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Assessing the Determinants of the Human Development Index in Oil-Dependent Nations

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Abstract

Numerous rentier states from around the world derive all or a fundamental portion of their national revenues from the rent of natural resources. These revenues are essential for the policy-making strategies pertaining to social welfare programs and for the funding of development projects within the country. In order to determine the effectiveness of rentier states in terms of development promotion, this paper will utilize the Human Development Index (HDI) as a proxy variable for development levels. Regression analysis indicates that a substantial proportion of the variation of the Human Development Index in oil-dependent economies can be explained by the adolescent fertility rate, the value added of different economic sectors, the effectiveness of governments in terms of policy formulation and implementation, and the levels of gender inequality.

Keywords

Human Development Index · Rentier state · Government Effectiveness Indicator · Adolescent fertility rate · Gender inequality

Cover Page Footnote

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1 Introduction

The Human Development Index (HDI) is considered one of the most relevant indicators by several international organizations in order to comprehend the development status of nations. It embraces and analyzes several variables in the areas of education, health, income, and standard of living, in order to fully develop a summary measure that includes all these elements and explains the well-being conditions of individuals within a country. The average HDI levels have risen constantly since 1990 – 22 percent globally and 51 percent in least developed countries.[1]

This indicator provides not only clear information about the development of nations, but also about government policy priorities.[2] Several countries differ on their rate of development progress, and this paper focuses on specific countries whose oil rents as a percentage of Gross Domestic Product (GDP) have reached at least a ten-percent value during one of the time periods of the study, which would be a total of three years (2012-2014). I will be evaluating this and other potential variables; ranging from economic to political and social determinants, that would be further explained in this paper.

By expanding the research from economic to political and social variables, it ensures the study is fully assessing the main differences in development among countries, without limiting the results of the study. For example, data regarding the political and social characteristics of oil-dependent countries, as well as their economic distinctions, are key in order to determine whether policy strategies are being effective in terms of improving the well-being of individuals.

All of these variables are also relevant to the study due to the political economy of these countries; that is characterized by using the rents provided by the export of this resource in order to execute policy. Since the profits coming from the oil industry dictate government spending, we should be able to observe different levels of development across countries depending on these political and social variables.

2 Sample

The sample used for this study consists of twenty oil-export countries whose GDP is highly influenced by oil rents (more than 10% of the GDP of each country in the sample accounts for oil rents – at least during one of the years of the time period of the study). All of the countries in the sample have state-owned oil companies.[3][4][5][6][7][8] I will observe these countries for a time period of three years

[1] United Nations Development Programme, "Human Development Index"
[2] United Nations Development Programme, "Human Development Reports"
[3] National Resource Governance Institute, "State-Owned Companies"
[4] TChad ANIE, "Chad Hydrocarbons Corporation (SHT)"
[5] Congo Petrole, "Société Nationale des Pétroles du Congo"
[6] Revolvy, "Société Nationale Petrolière Gabonaise"
[7] Timor Gap, "National Oil Company of Timor-Leste Government, TIMOR GAP"
[8] ADNOC, "Who Are We – Abu Dhabi National Oil Company"

(2012-2014).[9] This sample size adjusted for the years of this study, will provide me with exactly sixty observations.

The countries that will be observed in the study are: Algeria, Angola, Azerbaijan, Chad, Congo, Rep., Ecuador, Equatorial Guinea, Gabon, Iran, Islamic Rep., Iraq, Kazakhstan, Kuwait, Oman, Qatar, Russian Federation, Saudi Arabia, Timor-Leste, Turkmenistan, United Arab Emirates, and Venezuela, R.B.

3 Dependent Variable

3.1 Human Development Index (HDI)

For this study, my dependent variable would be the Human Development Index (HDI). This indicator was created to stress that economic growth alone is unable to explain the development progress of nations. This index proposes an alternative approach, using "people and their capabilities as the ultimate criteria" for measuring the development levels of nations.

