

Citizen Wealth and Natural Resource Rents: A contribution to GDP per capita

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Abstract

The problem of production, growth and development of nations and their inhabitants has been a constant in economic thought, policy decisions and, in general, in the destiny of humanity; the appearance of related concepts such as the Dutch disease has taken center stage at different moments of contemporary realities. This is how it is chosen to investigate from natural resource rents the contribution to GDP per capita for two nations that are producers of this type of resources, Norway and Angola, which a priori could be opposed but with a high academic value at the moment of evaluating the linearity of these two variables for each case, in essence, the Pearson correlation between the register of indicators of the two variables is evaluated: “income obtained from the exploitation of natural resources and GDP per capita,” coupled with a Spearman correlation that allowed to evaluate the development of behavior in the HDI ranking, statistical tools that allowed to evaluate the assumptions of linearity and homoscedasticity, as a good behavior for Norway in clear opposition to the case of Angola that in a mandatory way redirects the attention on nations strongly dependent on raw materials and that opens a wide range of research opportunities in the framework of the SDG 2030.

Keywords: *Spearman correlation, Pearson correlation, HDI classification, linearity, homoscedasticity.*

INTRODUCTION

Economic thought and its lines of influence have historically mediated the discussion on economic growth, equality and the development of nations. Thus, among others, the discussion of natural resources in the modern era can be traced back to mercantilism, with precious metals, the physiocrats with the wealth coming from the earth (nature) and even in more modern positions involving the abundance of factors with which a nation is endowed and the intensity of their production. These conversations have thus involved elements that, although they are part of economic science, have been gaining certain popularity in public opinion, particularly in countries that receive income from this type of resources in terms such as the Dutch disease, a recurrent term in developing nations, mainly in Latin America when national income suffers from oil revenues, as is the case of Colombia.

It is not an isolated fact or typical of the economic and administrative sciences to make policy decisions for nations, which is why the impact of research and the contribution of academia in generating awareness in daily discussions that appropriate the citizens of the world in understanding the implications for the construction of their destiny, in the framework of methodological usefulness that puts in clear terms from methodologies that may appear as distant to the common humanity. This allows new researchers to adopt these matters in a methodical and replicable way for a new range of works in a convenient way for academia, society and governments. Libya has the most important reserves with 3892 million tons, followed by Nigeria with 3000 million tons and Algeria with 1236 million tons.

Angola, South of the equator, has significant offshore reserves, making it the fourth-largest oil reserve country. Angola's economy is heavily dependent on oil exports. As imports declined since 1995, Angola's trade structure has undergone some significant changes: the

share of imports from China grew by 12% between 1995 and 2019, while the share of France declined by 8.2%, Portugal by 9.6%, and the US by 10.8% (Lazanyuk and Mambu, 2022). When China invests in the African oil industry, it should prioritize Nigeria and Angola, followed by Algeria, Egypt, Libya, etc. Investment in these countries should also focus on the country's extreme indices, such as the increasing trend of civil violence and political confrontation in Africa in recent years (He et al., 2022). Resources such as oil and natural gas are the great resources that represent to the republic of Angola a significant income to combat the poverty that afflicts a large part of its population.

Some researchers attribute this to the lack of quality institutions and politics surrounding oil production (Graham et al., 2016). Norway is a Scandinavian country with a wealth of natural resources and large surpluses in its trade for more than twenty years, but like Angola, its wealth comes mainly from oil and natural gas found in the North Sea, making it one of the world's leading exporters. As a small economy considerably open to international trade, Norway has been producing oil and gas for over 50 years, exporting vast amounts of crude oil and is the third largest in the world Largest exporter of natural gas, supplying approximately 25 percent of the EU's gas demand (Honningdal Grytten and Arngrim Hunnes, 2021).

