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RESEARCH PAPER

Happiness and the Resource Curse

Sabna Ali[1] · **Syed Mansoob Murshed**[1,2] · **Elissaios Papyrakis**[1,3]

Abstract
There has been increasing interest in the so-called 'resource curse': the tendency of resource-rich countries to underperform in several socio-economic outcomes. More recently, several papers have looked beyond the traditional impact on economic growth and instead focused on the effects upon broader human welfare indicators. A separate empirical literature in recent decades has probed into the determinants of happiness and subjective well-being (using either country or household data). Our paper contributes to the literature by bringing these two empirical strands of research together. This is the first study, to our knowledge, that makes use of a large panel dataset to explore the links between changes in happiness across countries and several measures of resource wealth. Consistent with prior empirical evidence of a resource curse in oil-rich nations, we find that oil rents are negatively linked to improvements in happiness over time. This happiness 'resource curse' curse appears to be oil-specific and holds both for the levels as well as changes in happiness.

Keywords Resource curse · Mining · Happiness · Cross-country analysis

1 Introduction

In recent years there has been a burgeoning literature researching the links between resource abundance and several measures of economic performance. Much of the so-called *resource curse* literature has developed theoretical and empirical research explaining the negative correlation observed between several measures of mineral wealth and long-term

✉ Elissaios Papyrakis
papyrakis@iss.nl; e.papyrakis@uea.ac.uk

[1] International Institute of Social Studies (ISS), Erasmus University Rotterdam, Kortenaerkade 12, 2518 AX The Hague, The Netherlands

[2] School of Economics, Finance and Accounting, Coventry University, Coventry, UK

[3] School of International Development, University of East Anglia (UEA), Norwich NR2 4AG, UK

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economic growth (Baggio and Papyrakis 2010; Murshed and Serino 2011; Papyrakis 2014). Much of this literature (to which this paper belongs) pays particular attention to oil and its correlates.[1]

While the resource curse literature initially focused attention on economic growth, it gradually widened its scope to broader welfare variables. For example, Bulte et al. (2005) and Daniele (2011) claimed that mineral resource rents are associated with lower values of the Human Development Index (a composite development index of life expectancy, education and GDP per capita), undernourishment, higher child mortality and limited access to safe water. Deaton and Niman (2012) and Pegg (2006) provide evidence of a poor empirical track record of poverty alleviation in mineral dependent economies. Several papers in the field of ecological economics have also linked mineral wealth to low scores of sustainable development indices (such as the genuine savings and genuine income measurements; see Atkinson and Hamilton 2003; Dietz and Neumayer 2007).

In parallel (but regrettably independently) a separate empirical literature in recent decades has probed into the determinants of happiness and subjective well-being (using either country or household data). Several of these papers examine the importance of absolute, relative and past income in explaining variations in reported happiness (see Asadullah et al. 2018; Clark et al. 2008). Some of them are in support of the so-called *Easterlin paradox*, suggesting that increasing average income (at the country level) yields diminishing marginal gains in average happiness (Blanchflower and Oswald 2004; Easterlin and Angelescu 2012; di Tella and MacCulloch 2008). Several other socio-economic and environmental factors appear to explain variation in reported happiness (e.g., unemployment and inflation, see di Tella et al. 2001, education levels, see Caner 2016, corruption, see Welsch 2008; trade, see Hessami 2011 and environmental quality, see Ferrer-i-Carbonell and Gowdy 2007).

So far, there has been no attempt to bring these two empirical traditions of research together and explore whether resource-rich countries find it more difficult, other things equal, to translate their resource wealth into happiness gains (i.e. a '*happiness resource curse*'). Our paper contributes to the literature by bringing these two empirical streams of research together. This is the first study, to our knowledge, that makes use of a large panel dataset to explore the links between changes in happiness across countries and several measures of resource wealth. Consistent with prior empirical evidence of a resource curse in oil-rich nations, we find that oil rents are negatively linked to improvements in happiness over time. This happiness 'resource curse' curse appears to be oil-specific and holds both for the levels as well as changes in happiness.

The next section consists of a theoretical note on happiness and the resource curse that can serve as a formal framework of analysis for subsequent chapters. Section 3 provides a brief literature review on happiness and its correlates (with an emphasis on the role of natural resource rents). Sections 2 and 3 together provide the justification behind the empirical specifications that are tested in subsequent sections. Section 4 is devoted to our empirical analysis on happiness changes and resource wealth, where we disaggregate the analysis per type of natural resource (abundance/dependence) measure. In Sect. 5 we extend our analysis by looking at how happiness levels (rather than changes over time) correlate with

[1] E.g. for the case of economic growth, see Khanna (2017), conflict, see Lujala (2010), gender and broader income inequality, see Ross (2008) and Parcero and Papyrakis (2016), bureaucratic efficiency, see Goldberg et al. (2008).

our measures of resource affluence. Section 6 summarises our main findings and offers concluding remarks.

2 A Theoretical Note on Happiness and the Resource Curse

The microeconomic literature on happiness focuses on the utility of an individual household. Following Clarke et al. (2008) and Layard (1980), this utility can be summarised to (largely) depend positively on four variables. These are individual consumption (related to household income) but at the usual diminishing rates, the household's income relative to the average or mean income in society, expected future income and leisure. This theoretical framework also assumes that there is some happiness adaptation to income gains; i.e. individuals become accustomed to higher income and consumption levels, and the consequent rise in happiness tends to diminish after the initial periods.

Moving on to a more aggregative view of happiness (which involves summing individual utilities in one country and arriving at some utilitarian welfare function, and then making the same comparison across countries) entails a number of steps and simplifications, particularly to carry out empirical investigation. Measured national average utility levels are expected to positively correlate with average per-capita income (GDP) levels. Growth in per-capita income captures expected improvements in average income over time (which helps offset the aforementioned adaptation effect). The relative income variable may explain a large part of the variation in utility levels across individuals (as a result of the status associated with higher income levels with respect to others), but it is less likely to do so at the more aggregate country level (the higher status of any individual gives rise to a lower status for all the rest in the economy, leading hence to a 'zero-sum game' on the whole, see Clark et al. 2008, p. 101). Nevertheless, there might be an aggregate negative correlation between income inequality (e.g. the Gini coefficient) and average utility, if, on average, individuals tend to have a preference for more egalitarian societies (Baggio and Papyrakis 2014). Then, as discussed earlier, individual valuation of labour could be replaced by societal (and individual) distaste for unemployment. We could further add utility from public goods, as in the case of educational expenditure. Across countries, happiness may also vary along with differences in institutions, e.g. captured by variations in the rule of law, control of corruption and the degree of democracy.

