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Revisiting the natural resource curse: A cross-country growth study

Khalid Adnan Saeed^{1*}

Abstract: This paper revisits the original natural resource curse study conducted by Sachs and Warner to investigate the relationship between natural resource dependence and per capita growth in recent data consisting of 68 developing countries that includes 14 Middle East & North Africa (MENA) and 6 Gulf Cooperative Council (GCC) countries between 1994–2014. Using a cross-country data and modeling we find robust evidence of a negative association between per capita growth and natural resource dependence. This negative affect is especially prominent in oil-rich MENA countries. The presence of a natural resource curse presents challenges to policymakers especially in countries who have been taking measures to diversify their income-base.

Subjects: Sustainable development; Economics; Political Economy

Keywords: Economic growth; natural resource curse; cross-country

1. Introduction

The natural resource curse is a phenomenon related to economic growth that has confounded researchers for decades. The *natural resource curse* represents a negative correlation between a country's natural resource abundance and economic growth, referring to a country's slow growth despite dependence on a productive natural resource sector as its main source of revenue. The negative association between natural resource wealth and growth was discovered in the late 1980s and early 1990s. Sachs and Warner (1995) work was the first to confirm the adverse effects of resource dependence on growth

ABOUT THE AUTHOR

For the past few years, I have been doing extensive research in sustainable economic development in high-income developing countries. Last year, I spent a semester as a Visiting Research Fellow at the Harvard Kennedy School where I conducted research in topics such as economic complexity and the barriers to development in the Gulf Cooperative Council (GCC) countries. I am interested in research around the transformation of GCC economies into Knowledge-Intensive economies. This paper highlights the continued existence of a natural resource curse in those countries and fits in my overall research in trying to identify ways to improve economic complexity to achieve sustainable development.

PUBLIC INTEREST STATEMENT

High-income Gulf Cooperative Council (GCC) countries have been pushing for years to diversify their incomes away from oil to achieve sustainable economic development and provide new employment opportunities for their citizens in new industries. Their efforts, thus far, have failed. They continue to depend on oil-exports as the main source of income and as a result, per capita growth suffered. This study indicates that policymakers in those countries must closely examine their diversification policies to identify the structural barriers preventing them from achieving better and more sustainable outcome. The natural resource curse—the oil curse—continue to haunt those governments, and unless they make serious reforms, their efforts in achieving sustainable development will not bear the intended results in the amount of time set-forth in their countries' development vision. This research demonstrates the need for urgent reforms in those countries.

through a comparative worldwide study. They proposed that natural resources may no longer be a major driver of economic growth given falling transportation costs and the benefits of globalization and contemplated whether natural resources pose an actual disadvantage to growth. In other words, they asked “is there a curse to easy riches?” The present paper investigates this same question using recent data on developing countries. By showing the negative association between natural resource dependence and per capita growth in recent data, this paper’s main contribution is to demonstrate the existence of a resource curse in Gulf Cooperative Countries (GCC) over the period from ’94 to ’14 despite efforts to mitigate the resource (oil) curse in those countries. Sachs and Warner found evidence of the natural resource curse between 1970–1989 in a sample of 87 countries that excluded oil-rich states from the Middle East due to a lack of data. The current study examines data from multiple countries, including 14 from the Middle East and North Africa (MENA) and six oil-rich nations belonging to the Gulf Cooperative Council (GCC), between the period of 1994–2014 to find potential evidence of the natural resource curse today.

This study involves a scientific replication of Sachs and Warner (1995, 1997) initial cross-country growth studies. This research contributes to existing literature by incorporating MENA countries into a cross-country growth model and updating the period of analysis for other developing countries. The remainder of this paper is organized as follows. Section II outlines theoretical and empirical evidence of the resource curse hypothesis. Section III details the empirical model specifications and data, with model results and estimates discussed in Section IV. Section V focuses on the MENA region and the extent to which it appears to have been affected by the natural resource curse. Section VI concludes the study and offers closing remarks.

2. Literature review

The resource curse is a phenomenon in growth economics that refers to slow or negative growth in developing countries that are rich in natural resources. Research on the negative association between resource dependence and growth began with Sachs and Warner (1995), the findings of which empirically supported the natural resource curse after controlling for other determinants of growth such as initial income levels, trade policies, average investment, and bureaucratic efficiency. Auty (1993) first coined the term *resource curse* to capture the inverse relationship between natural resource dependence and economic growth; a more specific *oil curse* has been applied to countries whose economies rely heavily on oil exports as described by M. L. Ross (2001). Humphreys et al. (2007) identified a key difference between resource wealth and other types of wealth: in contrast to other resources, natural resources such as oil, gas, and minerals are not produced but rather extracted. Because natural resource wealth is not a result of production, it occurs relatively independently of other economic processes and has little effect on employment generation. The oil and gas sectors are among the world’s most capital-intensive industries; thus, these sectors create fewer jobs per unit of capital invested, which also implies few forward and backward linkages in the overall economy.

Economists have long believed that natural resources play a central role in economic development. Rostow (1961) summarized this popular belief by suggesting that natural resource endowments would enable developing countries to transition from under-development to industrial take-off. This popular belief was based on the concept that economic development occurs when countries transition from agricultural-based economy to industrial-based. Therefore, natural resource wealth would help those countries make that transition faster. Indeed, countries such as the United States, Britain, and Australia did just that (Acemoglu, 2009). For years, scholars generally agreed that natural resources would facilitate industrial development, create markets, and encourage investment (Van der Ploeg, 2011). This optimistic view prevailed until the arrival of “Dutch disease” in the 1980s, named after the decline in Dutch manufacturing following the discovery of natural gas at Groningen (Apergis & Payne, 2014). *Dutch disease* is often used in the literature to describe the economic mechanisms associated with the resource curse.

Through descriptive analysis in his book *Oil Windfalls: Blessing or Curse?* Gelb (1988) found evidence that oil-rich economies experienced a more serious deterioration in their ability to

manage their domestic capital formation during the period 1971–1983 compared to non-oil-rich countries. He then argued that adverse effects of oil windfalls could offset any positive gains from windfalls themselves. The term “resource curse” was then coined by Auty (1993) to describe this phenomenon in the data how some natural resource-rich countries experience slower or even negative growth compared to countries who are resource-poor.

