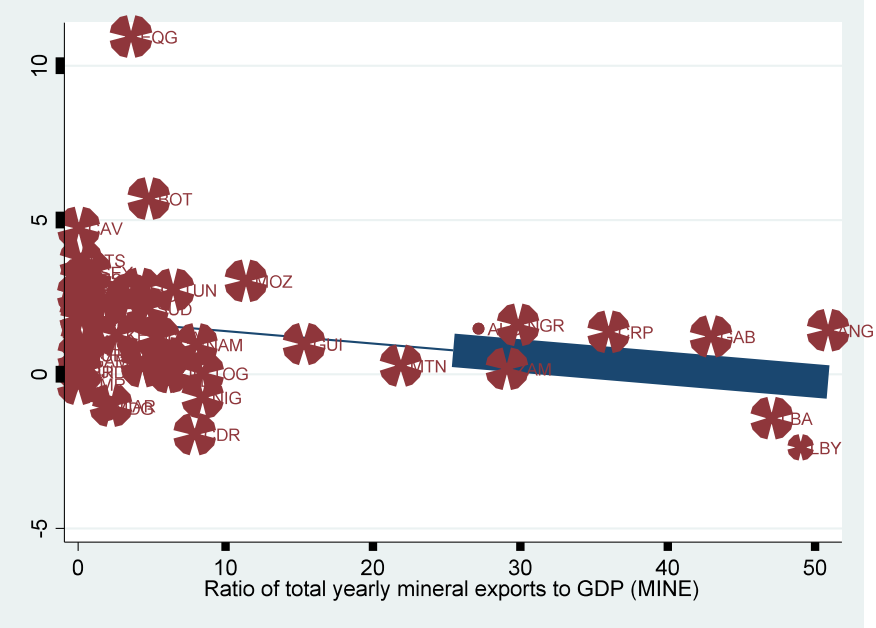

Figure 2: Growth in GDP per capita and Mineral exports (MINEXP)

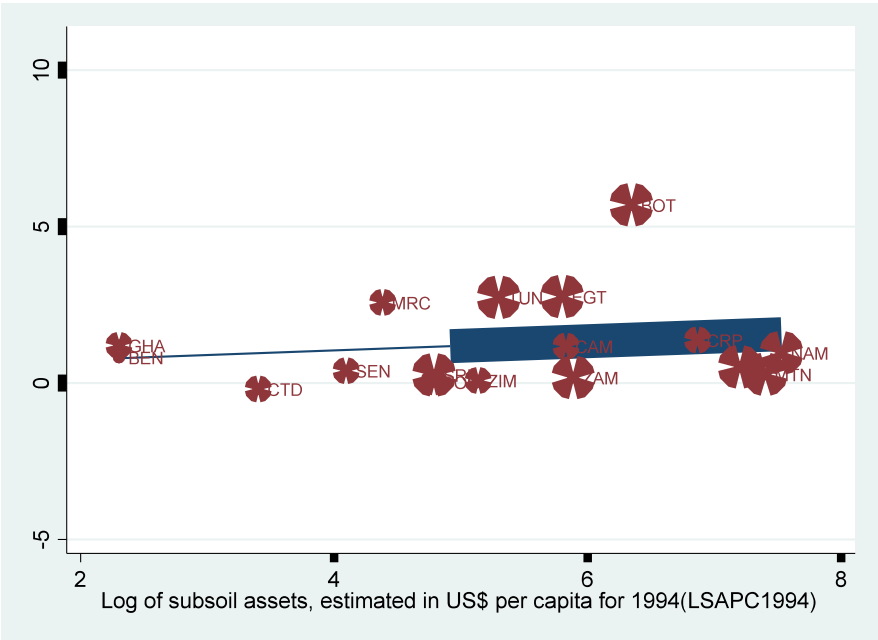

Figure 3: Growth in GDP per capita and 1994 subsoil per capita (SUBSOIL1994)

