Resource rents and happiness on a global perspective: The resource curse revisited

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Abstract: We revisit resource curse theory by providing empirical evidence for the effects of natural resource on the subjective wellbeing. Using cross-sectional model based on a global sample of 149 countries, we highlight that resources rents tend to reduce happiness but this effect differs according to (i) the political system and the level of development, (ii) the types and the measures of natural resources and (iii) the scale of happiness. Specifically, the negative effect of natural resources on happiness tends to be amplified in developing and weak democracy countries. Furthermore, the disaggregation of natural resource rents show that while oil rents and natural gas rent have a significant negative effect, forest, coal and mineral rents do not. However, after using the quantile regression approach, we find that these effects vary at different intervals throughout the happiness distribution.

Keywords: Resource Rents, Happiness, Resource Curse.
JELS codes: Q34, I31, C31.

1. Introduction

In recent decades, the role of natural resources in economic growth has been a topic of large debate in the literature. Many studies have tried to understand the reasons why resource-rich countries suffer from economic turmoil, and how these disorders jeopardize their growth compared to others. Indeed, since the pioneering work of Krugman (1987) and Corden (1984), contributions to understand the role of the abundance of natural resources in economic development have revealed that the macroeconomic difficulties of countries abundant in natural resources hamper their economic growth. However, this result highlighted by Sachs and Warner (1995, 1999 and 2001) and qualified as the natural resources curse since Auty (1993), has been the subject of much controversy in the literature (Leite and Weidmann, 1999; Sala-i-Martin et al, 2000; Atkinson and Hamilton, 2003; Lederman and Maloney, 2003, 2007; Sala-i-Martin and Subramanian, 2003; Wright and Czelusta, 2004 and Arezki and Van Der Ploeg, 2007).

The theory of the natural resources curse has evolved over time. This curse is explained either by the Dutch disease theory (Corden and Neavy, 1982; Corden, 1984; van Wijnbergen, 1984a, 1984b), the institutional theory (Mehlum et al., 2006; Stevens and Dietsche, 2008; Frankel, 2010; de Medeiros Costa *et al*., 2013; Eregha and Mesagan, 2016), the staples theory of economic growth (Watkins, 1963) and the theory of rent curse (Tollison, 1982; Davis and Tilton, 2005; Krueger, 1974; Auty, 2015). We can go back to Smith (1812) who demonstrated that natural resources are a blessing for the economy, in that it constitutes a source of income in foreign currency in particular. This positive relationship was contradicted more than a hundred and fifty years later by Corden and Navy (1982) when they developed the thesis of the Dutch disease. Six years later, Gelb (1988), based on a case study, established the thesis of the natural resource curse. However, Auty (1993) is attributed the authorship of the natural resource curse concept in his seminal work *Sustaining Development in Mineral Economies: The Resource Curse Thesis*. Two years later, this thesis was empirically highlighted by Sachs and Warner (1995), clearly demonstrating the negative effect of natural resources on economic growth. The last major articulation of this theory is the work of Gylfason (2001), who established the link between dependence on natural resources and some determinants of economic growth.

Empirically, the debate on the effects of natural resources on development generally led to a paradox, which of the natural resources curse. In other words, resources rich countries would find it difficult to develop, due to the crowding-out effect that these resources create for other sectors of the economy. Economically, the authorship of this concept returns as said earlier to Auty (1993), even if this theory has not been generalized to all countries [1]. Therefore, the exploitation of natural capital which should lead to the improvement of the living conditions of the population, sometimes lead to a drop in economic development through some channels as volatility in commodity prices (Davis and Tilton, 2008; Van der Ploeg and Poelhekke, 2017), economic mismanagement (Iimi, 2007) and corruption (Bhattacharyya anf Hodler, 2010). However, it should be noted after Lederman and Maloney (2003) that the results of Auty and Warhurst (1993) and Sachs and Warner (1995, 1999 and 2001) could be sensitive to the empirical technique and the indicators of abundance in natural resources used. By changing econometric methods, control variables and measures of resource abundance, the authors find a positive relationship with long-term growth. This result is corroborated by Arezki and Van Der Ploeg (2007) who showed that the empirical evidence of the resource curse is biased

[1]See for example among others Brunnschweiler and Bulte (2008), Alexeev and Conrad (2009), Cavalcanti et al. (2011), Boyce and Emery (2011), Haber and Menaldo (2011), Ross (2012), James (2015).

because it does not take into account endogenous parameters such as the quality of institutions and the degree of economic integration.

In the same way, Wright and Czelusta (2004) argued that the results of Sachs and Warner are influenced by the exceptional economic shocks that characterized the 1970s and which are not representative of long-term growth trends. Furthermore, Sala-i-Martin et al. (2000) used a Bayesian inference method with around thirty variables, and find a positive relationship of the mining sector on growth among other variables. Santos (2018) concluded that relationship between natural resources and development seems to be sensitive to the time horizon. Most recently, Marques and Silva Pires (2019) demonstrated in the short run that, natural gas abundance promotes economic growth and in the long run, while natural gas dependence has no impact on economic growth. In addition to the effect on economic growth widely documented in the literature, the resource curse is also associated with social conflicts (Collier and Hoeffler, 2004; Di John, 2007; Fearon, 2005; Le Billon, 2003 and 2005; Ross, 2001). Furthermore, the slowness in political changes is another negative consequence of the natural resources curse, with a significant impact on the perpetration of autocratic political regimes, favorable to an opaque management of the profits derived from natural resources (Auty, 2001).

However, several works have gone beyond the traditional impact of the natural resource curse on economic growth and have focused on its social externalities. In this profusion, we can cite the works of Karl (1997) and Ross (2001), showing that natural resource appears to be strongly correlated with poverty (Karl, 1997; Ross, 2001). In the same way, Segal (2011) highlighted the role of resource dividend and claims that if resource-rich developing countries implemented it, world poverty would decrease significantly. This conclusion was reinforced by Mosley (2017) and Apergis and Katsaiti (2018). In addition, Bulte et al. (2005) and Makhlouf et al. (2017) found that resources rents and the fluctuations of commodity prices are associated with a high infant mortality rate. Daniele (2011) indicated the existence of a negative correlation between metals and minerals export and human development. Similarly, Behubudi et al. (2010) and Carmignani and Avom (2010) found that dependence and abundance on natural resources have a negative impact on health and human capital although the effect depends on the degree of wealth on resources. Furthermore, Studies have also highlighted the role of natural resources on the environment (Gregoire and Valentine, 2007; Kula, 2012), inequality (Auty, 1994; Fields, 1989) and education Spending (Cockx and Francken, 2016).

