The (Potential) Curse of Abundant Natural Resources: An Examination of Oil-Rich Nations

Anisha Priya

ABSTRACT

This research investigates the resource curse theory in countries with natural oil reserves from an economic perspective. The resource curse theory suggests that resource-rich countries often experience paradoxically slow economic growth; however, this study explores instances where the theory holds true and cases where it does not, aiming to identify factors that influence these divergent outcomes. This study analyzes components that affect global GDP growth, applying linear regression to integrate economic findings with social and political contexts to assess future implications and potential solutions to the resource curse. Data for economic outcomes, including GDP and resource availability, was obtained from OPEC, OECD, The World Bank, and the International Monetary Fund. This research is particularly relevant in light of ongoing global economic challenges, including the correlation between oil production, economic inequality, authoritarianism, and institutional effectiveness, and the impact of rising oil prices over the past four years. This study finds that in politically stable and economically diverse nations, abundant oil reserves do not cast a ‘curse’ on the nation’s development outcomes. For nations that rely solely on oil and have weaker political institutional strength, the ‘curse’ of oil or other abundant natural resources can be manifest. The various factors determining these factors are discussed in greater detail throughout the paper.

INTRODUCTION

Are countries with abundant resources inherently cursed? The resource curse predicts that resource-rich countries tend to have counterintuitively slow economic growth, but evidence across multiple countries exhibits mixed returns from resource endowments. This study examines cases where the theory is both true and false, and analyzes what factors contribute to the difference in outcomes, which in this case are the monetary results or impacts of a particular case. The purpose of the paper is to show how different factors influence the effect of the oil supply on gross domestic product, one measure of a country’s economic success, as shown through two interaction term regressions. By doing this, we will be able to understand and clarify potential explanations for why the resource curse theory is so varied in its outcomes, and how we can use this to our advantage when looking at the economic performance indicators of a given country in the future.

This topic is important as it not only encompasses defining economic challenges of oil-producing countries and points out their correlation to economic inequality, authoritarianism, public institutions, and more, but also connects to understanding the impact of the recent spike in oil prices throughout the past four years. By analyzing the question at hand, we are able to clearly see how big of an impact a country’s retention of natural resources has on the global economy. Further, with the greater collective need for fleeting assets such as oil today, it is necessary to look at the fluctuations in patterns that create prosperous versus declining economies in the modern world, and how to identify methods to potentially shift the outcome when needed.

The paper will firstly delve into the analysis of the significant body of past empirical studies,exploring different outcomes and analyzing gaps in the current literature that this study aims to address. Then, it goes on to present and explain the data and methodology used throughout the experimentation, before analyzing the key results and concluding with political and social outcomes, as well as policy recommendations for future studies.

LITERATURE REVIEW

This study examines whether natural resource abundance boosts or stifles economic growth in a variety of diverse countries, and what factors contribute to the mixed outcomes of past papers. The multitude of past studies done on the resource curse have seen a variety of outcome metrics to measure success and failure rates, yet a pattern can be seen under two main categories: (1) governance and institutional quality, and (2) economic growth. Cato Institute has looked at the purchasing power parities (PPP), foreign direct investment (FDI), human development index (HDI), Freedom from corruption, and violations of civil liberties; The International Monetary Fund focused on the mining share of GDP as well as measures of employment; and similar papers have dived deeper into social outcomes such as education and health (Antonio Savoia and Kunal Sen).

The term natural resource curse was initially coined by economic geographer Richard Auty in 1993. It has been defined as “the perverse effects of a country’s natural resource wealth on its economic, social, or political well-being.” Essentially, the resource curse is a paradoxical situation in which a country underperforms economically, despite being home to valuable natural resources (Jason Fernando). For the purposes of this paper, the ‘resource’ in question will be crude oil. We will be studying both the successes and failures of this ‘oil resource curse’ on a global scale, as well as the number of factors that contribute to these varied outcomes.

Data on national oil supplies over time are from OPEC (Organization of the Petroleum Exporting Countries) and non-OPEC countries alike, yet each chosen country will still be considered ‘resource-rich’. The International Monetary Fund defines a country to be resource-rich when exports for natural resources account for more than 25% of the country’s total export value (IMF Staff). Instances where the resource curse has been proven correct align with the concept of the ‘Dutch disease’, an economic phenomenon where the rapid development of the natural resources sector of the economy precipitates a decline in other sectors (CFI). For example, countries simply focusing on the raw materials sector of their economy will see a decline in other sectors such as manufacturing or services.

By failing to make adequate investments in other sectors, countries can become vulnerable to declines in commodity prices, leading to long-run economic underperformance. In response to this pattern, the big push theory, the idea that a coordinated effort to develop multiple industries and infrastructure projects would catalyze economic development, has recently gained momentum (George Mason University, 2021). By failing to make adequate investments in other sectors, countries can become vulnerable to declines in commodity prices, leading to long-run economic underperformance (Jason Fernando). Mechanisms put in place that support the big push theory are stabilization funds, systems to insulate the domestic economy from large influxes of revenue, such as from commodities like oil. A primary motivation is maintaining steady government revenue in the face of major commodity price fluctuations as well as the avoidance of inflation (James Chen). The International Monetary Fund proves that expenditure volatility in countries with stabilization funds can be 13% lower than that in economies without them (IMF Staff).

Further, there are many contributing factors to the resource curse theory, one of them being the quality of governmental institutions of the country in question. Economic institutional deficiencies refer to the absence of credible market intermediaries and well-established market infrastructures (Chan et al., 2008, Chan et al., 2010). Lower quality rates can signify instability within the country's governmental systems, making it much more likely that their economy will reflect the resource curse. Correspondingly, economic freedom---measured by the EFW as rule of law and property rights, size of government and taxation, soundness of money, trade regulation and tariffs, regulation of business, labor, and capital markets---is a factor that directly affects the outcomes of the resource curse test on a global scale.

While many factors can influence the success versus failure of a country in regards to the resource curse theory, this paper will be focusing on two main aspects that can change the effect of oil supply on GDP growth: Economic Freedom and Human Development Index. Economic freedom, as previously defined as the extent to which individuals and businesses are free to operate in an economy with minimal government intervention, has been identified as a critical factor influencing the impact of oil wealth on economic growth. Gwartney, Lawson, and Hall (2013) argue that countries with higher levels of economic freedom are better positioned to make use of the benefits of oil wealth, as market-driven economies are more likely to foster entrepreneurship, innovation, and efficient resource allocation.