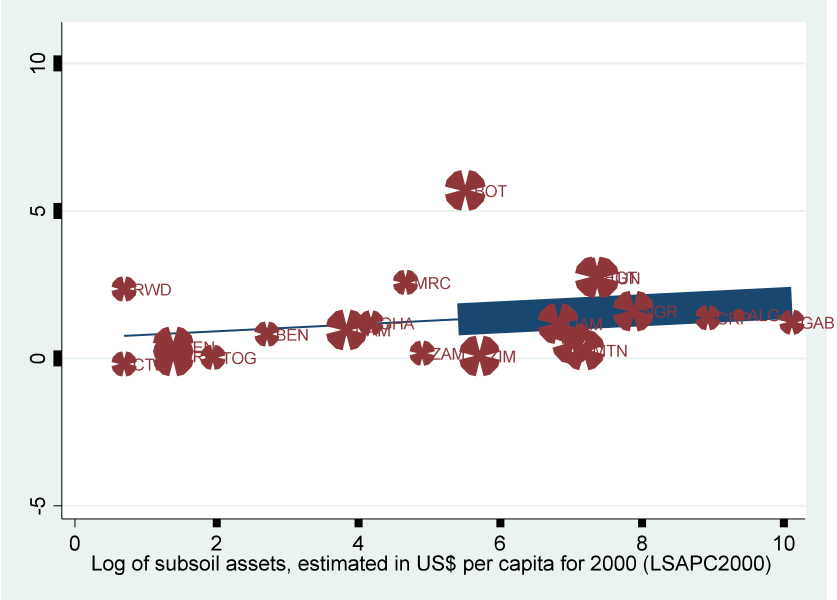

Figure 4: Growth in GDP per capita and 2000 subsoil per capita (SUBSOIL2000).

Figure 5: Growth in GDP per capita and ratio of oil production to GDP (OILPROD).

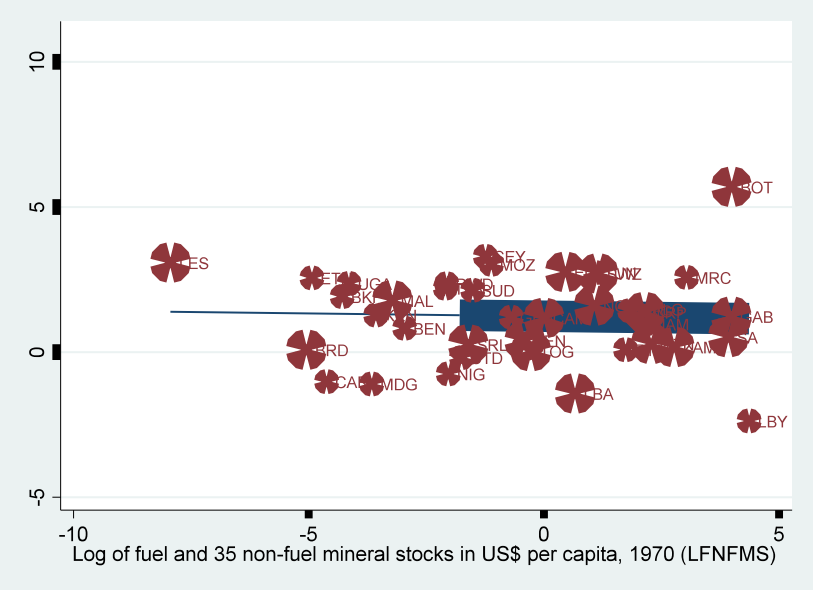

Figure 6: Growth in GDP per capita and fuel and 35 non-fuel mineral stocks per capita (MINRES).

Estimations

The results of the econometric estimations are presented in Tables 1 and 2. Due to the nature of the data, especially the resource abundance data, where observations were not available for all countries, only simple cross-section regressions were conducted. Specifically, three out of the four resource abundance variables were measured at single points in time and did not have time-series dimensions. The two variables capturing subsoil assets per capita were available for only two years – 1994 and 2000 – giving rise to the variable names: SUBSOIL1994 and SUBSOIL2000. Also, the variable capturing the per capita reserves of 35 fuel and non-fuel mineral resources only had data points for the year 1970 (MINRES). Due to these data limitations, it was not possible to conduct any time-series estimation. This limited the analysis to single-period cross-section estimations. This constraint also limited the number of explanatory variables that could be utilised, due to degrees-of-freedom considerations. Thus, it was not possible to include other control variables. Following from this, growth regressions,

which included two variables capturing each of resource dependence and different measures of resource abundance, were estimated.