Regarding the effect mainly on the well-being of the population, to our knowledge, the only reference that examine a direct link between resource rents and happiness is that of Ali et al. (2020). The authors explore the links between changes in happiness across countries and dependence on natural resources and finds that oil rents are negatively linked to improved happiness over time. This paper intends to fill this gap and make a major contribution to the literature by providing empirical proof of different measures effects of natural resources on the subjective well-being. Thus, in the continuity of all these works mentioned above, and starting from a sample of worldwide countries, we revisit the curse of natural resources by focusing on its consequences on happiness.

The interest of this study can be perceived at least at five levels. First of all, it contributes both to empirical literature on the determinants of happiness and the curse of natural resources. Indeed, our overall empirical results confirmed the existence of a resource curse through the channel of happiness. Second, unlike the existing literature on the resource dependence which focus on specific resource like oil, this paper uses the total measure of natural resource rents as well as all the 5 disaggregated indicators distinguished by the World Bank (oil, gas, mineral, coal and forest) and determine their marginal link with happiness. In this perspective, our results

revealed that total rents negatively influence happiness and particularly those derived from oil and gas. Third, we take into account the likely heterogeneity between countries that may exist when considering a large worldwide sample like ours, by studying the effects in different sample groups. We found that the negative effect of natural resources on happiness is amplified in developing and weak democracy countries. Fourth, this study goes beyond the average effect as did the previous studies and uses a quantile approach in order to assess the effect of natural resources on the extent of happiness. Thus, our results have shown that these effects vary at different intervals throughout the happiness distribution. Finally, this article suggests some recommendations for economic policies that can help better allocate resource rents in order to improve the well-being of the population.

The rest of this paper is organized as follows. Section 2 describes the methodology and data. Section 3 presents and analyses the results. Section 4 tests their robustness and section 5 concludes.

2. Methodology and data

2.1 Empirical model and variables

In order to test the effect of resources rents on happiness, we follow earlier work of Leite and Weidmann (2002), Isham et al. (2005) and Bulte et al. (2005), in their work on the effect of resource abundance on economic growth and institutions. We specify the following equation:

$$LL_i = X_i'\beta + \gamma RR_i + d_i + \varepsilon_i \quad (1)$$

Where ε_i is the residual term, d_i is the regional dummies, and i specifies the country.

The dependent variable LL_i is the subjective well-being measured by the life ladder index (Easterlin, 2004; Helliwell et al., 2018). This index come from the World Happiness Database which ranks 156 countries, measured as the level of happiness perception of their citizens. It is obtained by inviting respondents to think of their lives as a ladder, with the worst possible life for them as 0, and the best possible life as 10.

The independent variable of interest RR_i measures the total of resource rents as a percentage of GDP. In the literature of resource curse, the most common variables used to measure resources wealth are the percentage of exports of natural resources in total exports (Dietz et al., 2007), and the percentage of exports of natural resources in GDP (Sachs and Warner, 1995; Leite and Weidmann, 1999; Boschini et al., 2013). However, some authors have shown that studies on the resource curse should measure the consequences on behaviors that are caused by resource rent rather than those caused by the distortion of the structure of exportation that results from resource exploitation. From this perspective, Ebeke *et al.* (2015) argue that resource rents variable, by measuring the instantaneous real macroeconomic contribution of the resources (through redistribution via government spending, private sector consumption, *etc.*), appears the most relevant proxy to use as it affects directly households and individuals' utility functions through many channels.

The vector X gathers the controls variables represented by the potentials determinants of subjective well-being as suggested by the literature. This includes GDP per capital as proxy of the economic development, inflation rate, unemployment rate, population growth, life expectancy at birth as proxy of health and the human capital index as a proxy of education. According to Easterlin, (2001), Frey and Stutzer (2002) and Frey (2018), people with higher income unambiguously consider themselves to be more satisfied with their lives than persons with low income. Di Tella et al. (2001), Frey and Stutzer (2002) show that people appear to be

happier when inflation and unemployment are low. Cuñado and De Gracia (2012) and Chen (2012) show that education leads to a better quality of life, which results from relative higher income and stable job status. Helliwell *et al*. (2018) found that countries with higher healthy life expectancy at birth have also been documented to be associated with higher level of happiness. We add to these variables, regional dummies (Sub-Saharan Africa, Middle East and North Africa, South Asia, North America, Europe and Central Asia, East Asia and Pacific, Latin America and Caribbean) for controlling regional variability in the perception of happiness.

2.2 Estimation technique and data description

Based on a cross-sectional perspective, the preliminary results of the coefficient of interest γ is obtained with the ordinary least square (OLS) estimator with a full set of regional dummies, after controlling for normality, heteroskedasticity, multicolinearity and omitted variables (see Tables A3 in appendix). We also introduce into the regression, some control variables in order to limit the bias of variables omission. Subsequently, we appreciate the robustness of our results by opting for limited dependent approach and for a non-parametric econometric method based on quantile regressions (QR).