Since 2004, the Norwegian Government Pension Fund - Global has been subject to ethical guidelines. Since 1990, Norway has channeled its surplus from the oil sector into a fund (Nagell, 2011). Unlike other countries with natural resources such as oil or natural gas, Norway has had good management of natural resource revenues, diversifying its income by trying not to depend only on oil and natural gas revenues, achieving a high quality of life and welfare of its citizens. Taking Norway's lead in applying a fiscal policy focused on taxation

rules on its oil management, it is proposed that oil exporting countries will benefit significantly. The Norwegian fiscal system follows a prudent fiscal policy strategy and a savings and stabilization fund to manage the government's oil revenues (Ertimi et al., 2021). Energy-related companies, particularly oil companies, have dominated the Norwegian market in the last three decades (Kashif and Leirvik, 2022). Finally, and as it could not be different for a paper of this nature, it is necessary to consider the phenomenon of the Dutch Disease, a recurrent element in this type of discussion when defined as the boom of an economy in a commodity sector, draining resource movements from other sectors (e.g., industry), causing the exchange rate to appreciate via commodity exports negatively affecting the competitiveness of the national aggregate, once the boom via exploitation of these goods (natural resources) is over, this economy will go through a "hangover" of productivity and competitiveness. Thus, it is convenient to bring the analysis to the present, proposing hypotheses from the operationalization of variables that evaluate, either to revalidate or invalidate the findings of the proposed literature, effects that phenomena such as the pandemic revealed by showing new elements of judgment as was the case of the container crisis that even today continues to show its disastrous consequences particularly in Latin America and in its nations with greater dependence on international trade as shown by Romero Garibello et al. (2021 and 2022).

Methods

This article covers elements such as Pearson's correlation, Spearman's correlation and simple linear regression to determine whether there is a positive or negative correlation between the variables involved, particularly the rents obtained from the exploitation of natural resources and the GDP per capita of the nations involved. Linear Regression Model. To begin the proposal for the search of results, a simple

linear regression model is used on a straight line of the form.

$$\hat{Y} = \hat{a} + \hat{\beta}X = a + bX$$

The above is intended to provide a model involving natural resource income and GDP per capita, which is defined in the following section related to Model Assumptions. 1) There is a linear relationship between the income obtained from the exploitation of natural resources and the GDP per capita; 2) The variation of residuals is constant (homoscedasticity), considering Pearson's correlation coefficient as a valuable tool in the research since the correlation is calculated from the scores obtained in a sample on two variables. The scores collected on one variable are related to the scores obtained on the other, with the same participants or cases, and are given by the Pearson correlation coefficient formula.

Equation 1. Pearson's Correlation Coefficient Formula

$$r = \frac{n \cdot \sum x_i \cdot y_i - \sum x_i \cdot \sum y_i}{\sqrt{[n \cdot \sum x_i^2 - (\sum x_i)^2] \cdot [n \sum y_i^2 - (\sum y_i)^2]}}$$

Where

r = Pearson's coefficient

n= number of stock pairs

$\sum xy$ = sum of products of paired shares.

$\sum x$ = sum of the x scores.

$\sum y$ = sum of the scores y

$\sum x^2$ = sum of x-scores squared.

$\sum y^2$ = sum of the squared y-scores.

Level of measurement of the variables: intervals or ratio. Interpretation: Pearson's r coefficient can vary from +1.00 to -1.00, where:

+1.00 = Perfect positive correlation

+0.90 = Very strong positive correlation.

+0.75 = Significant positive correlation.

+0.50 = Average positive correlation.

+0.25 = Weak positive correlation.

+0.10 = Very weak positive correlation.

0.0 = No correlation between variables.

-0.10 = Very weak negative correlation.

-0.25 = Weak negative correlation.

-0.50 = Average negative correlation.

-0.75 = Significant negative correlation.

-0.90 = Very strong negative correlation.

-1.00 = perfect negative correlation.

Spearman's correlation can be helpful in this paper in order to complement the results of the linear regression and the correlation between variables by how much the Human Development Index HDI can be taken in a way that allows deepening the disaggregated

analysis of the discussion. For Hernández Sampieri (2014), Spearman's rho coefficients symbolized as r_s , and Kendall's tau, symbolized as t , are correlation measures for variables at an ordinal measurement level (both) so that individuals, cases or units of analysis of the sample can be ordered by ranks (hierarchies).

