

## **Export Fluctuation Earnings In Sudan(2001-2015)**

### **Causes and Consequences**

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#### **ABSTRACT:**

*Sudan's export is mainly agricultural raw materials. The conventional factors of exporting primary goods, commodity and geographical concentration are thought to be the main factors contributing to export instability. This paper aimed at analyzing the causes of export instability and the possible consequences on Sudan's export sector during 2001- 2015. A single country approach and time series are used. Where the instability of the export unit value and their effect on total export value was considered. The collected data were statistically analyzed using staistical inferences. The findings of this study showed theprimary commodity exporting, commodity concentration, and supply shifts induced instability in Sudan's export. As consequences this instability has negative impacts on agricultural share in the GDP and government revenue. This study suggested that primary products should be processed before export, more diversification of the commodities exported*

**Keywords:***Instability, time series, statistical inferences, Gini-Coefficiet*

#### **I.INTRODUCTION**

The study of export earnings instability, its causes and possible impact on economic growth of developing countries have received much discussion in last decades, and the concern for it revived in recent years. The export sector in most developing countries is of high importance to their development; since export receipts provide most of the foreign exchange needed for imports such as skills, strategic goods and services (Hag Elamin, N. A. 1997)

Early studies of export fluctuation, for instance, Coppock (1962), Michaely (1962), and Macbean (1966), have related the level of fluctuation to characteristics of the developing countries such as commodity concentration and geographical concentration of exports. Erb, Schiavo and Campo (1969) argued that export fluctuation constitutes an obstacle to developing countries economic planning and growth. Whereas Macbean (1969) argued that there is little or no empirical support to this contention.

However, the topic of export instability in developing countries is still very much alive and relevant since it is concerned with the trends and fluctuations in prices and proceeds of commodities they export Ocran, M. K. and N. Biekpe (2008). Studies on the sources of export instability have generally taken two main approaches. In the first approach, Massell (1970), tried to draw inferences about the relative importance of domestic and foreign factors in generating export instability by regression analysis, using explanatory variables such as

food ratio, raw materials ratio, commodity and geographical concentration, value of export and share and per capita income.

Also Naya (1973) and Soutar (1977) adopted a similar approach to that of Massell. Massell, however, did not present a formal model showing explicitly export instability. In the second approach, Murray (1978), examined the correlation between aggregate export price and quantity indices. A positive correlation is obtained if export instability is generated by foreign disturbances, while a negative correlation is obtained if export instability is caused by supply disturbances.

The objective of this study is to analyze the causes and consequences of export instability in Sudan. The study uses time series analysis for period from 2001- 2015, to investigate this problem from empirical point of view using the two approaches described above.

### **Vulnerability of the Sudanese Economy to Export Instability:**

Sudan is a low income developing country with nearly 80% of its population engaged in agricultural activities. Over 90% of Sudan's exports are agricultural raw products. But dependency of Sudan's economy on foreign trade is not as great as might be expected. The export sector accounts for only small share of the total gross domestic product (GDP) (9.3%) (Hag Elamin, 1987). In spite of this, the foreign trade sector remains crucial as taxes on foreign trade constitute about 45% of the central government revenue in the period from 2001- 2015.

Empirical evidence, with a few exceptions, supports the above statement (Massell, 1970). In an attempt to contribute to the debate on this issue, this study investigates causes and consequences of export instability in developing countries with special reference to Sudan. Export instability and its causes and/or consequences have been an issue of long and continuous debate in the field of foreign trade, for both developed and developing countries Hag Elamin, N. A. (1997). But the economics of developing countries are believed to be much vulnerable to export instability Alam, F. (2014). Thus, in the case of Sudan, the expectation is that the fluctuations in export earnings will create negative impact on export sector, because over 90% of Sudan's exports are agricultural raw materials with declining terms of trade over period 2001-2015. This study explores the level, causes and effect of export instability in Sudan.

### **Objectives:**

The general objective of this study is to investigate the level, causes and consequences of export instability in Sudan for the period 2001- 2015. The specific objectives include: (1) Measuring the degree of export instability in Sudan over the period 2001- 2015. (2) Investigating the causes of fluctuations in Sudan's export proceeds with special reference to the major export commodities.

### **Hypothesis:**

There are two main hypotheses to be tested in this study, these are: (1) Fluctuations in Sudan's export earnings result mainly from: (a) Exporting primary commodities. (b) Commodity and geographical concentrations. (2) Fluctuations in total export earnings of merchandise commodities have an adverse effect on Sudanese's export sector.

## II.METHODOLOGY

To accomplish the objectives listed above, data on Sudan's export for the period from 2001-2015 was collected from various sources: locally and internationally. The following statistical measures were used in the analysis: (1) Instability indices: to measure the extent of export instability in Sudan's export. (2) Regression analysis: was used to measure the impact of export earnings fluctuations on the export sector and the rest of the economy. (3) Variance and co-variance: to determine the major causes of fluctuations in export earnings in terms of supply and / or demand shifts. Sudan's export fall mainly under primary products category, namely; cotton, gum Arabic, sesame, and groundnut. The main sources of data include: Bank of Sudan, Department of Statistics, Ministry of Finance, and Foreign Trade, Department of Agricultural Economic and Statistics Division, Ministry of Agriculture, the International Monetary Fund (IMF), International Financial Statistics (IFS), and United Nations Conference on Trade and Development (UNCTAD). Export data used included only merchandised export and did not include service.

