

Testing The Equality Of Export And Import Commodities Price Index In Nigeria

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ABSTRACT: This study examined the equality of export and import commodities price index in Nigeria. The source of data employed in this study is secondary data obtained from the Central bank of Nigeria Statistical Bulletin 2010. The statistical tool used in analyzing the data was the Permutation method for Hotelling T-Squared and Descriptive statistics. The result of the analysis showed that there exists a significant difference between monthly export and import commodities price index in Nigeria with a test statistic value of 58.31 and a p-value of 0.00 for 10, 000 permutations. Also, it was observed that across the years import commodities price index has been greater than export commodities price index. Hence, we conclude that export and import commodities price index in Nigeria are not equal and that import commodities price index has always been larger than export commodities price index. We advocate for more studies within the context of price statistics in Nigeria since the significance of price statistics in the economy of any nation cannot be overemphasized because they constitute a very useful tool for policy making, economic planning, analysis and monitoring. Also, price signals have been found to enhance better understanding of the degree of economic stability in any nation.

Keywords: Export, Import, Permutation, Commodities, Economic Stability, Price Index

1 INTRODUCTION

A price index is a measure of the proportionate, or percentage, changes in a set of prices over time. A consumer price index (CPI) measures changes in the prices of goods and services that households consume. Such changes affect the real purchasing power of consumers' incomes and their welfare. Consumer price index measures indicate the relative movement in the general prices of goods and commodities consumed by the public relative to a base period, being made up of a basket of consumables that is not sacrosanct, but changeable. It is the general measure of the level of inflation existing in the economy and its impact on the living standards of the people. The constituents of the consumer prices index vary from rural to urban sectors of the economy as the consumption patterns are not the same. As the prices of different goods and services, do not all change at the same rate; a price index can only reflect their average movement. A price index is typically assigned a value of unity, or 100, in some reference period and the values of the index for other periods of time are intended to indicate the average proportionate, or percentage, change in prices from this price reference period. Price indices can also be used to measure differences in price levels between different cities, regions or countries at the same point in time.

The components of price index alter and vary from country to country, making international comparison meaningless. However, flotation of the domestic currency has positively affected export of commodities especially the agricultural produce in countries like Nigeria, Niger, Ghana and Zambia [1]. The price of the currency in any nation *vis a vis* the domestic prices have tended to move in tandem. [2], explained further that price increase in the foreign exchange market spirals to the domestic prices, though the goods are neither imported nor have imported inputs in their manufacture or assembly process. [3], noted that exports of goods and services represent one of the most important sources of foreign exchange income that ease the pressure on the balance of payments and create employment opportunities. An export led growth strategy aims to provide producers with incentives to export their goods through various economic and governmental policies. It also aims to increase the capability of producing goods and services that are able to compete in the world market, to use advanced technology, and to provide foreign exchange needed to import capital goods. Exports can increase intra-industry trade, help the country to integrate in the world economy and reduce the impact of external shocks on the domestic economy. Experiences of Asian and Latin American economies provide good examples of the importance of the export sector to economic growth and development, which led economists to stress the vital role of exports as the engine of economic growth. Trade liberalization is the removal of obstacles of free trade, obstacles such as tariffs and quotas, among others. This is a process of systematically reducing and eventually eliminating all tariff and non-tariff barriers between countries as trading partners. Trade liberalization is motivated by the economic theory that an unrestricted, market will result in the most efficient pattern of productivity [4]. Trade liberalization stimulates growth and efficiency by allowing producers to exploit areas in which they have a comparative advantage over foreign producers and by reducing their real cost. One way trade contributes to an increase in economic output is through comparative advantages which create more value with the same resources. However, [5], suggested that since 2007, in particular, the occurrence of two strong commodity price shocks has increased the uncertainty about the development of commodity prices and, therefore, the importance of monitoring these prices. The pass-through of commodity prices to