Resource dependent countries are deemed to have poorer institutions relative to less resource dependent nations, causing their citizens to be less happy on average. Secondly, expected income can fluctuate considerably along with commodity price volatility, especially in the case of oil prices. Thirdly, resource windfall gains and temporary increases in income may create few happiness gains to the extent that short-sighted governments in mineral-rich contexts do not aim for an equitable distribution of rents and investment in productive capacity. Natural resource booms and discoveries can create short-term income shocks with corresponding happiness gains, which can, though, be sustained only temporarily if resource-rich economies underperform in the long run (as it is often the case). Fourthly, although the happiness measure is an average for a nation based on representative surveys, the response rate to these surveys may be biased towards median individuals, who in the case of resource rich countries may be experiencing a relative decline in income compared to mean or per-capita income changes. This will happen with a greater concentration of wealth at the top, which is more likely in resource rich countries with poor institutional constraints and structures. Finally, resource-dependent economies tend to be less

diversified and with exports dominated by primary commodities; as a result, employment in the traded sectors is lower than in more diversified economies, along with the forward and backward linkages to employment in other sectors.

We may, hence, write a happiness function (H) as a function of several arguments:

$$H = f(Y, G, I, P, W, R/Y),$$

where Y is the level of per-capita income, G is growth of income per capita, I refers to institutional quality, P stands for public goods, W stands for work or employment and the last argument, R/Y, is a measure of resource dependence. Happiness is expected to vary positively with all the arguments in the function above, with the exception of resource dependence. Some of the right-hand side arguments may also correlate with one another to some extent (e.g. richer economies may be able to afford better institutions and invest more in public good provision). In addition, mineral resources may affect growth prospects or institutional development in accordance with the resource curse hypothesis—these endogeneity issues will be reflected upon in the empirical Sect. 4.

3 Happiness and the Resource Curse: A Brief Literature Review

In this section we discuss the mechanisms that are likely to link happiness to resource rents, as well as other possible explanatory factors.[2] The theoretical mechanisms presented will then shape the specifications that will be empirically tested in Sects. 4 and 5 of the paper.

3.1 Happiness and Resource Wealth

Resource rents may, in principle, be associated with larger happiness gains if the revenues become redistributed equitably and become invested in activities that enhance welfare (e.g. large public investment projects). On the other hand, it is likely that oil rich nations, in particular, fail to translate their resource wealth into increased happiness for the same reasons that often prevent them from experiencing faster economic growth. Some of these reasons may simply relate to how petrostate economies typically function; oil rents might fail to support happiness gains over time whenever they generally disadvantage activities in the non-oil sectors via Dutch Disease effects (where the majority of job opportunities are located; e.g. see Beine et al. 2012). Similarly, oil enclaves might create few spillovers to the rest of the economy (often as a result of their geographical clustering, either offshore or in few remote places onshore, e.g. see Auty 2006). In addition, changes in happiness may simply be influenced by the inability of many oil-rich countries to raise living standards or the macroeconomic volatility experienced as a result of fluctuating oil prices (see van der Ploeg and Poelhekke 2009).

A general feeling of dissatisfaction might also arise as a result of bad governance (a typical feature of many mineral rich economies) and the corresponding inefficient allocation of public revenues (based on rent-seeking rather than expected returns; Brollo et al. 2013). Oil rich countries are often characterised by weak rule of law and a high risk of expropriation, malfunctioning bureaucracies and endemic corruption (see Kolstad and Wiig 2009).

[2] For some excellent and more detailed reviews of the literature, see Radcliffe (2013), Weimann et al. (2015).

Fig. 1 Change in happiness and oil dependence. Note: Abbreviations correspond to 3-letter country ISO codes

The geographic clustering of mineral resource also intensifies (often pre-existing) power struggles and grievances across different interest groups (which are often divided across ethnic/religious lines; see Baggio and Papyrakis 2010; Hodler 2006). Furthermore, the limited democratic accountability typically found in authoritarian oil-rich states can further enhance the general dissatisfaction arising from the mismanagement of mineral rents (and public resources more broadly; Tsui 2011).

Figure 1 presents a scatterplot linking changes in reported happiness (between 2009 and 2012) to the initial level of oil dependence. Happiness is proxied by the Gallup World Poll measure of average subjective well-being (a measure of average reported satisfaction with life of the residents of each country, with scale from 0 to 10; see Gallup World Poll 2017). Oil dependence is measured as the share of oil rents in GDP (data provided by the World Bank 2016). Negative happiness changes characterise both oil rich and scarce economies; however, for high levels of oil dependency (where oil accounts for more than 10% of GDP), there is a much larger proportion of countries experiencing a negative change (please note that the horizontal red line now corresponds to no change in happiness—the vertical red line denotes a level of oil dependence equal to 10%).

3.2 Happiness and Income

Several empirical analyses argue that increased income does indeed 'buy happiness', although at a diminishing rate: i.e. there is a positive but concave relationship between happiness proxies and average income (Blanchflower and Oswald 2004; Easterlin and Angelescu 2012; di Tella and MacCulloch 2008). This is in line with the so-called *Easterlin paradox*, suggesting that the relationship between happiness and average income flattens out for sufficiently high levels of economic development (see Easterlin 1974, 2015). Economic growth, hence, results in happiness gains primarily for low-income countries,

where improvements in income levels allows access to some of the basic necessities of life (FitzRoy et al. 2012). In addition, while individuals tend to be also concerned about their relative income, this status return from having higher income with respect to a reference group has little impact on country-level happiness over time. Individuals also tend to quickly adjust to increased income levels (in other words, there is an adaptation/habituation effect, where any positive happiness effects of increases in income tend to fade away over time; di Tella et al. 2010).

3.3 Other Correlates

Several studies provide empirical support to a strong negative correlation between happiness and *unemployment* (as a result of the associated insecurity and anxiety that job-loss brings about; see Blanchflower et al. 2014). Other things equal, unemployed individuals tend to experience reduced life-satisfaction scores by approximately 5–20% (Di Tella et al. 2001; Lelkes 2006). There is also evidence suggesting that unemployment has a persistent effect on happiness (i.e. it does not decline with the length of unemployment; see Knabe and Rätzel 2011).

There is also some tentative evidence pointing to a positive relationship between *education* and happiness (Blanchflower and Oswald 2004; Cuñado and de Gracia 2012). For many, education has an intrinsic value since it provides an opportunity for self-improvement and broadening one's interests and understanding of the social world. Some studies, though, find no significant effect of education on happiness (e.g. Flouri 2004) or even a negative one (Caner 2016). This might be explained by the fact that education often correlates positively with income levels (as well as often unfulfilled income aspirations). As a result of this, controlling for income levels might make any positive significant statistical relationship between education and happiness to disappear (see Graham and Pettinato 2001).

Several studies claim that *inflation* can potentially reduce happiness—individuals tend to dislike inflation because of the ensuing uncertainty regarding changes in the cost of living and real income (see Shiller 1997). In general, studies find that unemployment tends to be much more harmful than inflation in terms of happiness losses (e.g. see Di Tella et al. 2001, 2003), although there seems to be no significant effect when one uses aggregate country data (see Bjørnskov 2003 and Ovaska and Takashima 2006). There is also some ambiguity regarding the relationship between *trade* openness and average happiness—while trade expansion has the potential for job creation and lower prices, efforts for freer trade worldwide often face stiff resistance (as a result of fear of displacement of domestic workers and closure of local industries). Many studies, hence, find a negative relationship between measures of trade openness and changes in happiness (e.g. di Tella and MacCulloch 2008; Hessami 2011; Ovaska and Takashima 2006).