**The Major Sudan's Export Commodities (2001- 2015):** Sudan's major export commodities are; long and medium staple cotton, gum Arabic, sesame, and groundnuts. Furthermore, almost all Sudan's exports are annual agricultural commodities. Table (1) and Fig.(1) show the values of major commodities exports for the period 2001- 2015.

**Cotton:** It is clear that cotton exports receipts constituted the bulk of the total export proceeds with an average contribution of 40% for the period under investigation. It can be seen that cotton proceeds and share were simultaneously declining and fluctuating over time. Long-staple cotton in Gezira Scheme (including the Managil Extension) is grown mainly under irrigation. The Gezira Scheme experience increasing difficulties of labor shortages. Cotton picking needs 50 man-days per feddan while 20-30 man-days are needed for post-harvest operations (Beshi, 1967). Previous estimates of cotton supply have shown that cotton supply, like other agricultural crops, is inelastic (Medani, 1970; Hag Elamin, 1990). The short term supply elasticity of Sudan's cotton export has been shown to be less than unity (Hussein and Thirlwall, 1984; Hag Elamin, 1993). The long staple cotton constitutes the bulk of Sudan's cotton followed by medium-staple-cotton.

**Sesame:** Sesame in Sudan is produced mainly under rain fed farming in Gedaref, Damazin, Kordofan and Darfur areas by both mechanized and traditional sub-sectors. It is worth mentioning that due to its relatively rising production costs, farmers in traditional rain fed areas shift cultivation from sesame to other crops. Table 1 and Fig. 1 show sesame export value for period 2001-2015.

**Table 1**  
**Exports Earnings Values of Four Major Agricultural Commodities During (2001-2015)**  
**in (Thousand US\$)**

Year	Cotton	Sesame	Gum Arabic	Groundnut
2001	44.4	104.5	24.3	*
2002	62.2	74.6	31.9	*
2003	107.8	74.4	35.4	*
2004	93.7	178.6	60.6	*
2005	107.2	118.5	107.5	*

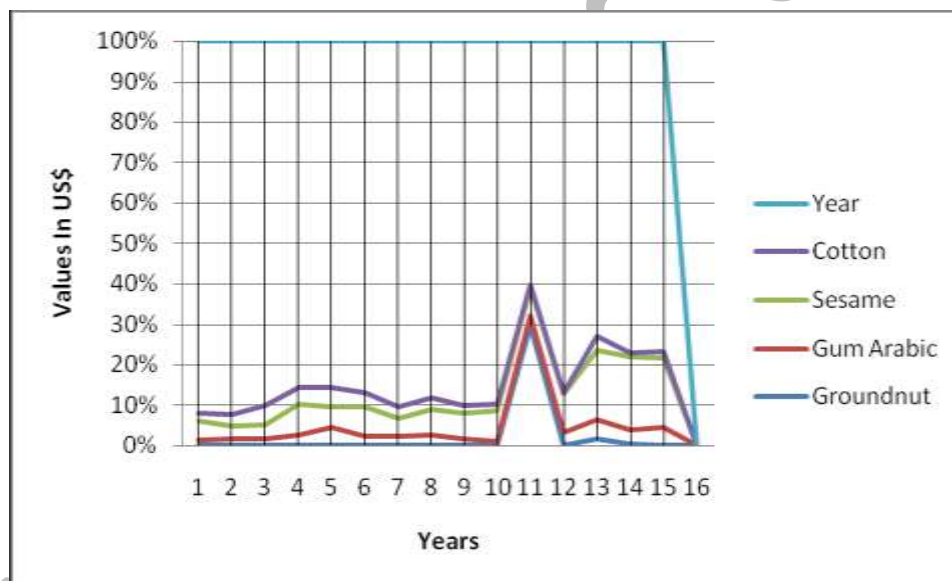
2006	82.3	167.0	50.2	*
2007	68.5	92.8	51.9	*
2008	61.8	141.8	60.9	-+
2009	42.1	143.3	33.1	-+
2010	40.4	167.3	23.8	
2011	27.0	231.0	81.8	990.0
2012	11.8	223.5	67.1	3.4
2013	102.7	472.4	134.8	42.8
2014	34.0	466.3	97.0	6.1
2015	39.4	453.5	111.7	3.0

Source: Cenral Bank of Sudan (various issues), Ministry of Foreign Trade Statistical Digest  
**Note:**

\* Values of Groundnut from 2001-2007 is 373.734

- +valuee of groundnut from 2008-2009 is not available

**Fig.1 Exports Earnings Values of Four Major Commodities During (2001-2015) in  
(Thousand US\$)**



Source: Cenral Bank of Sudan (various issues), Ministry of Foreign Trade Statistical Digest

**Gum-Arabic:** Sudan is the largest supplier of gum-Arabic, exporting more than 80% of the world export (Beshi, 1984). Gum- Arabic is produced under rain fed conditions. The important tree that supplies gum is Hashab (AcaciaSenegal). The weather conditions and local purchase prices are the main factors which influence its level of production (Beshi, 1984; Hag Elamin, 1993). The deterioration in gum-Arabic production was due to the unfavorable weather conditions, infestation of locusts, shortage of labor combined with haphazard cutting of trees for purpose of firewood and charcoal making during theperiod 2001- 2015. Gum-Arabic is marketed by gum-Arabic company(GAC) which was established in 1969 as a public entity. The (GAC) guaranteed a floor price to the producers with the objective of encourage gum collections. Gum production is expected to highly responsive to

price changes. However, the failure of (GAC) to fulfill its main role resulted in the reduction of gum-Arabic supply. The value of gum-Arabic in exports in the Table 1, and Fig. 1.