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consumer inflation is a topic of great interest in monetary policy studies, as a result of frequent inflationary pressures caused by these products price shocks. Understanding the pass-through mechanism enables the monetary authority to respond in a timely manner and in an appropriate intensity to commodity price shocks, smoothing the inflationary impact of such shocks and the economic cost of central bank actions. Also, [6], in their study argued that commodities have significant predictive power in explaining short-run movements or behavior in Commodities Price Index inflation, even when information contained in monetary aggregates, real output, interest rates, and exchange rates has been controlled. Often it is observed that commodity prices and consumer prices tend to diverge over time but on the contrary, commodity price levels and consumer price inflation tend to move together sometimes; hence, they work together to be more effective on the economy ([7], [6]). It is now understood that the significance of price statistics in the economy of any nation cannot be overemphasized because they constitute a very useful tool for policy making, economic planning, analysis and monitoring. Price signals have been found to help in the better understanding of the degree of economic stability in any nation. They also expose distortions and guide decisions regarding corrections. Every commodity produced or service rendered in an economy can be conceived of in terms of a price and quantity relation. Prices to some producers are costs to others, and in this sense the price of a commodity is a reflection of other prices. A single commodity or service usually has more than one price at a point in time. It is, therefore, intuitively appealing to explore these sources of price differentials as a basis for collecting and studying prices. Thus the motivation of using permutation method for Hotelling T-Squared in testing the equality of export and import commodities price index in Nigeria becomes a sine qua non.

1.1 LITERATURE REVIEW

[8], examined exchange rate and trade liberalization policies and the promotion of manufactured exports in Nigeria. He observed that the Nigerian economy has experienced overtime, structural transformation learning in its trail, an uneven growth process accompanied by dramatic sector changes, structural distortions and imbalance. Also observed was the emergence of Nigeria as a major net world oil exporter in the early 1970s which brought about fundamental structural changes in the economy with profound impact on the external sector such that the Nigerian economy which was titled in favors of production of exportable agricultural produce in the 1960s became considerably less diversified as the oil sector dominated products and trade structures. He stressed that the Nigerian economy was pushed into deep recession due to the attendant collapse of oil prices especially since early 1980s and lack of effective inter-sector balance. This led to a reduction in the size and magnitude of the tradable sector and gradually, the emergence of the "Dutch Disease" syndrome. Various policy measures were therefore put in place by the Nigerian government to check the rapid decline of the economy, one of which was the structural Adjustment Program (SAP) of 1986 which was designed to stimulate and enhance the production and export of non-oil productions. [9], examined the impact of liberalization policies on building construction industry in Nigeria. He concluded that the building construction industry in any economy provides a sensitive measurement and monitoring of the health or ill-health of an

economy, this is because the construction industry is assumed to have a large share of capital formation. [10], examined the effect of trade liberalization on exports of fish and shrimps in Nigeria. He developed a short run-forecasting model to predict the quantities of fish and shrimps that could be exported within a three-year period (1999-2001). The effect of liberalization was examined with the aid of an econometric model, which was estimated empirically. The findings of his study revealed that the liberalization policy of exchange rate adjustment is an important factor affecting fish and shrimps export. He also suggested that a real depreciation or appreciation of the naira for example, tends to stimulate farmers to increase or decrease supply of fish and shrimps exports thus taking advantage of the improved international competitiveness. According to [11], the macroeconomic consequences of trade liberalization have generated a great deal of debate among researchers the world over. For developing countries like Nigeria, the contribution of trade liberalization to overall economic growth is immense due to inadequate domestic resources (such as, capital goods, raw materials and technical know-how); and the potential revenue derived from international trade. In the light of this, their study examined the effect of trade liberalization on trade tax revenue in Nigeria. The empirical result of their study showed that trade liberalization, gross domestic product, public debt and labor force had a positive net effect on trade tax revenue while exchange rate had a negative net effect on trade tax revenue. Also they noted that the beta coefficient of the model generated in their study showed that labor force, public debt and exchange rate had significant influence on trade revenue while trade liberalization and gross domestic product were found to have an insignificant influence on trade tax revenue. They recommend the need for the implementation of appropriate policies (such as foreign exchange policy and financial market deregulation policy) as a complimentary policy to enhance the success of trade liberalization in Nigeria. [12], explored the relationship between the real exchange rate and economic activities in Nigeria considering the aggregate demand and supply transmission mechanism. The result of his study showed that while depreciation of real exchange rate encourages the cost of production, internal competitiveness of domestic goods and raises export in the former, it increases cost of production and distributes income against the poor in the later. The empirical result showed that only real exchange rate and interest rate are not significantly related to gross domestic product, though they are rightly signed. According to [13], the types of commodities exported by a country are key determinant of a country's vulnerability to exogenous economic shocks. The majority of developing countries are dependent on primary commodities for export revenues and, of the 141 developing countries, 95 depend on primary commodities for at least 50 percent of their export earnings. From the perspective of developing countries, especially those whose principal means of foreign exchange earnings come from the exports of primary commodities; unstable commodity prices create macro-economic instabilities and complicate macroeconomic management. [4], in her study examined the most efficient model for estimating annual export in Nigeria. The statistical tools employed in her study include the curve estimation analysis, cubic regression analysis, correlation analysis and line graph analysis. The result of her analysis showed that the cubic regression model was best in estimating annual Export in Nigeria. She observed that Export and