Sachs and Warner (1995, 1997, 1999, 2001) extensive research on the resource curse was pivotal; they produced the first scholarly work (Sachs & Warner, 1995) confirming the adverse effects of resource dependence for a wide range of countries. The results of their empirical study revealed a negative relationship between natural resource abundance and economic growth. Gylfason and Zoega (2006) later focused on broader channels through which natural resource dependence could shape sustained economic growth, such as through savings, investment, and human capital formation.

Using Sachs and Warner’s original set of countries, Mehlum et al. (2006) reproduced the original study with particular attention paid to the extent to which economic growth from natural resource dependence relies on the quality of a country’s institutions. Specifically, they suggested that the effects of natural resource dependence on growth are not necessarily negative if institutional quality is sufficiently high. To test this hypothesis, Mehlum et al. (2006) interacted a measure of resource dependence with one of institutional quality and demonstrated a positive relationship between the interaction term and growth. This institutional quality measure was an unweighted average index based on data from Political Risk Services and consisted of: a rule of law index, a bureaucratic quality index, a corruption in government index, a risk of expropriation index, and a government repudiation of contracts index. They found that even with a negative association between resource dependence and growth, the positive effect from the interaction term could offset the negatives if the positive value of the coefficient on the interaction term was large enough. In other words, if the positive association between the interaction term and growth exceeded a certain threshold, then the curse was in fact a blessing: when the effect of resource wealth on growth depends on institutional quality, then resource dependence may exert a net positive effect on growth.

Looking at the importance of factors such as the long-term decline in commodity prices world-wide, Frankel (2010) investigated links between natural resource dependence and growth in an attempt the negative correlation between them. He points out that high volatility in commodity prices imposes risk and crowds out the manufacturing sector. Van der Ploeg (2011) explained how long-term investments are crucial for countries’ growth and presented cases where resource-rich countries such as Botswana, Indonesia, and Malaysia were able to avoid the curse of natural resources. following Sachs and Warner’s influential 1995 study, a large body of subsequent research emerged showing the negative relationship between natural resource dependence and growth in an attempt to understand its extent and reasons behind this negative association. Gylfason et al. (1999) and Mehlum et al. (2006) argued that since 1970, countries rich in natural resources have often exemplified developmental failure. Michael L. Ross (2015) explains that this development failure can largely be explained by the nationalization of the natural resource sectors in those countries that occurred in the period from 1970–1985. During that period, governments seized ownership and operation of their natural resource sector which allowed them to keep more of the windfalls resulting mostly in development failure.

Arezki and Nabli (2012) studied the economic performance of resource-dependent countries in the MENA region spanning more than 45 years (1960–2008). They found that when referring only to standard income-level measures, many countries maintained a high income per capita; others, however, performed poorly when using a broader range of outcome measures. These countries had experienced relatively low and non-inclusive economic growth and high macroeconomic volatility. Akacem and Geng (2015) provided an alternative perspective on the resource curse in Arab countries by using panel data to attribute relatively poor economic performance to institutions.

Rather than focusing on dependence, Apergis and Payne (2014) examined the role of oil abundance in economic growth in several MENA countries during 1990–2013. They identified adverse effects on economic growth from 1990–2003, after which point oil abundance began to influence growth positively. The authors credited this shift to improvements in the quality of institutions and economic reform in the MENA region.

Other work highlighting reform efforts in MENA countries that achieved significant economic reforms, Apergis and Payne (2014) points out the importance of better trade policies and business environments for increasing countries' competitiveness. The benefits of providing better quality public administration and transparency often results in better overall governance. Data on institutional variables were collected from the Economic Freedom of the World database and included legal structure and security of property rights, freedom to trade internationally, judicial independence, and business regulation.

For over three decades, the natural resource curse literature has sought to explain why countries rich in natural resources tend to grow at a slower rate than resource-poor countries. Evidence exists of a robust negative association between natural resource dependence and economic growth after controlling for other structural variables such as investment, trade, and institutions. Data have highlighted oil as a potential culprit more than any other natural resource. Sachs and Warner (1995) tested this relationship using cross-country regressions at a time when the curse was purportedly at its worst. The 1970s and 1980s witnessed the nationalization of the oil sector in many oil-producing and exporting countries; however, research has yet to reveal whether this negative relationship characterizes recent data when using Sachs and Warner (1995, 1997) methods and whether the original modeling is sensitive to the inclusion of MENA countries.

3. Methods and procedures

This study began with a model of cross-country growth using structural characteristics as outlined in Sachs and Warner (1995, 1997) papers. Their original model used measures of trade openness, bureaucracy, and rate of investment along with initial income and natural resource abundance to study the relationship between per capita growth and natural resource wealth.

The original model specifications were as follows:

$$G7089 = \alpha_0 + \alpha_1 SXP + \alpha_2 SOPEN + \alpha_3 INV7089 + \alpha_4 BUR + \alpha_5 LGDP70 + \varepsilon_i$$

Where G7089 is per capita growth from 1970–1989. SXP is a measure of resource dependence, SOPEN is a measure of trade openness, INV7089 denotes the average investment rate between 1970–1989, BUR is a measure of bureaucracy, and LGDP70 represents initial income.

The dataset in the present study comprises cross-country data for 68 developing countries in 1994–2014. Cross-country growth data were obtained from the latest version of the Penn World Table, version 9.0 (PWT9.0). Other data on trade and governance were compiled from various sources such as the World Bank, the World Justice Project (WJP), and Transparency International (see Appendix). The initial model used a simple specification similar to the original from Sachs and Warner (1995, 1997), including only initial income and a resource dependence measure. Growth was measured by growth per employed persons rather than per capita growth based on population; Sachs and Warner (1997) used the same measure, an approach purely replicated later by Davis (2013).

The general specification of the model used in this study is as follows¹:

$$GPC_i = \beta_0 + \beta_1(LGDPE94_i) + \beta_2(NRD_i) + \beta_3(RL_i) + \beta_4(INV_i) + \beta_5(TOI_i) + \beta_6(HDI_i) + \varepsilon_1$$

where GPC^2 is per capita growth, $LGDP_{E94}$ is initial income used to test for convergence. NRD is a measure of natural resource dependence. We use fuels and non-fuels exports as our main measure of resource dependence. We expect the sign of this coefficient to negative—consistent with previous studies in the resource curse literature. RL is a measure of the rule of law.