Table 1 presents estimates of regressions using the first measure of resource dependence (RESEXP) in conjunction with the resource abundance variables.

Table 1: Resource dependence, resource abundance and economic growth in African countries

	1	2	3	4	5
RESEXP	-0.037**	-0.056	-0.058**	-0.050**	-1.007
	(0.014)	(0.042)	(0.026)	(0.019)	(0.059)
SUBSOIL1994		0.263			
		(0.228)			
SUBSOIL2000			0.289**		
			(0.111)		
MINRES				0.125	
				(0.122)	
OILPROD					0.089
					(0.052)
Constant	1.838***	0.475	0.619	1.995***	1.400**
	(0.339)	(0.810)	(0.425)	(0.399)	(0.590)
R^2	0.068	0.140	0.250	0.188	0.386
Obs.	52	17	21	39	20

Note: *, **, and *** denote 10%, 5%, and 1% respectively

The result in column 1 is a replication of the regressions of Sachs and Warner, where natural resource exports is the only explanatory variable in the growth regression. Column 1 shows a significant negative coefficient for natural resource exports. This is in agreement with the broad consensus in the literature that economic growth has been hampered by natural resource exports, thus indicating support for the resource curse hypothesis. However, as discussed in the introduction, there have been doubts cast on the appropriateness of the resource abundance variable, that the correct variable should be resource dependence.

Columns 2 to 5 present results using the resource dependence variable, RESEXP, and separate resource abundance variables. The results show that resource dependence was negative in all estimations. In addition, this variable is statistically significant in 2 estimations presented in columns 3 and 4. The results also reveal that all variables measuring resource abundance are positive, but only 1 of these is statistically significant (SUBSOIL2000). These results are conflicting. This is particularly seen from column 3 where the variable measuring resource dependence is significantly negative, while the variable measuring resource abundance is significantly positive. Thus, the results support both the propositions of Sachs and Warner (1995) and Brunnschweiler and Bulte (2008). Thus, while exports of natural resources have led to slower growth rates, the abundance of natural resources has been associated with faster economic growth in these African countries.

Table 2: Resource dependence, resource abundance and economic growth in African countries

	1	2	3	4	5
MINEXP	-0.040**	-0.052	-0.056*	-0.052**	-0.100*
	(0.016)	(0.040)	(0.027)	(0.023)	(0.054)
SUBSOIL1994		0.297			
		(0.260)			
SUBSOIL2000			0.287**		
			(0.120)		
MINRES				0.136	
				(0.131)	
OILPROD					0.088*
					(0.048)
Constant	1.802***	0.156	0.495	1.911***	1.194**
	(0.346)	(0.925)	(0.445)	(0.393)	(0.525)
R^2	0.074	0.116	0.216	0.172	0.415
Obs.	52	17	21	39	20

Note: *, **, and *** denote 10%, 5%, and 1% respectively

Upon examining the results in Table 2 using the second measure of resource dependence (MINEXP) in conjunction with the measures of resource abundance, similar results emerged. Resource dependence was negative in all estimations while resource abundance was positive in all estimations. The contradictory evidence is even more evident in Table 2. In columns 2 to 5, 2 of the variables measuring resource abundance were statistically significant while 3 of the variables measuring resource dependence were also significant. At first, this appears contradictory. However, closer examination of the nature of revenues from natural resource exports and how wealth from natural resources work, provide some explanations as to why we have these results.