Similarly, Arezki and van der Ploeg (2011) found that in countries with strong institutions and economic freedom, the negative impact of oil wealth on growth is significantly reduced. They suggest that economic freedom enhances the capacity of a country to manage oil revenues effectively, promoting sustainable economic development. On the other hand, countries with low economic freedom often suffer from poor governance and inefficient resource use, exacerbating the resource curse and leading to stagnation or decline in GDP growth. Additionally, documented corruption plays a significant part in countries with low economic freedom or justice, another reason why the resource curse is unable to be stopped.

The Human Development Index (HDI), a measure of a country's average achievements in health, education, and income, has also been explored as a factor that can influence the relationship between oil wealth and economic growth. Research by Bravo-Ortega and De Gregorio (2007) shows that investments in education and healthcare can enhance the ability to benefit from economic activities such as trade or manufacturing, thereby mitigating the negative effects of the resource curse. Additionally, Bulte, Damania, and Deacon (2005) argue that countries with a higher HDI are better equipped to utilize oil revenues for long-term development goals, as a healthier and more educated workforce can drive productivity and innovation. Conversely, countries with low HDI often struggle to translate oil wealth into sustainable growth, as poor health and education outcomes limit the potential for economic diversification and exacerbate the negative effects of resource dependence, such as lower living standards and limited job opportunities.

One of the first major empirical studies on the resource curse was provided by Jeffery Sachs and Andrew Warner (1995), where it was concluded that economies with a high ratio of natural resource exports to GDP would result in slower growth. Xavier Sala-I-Martin (1997) confirmed the findings of Sachs and Warner when looking at GDP as the measure for the country's growth. However, both studies were compared with the world average GDP during 1970-1990, and the 1980s saw a period with strong economic growth and institutions during periods of low oil prices. Thus, older studies concentrated on one period of time likely do not fully represent the theory.

Other examples where the resource curse has been proven to be correct found that natural richness produces a highly concentrated structure of the economy and export revenues, which leads to more of a risk if the oil market fluctuates, resulting in slow growth (de Ferranti and others, 2001); the indirect, negative effects of macroeconomic policies like trade openness and educational investment outweigh the direct, positive resource effects (Papyrakis and Gerlagh, 2004); resource industries tend to induce more corruption, hampering economic development (Leite and Weidmanns,1999); resource-rich countries motivate rent-seeking activities and intensify domestic conflicts (Sala-i-Martin and Subramanian, 2003; Davis and Tilton, 2005; and Srli, Gleditsch, and Strand, 2005); and natural resources may impede economic growth due to an inhibition of the development of democracy and the provocation of insurrection (Collier and Hoeffler, 2005). Each of these studies suggest that countries with an abundance of resources 'fail' in standards of price volatility, trade openness, corruption, domestic conflicts, and low democratic indices.

Yet on the other hand, different outcome metrics and time periods prove to show different results. That same year, Davis (1995) found that when focusing on people's standard of living---life expectancy, infant mortality, and access to basic human needs---there is no indication that resource abundant economies are unduly suffering over the long term. Data was studied across Saudi Arabia, Russia, Kuwait, Norway, and more. Osmel Manzano and Roberto Rigobon (2001) and Daniel Lederman and William F. Maloney (2007) also questioned the findings of Sachs and Warner, along with many others. Stijns (2005) specifically argued that the impact of oil wealth depends on the capacity of a country to manage its resources effectively, rather than the relationship being universally negative.

Even more so, several empirical studies have found that the resource curse is not an inevitable outcome of oil, gas or mineral windfall revenues and has the potential to be a 'blessing' (Stevens, 2006; Rosser, 2006; Wright and Czelusta, 2007). When focusing on the factor of economic freedom, we also see with Ross (2012) that countries with high levels of economic freedom such as Australia, Canada, Chile, and Norway, prove it is possible to disprove the resource curse for resources like diamonds, minerals, gas, and oil. Across these studies that 'disprove' the resource curse, there is consistent evidence that shows not all countries with higher amounts of natural resources face the same negative fate, and in fact can benefit them if utilized the right way.

When looking at the role of governance, Mehlum, Moene, and Torvik (2006) emphasized the importance of institutional quality in determining whether resource wealth leads to growth or stagnation. They argued that countries with "producer-friendly" institutions, which promote investment and protect property rights, are more likely to experience positive economic outcomes from resource wealth. Conversely, countries with "grabber-friendly" institutions, where rent-seeking and corruption are prevalent, are more likely to suffer from the resource curse. This institutional perspective was supported by Collier and Hoeffler (2009), who found that the resource curse is particularly severe in countries with weak institutions, where oil wealth can exacerbate corruption, conflict, and political instability. These studies suggest that the negative effects of oil wealth might not be inevitable, but rather can be mediated by the quality of governance and institutions.

The political economy perspective has also been crucial in understanding the mixed outcomes associated with oil wealth. Karl (1997) argued that oil wealth can entrench authoritarian regimes by providing rulers with the financial resources to suppress dissent and maintain power without broad-based economic development. This model suggests that oil wealth can lead to poor governance, weak democratic institutions, and limited social development. But on the other hand, different studies have shown that oil wealth can have positive social impacts under certain conditions. Smith (2004) found that oil revenues could be used to finance public goods and services, leading to improvements in education, healthcare, and infrastructure. Moreover, the measurement of resource wealth and economic performance varies across studies, leading to different conclusions. Alexeev and Conrad (2009) argued that many studies overestimate the negative effects of oil wealth by failing to account for the long-term benefits of resource revenues, such as investments in infrastructure and human capital.

The literature on the oil resource curse is a complex picture, with mixed outcomes depending on various factors such as institutional quality, economic diversification, political economy, and methodological approaches.

This paper will analyze the factors that are responsible for the varied outcomes, as well as policy recommendations based on strong data trends to help improve the success of a resource-rich country. For example, much evidence points to strong institutions as a solution to managing resource curse risks, and thus should be researched further. Additionally, the majority of research is swayed by the economic fluctuations of the time period it was written: From 2002-2014, economic and social stagnation occurred in many petrostates due to corruption and institutional deterioration even during the long period of inflated oil prices. This inconsistency creates a lack of research among longer time spans to find the true trends in the data in regards to investigating the resource curse theory. To address this, the aim of this paper is to fill in these research gaps and discover what factors are truly prevalent for the topic.