Fuels and non-fuels, as a percentage of GDP, were directly computed using data³ based on the current GDP. The RL measure in the present study covers eight broad categories, each with four to eight sub-indices to reflect institutional quality more thoroughly. We make the assumption here that institutional quality, as measured by the rule of law, is slow-changing and relatively constant over the ten to fifteen year-period from the date of our index measurement (2016). Hence, using a RL index value from 2016 is an indicator of the rule of the rule of law over our period of study, 1994–2014. For robustness, an alternative measure of institutional quality is used (CPI) to determine whether the selected resource dependence measure was sensitive to different institutional quality measures.

Various sources were used to obtain measures of countries' openness to international trade. Trade as a percentage of GDP is traditionally used in the growth literature as a measure of trade openness. The fewer barriers to trade that exist in a country, the larger the trade volume as measured by the sum of a country's exports and imports relative to its GDP. Open trade and the free movement of labor and capital benefits all countries involved due to a comparative advantage and presumably positive relationship with growth. Yet findings on the effect of trade openness on growth are mixed; some studies have suggested that openness has no significant effect on growth, whereas others such as Sachs and Warner (1995, 1997) revealed a positive and statistically significant relationship between the two factors. If trade openness measured as the sum of exports and imports relative to GDP is a determinant of growth, then we expect the sign of our trade openness measure to positive indicating higher values of openness to trade leads to higher growth.

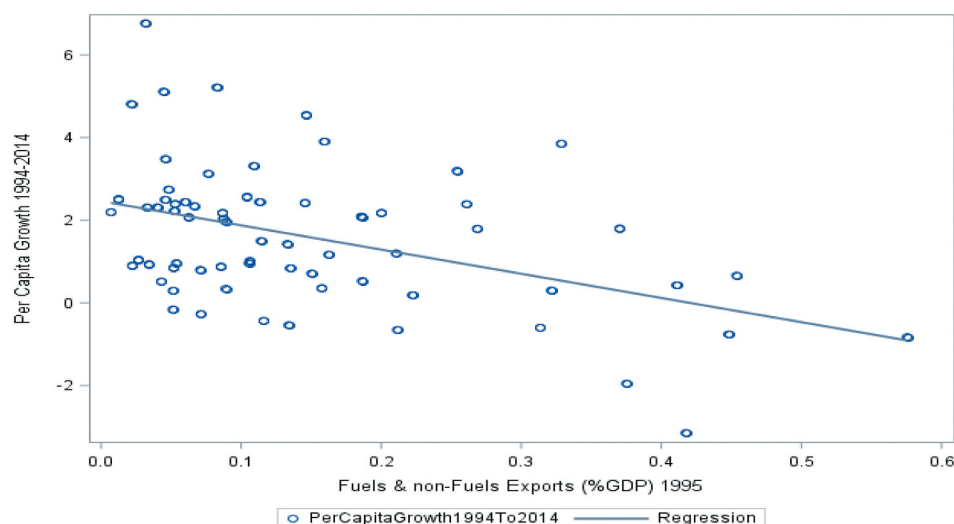
Yanikkaya (2003) noted that measures of openness varied in research aiming to address the relationship between trade openness and growth. Openness measures can be divided into two main categories: 1) measures of trade volumes; and 2) measures of trade restrictions. Studies using trade volumes generally rely on the sum of exports and imports divided by GDP (i.e., the shares of exports and imports in GDP), which is the same measure used in the present study. Measures of trade restrictions often focus on trade policy and its effects on growth. Trade policy measures, such as that applied in Sachs and Warner (1995, 1997), mainly examine the effects of trade barriers on economic performance. Given these inconsistencies, scholars have varied in their conclusions regarding the effects of openness on growth.

The estimation was initially conducted with the basic model, using the full sample of 68 developing countries.⁴ Sachs and Warner (1995, 1997) original work excluded eight of the most natural-resource-rich countries in the world due to lack of data. While those countries exhibited gradual or even negative growth between 1970–1989, data for all variables were unavailable for the full study period, hence their exclusion. Sachs and Warner (1995, 1997) explained that including the data in their original study would have reinforced a negative association between growth and natural resource dependence, as most of the excluded countries exhibited several years of negative growth. Similarly, some data were not consistently available between 1994–2014 for certain variables in the present study. This problem is common in growth research, especially when examining developing countries.

4. Results & discussion

The association between growth and fuel/non-fuel exports as a percentage of GDP in 1995 were plotted to obtain an overall impression of the data and the relationship between growth and resource intensity. Figure 1 shows that countries with lower natural-resource-based exports exhibited higher average growth between 1994–2014. As natural resource exports increased, countries tended to have lower average per capita growth, consistent with the natural resource curse.

Figure 1. Association between per capita growth (1994–2014) and fuels & non-fuels exports for 68 developing countries.



The final dataset of 68 countries⁵ was refined from an original set of 156 developing countries collected from World Bank data for South Asia, the Middle East and North Africa, the East Asia and Pacific regions, Sub-Saharan Africa, and Latin America and the Caribbean. Leverage (h_i), defined as the distance from the center of all observations for each variable, was used to detect outliers. A large leverage suggests that an observation exerts undue influence on its fitted value and should be excluded. An observation was considered an outlier if it had a leverage of $[h_i > 2 \cdot (k + 1)/n]$, where k is the number of independent variables (regressors) and n is the number of observations.

As not all outliers were influential, the author checked for influence using DFFITS, which measures the influence of the i^{th} observation on a single fitted value. An observation was considered an outlier and influential if $|DFFITS| > 2 \cdot [\text{Sqrt}(k + 1)/n]$. Cook's distance was employed to measure the influence of any observation on all fitted values. If Cook's distance was greater than $4/n$ ($d_i > 4/n$), then that observation was excluded from the dataset. DFBETAS, which measures the influence of the i^{th} observation on each estimated regression coefficient, was also applied to the data; if $|DFBETAS| > 2/\text{sqrt}(n)$, then the observation was excluded. The Shapiro-Wilk test for normality and the variance inflation factor were used to check for multicollinearity in all models. Most countries excluded from the dataset were removed due to missing data for many variables for the period in study.

