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Natural Resources and Wealth Inequality: A Cross-Country Analysis

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Abstract

This study investigates the impact of natural resources on wealth inequality as the first attempt on a panel of 45 developed and developing countries over the period 2000-2014. Using the Generalized Method of Moments, the results provide strong evidence that natural resources increase wealth inequality within a linear empirical framework. These results are robust to the use of alternative natural resources and wealth inequality measures. Additionally, a non-linear analysis provides evidence of an inverted U-shaped relationship between natural resources and wealth inequality. The net effect of enhancing natural resources on wealth inequality is positive, and building on the corresponding conditional negative effect, the attendant natural resource thresholds for inclusive development are provided. It follows that while natural resources increase wealth inequality, some critical levels of natural resources are needed for natural resources to reduce wealth inequality.

***Keywords*:** Oil wealth; Natural resources; Wealth inequality; Sustainable development

***JEL Classification*:** F21; F54; L71

1. Introduction

The widening income gap between rich and poor casts doubt on the ability of several countries to achieve sustainable development goals (SDGs), and at the same time undermines the feasibility of sustainable global economic growth. The figures put forward by Oxfam (2016) are evocative. According to the narrative, about 50% of the population of the world is living with below 5.5 USD a day, while only 1% of the richest in the world possess half of the global wealth. Moreover, 10,000 people die every day because they lack access to affordable healthcare. Piketty (2014) notes with regret that wealth inequality has increased to levels that have not been apparent since World War I, with disturbing evidence from the USA showing that the top decile in the country is controlling over 70 percent of the wealth. This increase in wealth inequalities is not specific to the USA and concerns all countries, particularly developing countries (Tchamyou et al., 2019a). Piketty and Zucman (2014) point out that the ratio of wealth inequality of the eight largest developed countries over the last four decades has increased from 200-300% in 1970 to 400-600% in 2010.

With regard to the socio-economic and political aspects of wealth inequalities, it seems more than urgent to identify the determinants of wealth inequalities. Some efforts have been made in this direction (Hasan et al., 2020; Berisha and Meszaros, 2020; Bagchi et al., 2019). However, this paper considers that one of the key determinants that has not been studied is natural resources.

Since the seminal study of Sachs and Warner (1995) supporting the resource curse hypothesis, many empirical and theoretical papers have investigated the nexus between economic prosperity and natural resources with rather mix evidence (see Havranek et al., 2016 for a meta-analysis). In recent years, many empirical papers have extended the resource curse hypothesis to other aspects of economic development, *inter alia* education (Cockx and Francken, 2016), health (Wigley, 2017) and labour mobility (Romero, 2016) and happiness (Mignamissi and Kuete, 2021). However, fewer studies have been concerned with the relationship between natural resources and wealth inequality. This gap in the literature is largely traceable to data availability constraints.

In the light of the above, due to the absence of data on the distribution of wealth for a sufficient number of countries, the existing literature has analysed the effect of natural resources and income inequality. Based on an analysis carried out in Latin American countries, Leamer et al. (1999) highlight the inequality implications that the resource sector does not require a lot of human capital. Subsequently, several studies confirm that natural resources positively effect income inequality (Gylfason and Zoega, 2003; Carmignani, 2013; Buccellato and Mickiewicz, 2009; Farzanegan and Krieger, 2018). In contrast, other studies find that natural resources reduce inequality (Goderis and Malone, 2011; Parcero and Papyrakis, 2016; Kim and Lin, 2018; Kim et al., 2020). The third group of studies highlight the role of ethnic fractionalization (Fum and Hodler, 2010) and democracy (Hartwell et al., 2019).

This paper is the first in the literature that investigates the effects of natural resources on wealth inequality using the most comprehensive dataset on wealth inequality. To sum up, applying the Generalised Method of Moments (GMM) to a large panel of 45 developed and developing countries over the period 2000-2014, we find strong evidence that natural resources increase wealth inequality. However, an extended analysis from a non-linear framework shows that enhancing natural resources has a positive net effect on wealth inequality and thresholds of natural resources at which the overall effect becomes negative..

The rest of the paper is organised as follows. Section 2 presents a brief theoretical framework on the link between natural resources and wealth inequality;section 3 describes the data and methodology, while section 4 presents the empirical results, and Section 5 concludes.

2. Theoretical underpinnings

Theoretically, two transmission channels can explain the positive relationship between natural resources and wealth inequality: (i) economic channels such as the Dutch disease and human capital, and (ii) the political channel of low institutional quality.