Several scholars claim that *environmental problems* have a detrimental effect on happiness—individuals tend to value the local and global ecosystem services provided by natural habitats (Ferrer-i-Carbonell and Gowdy 2007; Li et al. 2014). Other things equal, those living in polluted areas tend to report lower scores of subjective well-being (see Ferreira et al. 2013). There is also some evidence suggesting a positive link between transparency and happiness. Trust in public institutions, the legal system and the government is associated with higher happiness levels (Hudson 2006). Most individuals express preference for a strong *rule of law* system, that shields against meritocracy and prevents inefficiency, unfairness and criminal activity (Tavits 2008).

4 Happiness and the Resource Curse: Regression Analysis

4.1 Data and Estimation

In this section we examine the dependence of changes in happiness on natural resource wealth, as well as on a vector of other explanatory variables that have been found to be significant happiness correlates in the literature. We are especially interested in the sign of the correlation between our measures of natural resources and happiness (given the large evidence in the resource curse literature pointing to inferior development outcomes particularly in mineral rich economies; Gilberthorpe and Papyrakis 2015; Ross 2015). It is also of interest to explore whether there is a differentiated impact of different types of natural resources on happiness changes—several studies have suggested that point resources (oil, other minerals) are more strongly associated with inferior development outcomes than diffuse resources (agriculture), e.g. see Bulte et al. (2005), Boschini et al. (2013) and Lederman and Maloney (2007).[3] To identify the dependence of changes in happiness on different natural resource measures we estimate a series of cross-country panel regressions. For the purposes of our analysis the following empirical specification is estimated:

$$\Delta Happiness_{it} = \alpha_0 + \alpha_1 Resource\ Dependence_{i(t-1)} + \alpha_2 Z_{i(t-1)} + u_i + \varepsilon_{it}, \quad (1)$$

where $\Delta Happiness_{it}$ corresponds to changes in happiness for country i at time t, $Resource\ Dependence_{i(t-1)}$ refers to the value of each natural resource sector in total economic activity (in the previous year). $Z_{i(t-1)}$ corresponds to the vector of (1-year lagged) control variables found to explain variation in happiness across countries in the literature (e.g., income per capita, economic growth, unemployment, education, etc.; see Sect. 2) and u_i and ε_{it} are the country-specific (time-invariant) and variable components of the error term respectively.[4] Our panel data analysis covers the 2000–2012 period.

We opt for a random effects estimation, given that this leads to more efficient parameter estimates for variables exhibiting limited time variation (as it is the case for a number of our happiness determinants, e.g. the indices of resource dependence, education, corruption and income per capita—for a more detailed discussion of these issues, see Hsiao 2007; Neumayer 2004; Wooldridge 2010). Random effects explore both the between and within country variation (while fixed effects focus only on the latter). The standard errors of variables that fluctuate little over time typically become inflated in the case of fixed-effects estimators. This is not surprising given that fixed effects estimations involve 'time demeaning' variables to remove time-invariant observables (and as a result, time invariant variables drop out in fixed-effects regressions, while variables with limited time fluctuation typically become statistically insignificant). A recent example is the analysis by Corrigan (2014) who demonstrates how regressors typically found to be significant determinants of institutional quality (income per capita and democracy) become statistically insignificant in a fixed-effects setting.[5] In the same vein, when we replicate our random-effects estimations

[3] This is likely to be attributed to the geographical concentration and appropriability of different resource types (which tend to be high for the oil industry).

[4] "Appendix 1" lists countries in the sample (for the richer oil specification of Table 1). "Appendix 2" presents a correlation matrix for all regressors and "Appendix 3" provides variable descriptions and data sources. Descriptive statistics are presented in "Appendix 4".

[5] There are also several critiques of the Hausman test (as a means to choose between random and fixed effects estimators) in cases of variables exhibiting little variation over time (Baltagi 2011, p. 321; Clark and Linzer 2015).

Table 1 Changes in happiness and natural resource dependence

Dependent variable	ΔHappiness (1)	ΔHappiness (2)	ΔHappiness (3)	ΔHappiness (4)	ΔHappiness (5)
Constant	−0.09	−0.58	0.27	0.15	0.44
Happiness (t − 1)	−0.41*** (0.04)	−0.57*** (0.05)	−0.62*** (0.05)	−0.69*** (0.05)	−0.70*** (0.05)
Oil dependence	−0.62* (0.36)	−0.83* (0.49)	−0.99* (0.54)		
Mineral dependence				0.72 (1.09)	
Agricultural dependence					−0.35 (0.61)
Income pc	0.28*** (0.03)	0.42*** (0.05)	0.44*** (0.05)	0.49*** (0.05)	0.47*** (0.06)
Growth		1.35*** (0.39)	1.32** (0.61)	1.30** (0.56)	1.44*** (0.57)
Unemployment			−2.03*** (0.78)	−2.07*** (0.56)	−2.18*** (0.71)
Education			−0.74 (2.01)	0.45 (2.25)	−0.34 (2.24)
R^2 overall (within; between)	0.37 (0.56; 0.11)	0.40 (0.65; 0.19)	0.43 (0.69; 0.21)	0.41 (0.72; 0.19)	0.41 (0.73; 0.20)
Countries	126	121	118	136	130
N	437	322	296	333	321

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

using fixed-effects most variables lose statistical significance (and typically our random effects estimations are closer to the pooled-OLS estimations given the larger variation across space than time).[6]

4.2 Results and Discussion

We present our empirical estimations in Table 1. Our dependent variable (*ΔHappiness*) measures the change in average reported happiness (between 2000–2003, 2003–2006, 2006–2009 and 2009–2012). Happiness is proxied by the Gallup World Poll measure of average subjective well-being (a measure of average reported satisfaction with life of the residents of each country, with scale from 0 to 10—larger values correspond to higher levels of happiness; see Gallup World Poll 2017). This is one of the most comprehensible and widely used proxy of cross-country variation in happiness based on extensive opinion surveys (see Deaton 2008; Stevenson and Wolfers 2013). In all regressions we add the initial level of happiness (for the beginning of each period, i.e. $Happiness_{(t-1)}$), given that happiness gains are expected to be smaller for countries with high initial happiness levels (given that the happiness index has an upper bound). In Column (1) we add *Oil Dependence* (measured by oil rents as a share of GDP) and income per capita (*Income pc*) as additional

[6] Results available from the authors upon request.

explanatory variables (data provided by the World Bank 2016). We find evidence of an oil-happiness resource curse (significance at the 10% level)—a 100% difference in the share of oil rents in GDP is associated with a 0.62 units drop in the happiness index (over each 3-year period). This holds when controlling for the initial level of happiness and income per capita (with the latter being positively and significantly associated with changes in happiness, as suggested by the literature, see di Tella and MacCulloch 2008). This is an effect of substantial magnitude, given that the −0.62 coefficient of oil dependence refers to effects over a single (3-year) period that can cumulatively make a large difference over time. For example, a difference in oil dependency equal to 60% (which is about the size of the actual difference between the least and most oil dependent economies in our sample), that persists across all 4 subperiods, is associated with a happiness loss of approximately (0.62 × 0.60 × 4) one and a half happiness units over the entire 12 year period.[7]