Table 1: Data sources and descriptive statistics

Variables	Definitions	Sources	Obs	Mean	SD	Min	Max
Happiness index	Subjective well-being obtained by inviting respondents to think of their lives as a ladder, with the worst possible life for them as 0, and the best possible life as 10.	WHR (2017)	149	5.37	1.14	2.90	7.63
Total natural resources rents	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	WHR (2017)	148	7.71	9.72	0.00	45.27
Oil rents	Oil rents are the difference between the value of crude oil production at world prices and total costs of production.	WDI (2019)	136	6.24	10.78	0.00	44.84
Gas rents	Natural gas rents are the difference between the value of natural gas production at world prices and total costs of production.	WDI (2019)	138	0.56	1.32	0.00	10.69
Forest rents	Forest rents are round wood harvest times the product of average prices and a region-specific rental rate.	WDI (2019)	147	2.23	3.87	0.00	20.15
Coal rents	Coal rents are the difference between the value of both hard and soft coal production at world prices and their total costs of production.	WDI (2019)	129	43.41	33.80	10.82	264.84
Mineral rents	Mineral rents are the difference between the value of production for a stock of minerals at world prices and their total costs of production.	WDI (2019)	125	1.16	2.42	0.00	15.64
GDP per capita	GDP per capita is gross domestic product divided by midyear population.	WDI (2019)	147	8.27	1.50	5.54	11.10
Health	Life expectancy at birth.	WDI (2019)	149	63.75	10.22	40.50	77.91
Unemployment	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	ILOSTAT (2019)	148	7.85	5.52	0.82	30.99
Population growth	Exponential rate of growth of midyear population from year t-1 to t.	WDI (2019)	147	3.90	1.45	0.27	8.60
Education	Human capital index measured by the average years of schooling in the population.	PWT 9.1	129	2.11	0.67	1.06	3.52
Inflation	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals such as yearly.	WDI (2019)	144	31.93	78.91	1.07	675.85
Polity IV	Level of democratization: -10 ⩽ Autocracy <6 ; 6 ⩽ Democracy ⩽10	CSP (2017)	141	4.52	5.93	-10	10

Note: authors' construction. WHD, WDI, PWT and ILOSTAT respectively designates World Happiness Database, world Development Indicators, Penn World Table and Institute of Labor Statistics.

Our sample covers 149 cross-countries[2] depending on the data availability on the happiness index as well as those related to resources rents. The complete list of study countries is presented in the appendix (see Table A1). The definition, sources and main characteristics of all the data are presented in Table 1.

[2] This number can change depending on the estimation technique, the sample and the variables selected.

The study of the first two moments of our variables makes it possible to draw two major conclusions. First, the dependent variable is relatively less dispersed with regard to the proportionality between its standard deviation and its mean. Thus, the level of happiness would therefore be relatively grouped around its average of 5.37. Second, the variable of interest as well as its various components all seem to be over-dispersed, which augurs for volatility in the profits from the export of natural resources. This argument consolidates previous research explaining natural resources curse, which states that, the negative effect of natural resources on GDP is generally faster and more important. For the rest of the variables, the GDP per capita, health condition (life expectancy at birth), unemployment, population growth and education are relatively stable, while inflation and democracy are relatively volatile.

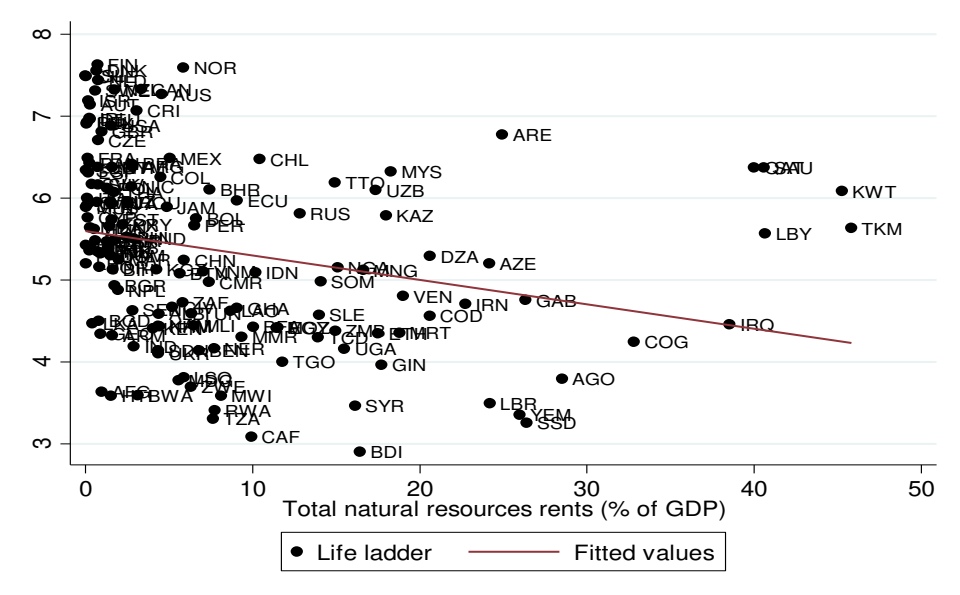
3. Results and discussion

We discuss first the results of our basic specification, then those of some sensitivity tests.

3.1 Preliminary evidence

Figure 1 provides a visual relationship between total resource rents and subjective well-being from our sample. Overall and as evidenced by the correlation matrix (see Table A2 in appendix), we observe from this graph a negative correlation between the total rent of natural resources and the measure of happiness. In other words, resources rents tend to reduce happiness in our sample on average. Countries with high resource rent level experiment a resource curse, due to the low diversification and the poor quality of institutions.

Figure 1: Correlation between total resources rents and happiness



Source: authors' construction using data of WDI and WHD.

Table 2 presents the results of the model estimations. While column 1 presents the results of the specific marginal effect of total natural resource rents on happiness, columns 2 and 3 present the results when the model is augmented by the determinants of happiness and sub-regional dummies. For all these specifications, we find a 1 % statistically significant and negative effect of natural resource rents on happiness. These results go in the same direction as those of the literature which shows the negative effect of natural resources on certain well-being variables such as Human Development Index (Carmignani and Avom, 2010; Daniele, 2010) and poverty (Segal, 2011). The main explanation for this result is undoubtedly the poor allocation of the rents derived from these resources due to the bad quality of institutions (Mehlum et al., 2006;

Stevens and Dietsche, 2008; de Medeiros Costa *et al*., 2013). Indeed, resource rents can in principle, be associated with greater happiness gains if income is redistributed equitably and invested in activities that improve well-being, such as social public investment projects. Conversely, if these are based on rent seeking rather than expected returns (Brollo et al. 2013), general dissatisfaction should increase sharply.

The control variables highlight the expected signs. The GDP per capita is positively associated with well-being. According to population growth, results validate the well-known Malthusian hypothesis explaining the imbalance between the growth of the resources necessary for determining well-being and population growth.

