

VALIDITY OF THE PREBISCH-SINGER HYPOTHESIS AND NIGERIA'S OIL SECTOR

UZUEGBU, Joshua Chibuzo

Department of Economics

College of Management Sciences

Michael Okpara University of Agriculture Umudike, Abia State, Nigeria

uzuegbu.chibuzo@mouau.edu.ng

ALUGBUO, Justin Chinweizu

Department of Economics

College of Management Sciences

Michael Okpara University of Agriculture, Umudike Abia State, Nigeria

jc.alugbuo@mouau.edu.ng

ABSTRACT

The study investigated the validity of prebisch-singer hypothesis in Nigeria's oil sector for the period 1981 to 2021. The OLS estimation technique was used for estimation while E-views version 11 facilitated the computing of results. Time series data were obtained from World Development Indicators (WDI) and Central Bank of Nigeria Statistical Bulletin 2021. Since the Prebisch-Singer postulation is based on long-run relationship, the study analysis was based on long-run observed results. Results showed that there exist 52% goodness of fit between the dependent and independent variables. Economically, commodity terms of trade and income terms of trade did not conform to a priori expectation at 5% level of significance, since statistically, commodity terms of trade and income terms of trade at individual level had a negative significant relationship with GDP of Nigeria implying that the oil sector international trade is not favorable to the Nigerian economy. Based on this finding, the study recommended among others that the government should ensure that domestic refineries should be functional and start producing at full capacity in order to improve the strength of the Nigerian currency and to achieve a favorable balance of payment.

Keywords: Commodity terms of trade, income terms of trade, Prebisch-Singer Hypothesis, Gross Domestic Product

INTRODUCTION

The possibility of long-term trend in primary commodity prices compared to prices of manufactured commodities has garnered a lot of attention in the trade and development literature. The supply of raw commodities would be confined by the finite amount of land, whereas the supply of manufactured goods would be increased by technological advancement, according to classical economists like David Ricardo and John Stuart Mill. However, separate research by Prebisch (1950) and Singer (1950) altered this viewpoint. The classical approach, according to Prebisch-Singer hypothesis, will hold true for industrialized nations (Atanu et al., 2011).

Prebisch-Singer hypothesis challenged the conventional wisdom, primary commodity prices should fall over time relative to manufactured goods for developing nations. This idea has become known as the Prebisch-Singer Hypothesis (Atanu et al., 2011). Terms of trade (TOT), which are used to measure profit from trade are defined as a country's readiness to buy and/or sell at reasonably possible prices, were utilized the Prebisch-Singer hypothesis.

Prebisch and Singer hypothesis also establishes the country's purchasing power parity. The two components of TOT are (a) Commodity Terms of Trade (CTOT), which mathematically equals (export prices divided

by import prices = (P_x / P_m) . CTOT evaluates the relationship between the price of a primary commodity at export and the price of a manufactured goods imported from abroad. (b) Income Terms of Trade (ITOT), which quantifies the amount of manufactured goods imported relative to the revenue generated from exporting basic goods. It can be expressed mathematically as (export prices multiplied by export volume divided by import prices = $(P_x * Q_x / P_m)$). Once more, ITOT gauges a nation's buying power parity.

Prebisch-Singer hypotheses acknowledged that trade partners anticipate favorable terms of trade, argued that this would be unfavorable for developing nations because they lack technical progress and export raw materials at lower prices only to import manufactured goods from high-tech nations at higher costs (Jhingan, 2008). To validate the Prebisch-Singer Hypothesis, it is worthwhile to link this theory to the activities of developing countries specializing in the production and export of primary commodities and imported manufactured commodities. One such country is Nigeria, particularly with respect to oil production and oil trade activities.

Nigerian crude oil production was exported, whereas indigenous petroleum products were imported from 1958 to 1965. The Nigerian government decided that it was appropriate to build refineries to meet domestic demand and export refined petroleum rather than crude oil because of the enormous revenue from oil exports and cost of petroleum product importation as well as the anticipated increase in population and industrialization, which will propel demand for petroleum products in Nigeria. These actions were intended to prevent imports of petroleum products, generate income through exports of refined petroleum products, and supply domestic demand through refineries, which will in turn promote price stability, economic sustainability, and growth.

Thus, the oil industry replaced other economic sectors, including agriculture, which was the backbone of the Nigerian economy before discovery of oil, as a crucial sector essential for industrial, commercial, and economic growth transformation. According to Babatope (2014), the oil industry in Nigeria accounts for more than 89% of all foreign exchange revenues, more than 83% of government export revenue, and more than 30% of the country's GDP.