In Column (2) of Table 1 we enrich our specification by adding the corresponding *growth* rate of GDP per capita for each period. The oil-happiness resource curse persists, while we also find that both the level and growth of per capita income are positively and significantly linked to happiness gains.[8] In Column (3) we also add the *unemployment* rate and the share of educational expenditure in GDP (variable: *education*) as additional regressors (data available from the International Labour Organization 2016, and United Nations 2016, respectively). In line with earlier studies, we find unemployment to correlate negatively with changes in happiness (Blanchflower et al. 2014)—on the other hand, the effect of education appears to be statistically insignificant (something that has been also observed in other studies, e.g. in Caner 2016; Flouri 2004). All earlier results hold and, the oil-happiness resource curse appears to be slightly stronger—a 100% difference in the share of oil rents in GDP is now associated with a 0.99 units drop in the happiness index. Columns (4) and (5) replicate the richer specification of Column (3) for the case of (non-petroleum) mineral and agricultural dependence respectively. *Mineral dependence* is measured as the share of non-petroleum mineral rents (from coal, gas, oil, tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, phosphate etc.) in GDP (data provided by the World Bank 2016). *Agricultural dependence* is captured by the equivalent measure for agricultural production (data by the World Bank 2016). The happiness 'resource curse' curse appears to be oil-specific—the corresponding coefficients of non-petroleum minerals and agriculture are both non-significant (positive and negative respectively). This is also in line with other papers in the resource curse literature that place particular emphasis on the negative development effects of oil (see Sect. 3).

Table 2 checks for the stability of the oil-happiness resource curse by replicating the richer oil specification [Column (3) of Table 1], by first dropping the educational variable (which was insignificant) and then introducing in alternate order some of the other happiness determinants discussed in Sect. 3 (please note, that alternative combinations of these regressors have no effect on the presence of a statistically-significant oil-happiness link; results available from the authors upon request). In Columns (6) (7), (8) and (9), we introduce variables capturing *inflation*, *trade* openness (the value of imports and exports in GDP), environmental quality (measured by the extent of carbon dioxide damage in national

[7] It is unlikely that the direction of causality runs from happiness to oil dependence, given that the latter is to a large extent the result of geographical factors and long-run investment in the extractive sector (which is also confirmed by a series of performed Granger causality tests).

[8] This is in line with the so-called adaptation/habituation effect; faster growth can compensate for the fact that individuals tend to quickly adjust to increased income levels, di Tella et al. (2010).

Table 2 Changes in happiness and oil dependence (alternative regressors)

Dependent variable	ΔHappiness (6)	ΔHappiness (7)	ΔHappiness (8)	ΔHappiness (9)
Constant	0.20	0.23	0.27	−0.45
Happiness (t − 1)	−0.62*** (0.05)	−0.61*** (0.05)	−0.63*** (0.05)	−0.60*** (0.05)
Oil dependence	−0.91* (0.52)	−0.90* (0.50)	−0.91* (0.53)	−1.24* (0.59)
Income pc	0.44*** (0.05)	0.44*** (0.05)	0.44*** (0.05)	0.51*** (0.07)
Growth	1.33** (0.52)	1.39** (0.56)	1.40** (0.57)	1.40** (0.55)
Unemployment	−1.94*** (0.73)	−1.98*** (0.74)	−2.10*** (0.73)	−1.95*** (0.71)
Inflation	0.19 (0.59)			
Trade		−0.12* (0.07)		
CO_2			−0.07 (0.15)	
Rule of law				−0.14 (0.09)
R^2 overall (within; between)	0.43 (0.69; 0.21)	0.43 (0.69; 0.22)	0.43 (0.69; 0.20)	0.68 (0.23; 0.43)
Countries	121	120	121	121
N	301	299	301	301

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

income[9]—the corresponding variable CO_2 can be perceived as a measure of the carbon intensity of production, as well as of air quality), and *rule of law* (measured by the corresponding World Governance Indicators index in the range of −2.5 to 2.5, where higher values correspond to better performance in rule of law).[10] With the exception of trade, the other control variables are statistically insignificant once controlling for other country characteristics (the negative and significant trade coefficient is in line with findings from other empirical studies, e.g. Hessami 2011; Ovaska and Takashima 2006). More importantly, all regressions of Table 2 point to a negative link between oil dependence and happiness gains, of similar size to the one identified in Table 1.[11]

4.2.1 Resource Abundance

Following Brunnschweiler and Bulte (2008), scholars working on the development effects of natural resources typically make a distinction between 'resource dependence' and

[9] The World Bank estimates this at $20 per ton of carbon times the number of tons of CO_2 emitted.

[10] Data for the inflation, trade and CO_2 variables are available by the World Bank (2016). The source for the rule of law data is WGI (2016).

[11] Replicating Columns (4) and (5) of Table 1 (mineral and agricultural dependence) by introducing the same additional regressors, does not change the earlier finding of an oil-specific happiness curse.

'resource abundance' measures. The former express the value of resources in relation to another economic activity (for instance, exports, total income etc.)—the latter express values in terms of a non-economic exogenous variable (e.g. population or land surface) that is unlikely to be determined by natural wealth at least in the short term. A number of econometric explorations of the resource curse find that this disappears when expressing mineral values in per capita terms (see, for instance, Kropf 2010; Brunnschweiler and Bulte 2008; Cavalcanti et al. 2011). Resource dependence measures tend to correlate more highly to resource curse phenomena, given that they capture more accurately how important the resource sector is relative to the rest of the economy.[12] To do justice to this stream of the literature, we replicate the richer specifications (3)–(5) of Table 1 (for the case of oil, minerals and agriculture) by using the equivalent measures of resource abundance (that is, the natural logarithm of oil, mineral and agricultural rents in per capita terms; see Table 3). In line with earlier findings from this stream of the literature, we also observe that the happiness-resource curse disappears for the case of oil abundant (but not necessarily dependent) economies, while it even turns to a blessing for the mineral and agricultural abundant ones [significant at the 10% level, see Columns (11) and (12)].

4.2.2 Non-linear Resource Effects

In Table 4 we examine the presence of a non-linear relationship between the different measures of resource dependence and changes in happiness—Columns (13)–(15) repeat the specifications found in Columns (3)–(5) of Table 1 after incorporating a quadratic term for each of our resource dependence measures. As previously, we only find evidence of a resource-happiness curse for the case of oil dependence, but the results now also suggest that oil dependence links to happiness losses only above a specific threshold level (which, though, tends to be quite low, close to 13%). In other words, oil rents have the potential to increase happiness but, as a whole, the relationship turns negative at relatively low levels of oil dependency.

4.2.3 Growth-Income Interaction

Table 5 introduces a growth-income interaction term in our key specifications [Columns (3)–(5) of Table 1]. In effect, this tests the so-called Easterlin paradox (Easterlin 2015), that hypothesises that economic growth yields smaller happiness increments above a certain level of economic development. Indeed, we find some evidence in support of the paradox—economic growth translates into happiness gains for countries with a GDP per capita level below approximately $37,000. This is a relatively high, though, threshold level (equivalent to the GDP per capita found in advanced economies, such as the UK and Germany), with few countries, hence exceeding this income level.[13] Most importantly, there is no change to the oil-specific happiness-resource curse that we identified in earlier regressions.

