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The Effects of Oil and Non-Oil Export Revenue on Income Inequality in Angola

Belizário João Abílio[1]

[1]belizariojoaoabilio@hotmail.com/belizario@ucan.edu (+244937275473)

[1]Catholic University of Angola, Luanda City, Angola

ABSTRACT

This study examines the impact of oil and non-oil export revenue on income inequality in Angola from 1995 to 2023, aiming to contribute to the existing discourse surrounding the empirical effects of these revenue streams on income disparity within the Angolan context. Our contribution is twofold. First, there is a notable scarcity of empirical studies addressing this issue within the Angolan economy; the prevailing literature often relies on aggregated or grouped data. Second, this research pioneers the application of the Palma Ratio as a metric to assess the relationship between natural resource revenues and income inequality in Angola. To ensure the reliability and validity of our econometric analysis, we conducted rigorous pre- and post-estimation tests. This research employs a quantitative correlational design to ascertain the existence and nature of the relationship between revenues from oil and non-oil exports and income inequality in Angola. A comprehensive statistical and econometric analysis was performed utilizing data from national sources, including the National Bank of Angola, and international databases, such as the World Bank. Employing the Ordinary Least Squares (OLS) method, our findings reveal that oil export revenues significantly exacerbate the income inequality gap between the wealthiest and the poorest segments of the population. In contrast, non-oil export revenues are found to mitigate this disparity. Based on the empirical evidence presented, this study advocates for the allocation of a portion of oil revenues towards social programs, particularly in health care and education subsidies, to promote a more equitable income distribution and enhance social welfare in Angola.

Keywords: Angola, Income Inequality, Oil Export, Non-Oil Export, Palma Ratio

I. INTRODUCTION

In 2023, there were 26 oil-exporting countries[1] in the world, distributed across Africa, the Americas, Europe, and Asia (Workman, 2024). As demonstrated in Figure 1, over 76.9 percent of the oil-exporting nations are categorized as developing countries. These countries typically exhibit below-average standards of living, income levels, and economic and industrial development. Such disparities are often linked to structural economic limitations, underinvestment in infrastructure and technology, and reliance on a limited range of export commodities, which hinders broader socio-economic progress. In other words, oil-exporting developing countries face significant income inequality challenges compared to oil-exporting developed countries.

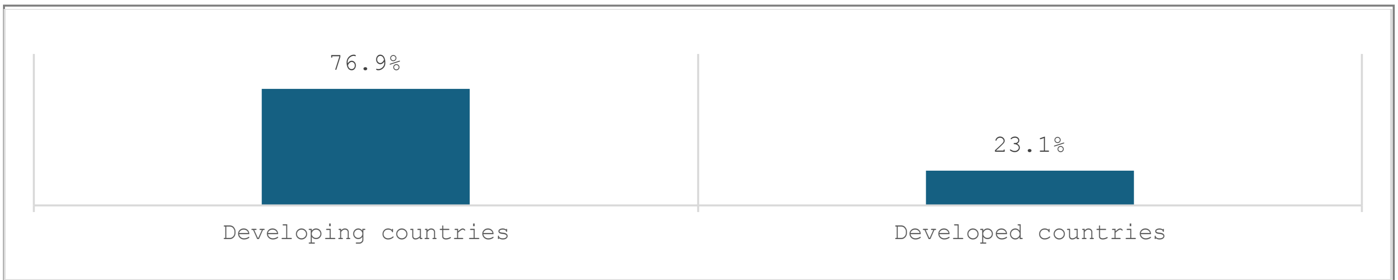

Figure 1
Share of Oil exporting Countries Classified as Developed and Developing (in 2023)
Source: *Workman* (2024) and *Authors' Own Elaboration.*

Angola is one of the world's top 15 oil exporting countries and the second largest producer in Sub-Saharan Africa. As shown in Figure 2, between 2014 and 2023, Angolan oil revenues accounted for an average of 26.76

[1]Algeria, Angola, Australia, Azerbaijan, Brazil, Canada, Colombia, Ecuador, Egypt, Iraq, Kazakhstan, Kuwait, Libya, Mexico, Netherlands, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, United Arab Emirates, United Kingdom, United States, Venezuela, Vietnam. Many of these countries also import oil, and some import more oil than they export, this is known as an oil export deficit.

percent of the country's Gross Domestic Product (GDP) and 94.7 percent of its total exports, with the remaining percentage representing non-oil exports (Banco Nacional de Angola [BNA], 2024; Calengi et al., 2024).