5. Regressions and model output

Table 1 presents an estimation with the simple model first used by Sachs and Warner (1995, 1997) using only initial income and a measure of resource intensity. In the final sample of 68 countries, coefficient estimates for initial income and natural resource intensity were calculated as -0.512 and -5.272 , respectively. Both measures were statistically significant and exhibited the expected signs.

In regression 1 we begin with the baseline model. The baseline model includes only initial income and a measure natural resource dependence. Regressions 2 through 6 explore the effect of including more variable on growth and whether they affect the relationship between natural resource dependence and growth. To understand the association between natural resource intensity and per capita growth, the coefficient estimate for fuel and non-fuel exports as a percentage of GDP was -5.273 with a cross-country standard deviation of 0.127 ; that is, an increase of one standard deviation in fuel and non-fuel exports in the initial year was associated with a reduction in annual per capita growth of less than 1% (i.e., $[-5.273] \cdot [0.127] = -0.670\%$). Initial income, defined as per capita income in the initial year (1994), was measured in logs with coefficients interpreted as elasticities.

Table 1. GDP per capita growth for 68 developing countries between 1994–2014

Dependent Variable: Growth of GDP per Employed Persons (GPC)

	(1)	(2)	(3)	(4)	(5)	(6)
LGDPE94	−0.512*** (−2.54)	−0.887*** (−4.00)	−0.916*** (−4.11)	−0.845*** (−4.13)	−1.034*** (−5.37)	−1.164*** (−5.75)
Fuel & non-fuel exports (% GDP, '95)	−5.273*** (−3.63)	−3.582** (−2.46)	−4.297*** (−2.70)	−3.464*** (−2.58)	−2.756** (−2.36)	−3.042*** (−2.75)
RL: Institutions	—	5.642(3.23)	4.691** (2.42)	4.611*** (2.82)	2.022(1.28)	—
CPI: Corruption	—	—	—	—	—	0.027** (2.13)
OPENNESS	—	—	0.005(1.11)	—	—	—
INV	—	—	—	0.091*** (3.51)	0.107*** (4.06)	0.100*** (3.84)
HDI	—	—	—	—	1.303*** (3.47)	1.371*** (4.08)
Constant(t statistic)Adj-R ² (N)	7.297(3.79) 0.24(68)	7.714(4.27) 0.34(68)	8.180(4.42) 0.34(68)	5.700(3.24) 0.44(68)	5.67(3.59) 0.58(59)	6.923(4.18) 0.60(59)

Note. t values are reported in parentheses. *** ** * statistically significant at the .10, .05, and .01 level, respectively.

The negative sign on initial income was consistent with conditional convergence. Next, RL was added to the model as a measure of the rule of law published by WJP. This index measures countries' performance over eight broad categories, such as constraints on government power, absence of corruption, open government, fundamental rights, order and security, regulatory enforcement, civil justice, and criminal justice. It is more comprehensive than the original BUR measure used by Sachs and Warner (1995, 1997). Coefficient estimates in the second model again demonstrated a strong negative association between natural resource exports, as measured by fuel and non-fuel exports as a percentage of GDP, and growth per capita. As shown in Table 1, a strong positive association was found between the rule of law and growth. This correlation highlights the relative importance of political and social institutions in each country's economic performance, such that nations with stronger and more credible institutions have higher rates of growth. The relative importance of this finding was reinforced by testing an alternative measure of institutional quality on growth, discussed later in this section.

In Regression 3 in Table 1, openness was included to test the relationship between trade openness and growth. Table 1 reveals that resource intensity was clearly negative ($\beta_2 = -4.297$, $t = 2.42$), while no statistically significant association emerged between trade openness and growth ($\beta_3 = 0.005$, $t = 1.11$). Openness was measured as the sum of export and import shares in GDP. Based on the coefficient estimate, openness exerted no noticeable economic impact on growth. Trade openness was not statistically significant therefore, no economic meaning can be inferred from this relationship. The original measure was constructed from PWT9.0 data on export and import shares. For robustness, other data from the World Bank on trade as a percentage of GDP were used with similar results. The author also tested a measure of trade openness reported by World Integrated Trade Solution (WITS); all trade measures demonstrated no statistically significant relationship between trade openness and per capita growth. These results are consistent with earlier studies such as that by Rodrik et al. (2002), which found that trade shares lose significance in growth equations when controlling for the rule of law.

Further investigation into the effects of trade openness on growth in the context of the resource curse hypothesis is worth pursuing to identify the long-term effects of increased trade volumes and/or eliminating trade barriers on growth. Findings of the present study call into question Sachs and Warner (1995, 1997) original assertion of a U-shaped relationship between openness and resource dependence; they suggested that at early stages of development, when countries rely on

natural resources to run their economies, nations tend to become more protectionist in an effort to combat the symptoms of Dutch disease. However, as nations' reliance on natural resources exceeds a certain level, they become more open to trade. Sachs and Warner (1995, 1997) thus argued that at certain levels of resource wealth, the natural resource sector is so vast that the only sustainable manufacturing is concentrated in the natural resource sector; hence, countries become more open to trade as they become more dependent on that sector. Yet results of the current study reveal no statistically significant evidence of trade openness on per capita growth.

INV (defined as the gross capital formation as a percentage of GDP) for the study period was added in Regression 4. The INV coefficient was positive and statistically significant as expected, whereas fuel and non-fuel exports remained negatively associated with growth and statistically significant ($\beta_2 = -3.464$, $t = 2.58$). Regression 5 included the Human Development Index (HDI). This measure evaluates countries on dimensions such as life expectancy and expected years of schooling, both of which are important for growth of per capita income. All variable from regression 5 have the expected signs and are statistically significant except for RL Regression 6 included a different measure of institutional quality to test whether the negative association between natural resource intensity and growth would persist. As listed in Table 1, results suggest the natural resource curse remained despite using alternative explanatory variables. Use of the HDI reduced the sample size to 59 countries, as HDI data were only available for 59 countries of the original 68 in this study's sample; however, this reduction had no effect on model estimates.