[12] Resource abundant economies, instead, might not necessarily be highly resource-dependent (and therefore vulnerable to macroeconomic shocks and rent-seeking).

[13] For a correct interpretation, one needs to keep in mind that there is also a positive indirect effect of growth on happiness changes, going through the income per capita variable.

4.2.4 Endogeneity Issues and Some Additional Robustness Checks

Several of the happiness explanatory variables might be endogenous (and dependent on either income levels or natural resource dependence). Natural resource booms and discoveries may for instance raise income per capita levels in the short run but negatively affect economic growth or institutions in the longer term (in accordance with the resource curse hypothesis). For this reason, we run a series of two-stage least squares regressions: in the first stage, potentially endogenous variables are initially regressed on exogenous instrumental variables (including other covariates appearing in the equation of interest), while in the second stage the endogenous variables are replaced with their first-stage predicted values. We make use of two variables as instruments: a. proximity to the tropics, captured by *latitude* (data by Hall and Jones 1999) and b. the extent of *ethnic fractionalisation* of the population (data by Montalvo and Reynal-Querol 2005; the index takes values between 0 and 1 with lower scores corresponding to more ethnically homogenous societies). Both have been extensively used in empirical cross-country analysis as proxies that can address the possible endogeneity of several intermediate variables (e.g. for the use of latitude as an instrument for income per capita and institutions, see Angeles and Neanidis 2015 and Cooray and Schneider 2016; for the use of ethnic fractionalisation as an instrument for income per capita and institutions, see Faria and Montesinos 2009 and Mauro 1995).

Table 6 replicates Column (3) of Table 1 in a two-stage least squares setting for alternative endogenous variables. In Columns (19) and (20), we use latitude and ethnic fractionalisation to instrument for income per capita and growth respectively. The coefficient of oil dependence (in the happiness regression) is of similar size and remains statistically significant at the 5% level (suggesting hence, that the relationship between oil and happiness is robust and statistically significant even when addressing the potential endogeneity of income per capita and growth). In Columns (21)–(24), we consecutively include four additional regressors in our main happiness specification (the Gini coefficient of income inequality, democracy, government effectiveness, control of corruption), which also become instrumented with latitude and ethnic fractionalisation. These aim to check whether oil dependence may influence changes in happiness primarily via eroding democratic accountability and institutional quality (or creating less egalitarian societies). The coefficient of oil dependence (for the happiness regressions) remains statistically significant.

Although the primary focus is on the second stage (i.e. the link between changes in happiness on oil dependence), it is worth briefly mentioning some key results from the first-stage regressions. Oil dependence appears to augment income per capita [Column (19)], reduce income inequality [Column (21)], hamper democracy [Column (22)] and decrease institutional quality (Columns 23–24)—however, as mentioned above, the coefficient of oil in the second-stage happiness regressions remains consistently statistically significant (suggesting, hence, that the effect of oil dependence on happiness losses cannot be attributed, at least primarily, to its indirect links with other explanatory variables).

Furthermore, Table 7 provides some further robustness checks regarding the link between changes in happiness and oil dependence. Columns (25) and (26) repeat Column (3) of Table 1 but now separately for developing and developed economies (using a GDP per capita level of $12,000 as the threshold level). The negative effect of oil dependence appears to be much stronger in the case of developing economies. We also find similar evidence for the countries located in the tropics (i.e. those countries located 23.5 degrees north/south of the Equator). Column (28) focuses on the years of the global financial crisis (hence, only the latest two subperiods of analysis: 2006–2009 and 2009–2012)—the

Table 3 Changes in happiness and natural resource abundance

Dependent variable	ΔHappiness (10)	ΔHappiness (11)	ΔHappiness (12)
Constant	0.20	0.13	− 0.68
Happiness (t − 1)	− 0.62***	− 0.69***	− 0.70***
	(0.05)	(0.05)	(0.05)
Oil abundance	0.004		
	(0.10)		
Mineral abundance		0.02**	
		(0.01)	
Agricultural abundance			0.11**
			(0.05)
Income pc	0.44***	0.49***	0.47***
	(0.05)	(0.05)	(0.06)
Growth	1.26**	1.25**	1.43***
	(0.62)	(0.56)	(0.57)
Unemployment	− 1.99***	− 2.32***	− 2.13***
	(0.75)	(0.64)	(0.64)
Education	− 0.20	0.29	− 0.32
	(2.00)	(2.10)	(2.12)
R^2 overall (within; between)	0.42	0.41	0.42
	(0.67; 0.19)	(0.73; 0.19)	(0.73; 0.20)
Countries	118	136	130
N	296	333	321

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

negative effect of oil dependence on happiness is stronger during this period (the coefficient is about half the size in the two preceding periods).[14] Controlling for exchange rate movements (namely the devaluation of local currency against the US dollar), also does not influence considerably the oil coefficient [see Column (29)].

4.3 A Synthesis of Results

Our research aims at investigating the links between changes in happiness across countries and several measures of resource wealth. We find evidence of an oil-happiness resource curse; countries with economies largely dependent on oil find it harder to improve the average happiness levels of their citizens over time (Tables 1, 2). A heavy reliance on other minerals or agriculture, however, has no statistically significant effect on changes in happiness (Table 1). We also find that it is the relative importance of the oil sector in the economy that matters—when oil rents are expressed in per capita terms (rather than as a share of GDP), the oil-happiness resource curse disappears (Table 3). In addition, our results suggest that oil dependence links to happiness losses only when oil rents account for more than 13% of GDP; it is only when economies rely excessively on the oil industry that countries fail to improve average happiness (Table 4).

[14] Results available from the authors upon request.

Table 4 Changes in happiness and natural resource dependence (quadratic terms)

Dependent variable	ΔHappiness (13)	ΔHappiness (14)	ΔHappiness (15)
Constant	0.12	0.15	− 0.23
Happiness (t − 1)	− 0.60*** (0.05)	− 0.69*** (0.05)	− 0.72*** (0.05)
Oil dependence	1.63* (0.99)		
Oil dependence squared	− 6.26** (2.77)		
Mineral dependence		1.17 (2.43)	
Mineral dependence squared		− 2.32 (10.28)	
Agricultural dependence			1.97 (2.02)
Agricultural dependence squared			− 3.96 (2.92)
Income pc	0.44*** (0.05)	0.49*** (0.05)	0.54*** (0.08)
Growth	1.37** (0.59)	1.30** (0.56)	1.39** (0.59)
Unemployment	− 2.06*** (0.72)	− 2.07*** (0.57)	− 2.22*** (0.68)
Education	− 0.36 (1.98)	0.43 (2.22)	− 0.27 (2.17)
R^2 overall (within; between)	0.44 (0.67; 0.24)	0.41 (0.72; 0.19)	0.42 (0.73; 0.20)
Countries	118	136	130
N	296	333	321

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

Our analysis also points to the significant role of other variables in explaining improvements in happiness across countries. Richer and fast-growing economies find it easier to improve average happiness levels (Tables 1, 2, 3 and 4); however, there is evidence of a non-linear effect, with economic growth supporting happiness gains only for countries with a GDP per capita level below approximately $37,000 (Table 5). Non-resource variables may be endogenous (and affected by other explanatory variables); instrumental variable techniques, however, still verify that oil dependence is negatively associated with changes in happiness (Table 6). In addition, the oil-happiness link appears to be stronger in the case of developing economies (Table 7). This robust evidence of an oil-specific happiness curse provides support to the theoretical rationale put forth in Sect. 2 of the paper; oil-dependent economies may find it more difficult, other things equal, to translate resource rents into happiness gains. This effect is likely to be the combined result of overall macroeconomic mismanagement, poor institutions, limited economic diversification, increased exposure to price shocks and volatility, and an unequal distribution of revenues from the extractive sector.