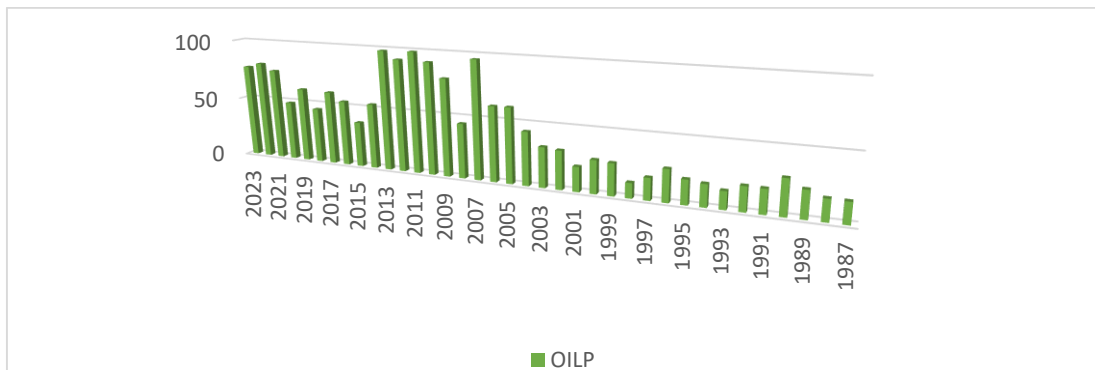


Fig. 1: Trend movement of Oil Prices in Nigeria, 1987 – 2023

Source: <https://www.macrotrends.net/1369/crude-oil-price-history-chart>

From 1987 to 2001, the international price of oil and the contribution of oil export revenue to GDP were each \$36.7 billion per day (21.5%), \$33.7 billion per day (17.3%), \$30.4 billion per day (13.9%), \$29.3 billion per day (15.1%), \$28 billion per day (16.7%), and \$15 billion per day (13.8%), respectively. From 2004 to 2023, international price of oil of oil and the contribution of oil export revenue to GDP were \$41.4 billion per day (37%) \$46.5 billion per day (42%) \$66.1 billion per day (40%) \$72.4 billion per day (48.4%) \$99.6 billion per day (56%) \$79.9 billion per day (52%) \$95.1 billion per day (47%) \$94.2 billion per day (45%) \$97.9 billion per day (48%) and \$92.3 billion per day (52%) except in 2009 and 2015 when the price

of oil fell to \$61 bpd (37%) and 48.5 bpd (35%) respectively (Central Bank of Nigeria (CBN) Statistical Bulletin, 2014 and Organisation of the Petroleum Exporting Countries (OPEC) Statistical Bulletin, 2015).

The average border price for petroleum products is 125.3, 126.55, 127.25, and 128.44 Naira per litre, respectively (OPEC Statistical Bulletin 2015). In contrast, the average import price of petroleum products has been consistent with its rising trend from 2012 to 2015. The import demand for petroleum products increased from 2012 to 2014, reaching 343.6, 384.9, 396.1, and 402.4 million metric tonnes (OPEC Statistical Bulletin 2015), reflecting the necessity of petroleum products in economic development as well as socioeconomic, technological, and demographic factors.

The Nigerian government made large investments to establish and expand its refineries, but these refineries have never been used to their full potential. Refineries produce far less domestic demand for petroleum goods, which makes the problem worse. Nigeria has become dependent on the exports of crude oil at volatile and erratic international prices and the importation of petroleum products at upwardly flexible pricing due to its incapacity to produce for whatever cause.

The fact that Nigeria exports crude oil to nations that purchase petroleum products is another cause for concern. This trading mindset has prompted a public discussion to examine the Prebisch-Singer Hypothesis' viability. Prebisch and Singer proposed the hypothesis that emerging nations' terms of trade will ultimately be unfavorable because they lack technical advancement, sell primary goods at lower prices, and import manufactured goods at higher costs. An illustration of the Prebisch and Singer theories is the Nigerian oil trade. In order to confirm or refute the Prebisch and Singer theory regarding Nigerian oil trade, this study evaluates the country's oil commerce.

CONCEPTUAL CLARIFICATIONS

Prebisch-Singer Hypothesis

The Prebisch-Singer hypothesis refers to the idea that manufacturers' relative prices for primary commodities exhibit a declining trend. However, as was already said, the Prebisch and Singer hypothesis is concerned with the broader issue of the widening disparity in per capita income between developed and developing nations and how it related to international commerce. It argue that because of global specialization and the concept of "static" comparative advantage, developing nations were left out of the benefits of technological advancement that had benefited the industrialized world.