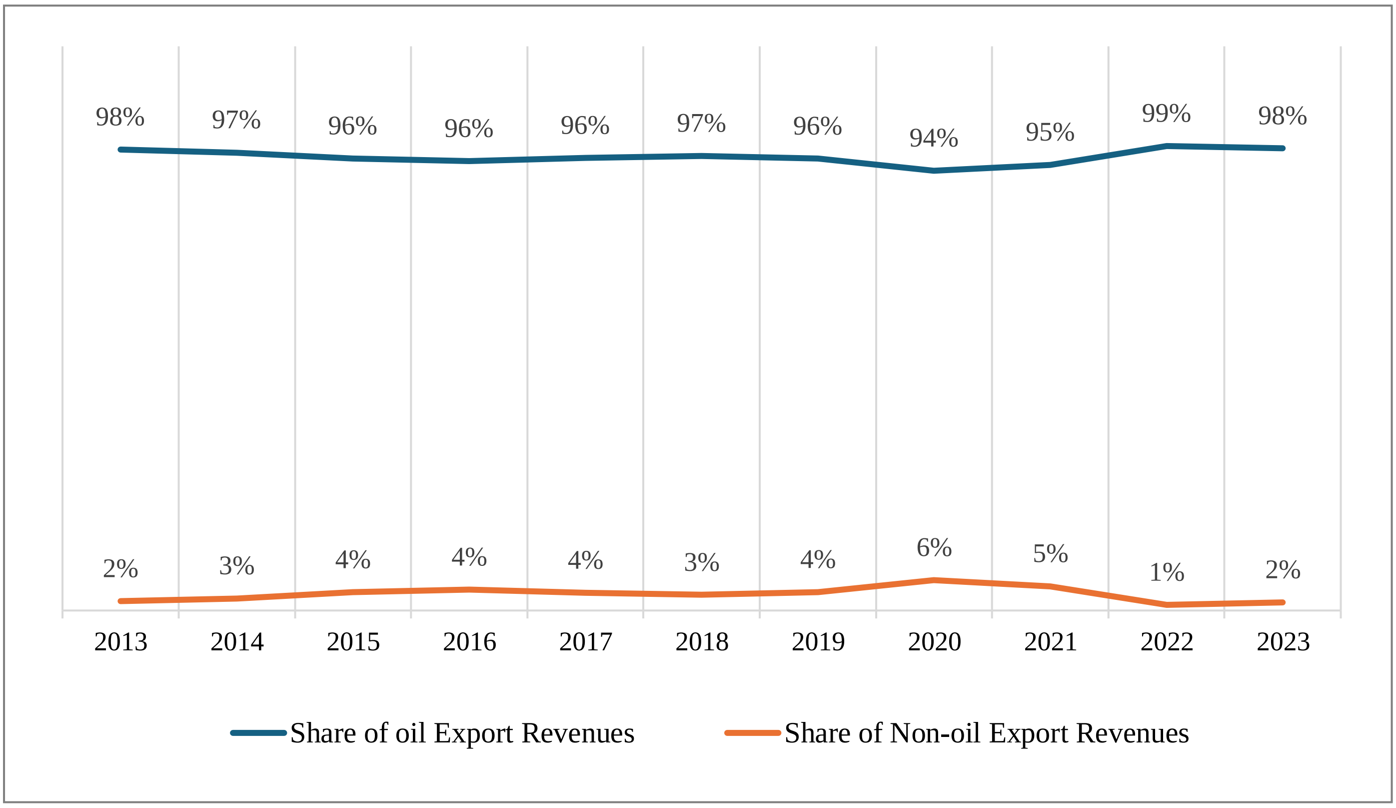

Figure 2
Share of Angola's Oil and Non-Oil Export Revenues, 2013 to 2023
Source: *BNA* (2024) and *Authors' Own Elaboration*.

Between 1990 and 2022, Angola had an average Gini index value of 66.91 percent, indicating that the income gap between the rich and the poor was substantial during this period (World Bank, 2024). The widening gap between the wealthiest and the poorest is a primary driver of inequality and may impact development indicators over time (Dabla-Norris et al., 2015). These statistics are typical in many oil-rich developing countries, suggesting that oil revenue has not sufficiently contributed to improving the living conditions of the poor in these nations, including Angola.

1.2 Research objectives and contribution

The primary objectives of this study are as follows:

i. To assess the impact of oil export revenues on income inequality in Angola;
ii. To evaluate the influence of non-oil export revenues on income inequality in Angola.

II. LITERATURE REVIEW

2.1 Introduction

This study examines how oil and non-oil export revenues affect income inequality between the richest and poorest in Angola. The literature on the impact of revenues on inequality is generally associated with the Heckscher-Ohlin (H-O) natural resource endowment model. The H-O model suggests that income will be transferred from owners of scarce goods to owners of abundant goods in the country (Krugman et al., 2015). A common view in this literature is that natural resources tend to increase inequality. For example, Leamer et al. (1999) argue that since human resource development does not require much human capital, those working in the human resource sector are not yet ready to develop human resources. As a result, these economies are likely to experience greater income inequality than less financed economies in the long run. It has been recognized that capital-exporting countries are more likely to experience greater income inequality than non-capital-exporting countries (Ndikumana & Boyce, 2012).