Import exhibit a strong positive relationship with a correlation measure of 98.4%. Also, she denoted that Import contributed significantly to the behavior or variability of Export in Nigeria. She claimed that from the year 2004, annual Export was observed have been steadily increasing more than Import in Nigeria. She attributed the steady increase of Export over import to the benefits of stable democracy and government which helps in building the country's image and in turn attracts international trade. [14], argued that while low commodity prices create obvious problems, even high prices can create a trap of sorts, forcing countries and producers to choose between immediate profits and future sustainability. Giving an instance of countries like Algeria, Nigeria and Venezuela, they noted that these countries have fallen prey to over optimistic spending habits during commodity booms, using current and expected profits to finance social and/or politically motivated projects. Such program which can quickly become unsustainable when commodity prices drop, but are typically very tricky for politicians to cut, and so tend to get funded out of borrowed money, add to the country's debt burden. They added that price index of exports from advanced economies is used to derive real commodity prices. Real commodity prices are therefore measured in terms of their purchasing power over advanced economies' exports. Price instability is measured as the absolute percentage deviation from the long-run exponential trend for the period. The measure of price instability is equal to $\left[\left| \frac{Y_{(t)} - y_{(t)}}{y_{(t)}} \right| \right] \times 100$ where $Y_{(t)}$ is the observed magnitude of the variable; $y_{(t)}$ is the magnitude estimated by fitting an exponential trend to the observed. The vertical bar indicates the absolute value (disregarding signs). Accordingly, instability is measured as the percentage deviation of the variables concerned from their exponential trend levels for a given month. [15], reported that import prices translate at higher rate in Asian emerging economies than developed economies. This raises the question of efficient pricing between exporters of goods to Nigeria and importers. The improvements in the lives of the people are more seen in their ability to consume imported goods at the micro level and the impact this trend has on the economy is to create pressure on the exchange rates (both official and autonomous). Alternatively more imported goods are taken as components of the index. He added that the Nigerian elite has developed a penchant for purchasing imported goods to show the new middle class status it has achieved, even sending children to study overseas. The ability to purchase some goods having been enhanced, has fuelled this trend, where most of the goods available for purchase from consumer loans granted by commercial banks are those imported into the country. [16], explained that there exist three channels through which commodity prices affect inflation in oil-exporting African countries like Nigeria. In addition to the direct pass-through to retail prices as a result of rising production costs, they argued that the rise in commodity prices may influence the level of domestic prices through increased private and public sectors spending, reflecting the positive income effect, or by the increase in banking sector liquidity as a result of the expansion of foreign exchange inflows. They equally explained that it is important to note that commodity markets cover a wide range of products that can be segmented into agricultural, metal and energy, with different impacts on retail price level. Although metal prices are the most affected by economic growth, this segment has the less significant impact on inflation. Also, price

changes of agricultural and energy commodities quickly affect the retail costs of food and transportation, while price fluctuations of base metals are smoothed along the usually large production chains. Emerging countries, for instance, tend to suffer from greater inflationary impact of commodity prices, since food has a higher share in the average consumption basket and production is usually less energy efficient. In countries where revenues from commodity exports account for a significant share of the exchange flow, the inflationary impact of a commodity price shock tends to be offset by the resulting currency appreciation.