**Groundnuts:** In Sudan it is produced under irrigated agricultural sub-sector (Gezira and Rahad) as well as traditional rain fed agricultural sub-sector (South Darfur and North Kordofan). Table 1 and Fig. 1 show that groundnut export value, export proceeds during the period 2001-2007 and 2011-2015. Due to prevalence of unfavourable weather conditions. Shortage of irrigation water, shortage of harvest labor, pests and diseases groundnuts production drastically declined during the period under investigation. Groundnut came fourth after cotton, gum-Arabic, and sesame in terms of its contribution on total export proceeds. The export proceeds of groundnut have fluctuated considerably during that period.

### III RESULTS AND DISCUSSION

**Causes of Export Instability in Sudan:** The attempt here is to measure the instability in Sudan's export for the period 2001-2015 and to investigate its main causes. For purposes of comparison the total period is decomposed into two sub-periods: 2001-2007 and 2008-2015. The study will estimate the magnitude of instability in export value, quantity and unit value in terms of indices.

**Computation of Instability Index:** In computing an export instability index, it is important to estimate the trend and averaging the deviations from it. In measuring export instability as average deviation from a trend, two obstacles arise in computation of the instability index. These include: (1) The selection of a suitable trend. (2) The choice of the appropriate measure of average deviations from that trend. Generally, there are two methods of measuring the average deviations from a trend. These are: (a) The mean absolute deviation (MAD), which takes the average of all percentage deviations from a trend in absolute terms. (b) The root average of the squared percentage deviations.

It was found that instability measured by using the root deviations index method was quite higher than that measured using the mean absolute deviations method (Hag Elamin, 1987). With regard to the trend, there are two methods that are commonly used: (1) The moving average method (MAM). (2) The least square method (LSM). The moving average method (MAM) sometimes gives smaller indices than the least square method (Hag Elamin, 1987). This is due to the inherent characteristics of the moving average trend method; in that it tends to absorb part of the short-run fluctuation causing an underestimation of instability. Moreover, the moving average may not be indicative of the long-run fluctuations. Index of the average absolute values of percentage deviations from trend is defined as:

$$U_{it} = \frac{1}{n} \sum_{i=1}^n |x_{it} - \hat{x}_{it}| / \hat{x}_{it}$$

$$i = 1, 2, 3, \dots, n$$

square percentage deviations from a trend is defined as:

$$U_{it} = \sqrt{\frac{1}{n} \sum_{i=1}^n |x_{it} - \hat{x}_{it}|^2 / \hat{x}_{it}^2}$$

$$i = 1$$

where;

$U_{it}$  = The percentage deviation i.e instability index.

$x_{it}$  = price (quantity, value ,etc.) of commodity i at time (t)

$\hat{x}_{it}$  = price (quantity, value, etc.) trend of commodity i at time (t)

**Instability in Total export earnings:** Using the average absolute values of percentage deviations from trend, instability indices of total export values, quantity (volume) and unit value (price) were estimated for the periods 2001-2007 and 2008-2015. Besides, the instability indices for the unit value and quantity for Sudan main export commodities are estimated.

For the first period (2001-2007) total proceeds fluctuations were lower than either quantum and unit value fluctuations, implying that some offsetting changes in unit value and quantum variables. Fluctuations in quantity and unit value are almost of the same magnitude. In the second period (2008-2015) quantum fluctuations is much pronounced than in either total export proceeds or unit value. Unit value is much stable. This implies that fluctuations in total export proceeds are mainly due to the fluctuations in quantity. As shown Table 2, the total instability indices of total export proceeds and quantity are higher in the second period (2008-2015), than in the first period (2001-2007), but unit value exports recorded a relatively higher instability index in the first than in the second period. As mentioned before, the instability index of total proceeds for the period 2001-2007 was much smaller than either quantity or unit value instability indices. This implies that instability of total export proceeds was partly stabilized by offsetting movements in unit value and quantity. The results, in Table 2 suggest that instability index of both total proceeds and quantity increased between 2001-2007/2008-2015, while instability of export unit value decreased.

**Table 2**

Total Export Instability Indices for Two periods

	2001-2007	2008-2015
Total proceeds	7.79	14.54
Unit value	16.08	3.96
Quantity	14.72	18.89

Source: Computations are based on data obtained from Bank of Sudan Annual Report (Various issues)