From an economic perspective, the Dutch Disease occurs when natural resource revenues increase and lead to higher domestic income and demand for goods (Frankel, 2010). In addition, labor and other factors of production are shifted from the manufacturing sector to the natural resource sector. The resulting decline in manufacturing exports and de-industrialization reduces demand and employment opportunities, resulting in increased inequality (Kim et al., 2020). On the other hand, dependence on natural resources may reduce incentives for human capital accumulation because of resource-based fiscal revenues. Indeed, compared to other industries, extractive industries require low-skilled labor. Thus, in resource-rich countries, governments tend to become dependent on the extractive industry and invest less in human capital (Gylfason, 2001). However, education is recognized as a factor reducing wealth inequality (Hasan et al., 2020; Tchamyou et al., 2019b). Therefore, natural resources increase wealth inequality through their negative effects on human capital.

From a political perspective, a large body of literature shows that natural resources undermine institutional development as governments use resource rents to appease dissent and alter public accountability (Isham et al., 2005). Isham et al. (2005) show how countries dependent on natural resources are prone to exacerbate economic and social divisions and weakened institutional capacity. Busse and Gröning (2013) corroborate this idea and find that natural resource exports lead to increased corruption; and the effect being greater in developing countries. Therefore, low institutional quality increases income and wealth inequality as the poor (such as youth and minorities) are most affected (Acemoglu and Robinson, 2006).

3. Data and Methodology

3.1 Data

Our sample covers 45 developed and developing countries over the period 2000 to 2014 with data from various sources: World Development Indicators (WDI) of the World Bank, Polity IV, Alesina et al., (2003) and the Bagchi and Svejnar (2015). The periodicity under investigation is chosen according to data availability constraints, particularly on wealth inequality.

The dependent variable is wealth inequality measured by the top one percentile as well as the top ten percent wealth shares from a Credit Suisse (2013) report. For robustness check, we use billionaire wealth as a percentage of GDP, a proxy of wealth inequality created by Bagchi and Svejnar (2015). Data on billionaire wealth are compiled from Forbes magazines' listing of billionaires. Since 1982, Forbes Magazine has published a list of the 400 richest Americans. However, at the beginning of 1987, the magazine expanded its list to include the wealthiest individuals and families in the world.

For natural resources, we use total natural resource rent as a percentage of GDP (Natural resources) from the WDI. This indicator uses the total weighted value of five resource rents: oil rent, forest rent, gas rent, mineral rent and coal rent as a proportion of GDP. For robustness and following Carmignani and Avom (2010), we use the share of primary product exports in total merchandise exports (Primary Export) as an alternative measure of natural resources. This indicator is conceived as the sum of exports of (i) agricultural raw materials, (ii) food and beverages, (iii) fuels, and (iv) metals and ores as a percentage of total merchandise exports. To ensure that our results are not biased by variable omissions, we include, according to the previous literature four potential determinants of wealth inequality namely: (i) logarithm of GDP per capita; (ii) trade openness; (iii) foreign direct investment (FDI) and (iv) population growth. For robustness checks, we use three additional control variables: final government consumption (Gov. Consump), inflation, and Polity 2. Table 1 presents the descriptive statistics. Figures 1 and 2 show correlations between total natural resource rents and the two main measures of wealth inequality; Top 10% wealth share and Top 1% wealth share, respectively.

Table 1: Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Top 10% wealth share	675	63.063	8.319	46.8	84.8
Top 1% wealth share	675	32.32	9.541	16.9	66.2
Billionaires wealth	625	6.477	8.145	0.056	73.304
Natural resources	675	4.591	8.067	0	55.312
Primary Exports	668	34.531	25.976	2.563	97.626
GDP per capita	675	28404.669	20986.153	826.592	91565.733
Trade	674	87.525	71.728	19.798	442.62
FDI	673	4.754	7.519	-5.671	86.611
Population growth	675	1.07	1.417	-1.854	15.177
Government consumption	674	16.893	4.873	6.532	27.935
Ethnic	675	0.304	0.225	0.002	0.752
Polity2	630	7.49	4.735	-10	10