The Human Development Index (HDI) is defined as a calculation based on the summary of three key dimensions in the study of human development: education, health and standard of living. The education dimension is evaluated based on the mean of years of schooling and the expected years of schooling for individuals. The health dimension is determined by the life expectancy at birth. Finally, the standard of living dimension is highly related to the economic standing of the country, since it is computed by measuring the gross national income per capita.[10]

In this study, I will utilize data obtained through the United Nations Development Programme official website, in order to respectively assign the values of the index to each of the oil-dependent countries in the study for the three-year period (2012-2014).[11] The index is characterized by some limitations: it is unable to account for inequality, poverty, human security, and empowerment. For the simplicity of the study, these measures will not be evaluated. The index will serve as a proxy for the development levels of nations, and it ranges from 0 to 1, where 0 is the lowest level of human development and 1 the highest. As of 2019, the country with the highest development levels in the HDI is Norway with an index of 0.953, while Niger ranks the lowest with an index of 0.354.[12] For the purpose of regressions, the variable will be rescaled by multiplying the index of each country by 1,000. This will cause the variable to be expressed in integers rather than decimals, making the coefficients simpler to interpret.

[9] World Bank, "World Development Indicators Database – Oil Rents (% of GDP) Most Recent Value"
[10] United Nations Development Programme, "Human Development Index (HDI)"
[11] United Nations Development Programme, "Human Development Data (1990-2017)"
[12] World Population Review, "Human Development Index (HDI) by Country 2019"

4 Independent Variables

4.1 Imports of Goods and Services (% of GDP)

Since this study will evaluate oil-dependent nations that have the characteristic of exporting large quantities of oil, I would expect imports to be at a relatively low percentage of GDP in nations with high levels of development. High imports as a percentage of GDP, however, does not necessarily imply that the economy is weak or less developed. Economic theory suggests that high imports may increase social welfare for citizens since they are able to consume a variety of foreign produced goods at lower prices. Research also reveals that growth is not necessarily constrained by imports, and it cites the example of the United States: where imports have been higher than exports since 1976.[13] The data for this variable is also obtained from the World Bank.[14]

As mentioned, I expect this variable to have a negative correlation with the Human Development Index. Though high imports may not necessarily have a negative impact on economic growth, the countries in the sample are oil-exporter nations, and their political economy is generally aligned with the views of the mercantilist school of economic thought: that advocates for trade surpluses and considers trade deficits and high imports as a negative factor in an economy.[15] I expect countries with high development levels to have low imports due to a developed national industry, meaning high levels of production that are able to satisfy at some extent their own local demand. According to an article from the Economic Policy Institute, high levels of production are highly correlated with a well-educated workforce and high levels of human capital.[16]

4.2 Oil Rents (% of GDP)

As previously mentioned, the countries in the sample for this study would be oil-dependent nations whose GDP is highly influenced by oil rents (by 10% or more of the total share of the GDP). The data from these countries is obtained through the World Bank Development Indicators, and the variable is estimated and built on foundations and approaches that are explained in the book published by the World Bank titled: "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium".[17] According to the methodology section of the data, the approximations of natural resources rents (in this study: oil rents) are calculated through a simple formula of production or extraction costs minus the price of the resource (the price of the commodity is obtained

[13] Federal Reserve Bank of St. Louis, "How Do Imports Affect GDP?"
[14] World Bank, "World Bank Development Indicators – Imports of Goods and Services (% of GDP)"
[15] Britannica, "Mercantilism – Economics"
[16] Economic Policy Institute, "A Well-Educated Workforce Is Key to State Prosperity"
[17] World Bank Group, "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium"

by estimating the world price). After the unit rents are computed, they are multiplied by the physical quantity that the country was able to extract through its production means, in order to determine their respective share of GDP.[18]

Having a high dependency on exports of one particular commodity may prompt cycles of 'boom and bust' in an economy.[19] The exposure and vulnerability to world price fluctuations is a key drawback for this type of economies. While high prices foster development and growth, low prices may seriously harm the society. The "resource curse" paradox emerges in this case as well – countries that have a vast reserve of natural resources, but cannot achieve high levels of growth and development such as those developed economies that do not have the same volume of resources.[20] I am uncertain about the effects of this variable in the HDI. Particularly because the industry sector in developed economies tends to account for less growth than the service industry, therefore, it could be expected that the HDI expects a greater service sector in the economy.