2.2 Empirical Review

Empirical literature reveals that previous studies on this topic have been analysed in various ways, either in terms of natural resources and inequality, export and income inequality, or oil exports and income inequality. Avom et al. (2022) found that the effect of natural resource rents on income inequality varies by resource type: coal rents increase inequality, while forestry and oil rents reduce it (Davis, 2020; Husaini et al., 2024; Bourguignon & Morrisson, 1990). Howie and Atakhanova (2014) investigated the impact of a major resource boom on income inequality in Kazakhstan's regions and found that oil had a positive but non-significant effect on income inequality.

Many studies have analysed the impact of exports on income inequality in developing countries. Hazama (2017) demonstrated that the export/GDP ratio has a negative impact on income inequality in low-income countries but does not have a significant impact on high-income countries. Prechel (1985) supported the hypothesis that exports increase income inequality, and covariant analysis indicated that the impact of exports on inequality is more significant in underdeveloped countries than in developed ones (Meshi & Vivarelli, 2009; Wang et al., 2020).

Previous studies on the impact of oil exports on income inequality have found mixed evidence. Using data from 40 developing countries, Mallaye et al. (2015) found an inverse, U-shaped, relationship between oil rents and inequality. Specifically, oil rent reduces inequality in the short run, but inequality increases over time as oil revenues increase (Lin & Fu, 2016; Ahmadi & Farahati, 2023; Parcero & Papyrakis, 2016; Tchitchoua et al., 2023). In a similar vein, Nademi (2017) found an inverse, U-shaped, relationship between oil revenues/GDP and inequality in Iran.

Other studies, such as those by Njangang et al. (2022), indicate that oil rents unconditionally increase inequality (Kakain & Ewubare, 2022). Much of the evidence from the literature devoted to this topic points that income inequality has a positive and statistically significant reaction to oil export rents (Farzanegan & Krieger, 2019; Berisha et al., 2021) and that natural resources may be more of a curse than a blessing for oil-exporting countries (Corden & Neary, 1982; Dizaji, 2016).

Kim et al. (2020) used dynamic panel co-integration techniques to account for cross-country heterogeneity and found that oil abundance triggers a negative long-run equilibrium relationship with income inequality (Howie & Atakhanova, 2014; Kim & Lin, 2018). Conversely, some studies showed that oil exports do not lead to higher gross or net income inequality (Goderis & Malone, 2011).

The literature review indicates that empirical studies on the relationship between oil exports and income inequality are limited. In Angola, the discussion on the linkage between oil and non-oil export revenue and income inequality is an emerging topic with few empirical studies. Özcan and Cazeiro (2021) examined the impact of trade flows on income inequality in Angola, finding that exports have a negative effect on the Gini coefficient. Most empirical works including Angola are aggregated-oriented research, which may obscure regional variations. Each country or grouping has unique structural characteristics, and generalized studies may not apply to specific regions. Therefore, more localized empirical analysis is needed.

To our knowledge, no prior research has employed the Palma Ratio.[2] To study the relationship between international trade variables and income inequality in Angola. Previous studies have used either the Gini index or the Atkinson (1975) index of income inequality. This paper contributes to the literature by using the Palma Ratio to focus on the distribution of income between the richest and poorest in Angola. So far, the Gini coefficient has dominated the landscape of inequality indicators. A complete distribution, whether of inequality or anything else, cannot be captured by a single measure. As Tony Atkinson observed in the 1970s, any single measure inevitably reflects a normative view about which aspects of the distribution are considered more important (Atkinson, 1975). Many critical voices have emerged, arguing that the Gini coefficient cannot answer the question, 'What happens to the richest and the poorest people?' (Piketty, 2015). Over time, other measures of inequality have been developed to challenge the Gini index's dominance. This paper adopts the Palma ratio of inequality to represent income inequality. This measure has gained prominence as research increasingly focuses on the widening disparity between the richest and poorest segments of society.

[2] The ratio is named after José Gabriel Palma, who showed that the income share of the middle and upper-middle groups (deciles 5 to 9) generally remains consistent at around 50 percent of the total income. Consequently, the significant global income disparities are primarily due to the differences within the other 50 percent of the population—the top 10 percent and the bottom 40 percent. Hence, Palma suggests using the ratio of the income share of the top 10 percent compared to the bottom 40 percent as a more relevant and transparent measure of inequality than the Gini coefficient (University of Cambridge, 2023).

III. METHODOLOGY

3.1 Study Area

The present research is a quantitative correlational study that centred on the intersection of economics and development studies, particularly in the fields of natural resource economics and income inequality. Specifically, this study examines the relationship between export revenues—from both oil and non-oil sectors—and income inequality within the context of Angola, a resource-rich developing nation.

3.2 Research Design

This research employs a quantitative correlational design to determine whether a relationship exists between revenues from oil and non-oil exports and income inequality within Angola. To assess the strength and direction of this relationship, a comprehensive statistical and econometric analysis has been conducted, employing data obtained from national sources, such as the National Bank of Angola, as well as international databases, including the World Bank. These methods provide a robust framework for exploring the interplay between export revenues and income inequality, contributing valuable insights to the broader discourse on economics and wealth distribution in resource-dependent economies.