**Instability in Cotton Exports:** Cotton is the export commodity in Sudan. It accounts for about 40% of total export proceeds (average for 2001- 2015). Cotton, therefore, plays a greater role in determining the level of instability in total export proceeds. Cotton in Sudan is grown under three well defined methods: (1) Artificial irrigation.(2) Rain land cultivation.(3) Flood land cultivation. The dominant variety growing in Sudan is the long-staple cotton which is grown primarily under artificial irrigation. It accounts for about 40% of total Sudan exports and accounts for about 30-35% of world total exports of that variety. Findings show that in both periods (2001-2007 and 2008-2015) unit values are less unstable than quantum and export proceeds seem to have been caused mainly by fluctuations in quantities. Since cotton constitutes the bulk of export earnings, therefore, it is expected to have a dominant impact in total earnings instability. Paradoxically, total earnings instability as shown before, is far more stable than cotton export proceeds. This indicates that the high

fluctuations in cotton proceeds were offset by opposite movement in other export commodities proceeds. Many reasons could be advance to explain these fluctuations in cotton proceeds. Incidence of pests and diseases, irrigation water shortages, shocks in world demand for cotton, are among the main factors that affect cotton proceeds over the period investigated. This means both supply and demand factors had played a role in the resultant and fluctuations. See Table 3 below:

Table 3  
Cotton Export Instability, 2001-2007and 2008-2015

	2001-2007	2008-2015
Export proceeds	16.9	35.6
Unit value	11.3	20.5
Quantity	19.9	31.0

Source: Computations are based on data obtained from Bank of Sudan annual reports

(Various issues).

**Instability in Other Export Commodities:**Table 4 shows the instability indices of proceeds, quantity and unit value for two periods for the rest of the major export commodities. From Table 4, it is obvious that, with a few exceptions, fluctuations in export proceeds, quantity and unit value in the period 2008-2015were far higher than those in the period 2001-2007. Gum-Arabic, groundnuts and sesame recorded the lowest instability index for the period 2001-2007and the highest for the period 2008-2015. It is clear that, fluctuations in individual commodity exports are more than those in total export proceeds.

Table 4  
Instability Indices of Proceeds, Quantity and Unit Value for Two Periods

commodity	2001-2007			2008-2015		
	proceeds	quantity	Unit value	proceeds	quantity	Unit value
Gum-arabic	15.5	25.2	26.3	14.8	23.7	46.8
sesame	16.0	9.7	15.1	19.5	39.9	96.3
groundnuts	23.9	27.9	15.3	107.7	57.7	90.3

Source: Computations are based on data obtained from Bank of Sudan Annual Reports

(Various issues)

**Export Concentration:**Conventionally commodity concentration and geographical concentration are thought to be common factors contributing to instability in export earning of developing countries. The concentration of exports on only a few commodities is often thought to be an important cause of export fluctuations.Because concentration on a few products reduces the country's chances of having fluctuations in one direction in some of its exports offset by others (MacBean, 1966). Similar is advanced with respect to geographical concentration. Massell argues that, high geographicalconcentration is likely to imply greater reliance on economic conditions is one or a few trading parteners. Fluctuations in demand in any recipient country will then have a more pronounced effect on receipts of the exporting country, than if receipts were diversified among recipients (massell, 1970).Empirical analysis by many authors, however, have shown little association between form of concentration and export instability. Coppock (1962), Massell (1964), MacBean (1966), found negative

association between geographical concentration and export fluctuations. On the other hand, Massell (1970), Naya (1973). Khalaf (1974), Kingston (1967), have found geographical concentration to be insignificant as an explanatory variable of export fluctuations. With regard to the relationship between commodity concentration and export fluctuations only Massell (1970) found a significant association. The weakness or the absence of any significant association between commodity concentration and the fluctuations of total export earnings has often been attributed to three factors: (1) Export earnings from individual commodities often tend to move in phase. (2) Developing countries with high commodity concentration in their exports often tend to specialize on commodities those whose earnings are relatively stable. (3) The wide dispersion of the degree of fluctuations of the earnings of individual commodities. The association between the degree of fluctuations of country's total export earnings and its commodity concentration is weaker, the greater is the dispersion of the degrees of fluctuations of its individual export earnings (MacBean, 1980). Measurement of Commodity Concentration Index: We use the Gini-Coefficient, which defined as:

$$C_i = \frac{\sum (x_i/x)^2}{n}$$

$C_i$  = commodity concentration coefficient index;

$x_i$  = the value of export commodity (i) in some specified year; and

$x$  = summation of the values of exports commodities ( $\sum x_i$ ) in some specified years.

The closer  $C_i$  is to one the greater degree of concentration and conversely the closer to zero the greater the degree of diversification. The Gini-Coefficient for Sudan exports for the years from 1970 to 1987 are presented in the Table 8: below. The concentration index shows more or less a decreasing trend over time which implies that Sudan's exports were gradually becoming a bit diversified.

Table 5  
Commodity Concentration Index in Sudan, 2001- 2015

Year	$C_i$	Year	$C_i$
2001	0.640	2010	0.679
2002	0.639	2011	0.561
2003	0.621	2012	0.489
2004	0.600	2013	0.567
2005	0.481	2014	0.639
2006	0.545	2015	0.615
2007	0.569	1985	0.216
2008	0.609	1986	0.586
2009	0.571	1987	0.515

Source: Calculated from data collected from Bank of Sudan Annual report (Various issues) Measurement of Geographical Concentration Index: The Gini-Coefficient is also used to measure geographical concentration index, which is defined as:

$$G_i = \frac{\sum_{i=1}^n C_i^2}{n}$$

$i = 1$

where;

$G_i$  = Geographical concentration index

$C_i$  = the share of each country (i) in exports in a given year

n = the number of customer countries for each year.