4.3 Services, Value Added (% of GDP) & Agriculture, Forestry and Fishing, Value Added (% of GDP)

These two variables represent the value added for the other two sectors of the economy (excluding the industry sector since it is highly correlated to the oil rents as a percent of GDP in the countries of the sample). I wanted to know the different effects that the other sectors of the economy have on the HDI. This data is gathered from the World Bank.[21][22] Data for the variable of Services (% of GDP) is not available for Turkmenistan.

I expect the service sector to positively affect the HDI, since this sector usually accounts for most of the economic growth of nations, and it also requires higher-skilled labor, which is highly beneficial for the development indicator.[23] On the other hand, I expect the agricultural sector to have a negative effect on development, since it requires low-skilled labor (does not require high education levels – it does not incentivize development) and it does not account for strong economic growth in several nations. Furthermore, the risks for individuals are higher in this sector of the economy: injuries and exposure to harmful pesticide.[24]

[18] World Bank Group, "Oil Rents (% of GDP) – Statistical Concept and Methodology"
[19] United Nations Development Programme, "Commodity Dependence and International Commodity Prices"
[20] Investopedia, "Resource Curse"
[21] World Bank Development Indicators, "Services, Value Added (% of GDP)"
[22] World Bank Development Indicators, "Agriculture, Forestry, and Fishing, Value Added (% of GDP)"
[23] Investopedia, "Service Sector"
[24] ScienceDirect, "Agricultural Sector"

4.4 Adolescent Fertility Rate (Births Per 1,000 Women Ages 15-19)

The data for this determinant is collected from the World Bank Development Indicators.[25] I would expect this variable to negatively affect the Human Development Index. This rate is defined as the number of births per 1,000 women ages 15 to 19, and it has been shown that early pregnancy would expose adolescent women to unnecessary risks reducing their likelihood of advancing in education, and limiting their opportunities for training and employment.[26]

4.5 Urban Population (% of Total Population)

The data for this variable is gathered from the World Bank, which cites the United Nations Population Division as the origin of the data.[27] I would argue that high urban populations face better standard of living conditions than rural populations. In terms of goods, urban populations tend to have access to a variety of high quality goods and services at low prices, while rural populations – due to high transaction costs – do not have access to these types of goods and services, and even if they do, the costs for them would be considerably higher. Education also seems to be an important factor, since the quality of education in rural areas is usually lower than the quality of education in urban areas. In terms of wages, the demand for high-skilled workers is greater in urban areas, as well as the wages for these employment opportunities, while in rural areas, low-skilled labor prevails, causing wages to be considerably lower.[28]

I expect this variable to positively affect the HDI. A higher proportion of a population living in urban areas would lead to more individuals with access to goods and services of better quality, in comparison to those that can be obtained in rural areas. I expect the difference in quality between urban and rural areas to be even wider in developing nations. Higher development levels can also be achieved by having higher wages, better education, and better-quality goods, and all of these positive elements are usually located in urban areas.

4.6 Government Effectiveness: Estimate – Worldwide Governance Indicators (WGI)

The Government Effectiveness Estimate is obtained through the Worldwide Governance Indicators (WGI) provided by the World Bank.[29] I decided to gather the estimates for this variable in order to find the effects of the role of governments in the promotion of development, and if their actions are key determinants for the Human Development Index. The variable captures the perceived quality of public services, civil service, policy formulation and implementation, as well as

[25] World Bank Development Indicators, "Adolescent Fertility Rate (Births per 1,000 Women Ages 15-19)"
[26] PRB, "Trends in Adolescent Fertility a Mixed Picture"
[27] World Bank, "Urban Population (% of Total Population)"
[28] Daily Yonder, "Explaining the Gap in Pay Between Rural and Urban Work"
[29] World Bank, "Worldwide Governance Indicators – DataBank"

the governments' degree of independence from political pressures. The estimates range from -2.5 and 2.5, where they indicate low and a high levels of government effectiveness respectively.[30]

I expect this indicator to positively affect the HDI. Governments with high levels of effectiveness in implementing policies would increase the quality of services for citizens, which will increase their standard of living and thus, development levels.