3.3 Target Population

The target population for this research consists of individuals and households within Angola who are affected by income inequality, particularly those engaged in various economic sectors, including both oil and non-oil industries. This population includes:

- Oil Sector Workers: Individuals employed in the oil industry, ranging from skilled labourers to management and administrative staff, who are directly impacted by oil revenues.
- Non-Oil Sector Workers: Individuals employed in sectors such as agriculture, manufacturing, and services, whose income levels may be influenced by fluctuations in oil revenues and broader economic policies.

3.4 Sample Size and Sampling Procedure

The sample size for this research was determined based on the target population of individuals and households in Angola affected by income inequality, specifically in the context of oil and non-oil export revenues from 1990 to 2023, encompassing 33 years. A random sampling and data collection approach has been employed to ensure that the sample accurately reflects the diverse characteristics of the target population. This methodology is essential for capturing the variations within the population and enhancing the reliability of the study's findings.

3.5 Data Collection Instruments and Procedures

A comprehensive dataset of secondary information covering the period from 1990 to 2023 has been systematically compiled from publicly accessible national and international databases. The selected data sources and their respective variables are as follows:

- National Bank of Angola: Source of detailed data on oil and non-oil export revenues (BNA, 2023).
- United Nations Conference on Trade and Development (UNCTAD): Provided data on Foreign Direct Investment (FDI) (UNCTAD, 2024).
- World Bank: Source of human capital metrics.
- Our World in Data: Provided Palma Ratio data, offering insights into income inequality trends.

This collection of secondary data facilitates a robust analysis of the relationship between export revenues and income inequality, allowing for the use of well-established, cross-validated data to support empirical rigour in the study's findings. All data used in this research are available in Appendix 1.

3.6 Reliability and Validity

To ensure a robust model, it should pass certain pre-estimation and post-estimation tests. The data for the variables are non-stationary at the level (results presented in Appendix 2) but stationary at the first difference (results presented in Appendix 3), as indicated by the Augmented Dickey-Fuller (ADF) test statistics. The ADF test statistics show that the value is smaller than the 5 percent critical value at the level but greater than 5 percent at the first difference. According to selection-order criteria, the optimal lag selection is 1 (results presented in Appendix 4).

Setting the null hypothesis as there being cointegration and the alternative hypothesis as there is no cointegration, Johansen cointegration tests indicated one cointegrating equation, as the trace-statistic value (13.67) is less than the critical value (15.41) at the 5 percent significance level (results presented in Appendix 5). Thus, it can be confidently inferred that there is a long-run relationship between income inequality and the explanatory variables (oil and non-oil exports) in Angola during the period under analysis. There is no problem of serial correlation in the present study, as indicated by both the Durbin-Watson d-statistic value (2.61) and the Breusch-Godfrey LM test for autocorrelation (P-value: 0.1252) (full results are presented in Appendix 6).

White's test for homoscedasticity indicates that the model is free from heteroscedasticity, with a P-value of 0.199, which is greater than 5 percent, thus unable to reject the null hypothesis. This result is consistent with the normality test (full results are presented in Appendix 7), where the Kernel density estimate shows that residuals are normally distributed without the presence of heteroscedasticity in the model (full results are presented in Appendix 8). This suggests an efficient and stable regression model that could be useful for further predictions.

The specified model falls within the 5 percent significance level, as shown by the cumulative sum of recursive residuals (CUSUM) presented in Appendix 9. The Ramsey test for the accuracy of the specified model indicates that the model specification is error-free (results in Appendix 10). Based on these findings, it is reasonable to infer that the model is reliable and suitable for policy formulation.

3.7 Data Processing and Analysis

Based on the literature review and the research objective, the functional form of the model examining the effects of oil and non-oil export revenue on income inequality and other controlled variables in Angola is specified as follows:

$$\textbf{Inequality} = \textbf{f}(\textbf{oil exports}, \textbf{non} - \textbf{oil exports}, \textbf{controlled variables})$$

The dependent variable, Inequality, is represented by the Palma Ratio, an alternative to the Gini index that focuses on the income distribution between the wealthiest and the poorest. This measure is more suited to examining the disparities between the top 10 percent and the bottom 40 percent of the population (Roser, 2021). Higher values indicate a more unequal distribution of income between the richest and poorest. For example, a Palma ratio of 2 means that the top 10 percent of the richest individuals receive 2 times the income of the bottom 40 percent poorest individuals. In contrast to the Gini coefficient, the Palma ratio measures changes in income distribution that affect either the lowest earners or the highest earners and thus relates better to the common understanding of inequality.

Oil and non-oil exports, the independent variables, are the interest variables of this research. Oil exports are the total value of Angola's oil export revenues (in USD), and Non-oil exports are the total value of Angola's non-oil export revenues (in USD). As shown by the empirical literature review, these two variables have been used in numerous studies to measure trade and to examine the impact of trade on income inequality.