Equation 2. Linear association of ranks.

$$r_s = 1 - \frac{6 \sum d_i^2}{n^3 - n}$$

Source: Martínez Ortega, Rosa María, & Tuya Pendás, Leonel C., & Pérez Abreu, Alberto, & Cánovas, Ana María, & Martínez Ortega, Mercedes (2009).

Hernández Sampieri (2014) also states that in Spearman's correlation, both coefficients vary from -1.0 (perfect negative correlation) to +1.0 (perfect positive correlation), considering 0 as the absence of correlation between the hierarchical variables.

Table 1. Definition and Operationalization of Variables

Variable	Definition	Operationalization
GDP per capita (US\$ at current prices)	Average Gross Product per capita. It is calculated by dividing the total GDP by the number of inhabitants of the economy.	(US\$ at current prices): obtained from World Bank national accounts data and OECD national accounts data files. Ministry of Economy and Finance Peru, (2022)
Total natural resource revenues (% of GDP):	They are the sum of income from natural resources such as oil, natural gas, coal, minerals and forestry.	The percentage obtained from calculations based on sources and methods described in "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium".
Human Development Index HDI	Indicator created by the United Nations Development Program (UNDP) that emphasizes that people and their capabilities should be the ultimate criterion for evaluating a country's development, not just economic growth.	A summary measure of average achievement in key dimensions of human development: a long and healthy life, being well informed and having a decent standard of living. The HDI is the geometric mean of the normalized indices for each of the three dimensions. United Nations Development Programme (UNDP), (2023).

Results

A dynamic analysis implies the recognition of the variables and their relationship. In this way and based on the reflection that gave life to this article, the paper intends to discuss the existence of a relationship between the income from the production of natural resources and the wealth or welfare of its population, initially understood as the size of the economy of a nation and the participation of its inhabitants (GDP per capita). Paradigms or an inadvertent mercantilist vision could lead to considering that a country will benefit greatly from exploiting its natural resources, which would positively impact its citizens. Thus, it would be expected that precisely these nations lead in

indicators such as GDP per capita and the Human Development Index. Because of the preceding analysis, it would be of interest to look at nations that lead the indexes of natural resource production and, therefore, the income they generate to their national accounts, which is why Angola is taken as the fourth leading country in the percentage of income for GDP for the period 2020, being a member of the Organization of Petroleum Exporting Countries OPEC, information that is presented in the table: Per Capita GDP data are taken directly from World Bank, (2022). Therefore, the study evaluated if this behavior is recurrent in another nation that obtains rents from natural resources, such as Norway. Table 2 presents the data for the Nordic country.

Table 2. Norwegian GDP per capita and total natural resource revenues (% of GDP) Norway (2011-2020)

YEAR	GDP PER CAPITA ANGOLA	Total natural resource revenues (% of GDP) ANGOLA
2011	4,511.15	41.09317327
2012	4,962.55	36.28887798
2013	5,101.98	30.85046542
2014	5,059.08	23.75862606
2015	3,100.83	10.82928906
2016	1,709.52	10,89222027
2017	2,283.21	16,43678183
2018	2,487.50	27,53311928
2019	2,142.24	26,13835474
2020	1,603.99	25.51796283

Source: Data World Bank (2022)

The SPSS software was used to correlate the variables from the data collected. See table 3.

Table 3. Correlation GDP per capita Norway vs. Total natural resource revenues (% of GDP) Norway

		PIBPERCAPI TANORUEG A	RENTRECN ATPIBNOR UEGA
PIBPERCAPITA NORUEGA	Pearson correlation	1	.881**
	Sig. (bilateral)		,001
	N	10	10
	Pearson correlation	.881**	1

RENTRECNATP	Sig. (bilateral)	,001	
IBNORUEGA	N	10	10
**. Correlation is significant at the 0.01 level (bilateral).			