DATA

This section describes the datasets used throughout the study and their connection to the oil resource curse, as well as discuss any key steps taken in the data collecting process. There are four main datasets used in this paper: Oil Production, Real Gross Domestic Product, Human Development Index, and Economic Freedom. The data covers 22 countries, 15 of which are mutual among all datasets, and 32 years, spanning from the year 1990 through 2022. This specific time period was chosen for two main reasons. First, it spans across over thirty years, which encompasses a wide range of economic events, making sure that the data isn't swayed by one or more international crises. Second, data before 1990 was inconsistent, proving difficult to find for each country and each dataset.

The summary statistics table below gives a more comprehensive understanding of each country in the sample and their average value across each of the four datasets.

Country	Oil Production	Real GDP	HDI	Economic Freedom
AUSTRALIA	838,499	2.9%	0.91	8.27
CANADA	4,919,661	2.1%	0.90	8.21
DENMARK	449,137	1.8%	0.90	8.16
FRANCE	57,629	1.5%	0.86	7.67
GERMANY	117,885	1.3%	0.91	8.04
GREECE	9,779	1.0%	0.84	7.02
HUNGARY	44,561	2.3%	0.80	7.28
ITALY	211,648	0.8%	0.86	7.50
MEXICO	5,770,288	2.2%	0.73	6.89
NETHERLANDS	71,251	2.2%	0.90	7.95
NEW ZEALAND	68,293	2.9%	0.90	8.65
NORWAY	4,586,533	2.3%	0.92	7.87
SPAIN	13,713	2.0%	0.85	7.77
UNITED KINGDOM	3,208,258	1.8%	0.88	8.30
UNITED STATES	15,047,466	2.5%	0.91	8.47

Figure 1. Summary statistics: Oil Production, Real GDP, HDI, and Economic Freedom Per Country (Average values, 1990-2022)

In this case, economic success will be largely determined through the growth in Gross Domestic Product. Alongside oil supply and two unique interaction terms, the data will be measured through a panel regression analysis to identify specific patterns relating to the key argument. The fundamental question of this study is to measure the effect of Oil Production on Real GDP growth, and use both Human Development Index and Economic Freedom, the interaction terms, as factors that can affect the return of that relationship. However, all factors used in the study were based solely on the data that was available and accessible for public download. Thus, even if there are other or more factors to test, these limitations, along with time and resource constraints, led me to choose the most clear and attainable variables.

Oil Production data is used as a measure of the amount of oil present in a country, taken from the International Energy Agency, or the IEA, in December of 2023. The data was originally sought from the World Bank, but as there can be no inconsistencies in the oil supply data specifically, being the foundation of measurement for this study, countries containing certain years without oil supply data needed to be removed, leaving a very small list. If the data had been used with the zeros or blank spaces, the regression would plot a cluster of observations along the vertical zero line, leaving little to no trend in the data and interfering with the results, since the goal is to analyze varying returns from oil supply. Conversely, the countries chosen from the IEA data were consistent in all 32 years, with no zeros or blank cells.

The Energy Statistics Data Browser offers charts and graphs on 16 energy types and over 170 countries. Each country has a unique chart or graph, thus the 22 countries chosen for the study were manually selected and downloaded through excel. In order to put the data into a standard format—years as columns and countries as rows—the 22 separate files of data were then arranged and transposed into one singular file. The oil production in the countries is measured in terajoules (TJ), which are very large numbers. Therefore, when processing the data in R, the data needed to be log transformed in order to account for differences in scale.

However, there are still many potential biases in this dataset. First, the time period in this experiment (1990-2022) might exclude countries that have significant gaps in their data, potentially due to political instability, economic crises, or technological limitations in earlier years. This exclusion may bias the analysis toward more stable, developed countries that could skew the results regarding the resource curse. Secondly, the data used from the IEA could potentially have differences in methodology compared to other sources like the World Bank. If the IEA uses certain estimation techniques or assumptions that differ from those used by other institutions, this could affect the generalizability of the findings. Additionally, since the data was manually selected and downloaded, there is the small potential for error during the extraction, cleaning, and transformation stages.

The Real Gross Domestic Product data, as stated earlier, is used as the main measure of the economic success of a country. The values make up the response variable of the study, determining how effective each interaction term is when regressed onto oil production. The data was taken from the OECD, the Organization for Economic Co-operation and Development. While there are a few missing observations in the data, they are in the earlier years of the timespan range, and were automatically filtered out of the data when creating the panel regression in R.

According to the OECD, the values are given in constant prices and refer to the volume level of the GDP growth. Specifically, these constant price estimates are obtained by expressing values of all goods and services produced in a given year, expressed in terms of a base period. By expressing GDP in constant terms, the data accounts for inflation over time, allowing for better comparisons of economic growth across the 32 years without worrying about price level changes. Moreover, this indicator is measured in growth rates compared to previous year, in percentages. This aligns with the study as it focuses on economic growth, and makes it easier to analyze the relationship between oil production and economic success over time. Once selecting the specific countries from the experiment, the data table was already horizontally organized and ready to import into R. In terms of selecting the data, it was obtained from the OECD, a highly reputable and reliable source for economic indicators. Further, I had to make sure the data had availability across the same countries and time period as all my other datasets, so that it would be compatible for the panel regression analysis.

Regardless, there are a few limitations to the data. Primarily, there is the problem of using GDP as the complete measure of success of a country. In past literature, GDP growth is frequently used as a standard measure of economic success because it represents the increase in the value of goods and services produced by an economy over time. However, while useful, GDP may not capture all the impacts of oil supply, especially in many countries of the study where oil wealth is not distributed evenly. This could result in a mismatch between oil production and economic success. Yet due to limited access to specific data throughout this study, it was decided that using GDP as a measure of success was still the best and most straightforward way to go.

The first interaction term implemented was Human Development Index, or HDI. The summary of the distributions of HDI values for each country over time is shown in Figure 2 below. The data was taken from the UNDP, or United Nations Development Programme, specifically from the Human Development Report Office. The UNDP's methodology for calculating HDI is consistent, making it a trustworthy dataset for this study. The HDRO defines HDI as a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and having a decent standard of living. To turn these sectors down to one value, the geometric mean of normalized indices for each of the three dimensions was taken. The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years as well as expected years of schooling for young children. Lastly, the standard of living dimension is measured by gross national income per capita. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean.