4.7 Gender Inequality Index (GII)

Adding this variable to the study will provide us with an additional societal factor to be evaluated in terms of development. I decided to account for this variable due to the lack of data for the Gini Coefficient in several countries of the sample. The Gender Inequality Index (GII) measures inequality in three pillars of human development: reproductive health, empowerment, and the proportion of parliamentary seats occupied by females. It is quantified by a value between 0 and 1, where 0 and 1 denote high gender equality and low gender equality respectively.[31] This index is essential to the study since it includes variables that are not evaluated in the composition of the HDI. Therefore, it is possible to ascertain if this index correlates with the HDI.

I expect this variable to be negatively correlated to the HDI (higher levels of gender inequality would lead to lower levels of development). Having greater gender equality leads societies to achieve higher levels of education and health, social and economic rights fulfillment, and even economic growth.[32]

5 Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum	Count
Human Development Index	715	117	391	855	60
Imports (% of GDP)	36.507	12.876	20.226	70.253	60
Services (% of GDP)	38.126	10.517	12.023	55.966	57*
Oil Rents (% of GDP)	28.042	13.274	8.933	61.071	60
Agriculture (% of GDP)	6.809	10.848	0.094	54.900	60
Urban Population (%)	67.388	19.556	22.100	100	60
Adolescent Fertility Rate	62.453	55.218	8.945	178.22	60
Government Effectiveness	-0.545	0.755	-1.606	1.436	60
Gender Inequality Index	0.402	0.132	0.210	0.616	45**

* Unavailable data for Turkmenistan.
** Unavailable data for Angola, Chad, Equatorial Guinea, Timor-Leste, and Turkmenistan.

[30] World Bank, "Government Effectiveness: Estimate"
[31] Human Development Reports, "Gender Inequality Index (GII)"
[32] Council on Foreign Relations, "Gender Equality Matters for Development Outcomes"

6 Correlation Matrix (Variables on Regression 1, 2 & 3)

Variables	Imp.	Serv.	Oil Rents	Agri.	Urban Ppl.	Adol. Fert.	Govt. Eff.	GII
Imp.	1							
Serv.	-0.69	1						
Oil Rents	0.34	-0.54	1					
Agri.	0.08	-0.06	-0.26	1				
Urban Ppl.	-0.40	0.32	0.28	-0.64	1			
Adol. Fert.	0.18	-0.25	-0.05	0.48	-0.44	1		
Govt. Eff.	-0.31	0.26	0.07	-0.40	0.62	-0.70	1	
GII	0.23	-0.44	0.10	0.28	-0.07	0.57	-0.42	1

Correlation Threshold: 0.75 (75%)
No multicollinearity among variables.

7 Regression Tables

Table 1: HDI (Dependent Variable)	Regression 1 (HDI)	Regression 2 (HDI)	Regression 3 (HDI)
Imports (% of GDP)		-15.232** (0.002)	-24.626*** (7.820E-05)
Services (% of GDP)	11.577* (0.035)		
Oil Rents (% of GDP)	-21.122*** (0.000)	-18.209*** (9.139E-05)	
Agriculture (% of GDP)	-26.469*** (3.454E-06)	-27.299*** (1.676E-06)	
Urban Population (%)	34.065*** (2.718E-06)	31.942*** (6.220E-06)	29.602*** (0.000)
Adolescent Fertility Rate	-61.048*** (5.526E-14)	-57.743*** (2.984E-15)	
Government Effectiveness	13.996* (0.030)	17.114** (0.005)	37.600*** (3.584E-06)
Gender Inequality Index (GII)			-18.459** (0.002)
Adjusted R Squared	0.949	0.946	0.796
Observations	57	60	45