The controlled variables in the model include logFDI and logHuman_capital. The variable logFDI measures foreign direct investment (in USD) made by a resident enterprise in Angola (direct investor or parent enterprise) to establish a lasting interest in an enterprise that is resident in another economy (direct investment enterprise or foreign affiliate) (UNCTAD, 2024). Data for this variable is available in the Data Centre of the United Nations Conference on Trade and Development. The variable logHuman capital represents a human capital index that calculates the contributions of health and education to worker productivity. This index scores range from zero to one and measures the productivity of a child born today as a future worker, relative to a benchmark of full health and complete education (World Bank, 2024).

The empirical model is specified as follows:

$$\textbf{log}(\textbf{Inequality}) = \boldsymbol{\beta_0}\textbf{log}(\textbf{Oil\_exports}) + \boldsymbol{\beta_1}\textbf{log}(\textbf{Nonoil\_Exports}) + \boldsymbol{\beta_3}\textbf{logControlled Variables} + \mu$$

Where:

The β coefficients (parameters) indicate the effects of changes in the explanatory variables on the dependent variable. The estimated β coefficients are generated using the Ordinary Least Squares (OLS) regression option in the STATA software. A negative coefficient indicates that an increase in the explanatory variable has a decreasing effect on the dependent variable, while a positive coefficient indicates that an increase in the explanatory variable has an increasing effect on the dependent variable.

IV. FINDINGS & DISCUSSION

4.1 Response Rate

Table 1
Empirical Model Results

Dependent Variable: Loginequality			
Variables	Coefficient	t-Statistic	Probability
logoil_export	1.42	2.28	0.04*
lognonoil_export	-1.87	-2.53	0.02*
Controlled Variables			
logInFDI	.88	2.45	0.03*
loghuman_capital	-21.56	-0.05	0.96
cons	-23.33	-0.05	0.96
R^2	0.37		

Source: Estimation using STATA 14.0.

The aim of this paper is to examine the effects of oil and non-oil exports on income inequality. Using OLS regression to analyse the time-series data on the relationships between the dependent variable (income inequality) and the independent variables (oil and non-oil exports), we obtain the econometric model outcomes presented in Table 1(full results are presented in Appendix 11).

The R-squared value suggests that 37 percent of the variation in income inequality is explained by the variation in oil and non-oil export revenues. Estimation results indicate that the effects of oil and non-oil exports on income inequality are statistically significant in explaining the variation in income inequality in Angola during the period under consideration. The result for oil export revenue shows a p-value of 0.039, which is below the 5 percent significance level. Its positive sign indicates that an increase in oil export revenue has led to increased income inequality in Angola from 1990 to 2023. The coefficient of 1.42 suggests that a 1 percent increase in oil exports corresponds to a 1.42 percent increase in income inequality during the analysed period. This finding aligns with evidence that non-oil trade rents concentration negatively and significantly affects income inequality, implying that export concentration contributes significantly to income inequality in the country (Gordón et al., 2021; Aigheyisi, 2023; Berisha et al., 2020; Alexeev & Zakharov, 2022).

The result for non-oil export revenue shows a p-value of 0.024, which is also below the 5 percent significance level. Its negative sign indicates that an increase in non-oil export revenue has led to decreased income inequality in Angola from 1990 to 2023. The coefficient of -1.87 suggests that a 1 percent increase in non-oil exports corresponds to a 1.87 percent decrease in income inequality during the period under consideration. These results corroborate evidence from Edore & Aigheyisi (2020), which showed that non-oil exports negatively affect income inequality, with significant effects at the 1 percent level, indicating that an increase in non-oil exports reduces income inequality in Nigeria. The results for controlled variables are consistent with findings from prior studies.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusions

This paper investigated the effects of oil and non-oil export revenue on income inequality in Angola, using data from 1995 to 2023. The analysis found that oil revenues exacerbate income inequality, while non-oil revenues have a mitigating effect.

From the available data on employment by sector in Angola, we observe that from 2011 to 2022, the average proportion of workers engaged in producing goods or providing services is 46 percent of the total. During the same period, 46 percent of the workforce was employed in agriculture, animal production, hunting, forestry, and fishing. The remaining 8 percent of workers were employed in the industry, construction, energy, and water sectors (World Bank, 2024; Calengi et al., 2023). In terms of monthly wages, the oil industry leads with earnings that are 500 times higher than those in the non-oil industry and other economic sectors. This disparity may help explain the increasing effects of oil export revenue on income inequality observed in this paper, as the proportion of the Angolan labour force employed in the oil sector is quite small compared to those in non-oil sectors. An increase in the labour force dedicated to the non-oil sector, particularly with increased exports, has been associated with a decrease in income inequality.