As shown in Table 2, the measure of resource intensity was changed to fuel and non-fuel exports as a percentage of merchandise exports⁶ in 1995. The relationship of trade openness with growth was tested by including openness in Regression 4. For natural resource intensity, results indicate the expected signs on coefficient estimates consistent with the curse but a much weaker association with growth. For example, Regression 1 returned a coefficient estimate of $\beta_2 = -0.030$ and a standard deviation of 0.336 for fuel and non-fuel exports as a percentage of merchandise exports; an increase of one standard deviation was associated with a 0.01% reduction in growth (i.e., $[-0.030] * [0.336] = -0.01\%$). Despite this small effect, the association remained negative and statistically significant in all regressions. Openness was still not statistically significant, and its coefficient became negative, possibly due to an association with another independent variable in the model. More specifically, the change in sign was likely due to a correlation with the measure of resource intensity. In these regressions, fuel and non-fuel exports were measured as a percentage of merchandise exports; because openness also represents the sum of exports and imports, a sufficiently strong association may have existed between these two measures in the model and caused the regression line to change slope. Even so, the findings in Table 2 still indicate support for a natural resource curse using this alternative measure.

Next, the natural resource curse was tested using the following alternative measures of natural resource intensity: average fuels and ores as a percentage of merchandise exports; log of land area per population in 1995, a measure used in the original Sachs and Warner (1995, 1997) papers; natural resource rents as a percentage of GDP; and average oil and mineral rents as a percentage of GDP. In this context, *rent* represents the additional revenue from the sale of a natural resource commodity above and beyond its cost of extraction.

All estimates are reported in Table 3. Interestingly, only fuels and ores as a percentage of merchandise exports were found to be statistically significant, although weakly ($t = 1.90$). The other measures returned even weaker t values (-0.61 and -0.42 for natural resource rents as a percentage of GDP and average oil and mineral rents as a percentage of GDP, respectively). These figures may be due to measurement and reporting differences or errors by the reporting agencies. For example, population data from the World Bank for some countries were off by millions when compared with other sources of population data, such as those from specific countries' Statistical Bureaus. Some values seemed suspicious when constructing the land area per population variable, implying that

Table 2. GDP per capita growth for 68 developing countries between 1994–2014 using different measures

Dependent Variable: Growth of GDP per Employed Persons (GPC)

	(1)	(2)	(3)	(4)	(5)	(6)
LGDPE94	−0.749*** (−4.02)	−1.030*** (−5.21)	−0.991*** (−5.29)	−0.967*** (−4.95)	−1.163*** (−6.50)	−1.131*** (−6.39)
Fuel & non-fuel exports (% merch exports, '95)	−0.030*** (−5.12)	−0.024*** (−4.10)	−0.020*** (−3.47)	−0.020*** (−3.47)	−0.016*** (−3.02)	−0.017*** (−3.43)
RL		4.980*** (3.09)	4.514*** (2.92)	4.680*** (2.94)	1.703(1.10)	—
INV			0.070*** (2.71)	0.073*** (2.73)	0.095*** (3.64)	0.100*** (3.88)
OPENNESS				−0.002 (−0.48)	—	—
HDI					1.290*** (3.53)	1.460*** (4.42)
Constant (t-statistic) Adj-R ² (N)	10.480(5.61) 0.35(68)	10.171(5.76) 0.42(68)	8.260(4.54) 0.48(68)	8.031(4.25) 0.47(68)	7.868(4.71) 0.603(59)	8.050(4.83) 0.60(59)

Note. t values are reported in parentheses. * ** ** represent statistically significant at the .10, .05, .01 level, respectively.

potential data inconsistencies may have compromised the regression results and led them to appear non-significant.

The variable of natural resource rents as a percentage of GDP was originally used in Sachs and Warner (1995, 1997) studies, defined as the sum of oil rents, natural gas rents, coal rents, mineral rents, and forest rents. This variable suffered from many gaps in the original data, presumably because relevant information was unavailable from the host countries. However, based on all other results from previous regressions using the measures demonstrated earlier in this section, results appear to substantiate a natural resource curse between 1994–2014.

6. Terms of trade and growth

Terms-of-Trade (ToT) is defined as the ratio of a country's export price to its import price. Each price is computed as an index and used to determine the country's ToT such that $ToT = [\text{export price index} / \text{import price index}]$. If the value of the index is greater than 1, then the country has favorable ToT (i.e., it accumulates more capital from its exports when the price index of its exports exceeds that of what it imports).

Hence, if a country's ToT ratio is greater than 1, then its economy grows more quickly than it would otherwise. Sachs and Warner (1995, 1997) used a version of this variable to control for global commodity price shocks. In this study, ToT is constructed using data from PWT9.0 on export and import price indices, namely by computing the growth rate of ToT; its stock levels are not as interesting as its rate of growth for measuring dynamic effects on per capita growth. The following formula was used to construct the growth rate of ToT between 1994–2014:

$$\text{Growth(Terms – of – Trade)} : G(ToT) = [LN(ToT_{14}) - LN(ToT_{94}) / T]$$

Table 4 lists the results of the model incorporating ToT along with the estimates of two regressions. Fuels and non-fuels as a percentage of GDP and ToT showed the expected signs and statistical significance; hence, natural resource intensity continued to be negatively associated

Table 3. GDP per capita growth for 68 developing countries between 1994–2014 using different variables for natural resource dependence

Dependent Variable: Growth of GDP per Employed Persons (GPC)

LGDPE94	(1)-1.288*** (-6.72)	(2)-1.126*** (-5.06)	(3)-1.293*** (-6.19)	(4)-1.278*** (-6.02)	(5)-1.253*** (-5.30)
CPI	0.024***(-3.27)	0.023*(1.72)	0.026*(1.87)	0.028**(2.06)	0.027*(1.97)
INV	0.089***(-3.43)	0.107***(-4.00)	0.104***(-3.76)	0.105***(-3.78)	0.106***(-3.85)
HDI	1.348***(-4.11)	1.434***(-4.14)	1.568***(-4.45)	1.472***(-3.96)	1.499***(-4.06)
(Fuel & non-fuel as % of merch exports, '95)	-0.020*** (-3.27)	—	—	—	—
(Avg. fuels & ores as % of merch exports, '95)	—	-0.021*(-1.90)	—	—	—
(log land area per pop., '95)	—	—	-0.111(-0.85)	—	—
(Nat. res rents as % of GDP, '95)	—	—	—	-1.230(-0.61)	—
(Avg. Oil & Minerals Rents as %GDP '95)	—	—	—	—	-0.020(-0.42)
Constant (t-statistic)Adj-R ² (N)	9.037(5.29) 0.62(59)	6.208(3.47) 0.42(68)	7.296(4.14) 0.55(59)	7.273(4.12) 0.55(59)	6.923(3.70) 0.54(59)

Note. *t* values are reported in parentheses. * ** *** represent statistically significant at the .10, .05, .01 level, respectively.