Figure 1: Natural resources and Top 1% wealth shares

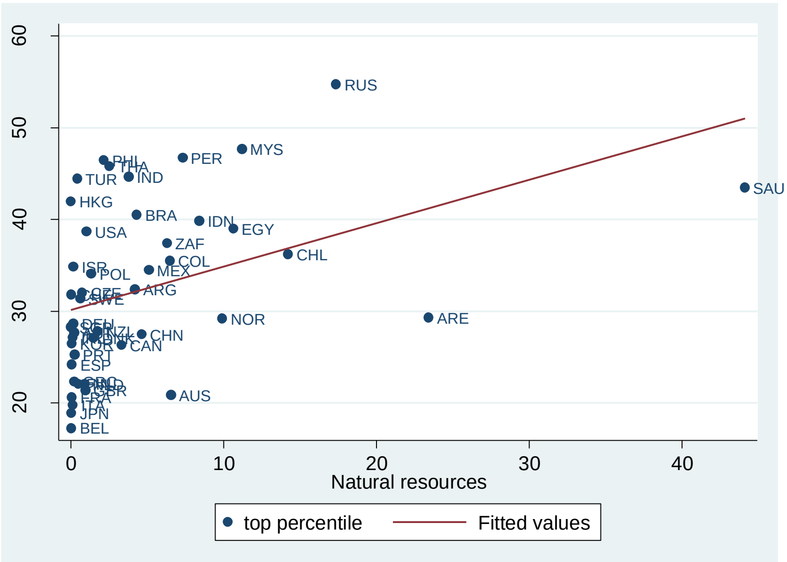
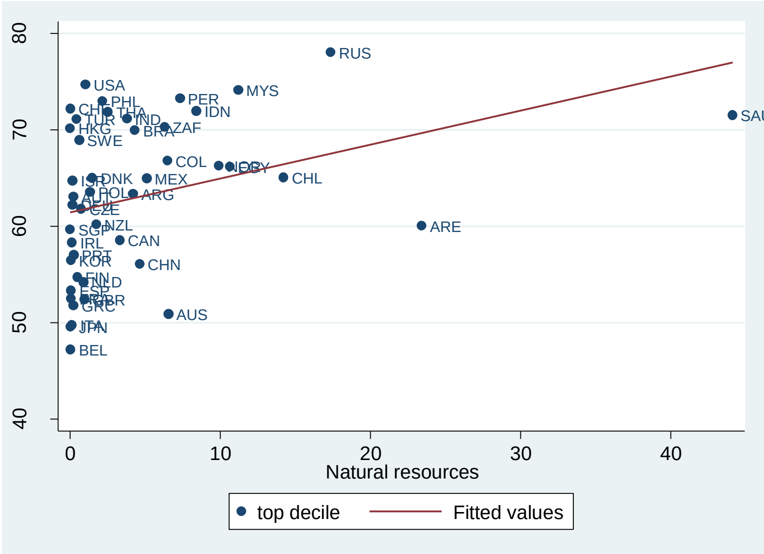


Figure 2: Natural resources and Top 10% wealth shares



3.2 Methodology

This paper aims o investigate the effect of natural resources on wealth inequality. Two main hypotheses are advanced in this paper. First, we hypothesize that natural resources increase wealth inequality.

To asset this hypothesis, we apply pooled Ordinary Least Squares (OLS), whose model is specified in equation (1):

$$WealthIN_{it} = \alpha + \beta WealthIN_{it} + \lambda NaturalRessources_{it} + \gamma X_{it} + \varepsilon_{it} \qquad (1)$$

Where $WealthIN_{it}$is wealth inequality for country *i* in period *t*, *NaturalRessources* stands for natural resources (% GDP), *X* is the vector representing a set of control variables and ε_{it} is the error term.

Although the Ordinary Least Squares method is simple to implement, it does not take into account some unobserved differences that can bias the estimation of parameters. In addition, pooled OLS do not protect us from the endogeneity issue resulting from measurement errors or inverse causality between our dependent variable and the explanatory variables. We fill this gap using a dynamic panel specification specified in equation (2).

$$WealthIN_{it} = \alpha + \beta WealthIN_{it-1} + \lambda NaturalRessources_{it} + \gamma X_{it} + \mu_i + v_t + \varepsilon_{it} \qquad (2)$$

Where $WealthIN_{it-1}$denotes the lagged wealth inequality, μ_i is the country-specific impact that is unobserved and v_t denotes the time-specific impact. The standard system GMM model by Arellano and Bover (1995) and Blundell and Bond (1998) is employed. This method enables the study to account for the unobserved heterogeneity while also enabling the control of simultaneity through the employment of internal instruments.