The coefficient of geographical concentration decreased slowly over 1981-86, indicating that there has been some diversification in export markets, see Table 9, below:

Table 6  
Geographical Concentration in Index in Sudan, 2001- 2015

Year	$G_i$	Year	$G_i$
2001	0.640	2010	0.679
2002	0.639	2011	0.561
2003	0.621	2012	0.489
2004	0.600	2013	0.567
2005	0.481	2014	0.639
2006	0.545	2015	0.615
2007	0.569	1985	0.216
2008	0.609	1986	0.586
2009	0.571	1987	0.515

Source: Calculated from data collected from Bank of Sudan Annual report (Various issues)

### The Relationship Between Deviations of Real Export:

Earnings from Trend and Export Concentration: This section attempts to examine the relationship between export concentration and export instability in Sudan. There are several a priori reasons which suggest a positive relationship between export concentration (both commodity and geographical) and export earnings instability. The relationship between export earnings instability and export concentration is examined using the following equation:

$$X_E = a_0 + a_1 C_i + a_2 G_i + T$$

Where;

$X_E$  = Deviation of export earnings from trend

$C_i$  = Commodity concentration index

$G_i$  = Geographical concentration index

T = Time (years)

$a_0, a_1, \&a_2$  = Constants

Regression  $X_E$  on  $C_i$  and  $G_i$  and T yield the following results:

$$X_E = 3.63 + 0.0251 C_i - 0.0263 G_i - 0.216 T$$

(1.37) (1.86) (-0.83) (-5.35)

$R^2 = 81.3\%$  (value in percentage are t-ratio of particular coefficient)  $C_i$  and  $G_i$  coefficients are not significant at 2% level of significance, but  $C_i$  coefficient is positive.

$$C_i = 0.5498$$

The equation above yield positive coefficients between  $X_E$  and  $C_i$  but geographical coefficient is negative.  $R^2$  shows that commodity and geographical concentration together explain about 55% of the variation in export earnings over the period 2001- 2015. As indicated by  $R^2$ , the

overall fit the model is good. Geographical concentration does not appear to be an important source of export instability.

Commodity concentration on the other hand, has an important influence on instability of export proceeds. This result could mean that policies that often aimed at increasing the diversity of export may have succeeded in reducing instability of export proceeds.

**Supply and Demand Shifts and Export Earning Instability:** Among the causes said to give rise to excessive fluctuations in developing countries export earnings are low price elasticities of export commodities and their tendency to experience sharp shifts in supply and/or demand. The reasons for price instability are large shifts in supply and demand; and low price elasticities of supply and demand contribute to earnings instability only to the extent that price elasticity departs from unity. This is because supply shifts cause opposite movements in price and quantity, while demand shifts cause movements both in price and quantity in the same direction.

**Causes of Prices Instability in Sudan Export:** Sudan is a developing country with its exports dominated by agricultural products. Thus, one can assume its exports to have the following characteristics: (1) Supply and demand for Sudan's exports are relatively inelastic. (2) Large changes in supply of agricultural primary commodity exports is indirect response to the violent changes in production due to changes in prices of inputs, frequent incidence of pests, diseases and sporadic changes in weather conditions. Export supply is the difference between domestic production and domestic consumption plus change in stock, which can be expressed as:

$$ES = DP - [DC + CS]$$

Where; ES = Export supply; DP = Domestic production; DC = Domestic consumption;

CS = Change in stock

The short-run supply and demand price elasticities of Sudan's major export commodities, as estimated by Hussein (1984) and Hag Elamin (1993) are presented in the following table 7.

Table 7  
Supply and Demand Elasticity

	Supply Elasticity		Demand Elasticity	
	Hussein	Hag Elamin	Hussein	Hag Elamin
Total export	0.49	-	-0.58	-
cotton	0.51	-	0.58	-
-Long -staple	-	0.12	-	-0.65
-Medium-staple	-	0.57	-	-
Gum-Arabic	0.32	0.07	-0.65	-0.52
Sesame	-0.91	0.28	-0.72	-1.08
Groundnuts	0.38	0.24	-0.38	-

Source: Hussein (1984), Hag Elamin (1993)

The estimates of both Hussein (1984) and Hag Elamin (1993) show that the price elasticities of supply are positive in all cases except in the case of sesame (-0.91) with no wide variation across other crops. Cotton has the largest positive elasticity (0.51) and total export supply elasticity is much close to that of cotton (0.49) perhaps due to the dominance of cotton exports in total Sudan's exports. The price elasticity of demand is negative for all crops and relatively smaller in magnitude with sesame showing the highest elasticity (-0.72 and -1.08). The price elasticities of Sudan's export are low. It is difficult to increase crop production in short-run, especially for cotton and groundnuts, where the area under cultivation is governed by public scheme boards which determine the cropping pattern. Fluctuation in export supply result largely from changes in domestic production, as domestic consumption of exportable was fairly negligible for the period under investigation. However, domestic consumption of exportable in Sudan had a negative but minor effect on total export earnings (Hag Elamin, 1990).