The hypothesis is based on three stylized facts: first, the fact that developing nations were indeed highly specialized in the production and export of primary commodities; second, the fact that technological advancement was primarily concentrated in industry; and third, the fact that the relative price of primary commodities in terms of manufacturers had been declining steadily since the late 19th century. Together, these data revealed that developing nations had not benefited significantly from industrial technological advancement, either directly through better productivity or indirectly through improved terms of trade.

Economic Growth

As many authors have written about economic growth, there are numerous meanings of it. Economic growth often refers to a rise in a nation's national production over time—typically one year. A rise in an economy's capacity to generate goods and services through time is referred to as economic growth. It is often calculated as the rise in a nation's Gross Domestic Product (GDP) over the course of a year. Economic growth can be calculated in real terms, which eliminates inflationary distortions, or in nominal terms, which includes inflation in the calculation. GDP per capita was used to gauge economic growth in this study.

Empirical Review

Fahmy (2021) carried out a research on wavelets analysis reappraisal of the Prebisch-Singer Hypothesis. The goal of the study was to evaluate how the terms of trade, or Income terms of trade, affected the test findings. The analysis shows that for the majority of individual commodity price series making up aggregate commodity price index as well as for the long term, the Prebisch-Singer hypothesis is not supported. The outcomes additionally demonstrated that the PS test depends on the term of trade classification of commodity prices in addition to the study' initial beginning point.

Usman et al. (2020) examined the influence of non-oil export on Nigeria's economic expansion. The Auto Regressive Distributive Lag (ARDL) approach was employed in the study to capture both the long run and short run dynamic interaction. To prevent the error of accepting the null hypothesis of the unit root test when it had been rejected, the enhanced dickey fuller of the unit root test was utilised. Data from annual time series were gathered and examined. According to the study's findings, Nigeria's non-oil exports and economic growth are positively and significantly correlated.

Ana and Jesús (2013) employing a panel of 24 agricultural commodity prices from 1900 to 2010, the Prebisch and Singer hypothesis was explored. The necessity to address (a) the existence of cross-sectional reliance among commodity prices and (b) the identification of potential structural breaks led to the development of the modelling technique. The Hadri and Rao (2008) test was used to address these issues. The results indicated that there is mixed support for the Prebisch and Singer hypothesis and that all commodity prices exhibit a structural break that is different in location across series. The persistence of commodity price shocks is shorter than that seen in other research using similar approaches once the breaks have been eliminated from the underlying series.

Ahmad et al. (2013) confirmed that Terms of Trade volatility has frequently been linked to underwhelming economic performance in developing nations that depend on commodities, but little research has been done for these nations, particularly oil exporting nations. Their study used the GMM approach to assess the effects of Terms of Trade Volatility (TOTV) on GDP growth in oil exporting nations between 1980 and 2005. According to the findings, economic growth depends favorably on the terms of trade's current level, while volatility in those terms of trade has a detrimental effect on growth.

Syed and Syed (2012) Using annual time series data from the years 1980 to 2010, the researchers examined the impact of terms of trade and its volatility on economic growth in India. The findings from cointegration pointed to a strong, positive long-run link between terms of trade and economic expansion. However, trade term volatility had a negative and severe impact on economic expansion. Sensitivity analysis validates the reliability of the findings.

John et al. (2002) revisited Prebisch and Singer's (1950) claim that the development objectives of the emerging regions would be hampered by lowering terms of trade. There are two basic goals for this essay. First, it is important to understand the problems brought up by Prebisch and Singer (1950), who discuss the commodity specialization of developing nations (with a focus on Latin America). The second is to use current information and methods to empirically reexamine the topic of commodity price movements. We demonstrate that real primary prices during the past century have instead suffered one or more abrupt shifts, or "structural breaks," downwards as opposed to a downward trend. The overwhelming body of evidence leads to a single break in 1921, with no prior or subsequent positive or negative trend.

METHODOLOGY

Because the Prebisch-Singer hypothesis did not develop an equation to represent its construct, traditional production function has been used by scholars as a substitute. It is written as $Y = f(L, K, T)$, where L stands for labour, K for capital, and T for technology. Researchers have changed this model multiple times because

some explanatory variables, such TOT, are not included in it. The production function mentioned above will be modified for this study to match its needs. The study's production function will be described as follows;

$$Y = f(\mathbf{CTOT}, \mathbf{ITOT}) \tag{1}$$

where Y = Economic growth, CTOT = Commodity Terms of Trade and ITOT = Income Terms of Trade.