Table 5 Changes in happiness and resource dependence (growth-income interaction term)

Dependent variable	ΔHappiness (16)	ΔHappiness (17)	ΔHappiness (18)
Constant	0.02	− 0.10	0.38
Happiness (t − 1)	− 0.62***	− 0.69***	− 0.70***
	(0.05)	(0.05)	(0.05)
Oil dependence	− 0.92*		
	(0.55)		
Minerals		0.82	
		(1.07)	
Agriculture			− 0.69
			(0.65)
Income pc	0.46***	0.52***	0.48***
	(0.06)	(0.05)	(0.06)
Growth	6.11*	6.58**	7.99***
	(3.35)	(2.81)	(2.75)
Growth * income pc	− 0.58*	− 0.65**	− 0.81**
	(0.37)	(0.32)	(0.32)
Unemployment	− 1.82**	− 1.84***	− 2.01***
	(0.79)	(0.57)	(0.72)
Education	− 0.56	0.59	− 0.39
	(1.96)	(2.17)	(2.12)
R^2 overall (within; between)	0.43	0.41	0.42
	(0.70; 0.21)	(0.73; 0.19)	(0.74; 0.20)
Countries	118	136	130
N	296	333	321

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

5 Happiness Levels and Resource Wealth

In this section we extend our analysis by looking at how happiness levels (rather than changes over time) correlate with our measures of resource affluence. In Sect. 4 we found evidence showing that oil-rich nations tend to experience happiness losses over time, other things equal—here, we examine whether these nations also rank lower in the global happiness distribution. Figure 2 replicates our earlier Fig. 1 for happiness levels in 2012. The horizontal red line corresponds to the average happiness level for the entire sample (5.9). High levels of happiness appear both for oil rich and scarce economies; however, one can also observe that for high levels of oil dependence (where oil accounts for more than 10% of GDP), there is a proportionately larger share of countries lying below the sample-average happiness level.

Columns (30)–(32) of Table 8 replicate the last three columns of Table 1 (which include the three resource dependence indices), with the level of happiness as the dependent variable. Columns (33)–(35) repeat these specifications for the resource abundance measures. Only two resource wealth indices appear to be statistically significant. Agriculture abundance correlates positively with happiness levels, other things equal (Column (35))—on the other hand, oil dependent economies score lower in the global happiness ranking [Column (30)]. In the case of oil dependence, the effect though is not of a substantial magnitude; a difference in resource dependence between a country entirely dependent on oil

Table 6 Changes in happiness and oil dependence (2SLS with latitude/ethnic fractionalisation as instruments)

Panel A: (second stage regression)	ΔHappiness (19)	ΔHappiness (20)	ΔHappiness (21)	ΔHappiness (22)	ΔHappiness (23)	ΔHappiness (24)
Constant	−0.02	1.30	−0.27	−1.36	−2.24	−1.13
Happiness (t−1)	−0.59*** (0.08)	−0.56*** (0.09)	−0.50*** (0.06)	0.66*** (0.07)	−0.68*** (0.06)	−0.64*** (0.06)
Oil dependence	−1.02** (0.46)	−1.00** (0.50)	−1.25*** (0.51)	−3.33* (2.03)	−2.32* (1.39)	−1.55* (0.86)
Income pc	0.43*** (0.10)	0.34* (0.19)	0.39*** (0.05)	0.77*** (0.28)	0.75*** (0.29)	0.59*** (0.19)
Growth	2.05*** (0.69)	2.17 (7.13)	1.87*** (0.62)	2.11*** (0.70)	2.79*** (0.88)	2.38*** (0.70)
Unemployment	−1.57 (1.00)	−1.65 (1.11)	−1.19 (0.94)	−1.52 (1.18)	−2.12* (1.14)	−1.72* (1.03)
Education	0.13 (3.72)	−2.92 (5.98)	−1.45 (3.32)	3.46 (5.16)	4.22 (5.71)	2.19 (4.82)
Gini			0.21 (0.99)			
Democracy				−2.34 (2.28)		
Government effectiveness					−0.46 (0.49)	
Control of Corruption						−0.20 (0.30)
R^2 overall	0.39	0.28	0.40	0.28	0.39	0.39
Panel B: (first stage regression)	**Income pc**	**Growth**	**Gini**	**Democracy**	**Government effectiveness**	**Control of corruption**
Constant	4.50	0.28	46.10	0.60	−4.84	−5.06
Latitude	0.04*** (0.01)	0.01 (0.01)	−0.37*** (0.05)	0.002** (0.001)	0.009*** (0.003)	0.02*** (0.01)
Ethnic Fractionalisation	−0.21 (0.26)	-0.03* (0.02)	0. 84 (2.56)	0.10* (0.05)	0.28** (0.13)	0.31** (0.16)

Table 6 (continued)

Panel B: (first stage regression)	Income pc	Growth	Gini	Democracy	Government effectiveness	Control of corruption
Happiness (t − 1)	0.58***	0.01	−0.18	0.01	0.01	−0.01
	(0.05)	(0.01)	(0.70)	(0.01)	(0.03)	(0.04)
Oil dependence	1.15**	-0.01	−15.22***	−0.93***	−2.51***	−2.16***
	(0.52)	(0.01)	(6.33)	(0.10)	(0.26)	(0.32)
Income pc		−0.03***	0.20	0.11***	0.52***	0.51***
		(0.01)	(0.68)	(0.01)	(0.04)	(0.04)
Growth	–2.34***		−1.88	−0.05	1.25***	1.11***
	(0.68)		(7.68)	(0.13)	(0.33)	(0.41)
Unemployment	-0.02	−0.01	37.38***	0.09	−0.93*	−0.69
	(0.01)	(0.03)	(11.19)	(0.22)	(0.55)	(0.68)
Education	0.04	−0.59	34.33	1.13	7.53***	8.59***
	(0.04)	(0.39)	(41.68)	(0.79)	(1.97)	(2.43)
R^2 overall	0.55	0.31	0.39	0.63	0.84	0.84
Countries	225	225	217	223	225	225
N	84	84	84	87	88	88

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

Table 7 Changes in happiness and oil dependence (some further robustness checks)