**Supply Shifts:** Changes in the supply of primary commodities, particularly of agricultural commodities may be random, caused by weather conditions, plant disease etc. These changes in the conditions of supply bring about price changes, which in turn are likely to have an impact on the volume of supply; high prices induce increased output, while low prices reduce output. Fluctuations in supply are more severe for agricultural raw materials, specially in the short-term. In case of annual crops supply fluctuations may arise from Cobweb effect. For both annuals and perennial, pests, plant diseases and weather variability often bring about change in supply. Fluctuations resulting from a given shift in supply will be influenced by demand. The short-run supply elasticity of most primary commodities is low and perhaps even zero for some. The long-run supply elasticities of primary commodities are generally greater than the short-run elasticities (Binwanger, 1989). Shifts in export supply are the result of fluctuations in output or domestic demand for the export commodity. Shifts in domestic demand result in opposite shifts in export supply curve. The above implies that fluctuations in quantity of exports and earnings should be inversely related to the percentage of total supply exported. Domestic demand will affect export price only to the extent that export demand is elastic.

**Demand Shifts:** For many products, shifts in foreign demand forms a major source of fluctuations in export receipts. An individual country is faced by a net foreign demand based on aggregate world demand supply. A shift in either the aggregate demand or the aggregate supply curve will change the position of the net demand curve. Short-run shifts in demand may arise from changes in prices of competing goods, changes in tastes and cyclical changes in income. These factors are more severe for raw materials than for food products and least severe for manufactured products. Thus, instability is held to vary with the shares of these products in total earnings. The effect on a country's export receipts of a given degree of supply instability also depends on the elasticity of foreign demand. The greater the departure of foreign demand elasticity from unity, the more pronounced is the effect on export receipts of shifts in supply. The demand elasticity of a country's export is a function of the price elasticity of world demand and the country's share of the world market. If a country's share in world market declines, its demand price elasticity will increase. It follows for a given shift in supply, the resulting change in price should be smaller while the change in quantity and earnings should be greater, the smaller is the country share in world market. In general, the smaller the country's share of the world market, the more elastic the relevant demand curve will tend to be.

The Importance of Supply and Demand Shifts in Earnings Instability in Sudan: To determine the relative importance of supply and demand fluctuations in determining earnings instability in Sudan; Murray's approach was used with respect to decomposing the variance of export earnings (E) into the variance and co-variance (around constant growth rate trend line) of export price (P) and quantity (Q). Murray shows that around trend:

$$E = P \cdot Q \dots\dots\dots (1)$$

$$\text{Then } \log E = \log P + \log Q \dots\dots\dots (2)$$

$$\text{Var}(\log E) = \text{Var}(\log P) + \text{Var}(\log Q) + 2\text{Cov}(\log P, \log Q) \dots\dots\dots (3)$$

$$CP = 100 \text{ Var}(\log P) / [\text{Var}(\log P) + \text{Var}(\log Q) + 2\text{Cov}(\log P, \log Q)] \dots\dots\dots (4)$$

$$CQ = 100 \text{ Var}(\log Q) / [\text{Var}(\log P) + \text{Var}(\log Q) + 2\text{Cov}(\log P, \log Q)] \dots\dots\dots (5)$$

Where;

Var = variance, Cov = covariance, CP = price contribution, CQ = quantity contribution

The relative contribution of fluctuations in (P) or (Q) to fluctuations in (E) can be determined, as Murray showed, by taking the appropriate term on the right-hand side of the equation (3) as a percentage of the sum of the right-hand terms as in equation (4) and (5) above. The sign of the covariance term indicates whether supply (-) or demand (+) variations has been the major source of earnings instability. The terms on the right-hand side are calculated from the price and quantity indices. Fluctuations in prices and quantities traded do not arise randomly, but reflect underlying changes in demand and supply. Movement in the demand schedule will result (supply unchanged) in price and quantity variations in the same directions. Shifts in the supply schedule will result (demand unchanged) in price and quantity variations in opposite directions. An examination of Tables 8 and 9; show that for most of the commodities examined (6 out of 7) for period 2001-2007, the covariance between price and quantity is negative. This implies that in these cases it is the supply fluctuations which have been the dominant cause of earnings instability. For the period 2008-2015, however, (4 out of 7) commodities had negative covariances; indicating supply variations as the dominant source of earnings instability. The covariance for cotton appears to be equal to zero which could be interpreted as indicating dominance of neither supply or demand shifts. The analysis of the sign of the covariance term of price and quantity suggests that it is supply but not demand fluctuations which is the dominant source of export earnings instability.

Table 8  
Components of the Variance of Individual Commodity Export Earnings (2001- 2007)

commodity	Var (log E)	Var (log P)	Var (log Q)	2cov(log Q.log P)
Cotton	0.17	0.01	0.21	-0.05
Gum-Arabic	0.09	0.10	0.15	-0.16
Sesame	0.06	0.04	0.03	-0.01
Groundnuts	0.15	0.02	0.18	-0.05

Source: computations are based on data obtained from Bank of Sudan Annual Reports (various issues)

Table 9  
Components of the Variance of Individual Commodity Export Earnings (2008- 2015)

commodity	Var (log E)	Var (log P)	Var (log Q)	2cov(log Q.log P)
Cotton	0.25	0.10	0.15	0.0
Gum-Arabic	0.10	0.18	0.16	-0.24
Sesame	0.28	0.18	0.37	-0.27
Groundnuts	2.60	0.83	1.83	-0.06

Source: computations are based on data obtained from Bank of Sudan Annual Reports (various issues)

Table 10 below, presents the variance analysis of price and quantity for total export earnings, it shows that supply shifts were the dominant source of total earnings instability for the period 2001-2007, while for the second period 2008-2015 demand appears to be main source of fluctuations but with little magnitude of variations (0.01). As it appears from Table 11 below, for the period 2008-2015, the effect of price on total earnings outweighed that of quantity. For the period 2001-2007, however, the variations in quantity contributes more to earnings instability than the variations in price (44.22).