Empirically the model for this study will be specified as

$$RGDP = \alpha_0 + \alpha_1 CTOT + \alpha_2 ITOT + u_1 \tag{2}$$

Where $\alpha_1 < 0$; $\alpha_2 < 0$.

Definition of variables

Commodity Terms of Trade (TTC): The most straightforward terms of trade for calculating the effectiveness or profit of international trade. The price of a country's export divided by the price of that country's import (Px/Pm) is referred to as the commodity terms of trade. The CTOT is interpreted economically to mean that as the price of export increases relative to the price of imports, each unit of a country's export can buy a larger quantity of import and increase utility and welfare for the citizens of the exporting country. The opposite will occur if the price of imports is higher than the price of exports.

Income Terms of Trade (TTI): The ratio of revenue from primary product exports to the amount of manufactured goods imported is measured by income terms of trade (TTI), which are mathematically defined as export prices multiplied by export volume divided by import prices = (Px*Qx / Pm). Income terms of trade once more gauge the purchasing power parity of a nation. An increase in ITOT shows that the country's export revenues now enable her to buy more imports.

Estimation technique and procedure

The Ordinary Least Squares (OLS) estimate method was used in this investigation. Preliminary tests including the unit root test, co-integration test, and error correction test were employed for further investigations.

Unit root test

Because most economic time series have been empirically shown to be non-stationary in nature, the unit root test is a test to check whether the variables are suitable for a time series regression. In order to accomplish this, the Augmented Dickey-Fuller (ADF), which is described below, will be implemented;

$$\Delta Y_t = \beta_0 + \beta_2 t + \psi Y_{t-1} + \alpha_1 \sum_{i=1}^p \Delta Y_{t-i} + \epsilon_t \tag{3}$$

Augmented Engle-Granger Co-Integration Test

If the variables are integrated in the same order, such as I(0) and I(0) or I(1) and I(1), after establishing the existence of the non-unit root (stationarity) and their order of identification, then the presence of co-integration as well as their linear combination is established (Enders, 1995). The stationarity and co-integration tests are shown in the equation below.

$$\Delta Y_t = \alpha_1 \Delta Y_{t-1} + x_t \psi + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-1} + \beta_p \Delta Y_{t-p} + \epsilon_t \tag{4}$$

Once the existence of a long run co-integration relationship has been established, the pump price of petroleum products growth rate and manufacturing output growth rate will be specified as:

$$RGDP = \alpha_0 + \alpha_1 \sum_{i=1}^p (CTOT)_t + \alpha_2 \sum_{i=1}^p (ITOT)_t + u_t \tag{5}$$

Error Correction Mechanism

In the short run there may be disequilibrium. Therefore the error term in the above equation will be treated as equilibrium error. To correct this disequilibrium the Error Correction Mechanism (ECM) will be used. Finally,

we obtain the short run parameters by estimating an error correction model associated with the equilibrium error estimates. This is specified as follows:

$$RGDP = \alpha_0 + \alpha_1 \sum_{i=1}^p (CTOT)_t + \alpha_2 \sum_{i=1}^p (ITOT)_t + \alpha_3 u_{t-1} + \alpha_4 ECM \quad 6$$

Where equation (3.11) is the ECM equation which indicates the speed of adjustment of variables that were in disequilibrium state into equilibrium and short-run result will be used for this study analysis.

RESULTS

Unit root test for stationarity

Table 1: Unit Root Test

Variables	Order of Difference	ADF-stat	Critical value 5%	Remarks
Log_RGDP	DLOG(RGDP)	-5.735934	-2.954021	I(1)
ITOT	D(ITOT)	-6.353754	-2.976263	I(1)
CTOT	D(CTOT)	-4.228232	-2.642010	I(1)

Source: Authors Compilation, 2023

Cointegration Test Two Stage Engle-Granger

Since the variables are integrated at the same order then the presence of co-integration is established as well as their linear combination

Table 2: Cointegration Test

Variable	Order of Difference	ADF-stat	Critical value 5%	Remark
RESID01	D(RESID01(-1))	-3.338677	-2.951125	Co-integrated

Source: Authors Compilation, 2023

Since the residual are integrated at level form I(0) then we conclude that variables are co-integrated implying that there exist a short run stability among the variables under study.