4. Empirical results

4.1 Baseline results

Table 2 presents the baseline estimation results of Eq. (1), measuring wealth inequality by both the top 1 percent and top10 percent wealth shares. Columns (1) to (4) show the results of the pooled OLS (POLS) with robust standard errors clustered by country. Columns (1) and (3) present the bivariate relationship between natural resources and wealth inequality, while Columns (2) and (4) introduce the control variables. According to Figures 1 and 2, the coefficients associated with natural resources are positive and statistically significant, suggesting that natural resources increase wealth inequality. More specifically, the coefficients associated with natural resources are 0.327 and 0.438 suggesting that a one-unit increase in natural resources will increase wealth inequality by 0.327 and 0.438 units, respectively. When the control variables are introduced into the model (see Columns 2 and 4), the coefficients associated with natural resources remain positive and statistically significant at the 1% level, thus confirming the role of natural resources in increasing wealth inequalities.

Although the OLS results confirm our first hypothesis, they nevertheless suffer from several limitations in that they do not take into account fixed effects and endogeneity problems. We address this by estimating equation (2) whose results are summarized in Columns (5) and (6) of Table 2. The coefficients are based on the two-step GMM system estimation, using the finite sample correction of Windmeijer (2005)[1]. The highest number of instruments used is 35. Hansen's test checks the validity of the instruments when the null hypothesis is that the instruments are uncorrelated with the residuals. The null hypothesis of the AR(2) test is that the error terms in the first differenced regression exhibit no

[1] All explanatory variables are treated as potentially endogenous. The lags of the explanatory variables are taken as an instrument for the difference equation, while the first differences of the explanatory variables are taken as an instrument for the level equation.

second-order serial correlation (Roodman, 2009). All regressions also satisfy the AR (1) test for first-order serial correlation. Thus, the estimated coefficients are valid.

Regarding the coefficients associated with natural resources, we find a positive and statistically significant effect of natural resources on wealth inequality. Concerning the control variables, we find that they all have the expected signs; GDP per capita, foreign direct investment and urban population growth reduce wealth inequality. In contrast, trade openness has a positive and statically significant effect on wealth inequality. These results are thus broadly consistent with the related literature (see for example Hasan et al., 2020).

Table 2: Baseline results

Variables	**Pooled OLS**				**System-GMM**	
	Top 10% wealth Share		Top 1% wealth share		Top 10% wealth share	Top 1% wealth share
	(1)	(2)	(3)	(4)	(5)	(6)
L. Dependent variable					0.937***	1.037***
					(0.0106)	(0.00713)
Natural resources	0.327***	0.279***	0.438***	0.357***	0.0138***	0.0122**
	(0.0348)	(0.0307)	(0.0450)	(0.0386)	(0.00422)	(0.00585)
GDP per cap. (ln)		-3.341***		-5.351***	-0.833***	-1.132***
		(0.271)		(0.271)	(0.157)	(0.219)
Trade		0.0254***		0.0324***	0.0100***	0.0164***
		(0.00452)		(0.00485)	(0.00115)	(0.00135)
FDI		-0.114***		-0.0787**	-0.0945***	-0.141***
		(0.0382)		(0.0342)	(0.0138)	(0.0124)
Population growth		-0.348**		-0.440***	-0.378***	-0.171***
		(0.139)		(0.163)	(0.0366)	(0.0236)
Constant	61.56***	93.34***	30.31***	81.30***	12.16***	9.483***
	(0.353)	(2.545)	(0.379)	(2.709)	(1.955)	(2.066)
Observations	675	672	675	672	628	629
R-squared	0.101	0.298	0.137	0.499		
Number of countries					45	45
Number of instruments					34	35
AR(1)					0.00351	0.00760
AR(2)					0.125	0.527
Hansen j-test					0.356	0.229

Note: *,**,*** denote statistical significance at the 10%, 5% and 1% levels respectively. Corrected standard errors reported in parenthesis.

4.2 Robustness checks

We perform several robustness tests to confirm our hypothesis that natural resources positively affect wealth inequality. First, we estimate the effect of natural resources on wealth inequality by including three control variables. The results obtained are summarized in Columns (1) through (6) of Table 3. We find that the coefficient associated with natural resources is statically significant for each specifications.