Table 2: Baseline results

	Dependent variable: Life ladder		
Variables	**(1)**	**(2)**	**(3)**
Total natural resources rents	**-0.034*** **	**-0.022*** **	**-0.025*** **
	(0.012)	**(0.006)**	**(0.008)**
GDP per capita		0.450***	0.486***
		(0.066)	(0.069)
Population growth		-0.108***	-0.095**
		(0.036)	(0.041)
Inflation		-0.000	-0.000
		(0.001)	(0.001)
Health		0.036***	0.020
		(0.013)	(0.015)
Unemployment		-0.058***	-0.055***
		(0.011)	(0.011)
Education		-0.074	0.231
		(0.148)	(0.157)
Sub-regional dummies	No	No	Yes
Observations	148	123	123
R-squared	0.083	0.799	0.828

Note: Authors' estimates. Results based on OLS regressions of equation (1). Robust standard errors in parentheses. ∗p < 0.10, ∗∗p < 0.05, ∗∗∗p < 0.010.

3.2 What important are the level of development and democratization?

We take into account the heterogeneity between countries by grouping our sample according to political and economic specificities. To do so, we first follow Marshall and Jagger (2009) and distinguish between autocratic countries (countries with Polity IV index is between -10 and 6) and relatively democratic countries (countries with Polity IV index between 6 and 10). Thereafter we use the World Bank classification of countries by level of development and distinguish two other group of countries, namely developed (upper middle income and high income) and developing countries (low income and lower middle income). Results are summarized in Table 3.

According to our results, the negative effect of total natural resource rents on happiness in countries with weak democracy is greater than that observed in democratic countries. Likewise, regarding the level of development, we find that the resources curse tends to be amplified in developing countries compared to develop ones. Overall, these results show that the natural resource curse is a serious problem worldwide, but its extent depends on the political system and the level of development across countries. Several arguments can be put forward to support these results. First, the limited democratic accountability typically found in authoritarian, resource-rich countries (Tsui, 2011). Similarly, a general feeling of dissatisfaction can also result from poor governance (characteristic of many resource-rich economies). Indeed, oil-rich countries are often characterized by a weak rule of law and a high risk of expropriation, failed bureaucracies and endemic corruption (see Kolstad and Wiig 2009), these in addition to power

struggles and tensions between different interest groups (see Baggio and Papyrakis 2010; Hodler 2006).

Table 3: Resources rents and happiness in different sample

	Dependent variable: life ladder				
	Global sample	Democracy level		Income level	
		Autocracy countries	Democracy countries	Developed countries	Developing countries
Total natural resources rents	**-0.025*** **	**-0.028***	**-0.021***	**-0.016***	**-0.051*** **
	(0.008)	**(0.014)**	**(0.013)**	**(0.010)**	**(0.015)**
GDP per capita	0.486***	0.440***	0.545***	0.484***	0.482***
	(0.069)	(0.129)	(0.083)	(0.096)	(0.148)
Population growth	-0.095**	-0.202***	-0.040	-0.154***	-0.100
	(0.041)	(0.071)	(0.058)	(0.044)	(0.089)
Inflation	-0.000	-0.000	-0.002	-0.002	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Health	0.020	0.022	0.004	0.035	0.007
	(0.015)	(0.025)	(0.021)	(0.029)	(0.031)
Unemployment	-0.055***	-0.056***	-0.051***	-0.042***	-0.045***
	(0.011)	(0.019)	(0.013)	(0.015)	(0.013)
Education	0.231	0.319	0.195	0.238	0.464
	(0.157)	(0.430)	(0.175)	(0.177)	(0.307)
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes
Observations	123	37	86	68	54
R-squared	0.828	0.769	0.841	0.808	0.779

Note: Authors' estimates. Results based on OLS regressions of equation (1). Robust standard errors in parentheses. ∗p < 0.10, ∗∗p < 0.05, ∗∗∗p < 0.010.

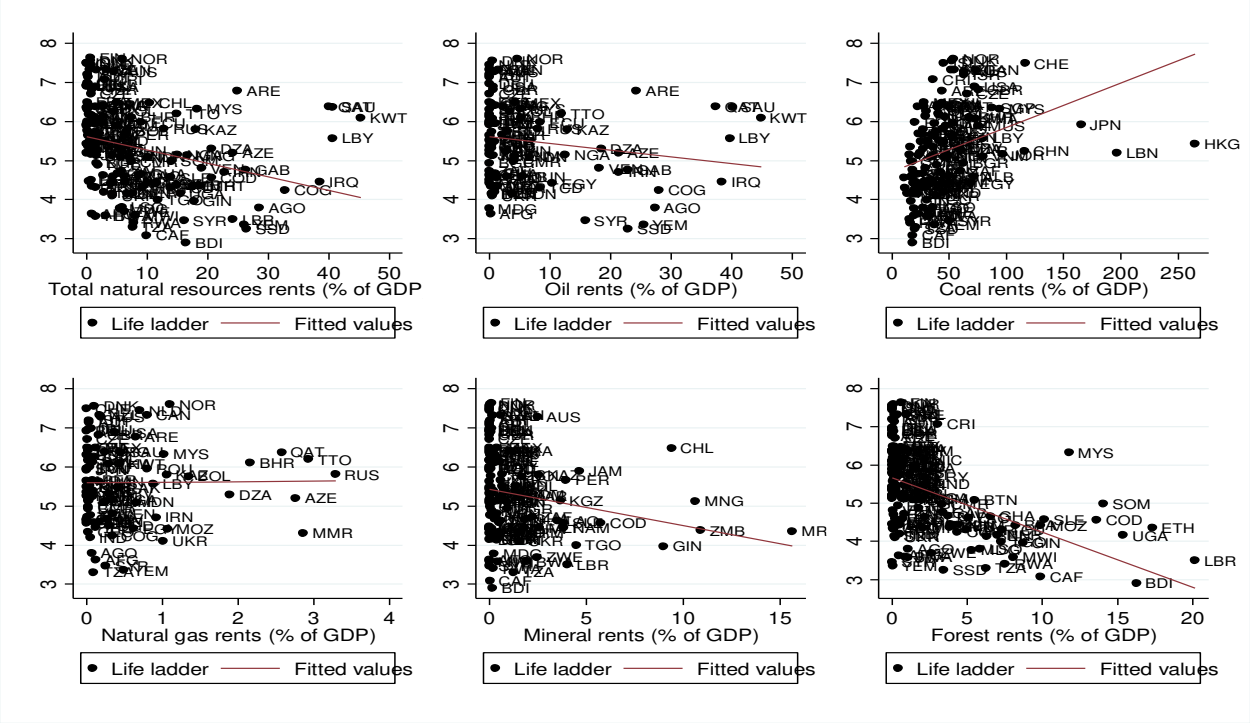
Furthermore, on average in the world, the resource-rich countries are mainly developing countries such as sub-Saharan African countries and are characterized by their poor quality of institutions. In fact, the rents benefits are not always well distributed and do not allow the improvement of the quality of life of the population. As Arezki and Gylfason (2013) have shown, higher resource rents lead to more corruption and the effect is significantly stronger in less democratic countries. Much more, the inability of many resource-rich countries to raise living standards as well as macroeconomic volatility resulting from the fluctuation of resource prices (see van der Ploeg and Poelhekke 2009) can also be considered as another factor that would justify the negative effect of natural resources on happiness.