Table 4. Terms of Trade (ToT)

Dependent Variable: Growth of GDP per Employed Persons (GPC)

	(1)	(2)
LGDPE94	-0.841***(-4.25)	-1.030***(-5.52)
Fuel & non-fuel exports (% of GDP, '95)	-3.910***(-2.98)	-3.410***(-3.03)
RL	4.60***(-2.91)	—
INV	0.090***(-3.51)	0.111***(-4.37)
ToT	0.824**(-2.33)	0.681***(-4.76)
HDI	—	1.600***(-4.76)
Constant(t-statistic)Adj-R ² (N)	5.550(3.26)0.47(68)	5.820(3.74)0.60(59)

Note. *t* values are reported in parentheses. * ** *** represent statistically significant at the .10, .05, .01 level, respectively.

with growth even after controlling for global commodity price shocks between 1994–2014. Regression 1 controlled for the rule of law and investment rate. Fuel and non-fuel exports and ToT demonstrated coefficient estimates of -3.91 and 0.82, respectively, with corresponding absolute *t* values of 2.98 and 2.33. Regression controlled for the investment rate and human development and revealed that coefficient estimates for resource dependence and ToT remained statistically significant; see Table 4.

Finally, the hypothesis that natural resource dependence in developing countries leads to corruption and rent-seeking was tested. This hypothesis has been well supported in the literature,

based on the argument that if a government uses natural resource windfalls to fund its operations, then the government does not need to tax its citizens to generate revenues, thereby promoting less accountability to citizens and a greater likelihood of corruption and rent-seeking. The rule of law was regressed on initial income and fuel and non-fuel exports as a percentage of GDP to test this. Results show that fuel and non-fuel had a coefficient estimate of -0.30 ($t = 3.11$). Therefore, the dataset of 68 developing countries in the period between 1994–2014 presents statistically significant evidence of a negative indirect effect of natural resource dependence on per capita growth operating through institutional quality: the higher the resource dependence, the lower the institutional quality.

7. Investigating the natural resource curse in MENA

The MENA region is one of the richest natural resource regions in the world, with five countries among the top 10 oil producers around the globe. The Gulf states have particularly enjoyed high per capita incomes and higher standards of living than other countries in the region. This section presents descriptive statistics for the MENA countries in the study sample, including GCC, to test whether a negative association exists between growth and natural resource wealth.

Due to political and social instability in the MENA region over the past decade, relevant data were difficult to obtain; however, data on 14 MENA countries in the original sample were used to study the natural resource curse. An examination of the region began with a plot of the relationship between fuel and non-fuel exports as a percentage of GDP and per capita growth between 1994–2014. Figure 2 illustrates that MENA countries with a lower percentage of natural resource exports tended to have higher average per capita growth.

As the share of natural resource exports increased, countries' average growth declined. This phenomenon was consistent with the natural resource curse discussed earlier using the full sample.

Investigating the role of institutions on economic performance, especially given different levels of natural resource intensity in MENA, is essential to understanding the countries' development trajectories. Such information can also facilitate the design of interventions to help stakeholders stay the course toward take-off and growth. Oil-rich GCC countries (except Qatar) demonstrated negative growth throughout 1994–2014 as indicated in Table 5. In Figure 2, the author includes Pakistan and Bangladesh in MENA under the assumption that those two countries have similar cultural backgrounds and structure of institutions—given that they are both Muslim-majority

Figure 2. Relationship between growth and primary products exports for MENA countries.

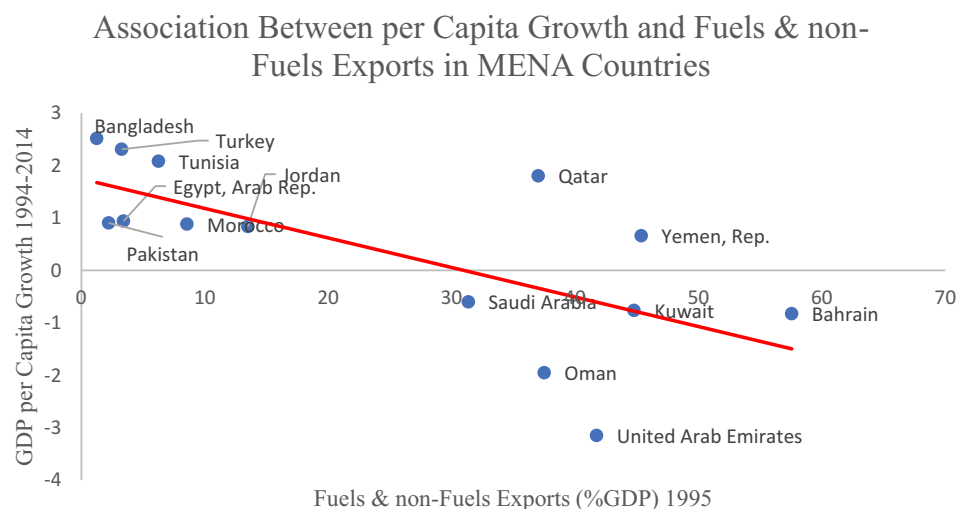


Table 5. Average growth in oil-rich GCC countries between 1994–2014

United Arab Emirates	–3.5
Bahrain	–0.83
Kuwait	–0.76
Oman	–1.95
Qatar	1.8
Saudi Arabia	–0.60