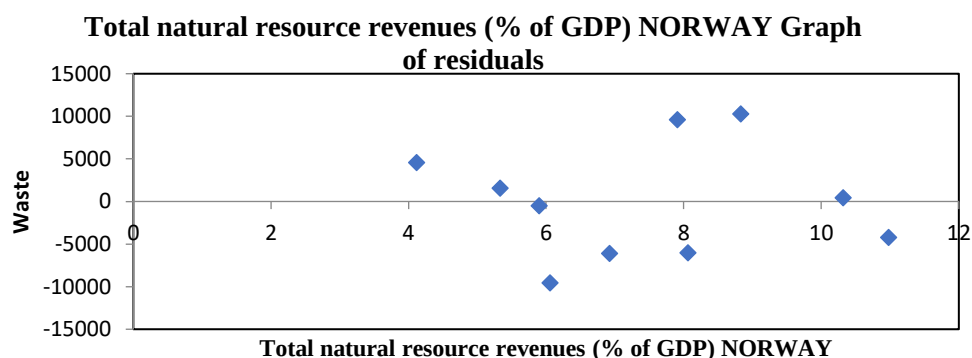
In contrast to Angola, Norway presents a high correlation level of 0.881 with a significance of 0.001, representing a considerable positive correlation that tends to be very strong. The

regression coefficient shows positive behavior between the variables, as well as the presence of the significance level:

Table 4. Linear Regression Model Results

Regression statistics					
Multiple correlation coefficient		0.88059593			
Coefficient of determination R ²		0.77544919			
R ² adjusted		0.74738034			
Standard error		7112.12977			
Remarks		10			
Degrees of freedom	Sum of squares	Mean squares	F	Critical value of F	
Regression	1	1397423525	1397423525	27.62668	0.00076812
Waste	8	404659118.4	50582389.8		
Total	9	1802082644			

Figure 1. Total natural resource rents (% of GDP) NORWAY Graph of residuals.



Once it is established that Norway does represent a positive relationship and a good behavior to the regression model, it can be considered that it is not a general rule that, for example, is not the case of Angola with a weak relationship between natural resource rents and GDP per capita, this finding inevitably leads to asking why a nation that ranks 61st in the ranking of natural resource rents has better conditions for its inhabitants than the country ranked fourth, Shouldn't the abundance of

natural resources and their intensity of production be a source of well-being for the inhabitants of a nation?

At this point in the paper, Spearman's correlation is used, which is more convenient when evaluating positions in rankings, as it was found in SPSS:

Table 5. Spearman correlation HDI Norway vs HDI Angola 2011-2020

			IDHRANKN OR	IDHRANK ANGOL
Spearman's Rho	IDHRANKNOR	Correlation coefficient	1,000	-,356
		Sig. (bilateral)	.	,313
		N	10	10
	IDHRANKAN GOL	Correlation coefficient	-,356	1,000
		Sig. (bilateral)	,313	.
		N	10	10

In effect, and corroborating what was previously exposed by the Pearson correlation and the linear regression model, a negative correlation of -0.356 without significance is observed, which leads to considering that we are observing a phenomenon of variables that present opposite behavior, with a very positive record for Norway, which is the nation that habitually leads this ranking in a very high level of human development compared to Angola, a nation that frequently occupies a low average level in the measurement.

Conclusion

From the initial approach, a welfare analysis was proposed, that is, the search for a relationship between income from the exploitation of natural resources and the GDP per capita of two nations, two countries that may appear diametrically opposed at first glance, but which share the production of natural resources. This is how Angola was proposed as one of the main producers of oil and some other primary resources, in an exercise that does not intend to involve (for now) elements such as added value, innovation, substitution and industrialization, among others that would be convenient to approach initially and that could easily constitute a new discussion. This is why in this opportunity, it is of greater interest for the research team to descend to a factor income level, a long-standing debate such as the Dutch disease and its effect on nations, a conversation in which employing a linear regression model, it was intended to evaluate precisely the existence of

linearity between natural resource rents as a % of GDP and GDP per capita as an element of contribution to the life of its citizens.

However, this situation requires a broader analysis, which is why Pearson's correlation was applied to evaluate the data corresponding to 10 years (2011-2020) available at the World Bank as a source of information, finding the disparities, which common sense would have relentlessly pointed out for the diversity of living standards between these two countries, with Norway that from its resources contributes to the GDP per capita in a direct correlation.

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