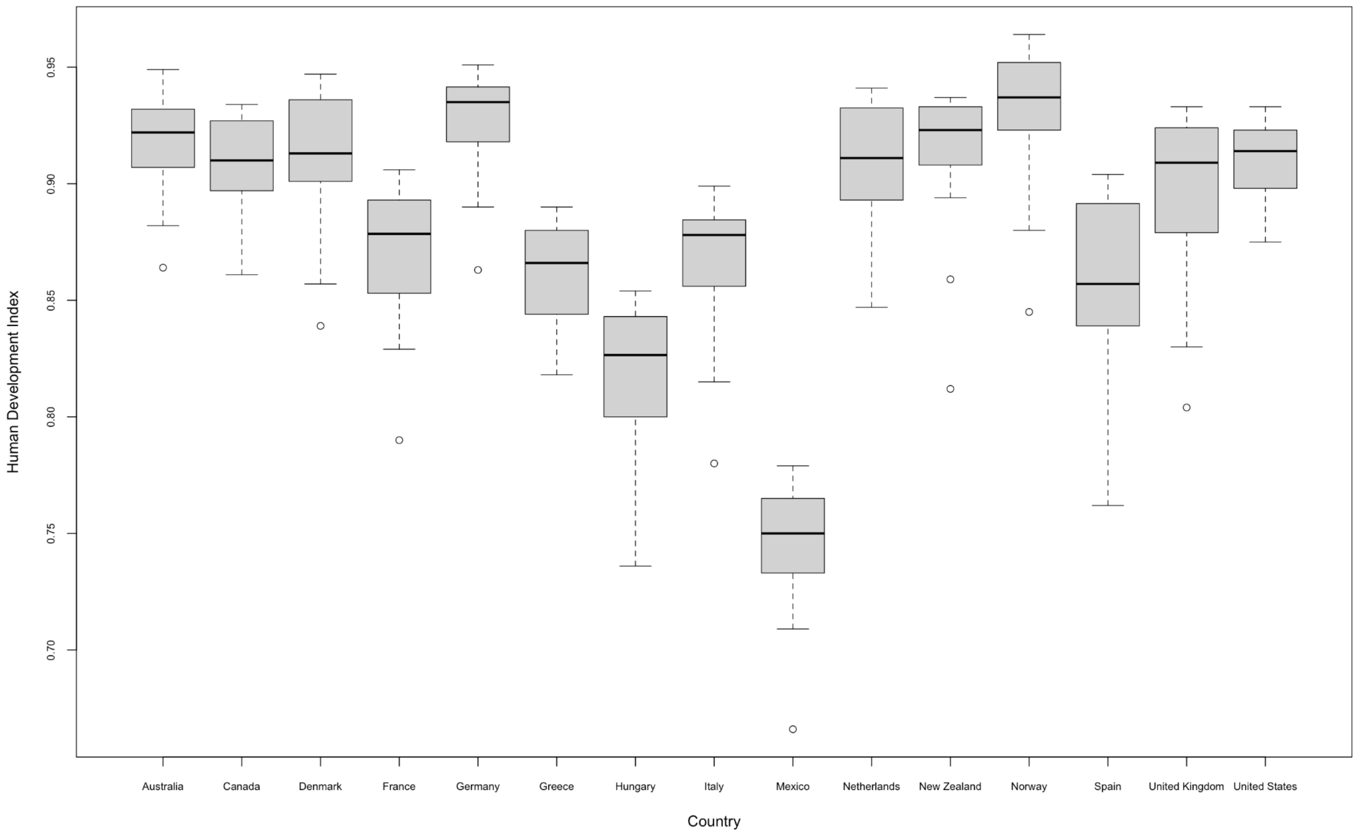

Figure 2. Human Development Index Distributions for Each Country over Time (1990-2022)

The data was downloaded in excel along with each different composite index for each country. The averages of each sector were given for each year, which is the value that remained in the table. All other values were manually removed, and the data was transposed to fit the horizontal formatting from previous datasets. There were no empty cells this time, confirming the credibility of the UNDP.

When selecting the data, I ensured that, as stated earlier, it spanned the same time period as my other three datasets. I also made sure that the data covered the same geographical scope that was previously established. In addition, since HDI covers education, health, and living standards, it provides a broader view of a country's development. This makes it a useful interaction term for the study, as it reflects how human development affects the relationship between oil production and economic growth. Limitations in the HDI data could be that HDI captures overall development, not accounting for internal disparities, such as income inequality, which can be highly relevant in resource-rich, oil-producing countries. This could affect the accuracy of HDI as an interaction term. Further, HDI doesn't fluctuate quickly in response to oil price changes like GDP growth does, as it evolves slowly over time. This could complicate HDI as an interaction term when measuring its effect on the relationship between oil production and GDP growth.

The second interaction term used was Economic Freedom, taken from the Fraser Institute in 2024. The summary of the distributions of economic freedom values for each country over time is shown in Figure 3 below.