Table 10  
components of the variance of total export earnings for the periods 2001-2007 and 2008-2015

Periods	Var(log E)	Var(log P)	Var(log Q)	2cov(log Q.log P)
2001-2007	0.04	0.19	0.08	-0.23
2008-2015	0.07	0.01	0.04	0.01

Source: computations are based on data obtained from Bank of Sudan Annual Reports (various issues)

Table 11  
The contribution of price and quantity to earnings instability for the periods (2001-2007) and (2008-2015)

Periods	Var (log P %) [CP]	Var (log Q %) [CQ]
2001-2007	-100.00	-42.11
2008-2015	-11.11	44.22

Source: computations are based on data obtained from Bank of Sudan Annual Reports (various issues)

**Domestic Consequences of Unstability in Sudan:** Large swings in export earnings affect the export sector, and less offset by policy action or adequate reserves or external borrowing. In addition, fluctuations in export earnings have an impact on GNP, government revenue as well as agriculture. The magnitude of the effect of export earnings fluctuations on each of these components differs according to the degree of association between the component and the fluctuation in earnings, hence, knowledge of such relationship is of importance. In this study simple regression equation procedure was applied to determine the impact of export instability on government revenue, agri-share in gross domestic product (GDP) and gross national product (GNP).

**Relationship Between Fluctuations In Export earnings and Government Revenue:** The Sudan government rely on traded sector for its revenue. Fluctuations in export earnings, therefore,

will cause the fluctuations in government revenue. In order to assess the extent of the effects of fluctuations in export earnings on government revenue, the relationship between these two variables was computed for the period under investigation. The deviations from trend of real export earnings ( $X_E$ ) was regressed on the deviations from trend real government revenue ( $Y_r$ ) and time trend (T) for a period of 15 years, covering 2001 to 2015. The following results were obtained:

$$X_E = 5.14 - 0.00165Y_r - 0.045T$$

$$(13.20) \quad (-3.26) \quad (-1.08)$$

$$R^2 = 68.9\%$$

(values in parenthesis are the t-ratios for particular coefficients).  $Y_r$  coefficient at 2% level of significance.

In the equation above if  $Y_r$  and T are both fixed at zero, the average value of the real export earnings  $X_E$  (reflecting the influence of all the omitted variables) is estimated at approximately 5.14 millions of Sudanese pounds. Though, in most cases the intercept term has no economic meaning. The partial regression coefficient (0.00165) means that, holding other variable constant (T, in the present case), as real government revenue decreases, say, by L.S 1, the mean real export earnings decrease by about (-0.00165) L.S. Similarly if  $Y_r$  is kept constant, the mean real export earnings is estimated to decrease at the rate of -0.045 millions of Sudanese pounds per year. The  $R^2$  value of 0.689 shows that the two variables explain about 68.9% of the variation in the real export earnings in the Sudan over the period 2001-2015. This implies that export instability had a negative impact on government revenue during the period above.

#### **Relationship between Fluctuations in Export Earnings and Agricultural share in GDP:**

To determine if the share of agriculture in GDP, had a relationship with export earnings instability, the deviation from trend of real export earnings ( $X_E$ ) was regressed on the deviation from the trend of the share of agriculture in GDP ( $Y_{as}$ ) and time (T). the following results were obtained:

$$X_E = -0.16 + 0.117Y_{as} + 0.05T$$

$$(-0.06) \quad (1.59) \quad (1.8)$$

$$R^2 = 53\%$$

(value between parenthesis are the t-ratios for particular coefficient).  $Y_{as}$  coefficient is significant at 2% level of significance.

The above equation shows that if  $Y_{as}$  and T are both fixed at zero, the mean value of the real export earnings  $X_E$  (reflecting the influence of all omitted variables) is estimated at approximately -0.16 million of Sudanese pounds. As mentioned before, in most cases the intercept term has no economic meaning. The partial coefficient (0.117) means that, keeping T constant, as the share of agriculture in GDP increase, say, by L.S 1, the mean real export earnings increase by about 0.117 L.S. by the same token, if  $Y_{as}$  is kept constant, the mean real export earnings is estimated to increase at a rate of 0.05 million of Sudanese pounds per year. The coefficient of determination value 0.537 indicates that the two variables explain about 53.7% in the Sudan export earnings over the period 2001-2015. This indicates that fluctuation in export earnings had a positive impact on the share of agriculture in the total GDP.

**Relationship Between Fluctuations In Export Earnings And GDP:** Regression of the deviation from trend of real export earnings ( $X_E$ ) against deviation from trend of GDP ( $Y_{gdp}$ ) and time (T). Yielded the following results:

$$X_E = 4.21 - 0.0051Y_{gdp} + 0.0561T$$

(12.64) (-0.04) (1.61)

$$R^2 = 48.0\%$$

(value in parenthesis are the t-ratios for particular coefficients).  $Y_{gdp}$  coefficient is not significant at 2% level of significance with minus sign.