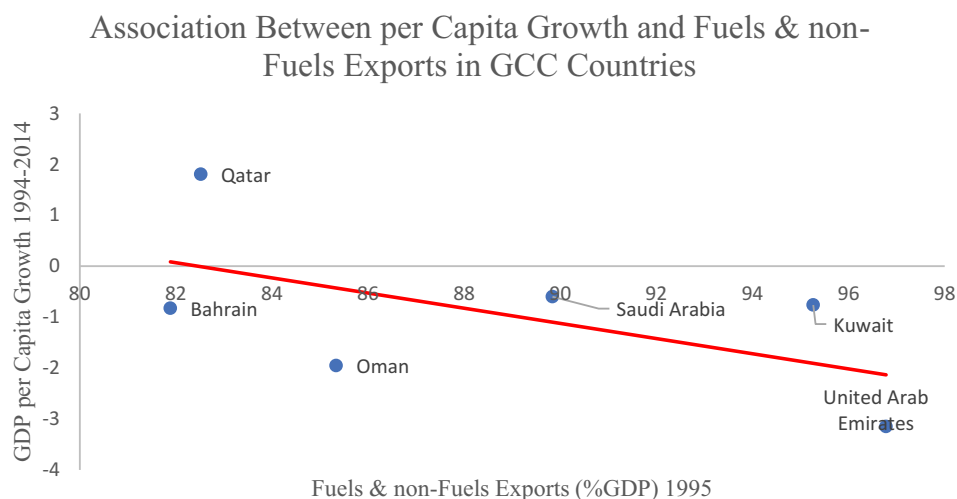
countries. The relationship between natural resource exports and growth for GCC countries depicted in Figure 3 further substantiates the natural resource curse hypothesis. Data on total factor productivity (TFP) were obtained for four GCC countries, revealing a negative rate of growth for TFP; for example, growth in Bahrain was -0.003 , -0.14 in Kuwait, -0.01 in Qatar, and -0.015 in Saudi Arabia.

The connection between negative rates of growth in TFP and dependence on natural resources in GCC countries warrants further examination considering the size of the natural resource sector in these economies. The negative association between natural resource intensity and growth in GCC is readily apparent as shown in Figure 3.

8. Conclusion

Using econometric techniques similar to those applied by Sachs and Warner (1995, 1997), this study tested the existence of a negative association between natural resource dependence and economic growth. The goal of this paper was twofold: 1) to use recent data on a sample of developing countries to test whether the natural resource curse persists; and 2) to verify this relationship in a sub-sample of MENA countries, including oil-rich GCC countries, using descriptive statistics. In the main sample of 68 developing countries over the period of 1994–2014, evidence supports the natural resource curse. As countries depend increasingly on natural resources, as measured by primary product exports as a percentage of GDP, they tend to experience slower growth. Furthermore, this relationship was found to persist in a sub-sample of 14 MENA countries. These findings have major policy implications, especially for GCC countries, as they implement their economic development plans. In this natural resource-rich region, governments have taken

Figure 3. Relationship between growth and primary products exports for oil-rich GCC countries.



measurable steps in combating the adverse effects of resource-dependence on growth. They've made considerable effort to diversify their economies away from an oil-exports base. The findings of this paper suggests that there is much work to be done to, and although this paper does not provide any policy prescription for dealing with the curse, the findings suggest further investigation is needed into the role of institutions in those countries in mitigating the curse to achieve sustainable economic development.

Since 2014, most developing countries, especially in the GCC region, still struggle in terms of the structure of their employment and output despite governments' efforts to diversify their incomes base. One fruitful area of future research is to do impact analysis to study whether these policies are working or not to help governments take corrective measures to align efforts with goals. Impact analysis also poses many challenges as reliable data is hard to obtain in many developing countries. This type of analysis for monitoring and controlling is critical in a post-Covid era given magnitude such negative shock had on many developing countries around the world.

The European experience, Norway for example, is much more positive when dealing with a natural resource boom. The next question is why would a country like Norway succeed in dealing with natural resource curse while Arab GCC countries continue to struggle? Examining the institutional structure in those countries and what changes may be needed in order to achieve better outcomes is a question for future research in this topic. One obvious limitation in this research is access to more reliable data. For example, Sachs and Warner used data on institutional quality published by the PRS Group Country Risk Guide. This data is only available for subscribers of their services at a hefty cost. Having access to better researched and compiled data gives researchers confidence in the interpretation of their findings, but also the ability to generalize beyond the sample in the study. Another limitation is related to issues of endogeneity that may be present in cross-country analysis. Endogeneity may arise from omitted variables due to the lack of availability of data. There are more than 70 variables that have been used on the right-hand side in growth equations. Omitted variables bias should be a cause for concern in empirical growth literature, however, since this study attempts to replicate Sachs and Warner's original cross-country approach, we found similar evidence of a natural resource curse based on their original specification and methods. Future research can use more sophisticated estimation techniques to further study and understand the backward and forward linkages from the natural resource sector to the rest of the economy.

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Notes

1. NRD is a measure of a country's natural resource dependence. This study uses different measures of resource dependence for robustness and to highlight relevance in other data subsets.
2. See Appendix A for a complete list of variables, their source, and method of computation.
3. Using GDP (current \$) World Bank data for 1995.
4. Model specification changed after running regressions as shown in the regression tables.
5. See Appendix B for the full list of countries in the study and their average growth rates between 1994–2014.

6. Merchandise exports are defined as the FOB, value (current U.S. \$) of goods provided to the rest of the world. Data on this variable were collected from the World Bank, which compiles data from the WTO.

Disclosure statement

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Appendix A Variable Descriptions and Sources