These statistics reinforces the observed effects of oil export revenue on income inequality, given that the share of the Angolan labour force employed in the oil sector is relatively small compared to any non-oil sector. A larger labour force in the non-oil sector, with increased exports, tends to decrease income inequality.

5.2 Recommendations

To address these disparities, it is recommended that Angola implement policies to effectively channel oil revenues into social welfare programs and promote non-oil sectors to achieve more balanced economic development. Specifically, oil revenues should be used to support social programs, including health insurance and education subsidies. Here's how these subsidies can contribute to reducing income disparities.

Health Insurance Subsidies can reduce income disparities by:

Reducing Financial Burden of Healthcare: Health insurance subsidies alleviate the financial strain of medical expenses. Without insurance, individuals facing illness or injury may incur significant out-of-pocket costs, which can exacerbate financial instability, especially for low-income families. By covering these costs, health insurance helps prevent financial hardship and reduces the likelihood of falling into poverty due to medical bills.

Improves Access to Medical Care: With insurance, individuals are more likely to access preventive care, early diagnosis, and treatment. Regular medical care helps prevent serious health issues that could lead to loss of income or employment. Improved health outcomes support sustained employment and productivity, which is crucial for economic stability.

Promotes Health Equity: Health insurance can help reduce disparities in health outcomes between different socio-economic groups. By ensuring that everyone has access to necessary medical services, insurance helps level the playing field, reducing the gap in health outcomes and associated economic impacts.

Education Subsidies can reduce income disparities by:

Education subsidies, such as grants, scholarships, and subsidized loans, lower the financial barriers to obtaining higher education. By reducing or eliminating tuition costs, these subsidies make it easier for individuals from low-income backgrounds to pursue and complete higher education.

Increases Educational Attainment: By making education more affordable, subsidies encourage higher enrolment and completion rates, particularly among disadvantaged groups. Higher educational attainment is strongly correlated with increased earning potential, helping to reduce income inequality by enabling individuals to access better-paying jobs.

Education subsidies support upward economic mobility by providing opportunities for individuals to gain skills and qualifications that improve their job prospects. This enhances the ability of low-income individuals to transition into higher-income roles, thereby reducing income inequality.

By improving access to both health insurance and education subsidies, policymakers can address two critical factors that contribute to income inequality. Health insurance ensures that individuals do not face financial barriers to healthcare, while education subsidies provide the means to achieve higher earnings and economic stability. This combined approach helps break the cycle of poverty and promotes a more equitable society, thereby securing Angola's economic future amidst rising uncertainty.

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APPENDIXES
Appendix 1 – Data

Year	Oilrevenue	NonOilRevenue	Palma Ratio	Human Capital
1990	36 071	27 557	9.303572	0.361198782444
1991	32 383	210 919	9.293355	0.361265043258667
1992	357 289	2 598	8.217391	0.361331304073334
1993	282 644	7 391 346 683	8.559399	0.361397564888001
1994	2 901 767 438	114 894 542	9.821428	0.361463825702667
1995	3 521 912 898	200 768 883	9.132377	0.361530086517334
1996	47 797	3 151	10.108202	0.361596347332001
1997	46 296	37 713	9.439344	0.361662608146668
1998	309 098	45 188	10.272567	0.361728868961334
1999	4 490 393	666 142	10.358289	0.361795129776001
2000	711 958	80 113	9.621035	0.361861390590668
2001	5 802 857	731 459	8.342772	0.361927651405335
2002	764 412 963	683 759 463	8.209822	0.361993912220001
2003	868 460 129	823 575 353	7.71612	0.362060173034668
2004	12 619 928 602	855 073 509	7.2264667	0.362126433849335
2005	2 285 443 590 699	1 254 975 691	6.0665083	0.362192694664002
2006	3 048 310 774	1 379 128 316	5.6489244	0.362258955478669
2007	43 003 407 311	1 392 786 458	5.06911	0.362325216293335
2008	6 245 736 623	14 565 748 873 394	5.2069716	0.362391477108002
2009	398 027 732 413 768	102 517 209 676 938	5.090909	0.362457737922669
2010	493 514 850 078 934	1 243 368 206 403	4.8321676	0.362523998737336
2011	655 909 596 455 226	171 932 408 680 561	4.8366337	0.362590259552002
2012	697 162 509 825 293	137 701 889 701 083	5.6793723	0.362656520366669
2013	669 020 650 966 853	134 445 297 392 815	5.7815313	0.362722781181336
2014	576 419 232 188 839	152 796 167 607 284	6.1985817	0.362789041996003
2015	31 894 977 553 368	128 615 267 227 607	7.1455026	0.362855302810669
2016	263 660 485 365 227	122 282 653 895 648	8.074344	0.362921563625336
2017	333 124 931 811 225	130 096 174 657 294	8.427286	0.361
2018	39 408 662 342 535	134 910 445 405 702	7.68486455862069	0.360190957784653
2019	333 651 554 137 489	136 040 597 738 442	7.68486455862069	
2020	195 844 135 110 953	13 530 236 066 683	7.68486455862069	0.362405389547348
2021	318 383 336 841 284	174 315 611 852 773	7.68486455862069	0.362060173034668
2022	494 356 026 709	602 389 988 808 6	7.68486455862069	0.362060173034668
2023	362 423 829 808 3	642 316 385 990 0	9.18109	0.362060173034668