Therefore, our results remain robust to introducing additional control variables. Regarding these variables, we find that government consumption increases wealth inequality while democracy reduces wealth inequality. Second, we estimate our model using an alternative measure of natural resources: exports of primary products. As summarized in Columns (7) and (8), the result obtained show that the coefficients associated with primary product exports are positive and significant. The magnitudes of associated coefficients suggest that all other things being equal, an increase in primary product exports of 10 units leads to an increase in wealth inequality of between 0.107 to 0.727 units. This confirms that our hypothesis is robust to using an alternative measure of natural resources. Third, we test the robustness of the results by now using an alternative measure of wealth inequality. Following Bagchi and Svejnar (2015), we use an aggregate measure of wealth inequality from the Forbes magazine Billionaires' ratio list. The results in Column (9) confirm that natural resources have a negative effect on wealth inequality. Fourth, let us estimate our model by excluding outliers. Indeed, Figure 1 and 2 show the existence of countries representing outliers. These are: Russia, the United Arab Emirates and Saudi Arabia. The results summarized in Columns (10) and (11) confirm that natural resources have a positive effect on inequality. Thus, our results are not driven by outliers.

We now examine a non-linear relationship between natural resources and wealth inequality by estimating Equation (3). The results are summarized in Table 4. The first two columns present the OLS results. We find that the coefficient associated with the quadratic form of natural resources is statistically significant and negative. This suggests that above a certain threshold of natural resource dependence, it eases liquidity constraints, and promotes investment in human capital and income redistribution, reducing wealth inequality. Columns (3) and (4) present the GMM results. Once again, we find an inverted U-shaped relationship between natural resources and wealth inequality. The net effect of natural resources in the last column of Table 4 is 0.0912 (2×[-0.00291× 4.591] + [0.118]). In this computation: 4.591 is the average value of natural resources, -0.00291 is the marginal effect of natural resources, 0.118 is the unconditional effect of natural resources, whereas the leading two is derived from the quadratic equation. The attendant computation is in accordance with contemporary literature on quadratic regressions (Asongu & Odhiambo, 2020, 2021). The corresponding negative threshold at which the positive unconditional effect becomes negative is 20.274 (0.118/[2 ×0.00291]) of oil rents as % of GDP. The computed oil rent thresholds make economic sense and have policy relevance because they are within the remit of minimum and maximum oil rent (i.e. 0 to 55.312).

Table 3: Robustness

	Top 10% wealth share			Top 1% wealth share			Top 10% wealth share	Top 1% wealth share	Billionaires' ratio	Top 10% wealth share	Top 1% wealth share
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
L.Dependent var.	0.938***	0.960***	0.960***	1.059***	1.046***	1.005***	0.993***	0.998***	0.865***	1.002***	1.007***
	(0.00427)	(0.0123)	(0.0131)	(0.0196)	(0.0222)	(0.0219)	(0.00540)	(0.00693)	(0.00890)	(0.00318)	(0.00618)
Natural resources	0.0185***	0.0195***	0.0184***	0.0580***	0.0512***	0.0643***			0.0340***	0.0434***	0.0319***
	(0.00474)	(0.00689)	(0.00628)	(0.0140)	(0.0146)	(0.0153)			(0.00445)	(0.0125)	(0.00494)
Primary_Export							0.0107***	0.0727***			
							(0.00256)	(0.0110)			
GDPpercap (ln)	-1.415***	-1.254***	-1.492***	-1.083***	-1.268***	-0.0376	-0.564***	-0.351	-0.272***	-0.0902**	-1.162***
	(0.105)	(0.155)	(0.169)	(0.378)	(0.379)	(0.654)	(0.0991)	(0.300)	(0.0467)	(0.0389)	(0.223)
Trade	0.0130***	0.0129***	0.0104***	0.0118***	0.0119***	-0.000509	0.00216**	-0.00542	0.0228***	0.000834	0.0154***
	(0.000981)	(0.00122)	(0.00194)	(0.00212)	(0.00205)	(0.00334)	(0.00101)	(0.00342)	(0.00110)	(0.000557)	(0.000982)
FDI	-0.0829***	-0.0852***	-0.0723***	-0.102***	-0.112***	-0.0486***	-0.0192***	-0.0208***	0.00463	0.00839	-0.122***
	(0.0112)	(0.0198)	(0.0165)	(0.0173)	(0.0247)	(0.0164)	(0.00585)	(0.00565)	(0.00988)	(0.00748)	(0.00645)
Population growth	-0.301***	-0.305***	-1.297***	-0.383***	-0.461***	-0.963***	-1.240***	-1.587***	-0.166***	-0.219***	-0.142***
	(0.0510)	(0.0865)	(0.113)	(0.0960)	(0.0969)	(0.138)	(0.0895)	(0.173)	(0.0246)	(0.0672)	(0.0178)
Gov. consump	0.181***	0.188***	0.0842**	0.119***	0.0828**	0.170***					
	(0.0233)	(0.0356)	(0.0349)	(0.0382)	(0.0336)	(0.0466)					
Ethnic		-0.193	-0.704		-1.343	6.136					
		(0.387)	(0.685)		(1.012)	(6.303)					
Polity2			-0.0163			-0.299***					
			(0.0311)			(0.0978)					
Constant	14.27***	11.36***	16.81***	6.615*	10.14***	-1.215	6.837***	3.304	1.826***	0.799	10.71***
	(1.112)	(2.180)	(2.086)	(3.683)	(3.916)	(6.627)	(1.225)	(3.064)	(0.477)	(0.518)	(2.064)
Observations	628	628	587	629	629	587	619	622	576	586	587
Number of countries	45	45	42	45	45	42	45	45	45	42	42
Instruments	39	35	35	29	30	35	0.346	0.173	40	29	35
AR(1)	0.00591	0.00380	0.00575	0.0115	0.0265	0.00595	0.0126	0.0468	0.0334	0.0100	0.00476
AR(2)	0.124	0.131	0.181	0.206	0.202	0.380	0.324	0.996	0.233	0.121	0.428