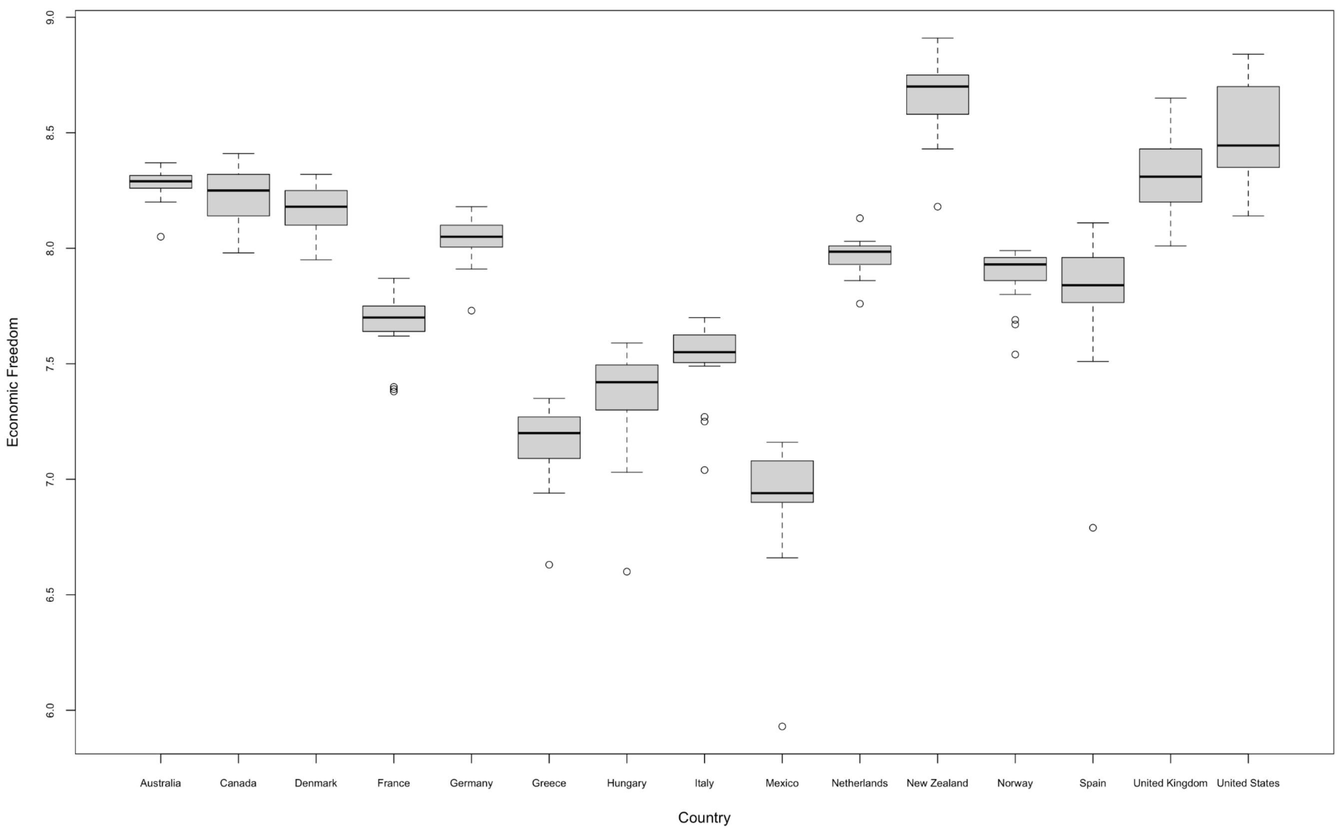

Figure 3. Economic Freedom Distributions for Each Country over Time (1990-2022)

The index published in Economic Freedom of the World measures the degree to which the policies and institutions of countries are supportive of economic freedom. The main categories of economic freedom are personal choice, voluntary exchange, freedom to enter markets and compete, and security of the person and privately-owned property. To construct a summary index, along with a Gender Legal Rights Adjustment to measure the extent to which women have the same level of economic freedom as men, 45 data points were used. Past literature suggests that those who live in jurisdictions with greater economic freedom experience higher levels of well-being, as measured by factors such as greater productivity, more rapid economic growth, higher income levels, less poverty, less corruption, and fewer conflicts.

Similar to HDI, the averages of each category were given and all other values were manually removed. Further, when selecting the data from the Fraser Institute, it had to be consistent across both time periods and the number of countries available to download. I also had to consider whether to use the overall Economic Freedom Index or focus on specific subcategories that might be more directly relevant to oil production and GDP growth. Because oil-rich countries often face unique institutional and policy challenges, different subcategories such as property rights, fiscal health, and regulatory efficiency can work for different countries depending on the situation.

There are a number of potential biases in this dataset. First, The Fraser Institute's Economic Freedom Index emphasizes market-oriented policies, so countries that follow less liberalized markets may score lower, even if their oil sector is relatively productive. In addition, since economic freedom is linked to other aspects of development, there is a potential for multicollinearity when using it alongside the interaction term of Human Development Index. A limitation in the Economic Freedom data is that it aggregates various subcomponents into a single score. This might obscure important details such as which specific aspects of economic freedom are most important for oil-rich economies.

METHODS

The data was processed using Excel and R programming language, and the regression analysis was also conducted using R. To answer the research question of whether oil production affects GDP growth and how HDI and Economic Freedom affect the return on this relation, a panel regression analysis with interaction terms was used. The purpose of this was to see how the oil supply and GDP growth could be influenced by varying levels of HDI and Economic Freedom. A panel regression was chosen because it analyzes the data across both timespan (1990-2022) and countries (22), as well as includes all four datasets. Using the "plm" package, the data was imported from excel and a panel regression was run. Further, the "stargazer" package was used for regression output formatting.

To test the factors that can alter the relationship between oil production and GDP growth, two separate models were run. The first model (1) included an interaction term between Oil Production with the Human Development Index, and the second model (2) between Oil Production with the Economic Freedom Index. The results were compared to observe the different effects that HDI and Economic Freedom have on the oil-GDP relationship. The interaction term in each model indicated whether higher levels of HDI or Economic Freedom better or worsen the economic returns from oil production. The regression models are seen below.

$$\log(\text{Real GDP}_{it}) = \alpha + \beta_1 \log(\text{Oil Production}_{it}) + \beta_2 \log(\text{HDI}_{it}) + \beta_3(\log(\text{Oil Production}_{it}) \times \log(\text{HDI}_{it})) + \epsilon_{it}$$

$$\log(\text{Real GDP}_{it}) = \alpha + \beta_1 \log(\text{Oil Production}_{it}) + \beta_2 \log(\text{EF}_{it}) + \beta_3(\log(\text{Oil Production}_{it}) \times \log(\text{EF}_{it})) + \epsilon_{it}$$

Equations 1-2. Regression equations measuring the natural logarithm of real GDP against various predictive inputs.

Here, *i* represents the country, *t* represents the year, Real GDP is the dependent variable, and Oil Production is the primary independent variable. In this case, HDI and EF are interaction terms (Human Development Index and Economic Freedom, respectively), and the coefficients represent both the individual and interaction effects of the variables.

RESULTS & ANALYSIS

The purpose of this section is to present and interpret the findings of the study based on the two models used, one for each interaction term. Before running the models and analyzing the results, a scatterplot of oil supply and GDP growth was created to visualize the correlation, as shown below.