Beta Coefficients
P-values in parenthesis
*p<0.05 **p<0.01 ***p<0.001

8 Interpretation for Regression Models

For this study, I decided to regress 1 independent variable for every 10 observations. The first model is the only exception, since it has 6 independent variables for 57 observations, and an adjusted R squared of almost 95%. The second model has 6 independent variables for 60 observations, and an adjusted R squared of almost 95% as well. Finally, the last model has 4 independent variables for 45 observations, with an adjusted R squared of almost 80%. The first and last model did not reach the desired number of observations due to the lack of data for certain countries, such as: Angola, Chad, Equatorial Guinea, Timor-Leste, and Turkmenistan.

8.1 Imports of Goods and Services (% of GDP)

The variable is statistically significant in the models 2 and 3 since the p-values equal 0.002 and 7.280E-05 respectively, which is <0.01. Therefore, the null hypothesis that states that there is no linear relation between the Human Development Index and the imports of goods and services as a percentage of GDP is rejected at 99% confidence interval. The coefficient then implies, that a 1 standard deviation increase in the imports of goods and services (% of GDP) would reduce the Human Development Index of the country by 15 points according to the first model, and roughly 25 points according to the third model. Though this result follows my initial prediction for this variable, economic theory does not suggest this should be true. Endogeneity may be present, or it is possible that the majority of the countries in the sample with low HDI levels also have very high imports, which causes the variable to be significant.

8.2 Services, Value Added (% of GDP)

The variable is statistically significant in the first model, and it is possible to reject the null hypothesis at 95% confidence interval (p-value=$0.035<0.05$). The coefficient suggests that a 1 standard deviation increase in the output of the service sector would increase the Human Development Index by roughly 12 points. I expected the variable to be significant, especially since a high amount of the economic growth of developed nations originates in the service sector.

8.3 Oil Rents (% of GDP)

The variable is statistically significant in models 1 and 2, and it is possible to reject the null hypothesis at 99% confidence interval since the p-value of model 1 (0.000) and the p-value of model 2 (9.139E-05) are less than 0.01. The coefficient implies that a 1 standard deviation increase in oil rents (as % of GDP) would decrease the HDI by nearly 21 points according to model 1, and by 18 points according to model 2. Initially I was uncertain about the significance of the variable. However, the models suggest that having a strong dependency

on oil rents will decrease the HDI. These results also follow the findings in the literature of trade economics, as stated earlier on the paper for the explanation of the variable.

8.4 Agriculture, Forestry, Fishing, Value Added (% of GDP)

The variable is statistically significant in models 1 and 2. The p-values of both models are less than 0.01, therefore, the null hypothesis is rejected at 99% confidence interval for both regressions. The coefficient suggests that a 1 standard deviation increase in the value added of agriculture, forestry, and fishing (as % of GDP), would decrease the HDI by 26 points and 27 points according to models 1 and 2 respectively. The coefficient of this variable follows my initial prediction that states that a larger agricultural sector in the economies of the sample would decrease their respective HDI values. The agricultural sector tends to account for the lowest growth in the GDP, as well as for a high relative demand for low-skilled and less educated workers. Taking all these factors into consideration, agriculture seems to not foster development in oil-dependent economies.

8.5 Urban Population (% of Total Population)

The variable is highly significant along all models, and I can reject the null hypothesis at 99% confidence interval (the p-value of each model$<$0.01). Therefore, we can infer that there is a positive linear relation between the urban population of a country and the HDI. The coefficient then implies that a 1 standard deviation increase in the urban population of a country would increase the Human Development Index by 34, 32, and roughly 30 points according to each of the models respectively. This follows the initial prediction for the effects of the variable, since urban populations tend to have access to a variety of higher quality goods and services at lower prices, in comparison to rural inhabitants. These factors contribute to development and raise the standard of living of individuals.