2 MATERIAL AND METHODOLOGY

2.1 Data Collection

The source of data employed in this study is secondary data obtained from the Central bank of Nigeria (CBN) Statistical Bulletin 2010. The data extracted includes monthly prices index for export and import in Nigeria from 2000 – 2010. The statistical tool used in analyzing the data was the Permutation method for Hotelling T-Squared and Descriptive statistics.

2.2 Permutation Method for Hotelling T^2

The permutation test is a conditional test since it generates the permutation distribution conditional on the observed values of the random variables (unlike the randomization model where the observed values were not random except their treatment assignments). The test is also conditionally distribution-free, since, conditional on the observed data, the permutation distribution of the test statistic does not depend on the population distributions ([17], [18], [19], [20], [21], [22]). Also, the permutation test is conditionally exact for the same reasons that the randomization test is exact, but it is also unconditionally exact since the probability of a Type I error is controlled for all possible samples [18]. The permutation method for Hotelling T^2 measures whether the mean vectors of the two groups differ significantly. One measures of the difference in mean vector is the two-sample Hotelling T^2 statistic which is given as

$$T^2 = \frac{n_1 n_2}{n_1 + n_2} (\bar{X} - \bar{Y}) S^{-1} (\bar{X} - \bar{Y}) \quad (1)$$

The pooled estimate of the variance-covariance matrix S is given as

$$S = \frac{A+B}{n_1 + n_2 - 2} \quad (2)$$

Where, X and Y are the mean vector of the two samples, A and B are the covariance matrix of the two samples.

2.2. The Testing Procedure of the Permutation Method for Hotelling T^2

1. Consider two independent random samples

$$\{X_i, i = 1, 2, \dots, n_1\}$$

and $\{Y_i, i = 1, 2, \dots, n_2\}$. To test the hypothesis

that both samples came from the sample distribution

we shall obtain the mean vector of the two samples \bar{X} and \bar{Y} .

2. We obtain the reference value of the test statistic, T^2 using Equation (1) and Equation (2)
3. Permute at random the rows and corresponding columns of the covariance matrix of one of the samples; A.
4. Compute the test statistic T_i^{2*} , obtaining a value T^{2*} of the test statistic under permutation.
5. Repeat steps 2 and 3 a large number of times to obtain the distribution of T^{2*} under permutation; add the reference value T^2 to the distribution.
6. For a one-tailed test involving the upper tail, calculating the probability (p value) as the proportion of values T^{2*} greater than or equal to T^2 . Conversely, for a test in the lower tail, the probability is the proportion of values T^{2*} less than or equal to T^2 .

2.3 Data presentation

Table 1: Export Commodity Price Index (January 2007=100)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
/Month	01	02	03	04	05	06	07	08	09	10	11
Jan	99.54	101.34	97.64	99.84	102.84	101.14	100.04	103.74	102.64	101.54	100.44
Feb	83.52	86.62	88.82	87.92	91.02	89.12	90.22	92.32	91.42	90.52	89.62
Mar	88.04	90.14	92.24	91.34	94.44	92.54	93.64	95.74	94.84	93.94	93.04
Apr	99.03	100.13	101.23	100.33	103.43	101.53	102.63	104.73	103.83	102.93	102.03
May	86.04	87.14	88.24	87.34	90.44	88.54	89.64	91.74	90.84	89.94	89.04
Jun	85.08	86.18	87.28	86.38	89.48	87.58	88.68	90.78	89.88	88.98	88.08
Jul	101.06	102.16	103.26	102.36	105.46	103.56	104.66	106.76	105.86	104.96	104.06
Aug	91.04	92.14	93.24	92.34	95.44	93.54	94.64	96.74	95.84	94.94	94.04
Sep	98.03	99.13	100.23	99.33	102.43	100.53	101.63	103.73	102.83	101.93	101.03
Oct	111.06	112.16	113.26	112.36	115.46	113.56	114.66	116.76	115.86	114.96	114.06
Nov	89.04	90.14	91.24	90.34	93.44	91.54	92.64	94.74	93.84	92.94	92.04
Dec	96.04	97.14	98.24	97.34	100.44	98.54	99.64	101.74	100.84	99.94	99.04