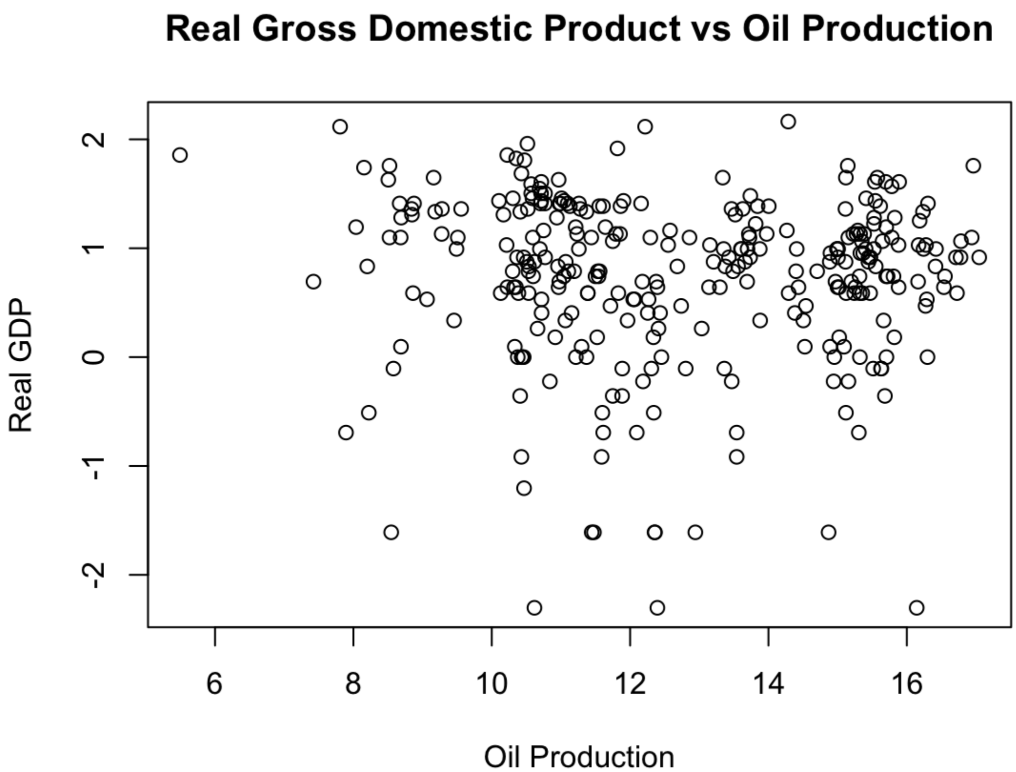

Figure 4. Scatter Plot of Real GDP vs. Oil Supply for Each Country (1990-2022)

Then, based on the data that was available and easily accessible, I ran each regression, and the results are broken up through tables and explanations in the following portion. The first model, as seen below, shows the output values for the regression of oil production on GDP, with Human Development Index as the factor.

Table 1:

	Dependent variable:
	log_Real_GDP
log_Oil_Production	0.055
	(0.112)
log_HDI	−5.319
	(7.867)
log_Oil_Production:log_HDI	0.243
	(0.575)
Observations	303
R^2	0.004
Adjusted R^2	−0.144
F Statistic	0.315 (df = 3; 263)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 1. Panel Regression Model Output Summary: log_Real_GDP against log_Oil_Production, log_HDI, and the interaction of log_Oil_Production and log_HDI

The top row represents the estimated coefficient value of the relationship between a country's oil supply and its gross domestic product. For each one percent increase in Oil Production, a country's GDP growth is expected to increase by 0.055 percent on average. Although the coefficient is small, it still suggests a positive relationship between the two variables. This supports the idea that having more oil creates a more successful economy. Below the estimate is its standard error, showing the potential variability in the relationship between oil supply and GDP growth as well as measuring the overall certainty about the estimate value. The standard of error is 0.112—because it is larger than the estimated value, this suggests that although the positive relationship between the variables may be true, there is a high amount of variability in the data.

The second row represents the relationship between a country's Human Development Index and their GDP growth. For each one percent increase in HDI, a country's GDP growth is expected to decrease by 5.319 on average. This is contradictory, as it is typically more logical for a country's economic success to increase if they have good health, education, and standard of living. The standard error of the estimated value is 7.867, implying that the estimate is very uncertain and the true relationship between HDI and GDP growth may differ from what the data presents. Even though the estimated value is uncertain, the negative correlation potentially makes sense from a theory perspective. This is because the extent to which HDI improves GDP growth also depends on the distribution of wealth and the quality of governance. In countries with high levels of income inequality, better health or education outcomes may not translate to rapid GDP growth. Past literature shows this phenomenon in cases of the resource curse, where countries with abundant natural resources experience high GDP growth but poor outcomes in terms of education, health, and income distribution. Additionally, while GDP measures the market value of goods and services produced in an economy, HDI captures the overall well-being of the population. This implies that GDP growth may not be the right variable to use, especially in large countries with low HDI values. This significant difference in amount could bias the effect to be negative.

The third row represents the effect of HDI on the effect of the return of oil on GDP growth. In other words, the effect of oil on GDP goes up or down for a country based on the value of their HDI. The estimated value is 0.243, meaning as the Human Development Index value increases, the return from oil on GDP growth also increases. Nevertheless, the standard error value, 0.575, is higher than the estimate, suggesting that there is a fair amount of uncertainty about the value. This fits the narrative about the negative relationship between HDI and GDP.

The R-squared value for this model explains the percentage of variation in Real GDP growth that is explained by the variation in oil supply and the Human Development Index. The value is 0.004, suggesting a lot of noise in the dataset and a relatively weaker correlation between the variables. The F Statistic value for this model explains the significance of the overall model using degrees of freedom. The F value is 0.315, suggesting that the data does not provide enough evidence to suggest that the two groups are meaningfully different from each other, and that they aren't very statistically significant. The degree of freedom of the model is 3, and the degree of freedom of the error is 263. The bottom of the table marks the p-values—how statistically significant each of the estimates are. Since there are no stars marked for any of the estimated values, this confirms that the model is not very strong or helpful in coming to a clear conclusion due to high variability or other factors in the data.

The second model, as seen below, shows the output values for the regression of oil production on GDP, this time with Economic Freedom as the factor.