Hansen j-test	0.250	0.239	0.395	0.272	0.314	0.709	38	38	0.111	0.242	0.221

Note: *,**,*** denote statistical significance at the 10%, 5% and 1% levels respectively. Corrected standard errors reported in parenthesis.

Table 4: Nonlinearity analysis

	Pooled OLS		system-GMM	
	Top 10% wealth share	Top 1% wealth share	Top 10% wealth share	Top 1% wealth share
	(1)	(2)	(3)	(4)
L.dependent var.			1.001***	1.027***
			(0.00751)	(0.00718)
Natural resources	0.553***	0.599***	0.166***	0.118***
	(0.0858)	(0.106)	(0.0287)	(0.0161)
Nat.resources squared	-0.00713***	-0.00630***	-0.00481***	-0.00291***
	(0.00170)	(0.00203)	(0.000928)	(0.000303)
GDPpercap. (ln)	-3.054***	-5.098***	0.227	-0.887***
	(0.285)	(0.289)	(0.167)	(0.182)
Trade	0.0269***	0.0337***	0.000172	0.0138***
	(0.00453)	(0.00487)	(0.00136)	(0.00113)
FDI	-0.116***	-0.0806**	-0.00708	-0.111***
	(0.0381)	(0.0340)	(0.0113)	(0.00881)
Population growth	-0.473***	-0.551***	-0.0614**	-0.0867***
	(0.154)	(0.183)	(0.0281)	(0.0194)
Constant	89.89***	78.26***	-2.524	7.222***
	(2.772)	(2.954)	(1.982)	(1.602)
Net effects	0.4875	0.5411	0.1218	0.0912
Negative thresholds	38.779% of GDP	47.539% of GDP	17.225% of GDP	20.275% of GDP
Observations	672	672	584	629
R-squared	0.309	0.505		
Number of countries			45	45
Instruments			25	35
AR(1)			0.00444	0.00204
AR(2)			0.614	0.426
Hansen j-test			0.127	0.138

Note: *,**,*** denote statistical significance at the 10%, 5% and 1% levels respectively. Corrected standard errors reported in parenthesis. The mean value of natural resource wealth is 4.591.

5. Conclusion

This paper presents empirical evidence on how natural resources affect wealth inequality on a large panel dataset of 45 developed and developing countries over the period 2000-2014. Using the Generalised Method of Moments estimation, we find strong evidence that natural resources have a positive and significant impact on wealth inequality. This result is robust to the use of an alternative measure of wealth inequality and to the use of an alternative measure of natural resources. Moreover, the paper provides evidence that there is a nonlinear relationship between natural resources and wealth inequality. The net effect of enhancing natural resources on wealth inequality is positive and corresponding natural resource thresholds for inclusive development are provided. It follows that while natural resources increase wealth inequality, some critical levels of natural resources are needed for natural resoruces to reduce wealth inequality. The established natural resource thresholds make economic sense and have policy relevance because they are situated with the statistical limit apparent in the summary statistics.

As a main policy implication, countries should exploit their natural resources wealth to certain critical levels in order for the attendant natural resource wealth to reduce wealth inequality. Understanding country-specific thresholds is a worthwhile future research direction especially as it pertains to providing policy makers with country-specific policy implications. Hence, as more data become available, such country-specific research considerations should be engaged using the relevant empirical strategies.

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