3.3 Differential effects on the type of natural resources

We check if the effect of resources rents on happiness may differ depending on the types of natural resources. To this end, we previously highlighted in Figure 2 the correlation between rents and happiness resources. We observe that the correlation varies according to the nature of the resources. Specifically, we detect negative correlations concerning the oil, mineral and forest rents; a positive correlation for coal rent and an ambiguous correlation for natural gas rent.

These correlations are confirmed in our estimations after considering in turn as variables of interest these different measurements of natural resources (see Table 4). However, while the coefficients of these variables have consistent signs in the sense of the previously observed correlations, only the coefficients associated with oil and natural gas rents are statistically significant. These results suggest that the negative effects of total natural resources rents are mainly driven by those of oil and natural gas. These results corroborate those of Ali et *al*. (2020) who show that oil rents are negatively correlate to human welfare over time, and those of Daniele (2011) who claimed that mineral resource rents reduce Human Development Index (a composite development index of life expectancy, education and GDP per capita).

Figure 2: Correlation between disaggregated resources rents and happiness



Source: Authors' construction using data of WDI and WHD.

Table 4: Disaggregated resources rents and happiness

	Dependent variable: life ladder					
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Total natural resources rents	**-0.022*** **					
	(0.006)					
Oil rents		**-0.024*** **				
		(0.006)				
Forest rents			**-0.011**			
			(0.019)			
Mineral rents				**-0.002**		
				(0.003)		
Coal rents					**0.002**	
					(0.020)	
Natural gas rents						**-0.147***
						(0.075)
GDP per capita	0.450***	0.498***	0.376***	0.462***	0.391***	0.383***
	(0.066)	(0.073)	(0.066)	(0.082)	(0.074)	(0.062)
Population growth	-0.108***	-0.103**	-0.076**	-0.077	-0.065*	-0.120**
	(0.036)	(0.043)	(0.034)	(0.050)	(0.038)	(0.045)
Inflation	-0.000	-0.001	-0.000	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Health	0.036***	0.026*	0.044***	0.041***	0.055***	0.027*
	(0.013)	(0.014)	(0.013)	(0.014)	(0.014)	(0.015)
Unemployment	-0.058***	-0.060***	-0.056***	-0.068***	-0.052***	-0.071***
	(0.011)	(0.010)	(0.012)	(0.012)	(0.012)	(0.013)
Education	-0.074	-0.039	0.022	-0.027	-0.085	0.190
	(0.148)	(0.178)	(0.150)	(0.182)	(0.180)	(0.161)
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123	80	123	107	105	74
R-squared	0.799	0.796	0.782	0.778	0.776	0.784

Note: Authors' estimates. Results based on OLS regressions of equation (1). Robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.010.

4. Robustness checks

To appreciate the solidity of the relationship between resources rents and happiness, we run three main robustness check. The first is for controlling the possible limited nature of the dependent variable. The second accounts for the possible variation in the magnitude of the interest coefficient depending on the distribution of the dependent variable. The third use alternative measures of natural resources dependence.

4.1 Controlling for the bounded nature of the dependent variable

As the dependent variable is bounded in [0-10] interval, our results could be biased with OLS or another related technique. OLS are also inappropriate with limited dependent variables, for which there are a large number of varieties. Sometimes a dependent variable can be continuous on one or more intervals of the line of the reals, but can take one or more values with a finite probability. Limited dependent variable models are designed to process samples that are truncated or censored. To address this bias, some estimators are appropriate. In this paper, we run TOBIT, Censored Poisson and Truncated Negative Binomial estimators. These models are qualified as count model, because they count the occurrences of an event. Specifically, they account for censoring and truncation issues. On one hand, a sample is truncated if some of its observations which were to be there were systematically excluded. On the other hand, a sample is said to be censored if no observation has been systematically excluded, but if certain information contained by these observations has been deleted. These two explanations could be the case for the extreme values (0 and 10) of happiness.