Table 2:

	Dependent variable:
	log_Real_GDP
log_Oil_Production	2.603**
	(1.227)
log_EF	15.567*
	(7.941)
log_Oil_Production:log_EF	−1.232**
	(0.592)
Observations	303
R^2	0.018
Adjusted R^2	−0.128
F Statistic	1.603 (df = 3; 263)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 2. Panel Regression Model Output Summary: log_Real_GDP against log_Oil_Production, log_EF, and the interaction of log_Oil_Production and log_EF

For this model, the top row indicates that for each increase in one unit of Oil Production, a country's GDP growth is expected to increase by 2.603 on average. The coefficient is strong and positive, clearly showing that having a bigger supply of oil correlates to more economic growth. Additionally, the p-value of the estimate is shown as important, meaning it is statistically significant. The standard of error is 1.227, suggesting that there is a good amount of certainty in this relationship.

The second row shows that for each increase in one unit of Economic Freedom, a country's GDP growth is expected to decrease by 15.567 on average. From a theory perspective, this makes sense, as a country with more economic freedom in their market is likely to see more economic growth. The standard error of the estimated value is 7.941, implying that the estimate is slightly uncertain, but is still a relatively good measure of the relationship between economic freedom and GDP. The p-value for this estimate is also shown to be statistically significant.

The third row represents the effect of Economic Freedom on the effect of the return of oil on GDP growth. The estimated value is -1.232, meaning as a country's economic freedom increases, the return from oil on GDP decreases. This is contradictory, as economic freedom is generally associated with higher levels of economic growth. A possible explanation for this unexpected relationship is that countries with high economic freedom typically have more diversified economies. As a result, they are less dependent on oil as the primary driver of GDP growth. So, even if oil production increases, its relative contribution to GDP might be smaller. The standard error value of 0.592 suggests that there is a good amount of certainty about the value. This fits the narrative about the negative relationship between HDI and GDP. Similar to the other estimated values of this model, this value is also statistically significant based on its p-value.

The R-squared value for this model explains the percentage of variation in Real GDP growth that is explained by the variation in Economic Freedom. The value is 0.018, suggesting a good amount of noise in the dataset and a moderate correlation between the variables. The F Statistic value for this model is 1.603, suggesting that the model is doing more explaining than the error, and that the difference between the groups is unlikely to be due to chance alone. Similar to model 1, the degree of freedom of model 2 is 3, and the degree of freedom of the error is 263.

Across both models and all data in the panel regression, there are 303 total mutual observations. Because the sample size is relatively small, it explains the reason for the weak and moderate correlations in the data. More observations could reveal a clearer trend in the data. The final data that encompasses and compares both models with both interaction terms, side by side, is shown below.

Table 3:

	Dependent variable:	
	log_Real_GDP	
	(1)	(2)
log_Oil_Production	0.055	2.603**
	(0.112)	(1.227)
log_HDI	−5.319	
	(7.867)	
log_Oil_Production:log_HDI	0.243	
	(0.575)	
log_EF		15.567*
		(7.941)
log_Oil_Production:log_EF		−1.232**
		(0.592)
Observations	303	303
R^2	0.004	0.018
Adjusted R^2	−0.144	−0.128
F Statistic (df = 3; 263)	0.315	1.603
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 3. Panel Regression Model Output Summary: Various Individual and Interaction Terms

All in all, the results of the regression models above provide important insights into the relationship between oil production and GDP growth, as well as the role of Human Development Index (HDI) and Economic Freedom as interaction terms. The positive relationship between oil production and GDP is well-documented in the literature, particularly for resource-rich countries. This is consistent with the results of both models, although the effect is more pronounced in Model 2 (Table 2). The negative relationship between HDI and GDP growth is surprising, as most theoretical frameworks suggest that higher human development should lead to better economic outcomes. However, this result can be linked to the resource curse hypothesis, where countries with abundant natural resources often experience lower levels of institutional development, resulting in unequal distribution of wealth and poor governance. Past studies have shown that high oil production can drive GDP growth without necessarily improving human development outcomes.

The negative relationship between Economic Freedom and the return of oil on GDP contrasts with the idea that free-market economies tend to grow faster. This finding may indicate that countries with high economic freedom have more diversified economies, making them less dependent on oil as a driver of growth. This is consistent with literature suggesting that economic diversification reduces reliance on single sectors like oil.

POLITICAL AND SOCIAL OUTCOMES

The purpose of this section is to analyze the findings presented in this study and how they influence political and social dynamics in oil-dependent economies. By looking at examples of specific countries and both their failures and successes, we will be able to see key insights and recommendations that would help for the future.

One of the most pressing examples of the complex relationship between oil wealth and political stability is Venezuela. Despite possessing the world's largest oil reserves, the country is in the midst of a severe economic collapse, characterized by mass food shortages, hyperinflation, and institutional failure (Cato Institute). This reflects the resource curse theory, where high dependence on oil revenue undermines governance and leads to social stagnation and discontent. Venezuela's economic issues emphasize the critical role of institutional quality in determining whether oil wealth can create social development.

In contrast, countries with high levels of economic freedom, such as Australia, Canada, Chile, and Norway, demonstrate that it is possible to build a prosperous and innovative economy while still relying on income from natural resources. As seen in past literature as well as in the data set for these countries, they have successfully avoided the resource curse by implementing transparent governance, strong legal frameworks, and policies that promote economic diversification.

The case of falling oil prices since 2014 further highlights the vulnerability of economies that are overly reliant on oil. Many petrostates have experienced accelerated economic and institutional deterioration as oil prices have declined, leading to increased social unrest and weakening of political systems. This decline in oil revenues often leads to cuts in social spending, exacerbating inequality and social tensions.

Based on the analysis and previous research, there are several possibilities of key recommendations for policymakers in resource-rich economies. First, governments should implement policies to reduce reliance on oil and encourage growth in non-oil sectors such as manufacturing, technology, and services. This will reduce the vulnerability of their economies to oil price shocks and improve long-term economic stability. Second, institutional reforms such as anti-corruption policies, strengthening the rule of law, and promoting transparency in terms of oil revenues, should be implemented. Countries that have avoided the resource curse, like Norway, have robust institutions that ensure oil wealth benefits society as a whole. For example, the Government Pension Fund of Norway is a massive savings fund created by the Norwegian government. The fund invests this oil and gas revenue in stocks, bonds, and real estate all around the world, growing the savings over time. This prevents the economy from being too dependent on oil revenue, and it is a great example of a system that could be used across many resource-rich countries. Lastly, oil revenues should be invested into health, education, and social safety nets to ensure long-term political and social stability. By doing so, governments can improve HDI outcomes and reduce social inequality.