On the one hand, resource exports can have adverse effects on the economy through a number of channels. First, resource exports are susceptible to volatile commodity prices. For the many African countries that rely heavily on exports of commodities, the boom-bust cycle characteristic of commodity prices have had adverse consequences for their fiscal positions. This has led in many cases to economic recessions. This could explain why a negative effect of resource exports on economic growth is always found. Second, because windfall revenues from exports of natural resources are a 'cheap' source of government revenue, they have often led to fiscal indiscipline and mismanagement of economies. Many of these African countries have resorted to excessive expenditure on grandiose projects with little or no discernible returns, thereby stifling rather than promoting growth. Third, revenue from resource exports in these African countries have been concentrated in the hands of a few. This has increased poverty and inequality. Increasing inequalities, coupled with striving to continue to control exploitation of and revenues from such resources, has often led to civil conflict in African countries, which inhibits economic growth.

On the other hand, natural resource wealth can be a catalyst for development. Since the 19th century, the mining sector has been at the forefront of technological advancements in exploration and extraction. These technological advancements have boosted production and reserve levels and further instigated advancements in innovations. There is a serious process of learning, investment, technological progress and cost reduction that accompanies resource exploration and production. These contribute to creating the driving force behind innovations and productivity increases in

mining. These also have positive effects on driving expansion in other sectors such as the manufacturing and transportation sectors. Thus, all these offer contrasting evidences against the resource curse hypothesis, and support our finding that resource abundance enhances economic growth.

Conclusion

This paper has re-examined the resource curse hypothesis in African countries. In summary, the results reveal that while resource dependence has had negative effects on economic growth, resource abundance has had positive effects on economic growth. Results from this study suggest that caution needs to be exercised in broadly accepting the resource curse hypothesis and concluding that all resource-rich African countries will experience slow economic growth because they have natural resource endowments.

This study states that natural resource endowments need not be a curse for African countries. With proper planning and adequate policies, they can indeed be a blessing. In addition to developed countries, some African countries, such as Botswana, have been able to avoid the resource curse and achieve sustainable growth and development. Thus, African countries that are resource rich should learn from advanced resource-rich countries and adopt suitable policies that will optimise the use of their natural resources and foster technological progress and advancement in other sectors of the economy.

This paper can also serve as a foundation for future empirical research into this issue. As more data, especially on resource abundance, becomes available, it would be interesting to exploit the time series dimension and conduct analysis based on panel data econometrics. The results from such estimations would provide further evidence on the effects of natural resources on African economies.

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Appendix

Variable	Description	Source	Period
RESEXP	Ratio of total yearly natural resource exports to GDP: sum of mineral and agricultural raw materials exports.	*World Development Indicators*, Penn World Tables (PWT) 6.1	1970-2016
MINEXP	Ratio of total yearly mineral exports to GDP: sum of mineral fuels, ores and metal exports. Fuels comprise SITC section 3 (mineral fuels); ores and metals comprise the commodities in SITC sections 27 (crude fertilizer, minerals not elsewhere specified), 28 (metalliferous ores, scrap), and 68 (non-ferrous metals).	*World Development Indicators*, Penn World Tables 6.1	1970-2016
SUBSOIL	Log of subsoil assets, estimated in US# per capita for 1994 and 2000 respectively. The measures include energy resources (oil, natural gas, hard coal, lignite) and other mineral resources (bauxite, copper, gold, iron, lead, nickel, phosphate, silver, tin, zinc)	World Bank (1997) and World Bank (2005) *Where is the Wealth of Nations? Measuring capital for the XXI Century*, Washington D.C.: World Bank	1994, 2000
OILPROD	Ratio of oil production value to GDP. Value of oil production is obtained by multiplying the number of barrels of oil produced by the world oil price of oil in corresponding periods of time.	Energy Information Administration; https://fred.stlouisfed.org/series/WTISPLC	1980-2016
MINRES	Log of fuel and 35 non-fuel mineral stocks estimated for 1970 at market prices, in US$ per capita.	Norman (2009) Rule of law and the resource curse: abundance versus intensity. *Environmental and Resource Economics*, 43(2), pp.183-207 and PWT 6.1 (for population data)	1970-2000
GRGDPPC	Log of growth of real GDP per capita	PWT 6.1	1970-2016