Table 5: Robustness test on the nature of the dependent variable

Variables	Dependent variable: Life Ladder					
	TOBIT		Censored Poisson		Truncated negative binomial	
Total natural resources rents	**-0.0220*** **	**-0.0246*** **	**-0.00383*** **	**-0.00455*** **	**-0.00391*** **	**-0.00469*** **
	(0.00658)	**(0.00740)**	**(0.00119)**	**(0.00138)**	**(0.00124)**	**(0.00143)**
GDP per capita	0.450***	0.486***	0.0734***	0.0843***	0.0743***	0.0861***
	(0.0660)	(0.0662)	(0.0122)	(0.0128)	(0.0127)	(0.0134)
Population growth	-0.108***	-0.0950**	-0.0201***	-0.0186***	-0.0208***	-0.0194***
	(0.0381)	(0.0373)	(0.00602)	(0.00652)	(0.00619)	(0.00667)
Inflation	-0.000154	-0.000411	-4.61e-06	-7.35e-05	-1.76e-06	-7.61e-05
	(0.000587)	(0.000560)	(0.000120)	(0.000141)	(0.000126)	(0.000148)
Health	0.0360***	0.0198	0.00856***	0.00445	0.00907***	0.00468
	(0.0118)	(0.0140)	(0.00245)	(0.00294)	(0.00256)	(0.00308)
Unemployment	-0.0580***	-0.0555***	-0.0105***	-0.00958***	-0.0109***	-0.00978***
	(0.00941)	(0.00957)	(0.00184)	(0.00187)	(0.00191)	(0.00194)
Education	-0.0740	0.231*	-0.0198	0.0356	-0.0212	0.0359
	(0.125)	(0.139)	(0.0260)	(0.0253)	(0.0267)	(0.0259)
Constant	0.565	0.353	0.744***	0.749***	0.705***	0.716***
	(0.399)	(0.569)	(0.0931)	(0.131)	(0.0978)	(0.138)
Sub-regional dummies	No	Yes	No	Yes	No	No
Observations	123	123	123	123	123	123
Pseudo R-squared	0.5148	0.5641	0.0512	0.0533	0.0527	0.0549

Note: Authors' estimates. Robust standard errors in parentheses. ∗p < 0.10, ∗∗p < 0.05, ∗∗∗p < 0.010

The results obtained in Table 5 remain consistent with the previous results: the natural resource curse is a worldwide reality. However, the effect seems to be higher with sub-regional dummies, the adjustment quality being better under TOBIT model.

4.2 Resource rents and happiness: a non-parametric approach

The non-parametric approach used is based on quantile regression (QR). First introduced in Koenker and Bassett's (1978) seminal contribution, the QR method enables us to examine the

effects of resource rents at different intervals throughout the happiness index distribution. As such, this approach is more robust than OLS for at least two reasons. First while OLS can be inefficient if the errors are highly non-normal, QR is more robust to non-normal errors and outliers. Second, QR also provides a richer characterization of the data, allowing us to consider the impact of a covariate on the entire distribution of the dependent variable, not merely its conditional mean[3]. The quantile estimator is obtained by solving the following optimization problem:

$$min_{\beta \epsilon R^K} \left[\sum_{i \epsilon \{i: y_i \geq x_i' \beta\}} \theta |y_i - x_i' \beta| + \sum_{i \epsilon \{i: y_i < x_i' \beta\}} (1-\theta) |y_i - x_i' \beta| \right] \quad (2)$$

for the θ^{th} quantile $(0 < \theta < 1)$.

y_i is the happiness index of country i. β is the vector of parameters to be estimated and x_i is a K- 1 vector of the explanatory variables.

Tableau 7: OLS vs QR

	Dependent variable: Life Ladder					
Variables	**OLS**	**Q10**	**Q25**	**Q50**	**Q75**	**Q95**
Total natural resources rents	**-0.025*** **	**-0.017**	**-0.022*** **	**-0.029*** **	**-0.028*** **	**-0.012**
	(0.008)	**(0.033)**	**(0.007)**	**(0.006)**	**(0.010)**	**(0.021)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123	123	123	123	123	123
R-squared/Pseudo R-squared	0.828	0.570	0.588	0.638	0.635	0.663
Oil rents	**-0.028*** **	**-0.044** **	**-0.023** **	**-0.026*** **	**-0.024** **	**-0.009**
	(0.008)	**(0.019)**	**(0.011)**	**(0.009)**	**(0.010)**	**(0.010)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	80	80	80	80	80
R-squared/Pseudo R-squared	0.836	0.576	0.615	0.655	0.660	0.691
Gas rents	**-0.133*** **	**-0.146**	**-0.071**	**-0.111**	**-0.109**	**-0.269*** **
	(0.062)	**(0.107)**	**(0.188)**	**(0.130)**	**(0.069)**	**(0.099)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	74	74	74	74	74	74
R-squared/Pseudo R-squared	0.815	0.507	0.528	0.580	0.601	0.616
Mineral rents	**-0.003**	**0.017**	**-0.016**	**-0.012**	**-0.036**	**-0.044**
	(0.017)	**(0.085)**	**(0.034)**	**(0.016)**	**(0.031)**	**(0.047)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	107	107	107	107	107	107
R-squared/Pseudo R-squared	0.811	0.551	0.553	0.609	0.640	0.674
Forest rents	**-0.001**	**-0.027**	**-0.033**	**0.006**	**0.012**	**-0.000**
	(0.023)	**(0.026)**	**(0.039)**	**(0.032)**	**(0.028)**	**(0.059)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123	123	123	123	123	123
R-squared/Pseudo R-squared	0.812	0.557	0.573	0.610	0.618	0.656
Coal rents	**0.001**	**-0.010**	**0.002**	**0.002**	**0.001**	**-0.002** **
	(0.004)	**(0.010)**	**(0.005)**	**(0.003)**	**(0.005)**	**(0.001)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sub-regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	105	105	105	105	105	105
R-squared/pseudo R-squared	0.805	0.520	0.549	0.612	0.623	0.687

Note: Authors' estimates. Robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.010

The results for quantile estimation compared to those of OLS are reported in Table 7. In accordance with the methodology used previously, we appreciate the effect on happiness of the