Dependent variable: ΔHappiness	Developing countries (25)	Developed countries (26)	Tropics (27)	Global financial crisis (28)	Exchange rates (29)
Constant	0.49	− 1.39	− 0.39	− 0.57	0.38
Happiness (t − 1)	− 0.63*** (0.06)	− 0.38*** (0.08)	− 0.67*** (0.09)	− 0.60*** (0.06)	− 0.60*** (0.06)
Oil dependence	− 1.42** (0.63)	− 0.25 (0.44)	− 2.06** (0.93)	− 1.00* (0.55)	− 1.01* (0.54)
Income pc	0.44*** (0.07)	0.40*** (0.11)	0.60*** (0.14)	0.44*** (0.06)	0.43*** (0.06)
Growth	1.05 (0.79)	1.99*** (0.67)	1.65 (1.34)	1.44** (0.54)	0.61 (0.54)
Unemployment	− 1.74** (0.89)	− 2.60* (1.96)	− 1.05 (1.33)	− 2.11*** (0.89)	− 1.86** (0.83)
Education	− 2.02 (2.36)	0.24 (2.72)	− 5.15 (4.98)	0.95 (2.02)	0.72 (2.43)
Exchange rate (depreciation)					0.09 (0.19)
R^2 overall (within; between)	0.43 (0.68; 0.32)	0.56 (0.71; 0.15)	0.28 (0.74; 0.07)	0.41 (0.71; 0.20)	0.42 (0.68; 0.21)
Countries	81	42	49	118	118
N	192	104	109	234	296

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

Fig. 2 Happiness and oil dependence. Note: Abbreviations correspond to 3-letter country ISO codes

and one with no oil resources (i.e. a difference equal to 100%) would only imply a lower happiness level for the former by 0.76 units. This suggests, that although oil dependence results in happiness losses over time (see Sect. 4), this has still not been translated into a

Table 8 Happiness levels and natural resource dependence

Dependent variable	Happiness (30)	Happiness (31)	Happiness (32)	Happiness (33)	Happiness (34)	Happiness (35)
Constant	1.40	1.21	1.01	1.40	1.24	–0.15
Oil dependence	−0.76* (0.44)					
Mineral dependence		1.28 (0.88)				
Agricultural dependence			0.30 (0.68)			
Oil abundance				–0.01 (0.01)		
Mineral abundance					0.02 (0.01)	
Agricultural abundance						0.17*** (0.06)
Income pc	0.56*** (0.04)	0.58*** (0.03)	0.60*** (0.05)	0.56*** (0.01)	0.57*** (0.03)	0.53*** (0.03)
Growth	0.48* (0.29)	0.45 (0.29)	0.44 (0.28)	0.48* (0.29)	0.42 (0.30)	0.42 (0.29)
Unemployment	−0.04*** (0.01)	−0.04*** (0.01)	−0.04*** (0.01)	−0.04*** (0.01)	−0.04*** (0.01)	−0.04*** (0.01)
Education	0.02 (0.03)	0.04 (0.03)	0.03 (0.03)	0.02 (0.03)	0.04 (0.03)	0.03 (0.03)
R^2 overall (within; between)	0.59 (0.25; 0.66)	0.61 (0.23; 0.68)	0.61 (0.24; 0.66)	0.59 (0.25; 0.65)	0.62 (0.23; 0.68)	0.62 (0.24; 0.67)
Countries	134	162	155	134	162	155
N	434	500	478	434	500	478

Robust standard errors of coefficients in parentheses. Time dummies included in all specifications

*, **, *** correspond to a 10, 5 and 1% level of significance

significant downgrade of oil-rich nations in the global happiness distribution. This is similar to what economists observe when looking at the resource curse through the lens of the income per capita distribution—while oil-rich nations tend to grow at a slower pace, they still do not score much lower in the global income per capita distribution, other things equal (see Carmignani and Chowdhury 2012).

6 Conclusions

There has been a growing interest in recent years in the 'resource curse', and more generally in the relationship between natural resources and several welfare indices. In parallel (but regrettably independently) a separate empirical literature in recent decades has probed into the determinants of happiness and subjective well-being (using either country or household data). To our knowledge, this is the first empirical attempt to bring these two separate strands of the literature together. Consistent with prior empirical evidence of a resource curse in oil-rich nations, we find that oil rents are negatively linked to improvements in happiness over time. This happiness 'resource curse' curse appears to be oil-specific and holds both for the levels as well as changes in happiness.

These findings have significant policy implications for oil-rich nations. Governments in these countries need to take corrective actions that improve the average life satisfaction of their citizens (in line with the discussion of Sects. 2 and 3—i.e. by ensuring a more equitable distribution of oil rents, more transparency and accountability, efficient bureaucracies etc.). The extractive industry needs to be actively involved in such debates to ensure that any ancillary benefits are enhanced (e.g. in terms of local employment, infrastructure etc.), while any negative externalities (e.g. regarding displacement of local communities, environmental impacts) are minimised. More broadly, policy-makers and researchers need to realise that the resource curse focus needs to shift from the immediate (and often more visible) growth effects towards broader welfare impacts—in other words, any development strategy based on extraction needs to critically reflect on the intended use of accrued resource rents and the distributive aspects of associated policies. We argue that measured happiness would make a better target for government policy (in oil rich states but not only) than GDP. This stresses the necessity of improving the data reliability of happiness measures in the future (ideally across multiple dimensions of human well-being) and creating adjusted GDP values that incorporate elements of well-being typically ignored in national accounts (e.g. environmental and social externalities, informal production, inequality in income and access to resources etc.). By construction, existing happiness indices are constrained by an upper and lower bound—in other words, while individuals and countries can perpetually get wealthier (at least in theory), increases in happiness cannot be without limits.

The relationship between natural resource management and several measures of socio-economic development is intriguing but certainly a complex one (as evident from the number of empirical analyses on the issue in the last two decades)—our paper is simply a first attempt to explore the fascinating relationship between oil rents and happiness. Several limitations remain. Future empirical work could attempt to unravel the channels (mechanisms) through which natural resources can affect happiness levels and changes. In addition, our happiness index is simply an average and, hence, does not reveal any information about the distribution and inequality of perceived well-being levels within each country's population. Case studies and more disaggregated econometric models should complement the more

aggregate country-specific analysis by examining the localised effects of oil presence (e.g. as in the case of environmental externalities or employment creation). In addition, it might be the case that the scale used to measure happiness is perceived differently within different cultural contexts and subnational studies may be more suitable for comparison purposes. Furthermore, the subperiods of our analysis have a relatively short time span (of 4 years)—longer time series will allow in the future to uncover relationships that are less likely to be influenced by short-term fluctuations (in happiness and other explanatory variables).

Appendix 1

See Table 9.