Data Estimation Procedure

The results below are based on long-run computation of the model specified in the method of study and will be used to capture the objectives of the study. The long-run estimation procedure follows thus:

Table 3: OLS Estimates for validity of Prebisch-Singer Hypothesis and Nigeria's Economy (RGDP)

Variables	Coefficient	Std.Error	T-Stat	Probability
C	0.128853	0.171553	0.751098	0.4586
ITOT	-0.130823	0.363252	-2.360145	0.0213
CTOT	-0.011837	0.010417	-2.136256	0.0352

Source: Authors Compilation, 2023

$$R^2 = 0.52; R^{-2} = 0.42; \text{Durbin Watson} = 2.15; \text{F-test } 2.29; \text{Prob (F-statistic)} = 0.03$$

Our result shows that a unit increase in income terms of trade (ITOT), will decrease national output (RGDP) by 13%, and a unit increase in commodity terms of trade (CTOT) will decrease RGDP by one percent.

Table 4: Post Estimation Test of Significance

Variables	Prob.	Decision	Conclusion
ITOT	0.0213	Reject H _o	Statistically Significant.
CTOT	0.0352	Reject H _o	Statistically Significant.

Source: Authors Compilation, 2023

Table 5: Fishers Test of Significance

F-tab; Prob(F-statistic)	Decision	Conclusion
0.03	Reject H _o	Statistically Significant

Source: Authors Compilation, 2023

From the empirical F-test, it shows that there is a significant relationship between oil sector trade and growth of Nigeria's economy. Also, the empirical t-test shows that there is a negative significant relationship between oil sector commodity terms of trade and economic growth in Nigerian economy. Further, the empirical t-test shows a negative relationship between oil sector income terms of trade and economic growth in Nigerian economy.

DISCUSSION OF FINDINGS

First, economically ITOT, CTOT conformed to a priori expectation. t-test results revealed that individually the oil trade variables (ITOT, CTOT) are statistically significant negatively, while the F-test shows that the overall contribution of the oil trade variables are statistically significant, meaning that international price of crude oil, crude oil export revenue are not high enough to offset international import price of petroleum products and cost incurred from importation of petroleum products respectively. The economic and individual statistical results agree with the Prebisch-Singer Hypothesis while the overall statistical result nullify Prebisch-Singer Hypothesis with respect to Nigerian oil sector. In furtherance, evidence to this outcome is the relatively poor explanatory power of the R² of 52%.

CONCLUSION AND RECOMMENDATIONS

This study examined the validity of Prebisch-Singer Hypothesis in Nigerian oil sector from 1981 to 2021. Enshrined in the body of this work is a theory that has been instituted by scholars connecting international trade and economic growth. Empirical findings have also been inputted in this work to further give a more robust outlook to the study. It is important to note that prebisch-singer hypothesis held with respect to Nigerian oil sector indicated that oil trade in Nigeria is not favorable and/or efficient given the available data used in the study.

Based on our results, the study recommends that the government of the day should ensure that domestic refineries should be functional and produce at full capacity. The study also recommends that there should be diversification in Nigeria oil sector from crude oil export dependent to petroleum products export dependent; and that there should be proper accountability, transparency and sell-off of compromise by adhering to economic rationalities rather than political expediencies.

REFERENCES

- Ahmad, J. S., Somaye, S., & Soraya, S. (2013). The impact of the terms of trade volatility on economic growth: Evidence from oil exporting countries. *International Journal of Economics and Management Engineering*.
- Ana, M.I., & Jesús, O. (2013). The long-run behaviour of the terms of trade between primary commodities and manufactures: A panel data approach. Annual Conference of the Agricultural Economics Society, University of Warwick, United Kingdom.
- Atanu, G., Mohitosh, K., & Mark, W. (2011). Breaking trends and the Prebisch-Singer hypothesis: A further investigation, Change and uncertainty challenges for agriculture, food and natural resources. ETH Zurich, Switzerland.
- Babatope, O. (2014). Disaggregated analysis of energy consumption and economic performance in Nigeria *energy technology and infrastructure for development*, in A. Adenikinju, A. Iwayemi, & W. Iledare (eds.). *Energy access for economic development*.
- Jhingan, M. L. (2008). *The economics of development and planning*. VRINDA Publication.
- John, T. C., Rodney, L., & Shamila, A. J. (2002). Prebisch-Singer Redux. Office of economics working paper, U.S. International trade commission.
- Syed, D., & Syed, E. (2012). Effects of terms of trade and its volatility on economic growth in India. MPRA Paper No. 38998. Retrieved from <https://mpra.ub.uni-muenchen.de/38998/>
- Umar, A., & Jerry, A. M. (2014). The downstream sector, an assessment of the petroleum products supply in Nigeria: *energy technology and infrastructure for development*. In A. Adenikinju, A. Iwayemi, & W. Iledare (eds.). *Energy access for economic development*.
- Usman, M., Badawi, M. M., & Farouq, K. M (2020). Impact of non-oil export on economic growth in Nigeria. *Journal of Economics and Finance*, 11(1), 2321-5925.