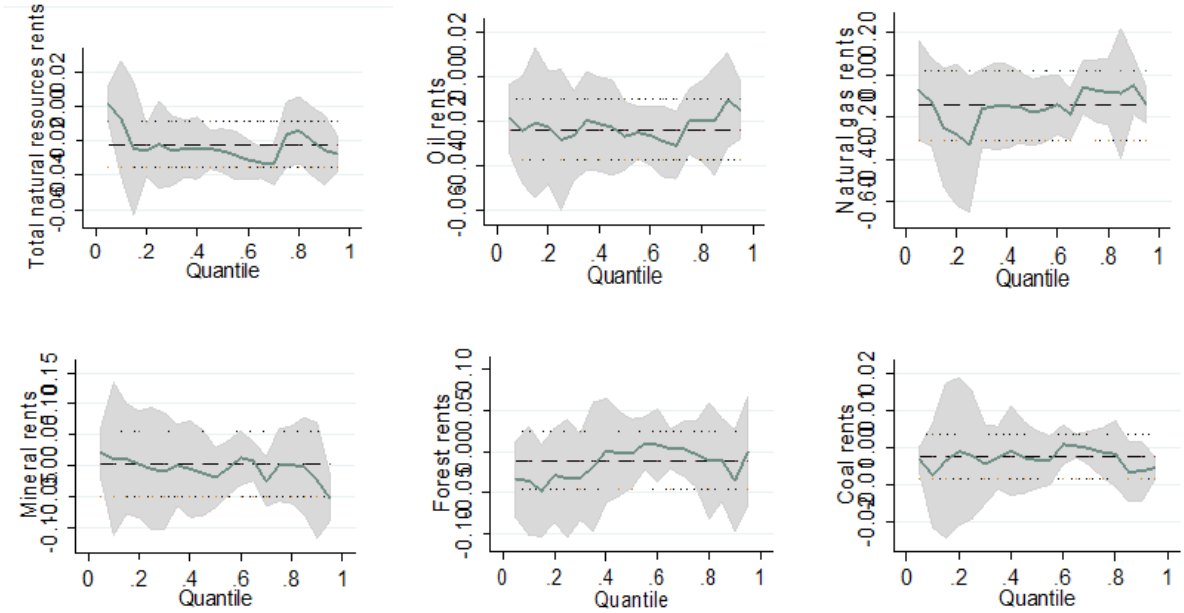
[3] More on quantile regression techniques can be found in the surveys by Buchinsky (1998) and Koenker and Hallock (2001); for applications see Coad (2006).

total natural resources rents and those of disaggregated resources. Column (1) shows OLS estimation results, which suggest that an increase in total resources rents as well as oil rents, natural gas rents, forest rents, mineral rents and coal rents significantly reduce wellbeing. Columns (2)–(6) report estimates for the 10th, 25th, 50th, 75th and 95th quantiles using quantile regression.

We observe that negative effect of total resource rent varies throughout the happiness distribution. More specifically, effect is statically significant from the 25th quantile up to the 75th, beyond which the effect tends to be no longer significant. Regarding disaggregated resources, we find that while oil rents negatively influences happiness at the bottom of its distribution up to the 75th quantile, gas rents influences it only from 95th quantile, i.e. at an extremely high level of happiness. Likewise, coal rents which initially had no significant effect with the OLS approach, also had a negative effect on happiness from 95th quartile.

These results are confirmed on the Figure 3 which illustrates how the effects of resources rents on happiness vary over quantiles, and how the magnitude of the effects at various quantiles differ considerably from the OLS coefficient (presented as horizontal lines). We observe that when the QR is evaluated before the median happiness index (i.e. before the 50th quantile), the total of resource rents seem to have a positive influence on happiness. However, for quantiles over the 50th, the effect tends to be negative. Thus, countries which have few natural resources apply the best management mechanisms compared to countries which are highly endowed with them. Thus, the thesis of the curse of raw materials is verified according to the level of happiness and to the type of natural resource in the world.

Figure 3: The magnitude of the resources rent effects on happiness over the quantiles



Source: Authors' constructions using data of WDI and WHS. Horizontal lines represent OLS estimates with 95% confidence intervals.

4.3 Alternative measures of natural resource dependence and happiness

In this robustness analysis, we use other measures of natural resource dependence, namely: (i) the share of primary exports in total exports (see Sachs and Warner, 1995; Leite and Weidmann, 1999) calculated according to Standard International Trade Classification Rev. 3 (SITC

categories 0, 1, 2, 3 and 68); (ii) the share of exports of metals and ores on the total exports (see Danielle, 2011).

Table 6: Other measures of natural resource dependence and happiness

	Dependent variable: Life Ladder					
	OLS	**Q10**	**Q25**	**Q50**	**Q75**	**Q95**
Primary exports/Total exports	**-0.867*** **	**-1.047***	**-0.283**	**-0.946***	**-0.953***	**0.0171**
	(0.331)	**(0.553)**	**(0.458)**	**(0.496)**	**(0.489)**	**(0.703)**
Constant	5.741***	4.499***	4.572***	5.662***	6.608***	7.311***
	(0.200)	(0.329)	(0.272)	(0.294)	(0.290)	(0.417)
Number of countries	125	125	125	125	125	125
R-squared/Pseudo R-squared	0.048	0.0075	0.0106	0.0337	0.0286	0.0000
Exports of metals and minerals /Total exports	**-0.0148*** **	**-0.00929**	**-0.00988**	**-0.0160***	**-0.0183*** **	**-0.0162*** **
	(0.00425)	(0.00959)	(0.00815)	(0.00817)	(0.00801)	(0.00784)
Constant	5.545***	4.143***	4.667***	5.588***	6.377***	7.487***
	(0.108)	(0.192)	(0.163)	(0.163)	(0.160)	(0.157)
Number of countries	147	147	147	147	147	147
R-squared/Pseudo R-squared	0.048	0.0073	0.0084	0.0389	0.0413	0.0198

Note: Authors' estimates. Results based on OLS and QR. Robust standard errors in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < 0.010$

Overall, the use of alternative measures of dependence on natural resources confirms the thesis of the curse, but dependence is higher for primary products than for metals. These results are in line with those of Davis (1995), Mikesell (1997), Auty and Mikesell (1998), Auty (2001), Berman et al. (2017), Apergis and Katsaiti (2018) using other economic variables than happiness.

5. Conclusion and policy implications

The aim of this paper was to study the effects of resource rents on subjective wellbeing. Based on data covering 149 cross-countries and using both parametric and non-parametric approaches, we highlighted the existence of resource curse on subjective wellbeing. Specifically, we found that resources rents tend to reduce happiness but this effect differs depending on the political system and the level of development, the types of natural resources and varies according to the level of happiness. Indeed, studying heterogeneity of results across countries, we found that the negative effect of natural resources on happiness tends to be amplified in developing and weak democracy countries. Furthermore, the disaggregation of natural resources rents show that while oil rents and natural gas rent have a significant negative effect, forest, coal and mineral rents do not. These results remain globally robust when we use the other measures relating to dependence on natural resources such as the share of primary exports in total exports and the share of exports of metals and minerals on the total exports. This solid and negative average effect of natural resources on happiness was obtained by parametric approaches. To put our result into perspective, we used a non-parametric approach by retaining the quantile regression technique. The results suggest that, the negative effect of natural resources on happiness vary at different intervals throughout the happiness distribution. So, as noted by Badeeb et al. (2017) in their survey, "*the evidence that resource dependence negatively affects growth remains convincing, particularly working through factors closely associated with growth in developing countries*".