8.6 Adolescent Fertility Rate (Births per 1,000 Women Ages 15-19)

The variable is statically significant in models 1 and 2, and I can reject the null hypothesis at 99% confidence interval for both models (p-value of each model$<$0.01). The coefficient implies that a 1 standard deviation increase in the adolescent fertility rate would decrease the HDI by 61 and roughly 58 points according to models 1 and 2 respectively. The results follow my initial prediction and reflect on the development literature detailed earlier on the paper.

8.7 Government Effectiveness (Estimate)

The variable is highly significant in all the models. The null hypothesis can be rejected at 95% confidence interval in the first model, and 99% confidence interval

for models 2 and 3. The coefficient implies that a 1 standard deviation increase in the estimate of the government effectiveness indicator would increase the HDI by roughly 14 points (model 1), 17 points (model 2), and roughly 38 points (model 3). I expected high levels of government effectiveness to lead to higher levels of HDI, especially in oil-dependent nations. As mentioned in the introduction of the paper, the oil rents generated by the central governments of the countries in the sample are used for policymaking and development projects. Having high levels of government effectiveness signals effective resource allocation, that helps foster development in these nations.

8.8 Gender Inequality Index (GII)

The variable is statistically significant in the third model, and the null hypothesis that states that the Gender Inequality Index does not affect the HDI is rejected at 99% confidence interval. The coefficient then implies that a 1 standard deviation increase in the GII will decrease the HDI by 18 points. I expected the Gender Inequality Index to affect the Human Development Index in a negative manner, but not to the extent shown in the regression. This shows the absolute significance of maintaining levels of gender equality among societies, to promote not only development and well-being, but also the values of diversity and inclusion.

9 Conclusion

The three models have considerably high adjusted R^2 (95%, 95%, and 80% respectively), which indicates that the independent variables in all of the models explain the variation of the dependent variable (HDI) quite precisely, causing the coefficient estimates to have small margins of error around them.

It is important to emphasize that the variable of imports analyzed in model 2 does not follow the findings of economic theory, and its significance may be due to endogeneity or the fact that several countries in the sample that have low HDI levels also have high imports. In order to attempt to solve this limitation, the sample can be enlarged by including more countries, and regressing the variable once again to test for significance.

The results pertaining to the variables representing the sectors of the economy (agriculture, oil rents, and services) follow the findings of economic theory. The sectors of agriculture and industry are rejected by the models since increasing their levels of output (as a percentage of Gross Domestic Product) would not increase the Human Development Index. On the other hand, the service sector -due to its high contribution to economic growth and necessity for high skilled and educated labor- seems to be a strong determinant for development, and increasing its output level as a percentage of Gross Domestic Product would considerably increase the Human Development Index.

The Adolescent Fertility Rate proved to be the variable with the most significant impact. This effect is mainly due to the consequences of early pregnancy, since it exposes adolescent women to unnecessary risks reducing their opportunities in education, and therefore limiting their opportunities for future training and employment. When considering the repercussions, it is possible to notice how it negatively correlates with the Human Development Index. Reducing opportunities in education and limiting employment opportunities for adolescent women considerably affects the three main areas that compose the index: income, education, and health. Income would be considerably affected by lack of education, and health would also be influenced by the conglomeration of these consequences.

The Government Effectiveness Estimate also proved to be an important determinant in the study. I would argue that its significance is due to the importance for governments to maintain a transparent allocation of oil rents in essential development projects and initiatives, in order to ensure their effectiveness in terms of improving the standard of living of individuals, and avoid having a leakage of resources into the wrong hands. Perhaps the most surprising finding was the Gender Inequality Index (GII), that clearly shows how inequality levels should always be considered in the field of development economics, due to their high impact on the well-being of societies. Furthermore, regression analysis indicated that there is a positive linear relation between the percentage of inhabitants of oil-dependent economies living in urban areas and the Human Development Index.

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