G9414	Growth of GDP per employed persons computed over the period between 1994–2014. RGDP ^{NA} data from PWT9.0 were used, and data on the numbers of engaged persons were also used from PWT9.0.
LGDPPE94	The natural log of GDP per employed persons in 1994.
LGDPPE14	The natural log of GDP per employed persons in 2014.
Fuels & non-fuels exports as % GDP '95	Fuels exports comprise the commodities in SITC section 3 of the World Bank which contains mineral fuel and lubricants. Non-fuels exports consist of Ag raw materials exports—SITC sections 2 excluding divisions 22 and 27. Food exports—SITC section 0. Ores and metals exports—SITC sections 27, 28, & 68. Data are from 1995 World Bank Development Indicators.
RL	The WJP rule of law index in 2016 The index ranges in value from 0 to 1 with higher values (closer to 1) imply better rule of law. This index covers 8 factors such as absence of corruption, open government, fundamental right, etc. For a full description refer to: http://www.data.worldjusticeproject.org
CPI	Corruption Perceptions Index (CPI) published by Transparency International ranks participating countries from 0 to 100 with higher value index meaning less corruption perception in that country. http://www.transparency.org
Trade as % GDP '95 (WB)	The sum of merchandise exports and imports divided by GDP (current \$) in 1995. World Bank data.
Trade as % GDP '95 (WITS)	The sum of exports and imports divided by GDP from World Integrated Trade Solutions for 1995.
Openness (X + M) shares in GDP '95 (pwt9.0)	The sum of the shares of merchandise exports and merchandise imports at current PPP's in 1995 PWT9.0.
Merchandise Trade as % GDP (WITS)	Average trade as % of GDP in the period between 1994–2014 from WITS.
INV	Average investment rate in the period between 1994–2014. Average investment computed as average gross capital formation which is the sum of private and public investments. PWT9.0.
HDI	Human Development Index is an index of human capital per person estimated in PWT9.0 using data on average years of schooling and rates of return on education.
Avg. fuels & ores as % merchandise exports '95 (WB)	Comprise of fuels exports, SITC section 3 World Bank, and ores & metals SITC sections 27, 28, & 68 from the World Bank for 1995.
LN(Land Area per Pop) '95	The natural log of the ratio of total land area of a country to its population in 1995.
Natural resource rents as % GDP '95	Total natural resource rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rent. Natural resource rents computed as a percentage of total GDP in 1995. World Bank.
Avg. oil and minerals as % GDP '95 (WB)	The average share of oil and minerals rents as a percentage of GDP in 1995. World Bank.

(Continued)

(Continued)	
ToT	ToT is the ratio of a country's export price index to its import price index. Price indexes taken from PWT9.0.
G(ToT)	Growth of ToT between the years 1994–2014. The exact formula is $G(ToT) = (1/T) * [Ln(ToT14) - Ln(ToT94)]$
LN(ToT14)	Natural log of the Terms-of-Trade in 2014.
LN(ToT94)	Same variable for 1994.
TFP	Total factor productivity at constant prices. PWT9.0.

Descriptive Statistics

Variable	Mean	STD Dev	Minimum	Maximum
Per Capita Growth	1.60	1.71	−3.15	6.77
Log of Initial Income	10.16	1.12	7.17	12.34
Fuels & non-Fuels Exports (%GDP)	14.69	12.66	0.71	57.56
Fuels & non-Fuels Exports (% Merchandise Exports)	56.84	29.39	9.06	99.89
Avg. Oil & Mineral Exports (%GDP)	37.38	34.71	0	83.46
Total Natural Resource Rents (% GDP)	5.87	7.94	0	34.66
Investment Rate	24.25	6.15	1.00	41.32
Log (Land Area/ Population)	0.45	1.28	−3.96	3.56
Trade Freedom	77.46	8.71	52.70	90.00
Average Trade (% GDP)	83.17	48.18	23.32	368.73
Rule of Law	0.52	0.12	0.14	0.82
Corruption Perception Index (CPI)	41.25	14.21	14.00	84
Human Development Index (HDI)	0.74	0.53	0.49	0.81
Growth of (ToT)	0.31	0.43	−1.29	1.19

Note. Trade Freedom ranges from 0–100; Rule of Law from 0–1; CPI from 0–100; HDI from 0–1.

Appendix B Per Capita Growth 1994–2014

	Country Code	Country Name	Growth ("94-"14)
1	ARE	United Arab Emirates	−3.14939
2	ARG	Argentina	0.962381
3	BFA	Burkina Faso	3.314918
4	BGD	Bangladesh	2.516606
5	BHR	Bahrain	−0.82698
6	BHS	Bahamas, The	−0.15916
7	BLR	Belarus	5.217217
8	BOL	Bolivia	1.427607
9	BRA	Brazil	1.047063
10	BRB	Barbados	0.517924
11	CHL	Chile	2.088227
12	CHN	China	6.767585
13	CIV	Cote d'Ivoire	0.300596
14	CMR	Cameroon	0.359861
15	COL	Colombia	0.798819
16	CRI	Costa Rica	1.198959
17	CZE	Czech Republic	2.437632
18	DOM	Dominican Republic	2.495437
19	ECU	Ecuador	1.164946
20	EGY	Egypt, Arab Rep.	0.939854
21	EST	Estonia	4.549469
22	GTM	Guatemala	0.96087
23	HND	Honduras	0.427468
24	HRV	Croatia	2.399653
25	HUN	Hungary	2.034052
26	IDN	Indonesia	2.571043
27	IND	India	4.813348
28	JAM	Jamaica	−0.26843
29	JOR	Jordan	0.835526
30	KAZ	Kazakhstan	3.903711
31	KEN	Kenya	0.710772
32	KGZ	Kyrgyz Republic	2.421305
33	KWT	Kuwait	−0.7632
34	LCA	St. Lucia	−0.43125
35	MAR	Morocco	0.881733
36	MDA	Moldova	3.851319
37	MDG	Madagascar	−0.53893

(Continued)

(Continued)			
	Country Code	Country Name	Growth ("94–'14)
38	MEX	Mexico	0.295797
39	MKD	Macedonia, FYR	2.439854
40	MWI	Malawi	1.792969
41	MYS	Malaysia	2.182186
42	NIC	Nicaragua	0.342101
43	NPL	Nepal	2.193417
44	OMN	Oman	−1.95355
45	PAK	Pakistan	0.905458
46	PAN	Panama	2.220278
47	PER	Peru	1.963887
48	PHL	Philippines	2.745414
49	POL	Poland	3.484488
50	QAT	Qatar	1.802681
51	ROU	Romania	5.114222
52	SAU	Saudi Arabia	−0.60047
53	SGP	Singapore	2.071633
54	SLV	El Salvador	1.016363
55	SUR	Suriname	0.184975
56	SVN	Slovenia	2.312314
57	THA	Thailand	2.180466
58	TTO	Trinidad and Tobago	2.393331
59	TUN	Tunisia	2.080945
60	TUR	Turkey	2.30934
61	UGA	Uganda	3.127555
62	URY	Uruguay	2.343148
63	VCT	St. Vincent & Grenadines	1.499611
64	VEN	Venezuela, RB	−0.65137
65	YEM	Yemen, Rep.	0.660451
66	ZAF	South Africa	0.850737
67	ZMB	Zambia	3.194952
68	ZWE	Zimbabwe	0.533195



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