These results suggest the formulation of three main recommendations: (i) first, it is fundamental to diversify the productive structure of economies to counteract the curse of natural resources. With this in mind, countries should reflect on their transition from the status of rent economies to that of production economies. To this end, it is a matter of promoting a diversified productive base, with an important industrial sector, a vector of structural transformation; (ii) second,

countries should build strong institutions to avoid rent-seeking and survival behavior. Better quality institutions are the key to a prosperous economy, in that they shape behavior, guarantee equity, a vector for combating inequality and conflict in resource-rich countries; (iii) third, governments should promote a system of optimal allocation of resources through targeting and redistribution mechanisms that reduce injustice and inequalities.

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Appendix

Table A1: list of countries by sub-regions, level of development and democratization.

Sub-Saharan Africa	Middle East North Africa	South Asia	North America	Europe Central Asia	East Asia Pacific	Latin America Caribbean
Angola	Algeria **(a)**	Afghanistan	Canada **(ab)**	Albania **(ab)**	Austria **(ab)**	Argentina **(ab)**
Benin	Bahrain **(a)**	Bangladesh	USA **(a)**	Armenia **(ab)**	Cambodia	Belize **(a)**
Botswana **(ab)**	Egypt	Bhutan		Austria **(a)**	China **(a)**	Bolivia
Burkina Faso	Iran **(a)**	India		Azerbaijan **(a)**	Hong Kong	Brazil **(ab)**
Burundi	Iraq **(ab)**	Nepal		Belarus **(a)**	Indonesia	Chile **(ab)**
Cameroon	Israel **(ab)**	Pakistan		Belgium	Japan **(ab)**	Colombia **(ab)**
Central African R.	Jordan **(a)**	Sri Lanka **(ab)**		Bosnia	Lao PDR	Costa Rica **(a)**
Chad	Kuwait **(a)**			Bulgaria **(ab)**	Malaysia **(ab)**	Dominican Rep. **(ab)**
Congo, D. Rep.	Lebanon **(ab)**			Croatia **(ab)**	Mongolia	Ecuador **(a)**
Congo, Rep.	Libya **(a)**			Cyprus **(ab)**	Myanmar	El Salvador
Cote d'Ivoire	Malta **(a)**			Czech Rep. **(ab)**	N. Zealand **(ab)**	Guatemala **(ab)**
Ethiopia	Morocco			Denmark **(ab)**	Philippines	Haiti
Gabon **(a)**	Qatar **(a)**			Estonia **(ab)**	Singapore **(a)**	Honduras
Ghana	Saudi Arabia **(a)**			Finland **(ab)**	Thailand **(a)**	Jamaica **(ab)**
Guinea	Syrian Arab R.			France **(ab)**	Vietnam	Mexico **(ab)**
Kenya	United Arab E. **(a)**			Georgia **(ab)**		Netherlands **(ab)**
Lesotho	Yemen, Rep.			Germany **(ab)**		Nicaragua
Liberia				Greece **(ab)**		Panama **(ab)**
Malawi				Iceland **(a)**		Paraguay **(ab)**
Mali				Ireland **(ab)**		Peru **(ab)**
Mauritania **(a)**				Italy **(ab)**		Trinidad **(ab)**
Mauritius				Kazakhstan **(a)**		Uruguay **(ab)**
Mozambique				Kosovo **(ab)**		Venezuela
Namibia **(ab)**				Latvia **(ab)**		
Niger				Lithuania **(ab)**		
Nigeria				Luxembourg **(ab)**		
Rwanda				Montenegro **(ab)**		
Senegal				Norway **(ab)**		
Sierra Leone				Poland **(ab)**		
Somalia				Portugal **(ab)**		
South Africa **(ab)**				Romania **(ab)**		
South Sudan				Russian **(a)**		
Tanzania				Serbia **(ab)**		
Togo				Slovak Rep. **(ab)**		
Uganda				Slovenia **(ab)**		
Zambia				Spain **(ab)**		
Zimbabwe **(a)**				Sweden **(ab)**		
				Switzerland **(ab)**		
				Uzbekistan **(a)**		

Note: authors' construction. **(a)** denotes developed country, (**b)** denotes democratic country and (**ab)** denotes both developed and democratic country.

Table A2: correlation matrix table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Happiness index	1							
(2) Total natural resources rents	-0.27	1						
(3) GDP per capita	0.82	-0.11	1					
(4) Population growth	0.11	-0.35	0.11	1				
(5) Inflation	-0.09	0.13	-0.08	-0.14	1			
(6) Health	0.80	-0.34	0.86	0.28	-0.11	1		
(7) Employment	-0.13	0.08	-0.28	-0.01	0.04	-0.33	1	
(8) Education	0.08	-0.12	0.19	0.56	0.01	0.32	0.43	1

Note: Authors' calculations.

Table A3: Diagnostic tests for OLS (normality, heteroskedasticity, multicollinearity and omitted variables)

1. Normality test: Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
residual	123	0.0995	0.8324	2.82	0.2445

2. Heteroskedasticity test: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of life ladder
chi2(1) = 1.11
Prob > chi2 = 0.2929

3. Multicollinearity test

Variable	VIF	1/VIF
Health	6.54	0.152
GDP per capita	4.75	0.210
Human capita	3.27	0.306
Total resource rents	1.50	0.667
Population growth	1.32	0.761
Unemployment	1.10	0.905
Inflation	1.08	0.923
Mean VIF	2.79	

3. Omitted variables test

Ramsey RESET test using powers of the fitted values of LL
Ho: model has no omitted variables
F(3, 112) = 1.58
Prob > F = 0.1981

Note: Authors' calculations.