Table 9 List of countries in sample

Albania	Iran	Tajikistan
Algeria	Iraq	Thailand
Angola	Ireland	Togo
Argentina	Israel	Trinidad and Tobago
Armenia	Italy	Tunisia
Australia	Jamaica	Turkey
Austria	Japan	Ukraine
Azerbaijan	Jordan	United Kingdom
Bangladesh	Kazakhstan	United States
Belarus	Kenya	Uruguay
Belize	Kuwait	Uzbekistan
Belgium	Kyrgyz Republic	Venezuela
Benin	Latvia	Vietnam
Bolivia	Lebanon	Yemen, Rep.
Botswana	Lithuania	Zambia
Brazil	Luxembourg	Zimbabwe
Bulgaria	Malaysia	
Cambodia	Malta	
Cameroon	Mauritania	
Canada	Mexico	
Chad	Mongolia	
Chile	Morocco	
China	Mozambique	
Colombia	Namibia	
Congo, Dem. Rep.	Nepal	
Congo, Rep.	Netherlands	
Costa Rica	New Zealand	
Croatia	Nicaragua	
Cuba	Nigeria	

Table 9 (continued)

Cyprus	Norway
Czech Republic	Pakistan
Denmark	Panama
Dominican Republic	Paraguay
Ecuador	Peru
Egypt	Philippines
El Salvador	Poland
Estonia	Portugal
Ethiopia	Romania
Finland	Russia
France	Saudi Arabia
Georgia	Senegal
Germany	Serbia
Ghana	Singapore
Greece	Slovakia
Guatemala	Slovenia
Haiti	South Africa
Honduras	Spain
Hungary	Sri Lanka
Iceland	Sudan
India	Sweden
Indonesia	Switzerland

Countries appearing in specification 3 of Table 1

Appendix 2

See Table 10.

Table 10 Correlation matrix

	ΔHappiness	Happiness (t − 1)	Oil Dependence	Mineral Dependence	Agricultural Dependence	Oil Abundance	Mineral Abundance	Agricultural Abundance	Income pc	Growth	Unemployment	Education
ΔHappiness	1.000											
Happiness (t − 1)	−0.178	1.000										
Oil dependence	0.120	−0.106	1.000									
Mineral dependence	−0.327	0.081	−0.218	1.000								
Agricultural dependence	−0.141	0.167	−0.197	0.612	1.000							
Oil abundance	−0.167	0.118	−0.310	0.501	0.222	1.000						
Mineral abundance	−0.258	0.079	−0.332	0.517	0.270	0.954	1.000					
Agricultural abundance	0.239	0.039	0.199	−0.452	−0.115	−0.439	−0.486	1.000				
Income pc	0.241	0.028	0.196	−0.448	−0.123	−0.425	−0.478	0.997	1.000			
Growth	−0.229	0.269	−0.097	−0.124	0.045	−0.072	−0.075	0.493	0.488	1.000		
Unemployment	0.207	−0.052	−0.098	−0.170	−0.126	0.171	0.065	0.170	0.174	−0.056	1.000	
Education	−0.106	−0.017	0.094	0.039	−0.010	0.033	0.038	−0.045	−0.042	−0.028	−0.009	1.000

Appendix 3

See Table 11.

Table 11 List of variables used in regressions

Happiness	Average reported satisfaction with life of the residents of each country. Scale from 0 to 10—larger values correspond to higher levels of happiness. Source: Gallup World Poll (2017)
Oil dependence	Oil rents as a share of GDP. Source: World Bank (2016)
Mineral dependence	Non-petroleum mineral rents (from coal, gas, oil, tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, phosphate etc.) in GDP. Source: World Bank (2016)
Agricultural dependence	Value of agricultural production in GDP. Source: World Bank (2016)
Oil/mineral/agricultural abundance	The log of oil/mineral/agricultural in per capita terms. Source: World Bank (2016)
Income pc	The log of real GDP per capita at 2010 international prices. Source: World Bank (2016)
Growth	Growth in real GDP per capita. Source: World Bank (2016)
Unemployment	Unemployment as a share of total labour force. Source: International Labour Organization (2016)
Education	Total educational expenditure as a share of total income. Source: United Nations (2016)
Inflation	Annual inflation rate (based on GDP deflator, 2010 base year). Source: World Bank (2016)
Trade	Share of total value of imports and exports in GDP. Source: World Bank (2016)
Exchange rate (depreciation)	Percentage change in official exchange rate for each period (local currency per US). Positive values denote depreciation. Source: World Bank (2016)
Democracy	0–1 liberal democracy index (capturing the importance of protecting individual and minority rights against the tyranny of the state). The index measures the quality of democracy by the limits placed on government. Source V-Dem (2017)
Rule of law	Rule of law index that captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. − 2.5 to 2.5 scale—higher values correspond to better performance in rule of law. Source: WGI (2016)
Government effectiveness	The government effectiveness index captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures. − 2.5 to 2.5 scale—higher values correspond to better performance in rule of law. Source: WGI (2016)
Control of corruption	Control of corruption index that captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. − 2.5 to 2.5 scale—higher values correspond to lower levels of corruption. Source: WGI (2016)

Table 11 (continued)

CO_2	Carbon dioxide damage in national income. Source: World Bank (2016)
Gini	Gini index of income inequality. Source: UNU-Wider (2017)
Ethnic fractionalisation	Ethnic fractionalisation index (0–1 continuous scale, with higher values corresponding to more ethnically heterogeneous societies). Source: Montalvo and Reynal-Querol (2005)
Latitude	The absolute value of the latitude of a country. Source: Hall and Jones (1999)

Appendix 4

See Table 12.

Table 12 Descriptive statistics

Variable	Mean	Standard deviation—overall (between, within)	Minimum	Maximum
ΔHappiness	−0.167	0.741 (0.419, 0.687)	−3.1	2.2
Happiness (t − 1)	5.903	1.256 (1.161, 0.519)	2.4	9.1
Oil Dependence	0.063	0.130 (0.124, 0.040)	0	0.558
Mineral Dependence	0.035	0.038 (0.031, 0.019)	0	0.355
Agricultural dependence	0.014	0.135 (0.133, 0.035)	0	0.654
Income pc	8.397	1.525 (1.506, 0.219)	5.143	11.543
Unemployment	0.086	0.062 (0.059, 0.018)	0.001	0.373
Education	0.042	0.026 (0.023, 0.013)	0.004	0.366
Inflation	0.251	2.693 (1.070, 2.461)	−0.276	62.612
Trade	0.887	0.527 (0.485, 0.192)	0.002	4.450
Exchange Rate (Depreciation)	0.307	1.419 (0.693, 1.245)	−7.007	22.933
CO_2	0.003	0.003 (0.002, 0.001)	0.001	0.025
Democracy	0.411	0.273 (0.265, 0.078)	0.012	0.902
Rule of Law	−0.009	0.998 (0.986, 0.194)	−2.450	2.120
Government effectiveness	−0.022	0.997 (0.984, 0.199)	−2.260	2.281
Control of corruption	−0.024	1.001 (0.984, 0.214)	−1.914	2.485
Oil abundance	6.027	4.736 (4.694, 0.727)	0	14.775
Mineral abundance	3.809	3.846 (3.476, 1.654)	0	12.616
Agricultural abundance	10.383	1.047 (1.052, 0.216)	0	12.708
Gini	40.223	9.536 (9.118, 3.518)	16.64	73.9
Ethnic fractionalisation	0.437	0.277 (0.277, 0)	0.01	0.96
Latitude	26.614	17.015 (17.015, 0)	0	72

Between (cross-country) and within (cross-time) standard deviations inside parentheses

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