Appendix 2 – Level Augmented Dickey-Fuller Test for Unit Root

```
. dfuller loginequality , noconstant lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -0.696            -2.649            -1.950            -1.603

. dfuller logoil_export, noconstant lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)              0.971            -2.649            -1.950            -1.603

. dfuller lognonoil_export, noconstant lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)              0.368            -2.649            -1.950            -1.603

. dfuller logInFDI , noconstant lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        12

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -0.317            -2.660            -1.950            -1.600

. dfuller loghuman_capital , noconstant lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -0.262            -2.649            -1.950            -1.603
```

Appendix 3 – First Difference Augmented Dickey-Fuller Test for Unit Root

. dfuller log_inequality , noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = **31**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-6.951**	**-2.650**	**-1.950**	**-1.602**

. dfuller logoil_exports, noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = **31**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-4.420**	**-2.650**	**-1.950**	**-1.602**

. dfuller log_nonoil_exports , noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = **31**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-3.715**	**-2.650**	**-1.950**	**-1.602**

. dfuller log_InFDI , noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = **31**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-4.470**	**-2.650**	**-1.950**	**-1.602**

. dfuller log_humanCapital , noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = **31**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-7.047**	**-2.650**	**-1.950**	**-1.602**

Appendix 4 – Selection – Order Criteria

```
. varsoc loginequality logoil_export lognonoil_export

  Selection-order criteria
  Sample:  1994 - 2023                     Number of obs      =        30
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-93.1573				.122081	6.41049	6.45531	6.55061
1	-37.7072	110.9	9	0.000	.005544*	3.31382	3.49312*	3.87429*
2	-30.8456	13.723	9	0.133	.006532	3.45637	3.77015	4.43721
3	-21.1712	19.349	9	0.022	.006586	3.41141	3.85967	4.81261
4	-10.1022	22.138*	9	0.008	.00637	3.27348*	3.85621	5.09503

```
  Endogenous:  loginequality logoil_export lognonoil_export
   Exogenous:  _cons
```

Appendix 5 – Johansen Tests for Cointegration

```
. vecrank Palma oilrevenue nonoilrevenue, trend(constant) lags(1) max

                       Johansen tests for cointegration
Trend: constant                                        Number of obs =      33
Sample:  1991 - 2023                                            Lags =       1
```

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	3	-703.85247	.	37.0607	29.68
1	8	-692.15678	0.50778	13.6693*	15.41
2	11	-686.83531	0.27567	3.0264	3.76
3	12	-685.32212	0.08763		

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	3	-703.85247	.	23.3914	20.97
1	8	-692.15678	0.50778	10.6429	14.07
2	11	-686.83531	0.27567	3.0264	3.76
3	12	-685.32212	0.08763		

Appendix 6 – Autocorrelation Tests

```
. estat dwatson

Number of gaps in sample:   3

Durbin-Watson d-statistic(  5,    19) =   2.61153

. estat durbinalt

Number of gaps in sample:   3

Durbin's alternative test for autocorrelation
```

lags(p)	chi2	df	Prob > chi2
1	1.836	1	0.1754