Source: CBN Statistical Bulletin 2010

Table 2: Import Commodity Price Index (January 2007=100)

Year /Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jan	108.2	106.9	96.9	104.3	128.5	125.2	127.4	100.0	106.2	113.5	108.0
Feb	110.9	106.3	98.5	104.6	121.5	119.1	106.1	98.35	106.4	125.6	117.0
Mar	111.3	107.4	97.6	104.3	121.8	123.7	103.1	104.4	110.1	106.1	113.0
Apr	111.4	108.1	116.3	105.4	124.3	119.5	123.4	106.2	107.8	135.6	132.9
May	112.0	107.3	103.3	108.6	121.3	112.4	103.3	101.2	108.2	128.6	115.1
Jun	110.9	103.2	101.8	108.5	121.1	107.7	103.9	101.9	110.6	101.1	108.5
Jul	110.7	106.6	108.1	106.9	112.8	107.6	98.34	142.3	133.1	115.8	126.6
Aug	110.4	111.5	109.5	109.0	107.2	99.54	109.145	111.8	144.0	112.5	136.7
Sep	110.3	110.6	101.1	108.5	134.1	118.9	113.5	110.7	103.9	111.6	106.6
Oct	110.7	111.6	106.6	108.7	111.7	132.0	117.3	113.4	108.7	111.8	144.0
Nov	111.8	112.5	136.7	106.6	176.7						
Dec	103.80	85.69	85.48	91.11	83.92	102.58	130.91	115.70	114.69	117.56	160.79

Source: CBN Statistical Bulletin 2010

2.4 Research Hypotheses

H₀₁: The monthly price index of export and import commodities is statistically the same.

H₁₁: The monthly price index of export and import commodities is not statistically the same.

3.0 DATA ANALYSIS AND RESULT

Inputting the data in Table 1 and Table 2 into R 2.13.0 command window and calling the hotelling.test function [24].

```
R> Export=matrix(c(78.54, 99.52, 91.34, 79.64, 89.78, 92.83, 116.27, 100, 127.03, 68.78, 93.72, 79.52, 83.02, 73.62, 78.85, 98.19, 77.45, 115.80, 107.26, 117.72, 117.74, 97.71, 81.04, 88.78, 79.36, 90.98, 86.51, 96.23, 113.90, 117.69, 107.21, 117.84, 160.78, 82.93, 99.36, 80.56, 87.63, 84.44, 98.38, 128.39, 125.15, 115.11, 107.12, 169.87, 84.48, 86.37, 80.28, 90.98, 87.29, 94.44, 107.06, 112.98, 117.63, 114.73, 188.80,
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103.80, 85.69, 85.48, 91.11, 83.92, 102.58, 130.91, 115.70, 114.69, 117.56, 160.79, 81.60, 101.56, 83.12, 119.42, 80.98, 110.79, 118.27, 117.70, 125.25, 114.71, 103.78, 64.47, 91.49, 86.78, 83.76, 81.60, 107.62, 112.67, 114.71, 116.71, 125.27, 108.89, 85.39, 98.34, 95.24, 90.85, 86.81, 87.08, 119.23, 114.62, 112.84, 110.74, 101.24, 83.60, 111.08, 87.79, 94.72, 95.52, 98, 118.73, 116.68, 110.74, 113.06, 104.38, 87.74, 89.45, 84.31, 79.12, 83.49, 94.74, 118.88, 110.87, 115.77, 116.68, 103.36, 97.49, 96.54, 85.47, 81.66, 74.85, 105.58, 119.71, 68.68, 117.71, 115.87, 105.72), nrow=12, byrow=TRUE)
```

```
R> Import=matrix(c(108.2, 106.9, 96.96, 104.3, 128, 125.2, 127.4, 100, 106.2, 113.5, 108, 119.1, 106.1, 98.35, 106.4, 125.6, 117, 127.4, 103.1, 104.4, 110.1, 106.1, 113, 107.9, 97.64, 145.3, 128.4, 128.7, 138.9, 104.7, 104.9, 109.3, 112.5, 111.4, 108.1, 116.3, 105.4, 124.3, 119.5, 123.4, 106.2, 107.8, 135.6, 132.9, 120.1, 107.2, 103.3, 113.8, 136.6, 123.4, 126.2, 104.3, 133, 104, 143.7, 101.9, 103.3, 101.2, 108.2, 128.6, 115.1, 114.4, 105.5, 110.7, 103.7, 158.5, 107.8, 106.7, 97.94, 108.8, 127, 112, 118, 104.1, 135.5, 106.8, 147, 109.4, 111.4, 100.1, 105.3, 121.8, 114.7, 120.4, 104.3, 106.3, 107.8, 157.1, 101.9, 110.6, 101.1, 108.5, 134.1, 118.9, 113.5, 110.7, 103.9, 111, 215.4, 108.1, 106, 98.14, 111.7, 132, 117.3, 113.4, 108.7, 111.6, 106.6, 156.9, 112.8, 107.6, 98.34, 142.3, 133.1, 115.8, 126.6, 113.6, 108, 111.5, 199.5, 109, 107.2, 99.54, 109, 145, 111.8, 144, 112.5, 136.7, 106.6, 176.7), nrow=12, byrow=TRUE)
```

```
R> Test=hotelling.test(Export, Import, shrinkage = FALSE, perm = TRUE, B= 10000)
```