However, there are a few challenges and limitations when implementing these recommendations. In many oil-dependent economies, a variety of stakeholders want to maintain the status quo, as they benefit from the concentration of oil wealth. Further, countries facing social unrest or institutional collapse may not be able to implement these reforms without prioritizing stabilization efforts first.

Overall, the findings of this study suggest that the relationship between oil supply and GDP growth strongly connects to political and social factors. Countries that have strong institutions and promote economic freedom are better able to use their oil wealth for long-term development, while those with weak institutions are more likely to face stagnation and social unrest. Future research should focus on more about how governance and institutional quality influence the outcomes of oil-dependent economies. This could include comparing countries that have successfully diversified their economies versus those that remain trapped in the resource curse.

CONCLUSION

This study aimed to explore the relationship between oil production and economic success, focusing specifically on how factors Human Development Index and Economic Freedom impact this relationship. This research is significant because it is relevant to understanding the dynamics of resource-rich economies, particularly in the context of the resource curse theory, which says that an abundance of natural resources can lead to economic harms rather than benefits.

The analysis indicated a positive correlation between oil production and GDP growth, particularly when accounting for Economic Freedom, while the interaction with HDI presented a negative correlation. These results contribute to existing literature by highlighting the relation between natural resources, institutional quality, and economic outcomes, filling critical gaps in knowledge surrounding the resource curse and its implications for economic growth and social development.

The broader societal and economic impacts of these findings are significant. They suggest that while oil wealth can stimulate economic growth, the benefits may not be equitably distributed, potentially exacerbating income inequality and undermining social welfare. This proves the importance of institutional integrity and economic diversification in maximizing the benefits of natural resource wealth. Future research should aim to delve deeper into the governance structures that influence the outcomes of oil-dependent economies, particularly by comparing successful models of economic diversification with those that continue to struggle under the resource curse.

All together, this research paper advanced my understanding of how oil production affects economic growth and the vital role that human development and economic freedom play in shaping this. By addressing real-world economic challenges faced by resource-rich nations, this study offers a foundation for policymakers to develop strategies that promote sustainable economic development and improve social welfare.

REFERENCES

Committee, United States Joint Economic. “Oil Companies Are Enjoying Market Influence and Record Profits, While U.S. Families Foot the Bill for High Gas and Energy Prices.” *Oil Companies Are Enjoying Market Influence and Record Profits, While U.S. Families Foot the Bill for High Gas and Energy Prices - Oil Companies Are Enjoying Market Influence and Record Profits, While U.S. Families Foot the Bill for High Gas and Energy Prices - United States Joint Economic Committee*, 26 May 2022, www.jec.senate.gov/public/index.cfm/democrats/2022/5/oil-companies-are-enjoying-market-influence-and-record-profits-while-u-s-families-foot-the-bill-for-high-gas-and-energy-prices.

Fasano , Ugo, and Zubair Iqbal. “Mena -- GCC Countries: From Oil Dependence to Diversification, Ugo Fasano and Zubair Iqbal.” *International Monetary Fund*, 2003, www.imf.org/external/pubs/ft/med/2003/eng/fasano/.

Fraser Institute. “Economic Freedom.” *Fraser Institute*, 19 Sept. 2024, www.fraserinstitute.org/studies/economic-freedom.

Gerval, Adam, and James Hansen. “Sub-Saharan Africa’s Reliance on Oil Exports Leads to Decline in Agricultural Imports during Pandemic.” *USDA ERS - Sub-Saharan Africa’s Reliance on Oil Exports Leads to Decline in Agricultural Imports During Pandemic*, 26 Sept. 2022, www.ers.usda.gov/amber-waves/2022/september/sub-saharan-africa-s-reliance-on-oil-exports-leads-to-decline-in-agricultural-imports-during-pandemic/.

IEA. “Energy Statistics Data Browser – Data Tools.” *IEA*, 21 Dec. 2023, www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=UAE&fuel=Oil&indicator=OilProd.

IIMI, ATSUSHI. “Escaping from the Resource Curse.” *IMF Staff Papers*, 2007, www.imf.org/External/Pubs/FT/staffp/2007/04/pdfs/Iimi.pdf.

IMF Staff. “Economic Diversification in Oil-Exporting Arab Countries.” *Annual Meeting of Arab Ministers of Finance*, Apr. 2016, www.imf.org/external/np/pp/eng/2016/042916.pdf.

Kakanov, Evgeny, et al. “Resource Curse in Oil Exporting Countries.” *ECONOMICS DEPARTMENT WORKING PAPERS* , 8 Oct. 2018, one.oecd.org/document/ECO/WKP(2018)59/En/pdf.

Kaznacheev, Peter. “Curse or Blessing? How Institutions Determine Success in Resource-Rich Economies.” *Cato.Org*, 11 Jan. 2017, www.cato.org/policy-analysis/curse-or-blessing-how-institutions-determine-success-resource-rich-economies.

OECD. “Real GDP Forecast.” *OECD*, 2023, www.oecd.org/en/data/indicators/real-gdp-forecast.html?oecdcontrol-6d464da75a-var3=2015&oecdcontrol-6d464da75a-var5=A.

Savoia, Antonio, and Kunal Sen. “The Political Economy of the Resource Curse: A Development Perspective.” *Annual Review of Resource Economics*, Annual Reviews, 5 Oct. 2021, www.annualreviews.org/content/journals/10.1146/annurev-resource-100820-09261.

Shahbaz, Muhammad, et al. “Resource Curse Hypothesis and Role of Oil Prices in USA.” *Munich Personal RePEc Archive*, 6 Oct. 2019, mpra.ub.uni-muenchen.de/96633/.

Stevens, Paul, and Evelyn Dietsche. “Resource Curse: An Analysis of Causes, Experiences And ...” *Energy Policy*, 8 Nov. 2007, resourcegovernance.org/sites/default/files/Stevens & Dietsch - Resource Curse - Causes, Exp & Way Forward.pdf.

United Nations. “Documentation and Downloads.” *Human Development Reports*, 2021, hdr.undp.org/data-center/documentation-and-downloads.

United Nations. “Human Development Index.” *Human Development Reports*, 4 June 2024, hdr.undp.org/data-center/human-development-index#/indices/HDI.