```
                        H0: no serial correlation

. estat bgodfrey

Number of gaps in sample:   3

Breusch-Godfrey LM test for autocorrelation
```

lags(p)	chi2	df	Prob > chi2
1	2.351	1	0.1252

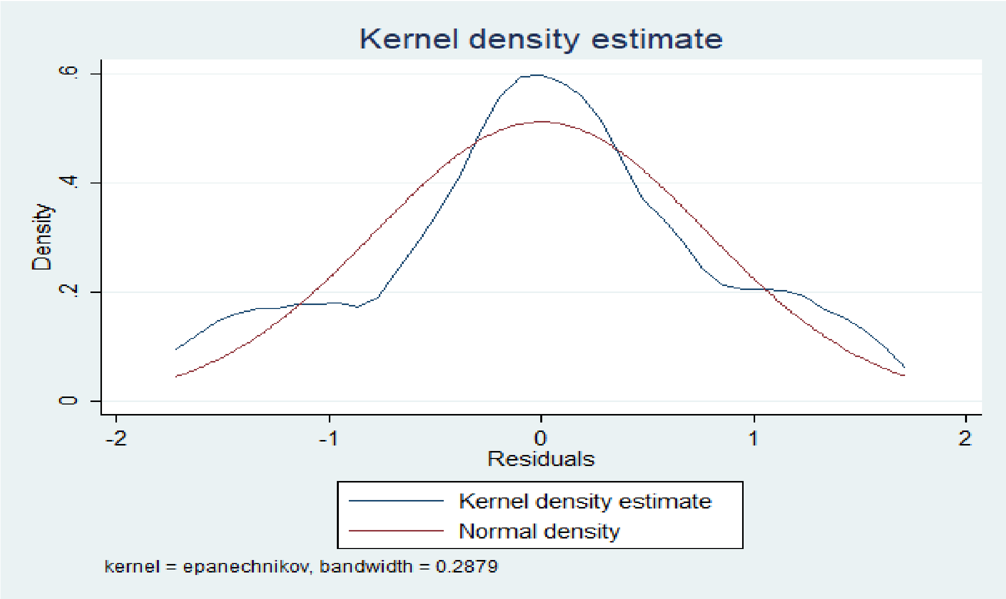
```
                        H0: no serial correlation
```

Appendix 7 – White Test for Heteroskedasticity

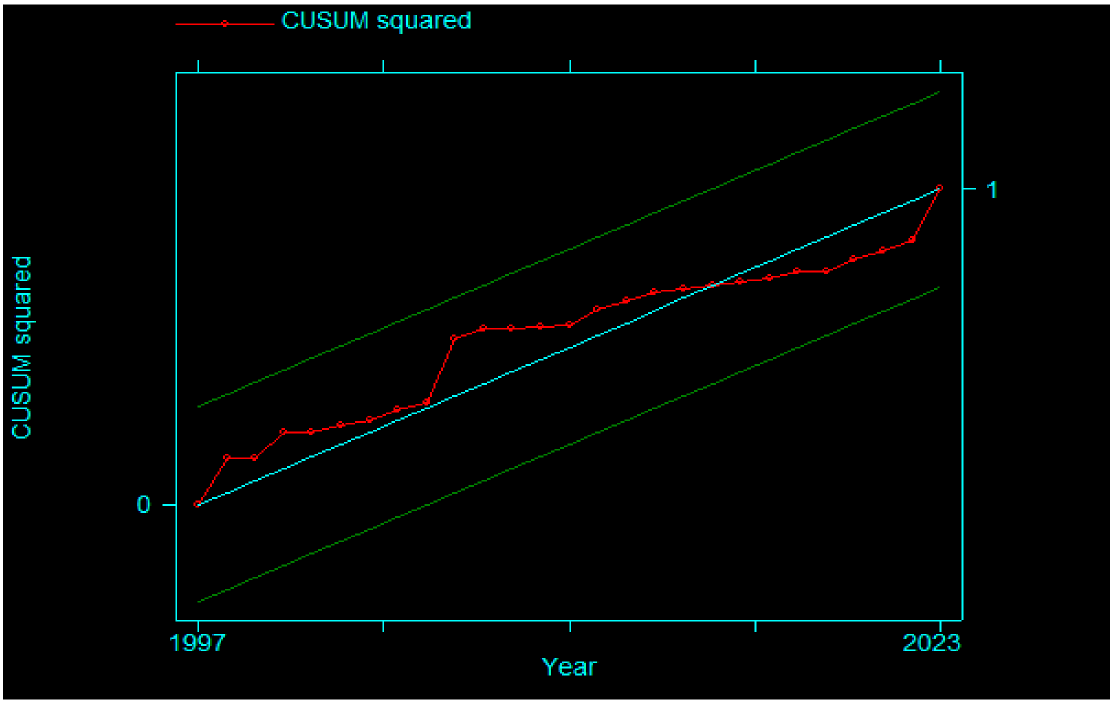
```
. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(14)      =     18.18
         Prob > chi2   =    0.1988

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	18.18	14	0.1988
Skewness	3.78	4	0.4373
Kurtosis	0.20	1	0.6585
Total	22.15	19	0.2770

Appendix 8 – Kernel Density Estimate



Appendix 9 – CUSUM



Appendix 10 – Ramsey RESET Test

```
. ovtest

Ramsey RESET test using powers of the fitted values of var60
       Ho:  model has no omitted variables
                  F(3, 24) =      2.20
                  Prob > F =      0.1143
```

Appendix 11 – Regression Outcome

```
. reg loginequality logoil_export lognonoil_export logInFDI loghuman_capital
```

Source	SS	df	MS
Model	6.08184837	4	1.52046209
Residual	10.9639833	14	.783141661
Total	17.0458316	18	.946990646

Number of obs	=	19
F(4, 14)	=	1.94
Prob > F	=	0.1593
R-squared	=	0.3568
Adj R-squared	=	0.1730
Root MSE	=	.88495

loginequality	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logoil_export	1.419257	.6227607	2.28	0.039	.083568	2.754946
lognonoil_export	-1.870845	.7408933	-2.53	0.024	-3.459903	-.2817869
logInFDI	.8811106	.3602469	2.45	0.028	.1084577	1.653763
loghuman_capital	-21.55626	451.3526	-0.05	0.963	-989.6114	946.4989
_cons	-23.33081	463.2008	-0.05	0.961	-1016.798	970.1361