Test stat: 58.312
 Numerator df: 11
 Denominator df: 12
 Permutation P-value: 0
 Number of permutations : 10000

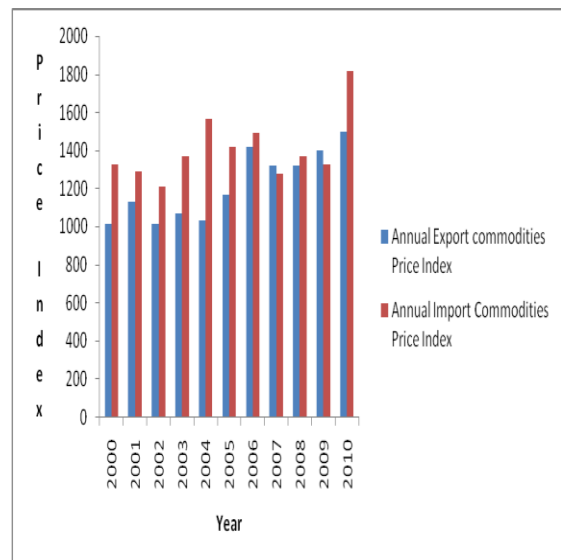


FIGURE 1: DISTRIBUTION OF ANNUAL EXPORT AND IMPORT COMMODITIES PRICE INDEX IN NIGERIA

4 DISCUSSION

The result obtained from the analysis showed that there exists significant differences in monthly price index of export and import commodities with a test statistic value of 58.31 and a p-value of 0.00 for 10, 000 permutations as was presented by the hotelling.test function. This result indicates that the obtained significant value of 0.00 falls on the rejection region of the hypothesis assuming a significance level of 5% ($\alpha = 0.05$) and implies that monthly price index of export and import commodities is not statistically the same. Hence, the null hypothesis was rejected since p-value = 0.00 is less than $\alpha=0.05$ assuming a 95% confidence interval level. Also, from the graphical expression in Figure 1, it was observed that across the years Import commodities price index has been greater than Export commodities price index.

5 CONCLUSIONS

This study examined the equality of export and import commodities price index in Nigeria. The result of the analysis showed that there exists a significant difference between monthly export and import commodities price index in Nigeria. Also, it was observed that across the years import commodities price index has been greater than export commodities price index. Hence, we conclude that export and import commodities price index in Nigeria are not equal and that import commodities price index has always been greater than export commodities price index. We advocate for more studies within the context of price statistics in Nigeria since [5], noted that the significance of price statistics in the economy of any nation cannot be overemphasized because they constitute a very useful tool for policy making, economic planning, analysis and monitoring. They added that price signals have been found to help in the better understanding of the degree of economic stability in any nation.

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