In the above results: if  $Y_{gdp}$  and T are both fixed at zero, the average value of the real export earnings ( $X_E$ ) is estimated at approximately 4.21 millions of Sudanese pounds. If  $Y_{gdp}$  is kept constant, the mean real export earnings is estimated to increase at rate of 0.0561 million of Sudanese pounds per year. The coefficient of determination value 0.48 indicates that two variables explain about 48% in the Sudan export earnings over period 2001-2015. This indicates that fluctuation in export earnings had positive impact on the GDP.

**Relationship Between Fluctuations in Export Earnings And Gross national Product (GNP):**

The same model used above was applied to test the relationship between fluctuations in export earnings with GNP. The results obtained are as follows:

$$X_E = 4.43 - 0.000094 Y_{gnp} + 0.0218 T$$

(13.39) (-1.55) (0.59)

$$R^2 = 0.478$$

(values in parenthesis are t-ratios for particular coefficient).  $Y_{gnp}$  coefficient is not significant at 2% level of significance with minus sign.

The above results show the following: if  $Y_{gnp}$  and T are both fixed at zero, the average value of the real export earnings ( $X_E$ ) is estimated at approximately 4.43 millions of Sudanese pounds. But the intercept term has no economic meaning. The partial regression coefficient 0.000094 indicates that, keeping other variables constant (T), as gross national product (GNP) decreases, say, by L.S 1, the mean real export earnings decrease by about 0.000094 L.S. Similarly, if  $Y_{gnp}$  is kept constant, the mean real export earnings is estimated to increase at a rate of 0.0218 millions pounds per year. The  $R^2$  value of 0.478 shows that the two variables explain about 47.8 % of the variation in the real export earnings in the Sudan over the period 2001-2015. This indicates that export instability had little impact on GNP.

The foregoing analysis shows that there is relationship between export earnings instability and government revenue, and agricultural share in GDP, but the relationship between export earnings and GDP and GNP are moderate for the period under study (2001-2015). Generally, these results suggest that fluctuations in export earnings have clear negative consequences on the agricultural share in GDP and government revenue, and no clear negative effect on GDP and GNP. Two reasons could be advanced to explain the absence of negative effect on GDP and GNP: Inflow of foreign capital during the period 2001-2015 in form of loans and grants have granted a protective cushion for certain sectors against adverse effects of fluctuations in export earnings. Total debt stood at U.S \$ 50 billion (61% of GDP) in 2015. Thus, the adverse effects of fluctuations in export earnings may have been largely offset by these factors. The expectation, therefore, is that once these cushioning facilities are tampered off fluctuations in export earnings may create more harmful effects than would have been thought of before.

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#### IV.CONCULOSIONAND RECOMMENDATIONS

The issue of export instability, its causes and consequences have been considered of great importance by this study. Most of the theoretical literature tend to argue that export instability could have adverse effect on the rate of economic growth. The empirical evidence, however, have not settle this issue. Our study adopted the one country approach to study the problem and looked at causes and consequences of instability in Sudan for 2001-2015period. The methods used in this study are various statistical measures, mainly: (1) Instability indices; to measure the extent of export instability inSudan.(2) Regression; to estimate the impact of export earnings fluctuationss on export sector and the rest of the economy.(3) Variance/ co-variance; to measure the major cause of fluctuation in export earnings in terms of supply and/or demand.(4) Producer prices/ border prices index ratio; to determine the efficiency of marketing boards in stabilizing producer prices.Primary commodity exports remain the chief source of foreign exchange for Sudan. Sudan still earns bulk of its foreign exchange from a few commodities. The trend and fluctuations in the prices and proceeds of the export commodities determined the country's ability to pay for imports of capital goods and/or fuel. Sudan's share in world export of primary products declined during the period 2001-2015. The decline in Sudan's share in world primary product exports was partly due to its concentration on commodities which on average lower growth rates than those exported by the rest of the world. Price instability has caused concern, because it is believed to raise risks to traders, producers and consumers and contributes to the instability of export earnings, imports, investment and government expenditure.However, not all price changes are harmful. In a market system more price changes are necessary to provide a signal to producers and consumers to take actions to prevent or reduce shortages or surpluses. Sudan export unit value shows that there was considerable variation in the degree of instability of export unit value for all commodities exported. The degree of earnings instability for individual commodities appeared to vary widely; and volume instability showed even greater instability than earnings instability.Price and earnings instability are interrelated and may share common causes, although large shifts in supply and/or demand and low price elasticities of supply and demand are responsible for earnings instability.With regard to other causes of export instability the evidence shows a very weak association between commodity concentration and instability. This is mainly because:(1) Sudan tends to specialize in commodities which are relatively stable or whose fluctuations tend to be mutually offsetting.(2) Sudan tends to have relatively high degree of commodity diversification.Diversification means shifting out of unstable commodities into more stable ones which would generally reduce export earnings instability. There is no clear evidence that geographical concentration causesinstability in Sudan.The evidence from time series analysis an country approach takes along with a priori reasoning suggest that a large swings in exports above or below trend would affect strongly the export sector. The main proposals for raising the foreign exchange earnings from commodities in Sudan are related to facilitating marketing of Sudan's primary products and the processing of primary products in Sudan before export. It is found that the random movement in various commodities receipts were offsetting which lead to a relatively higher stability in total export earnings. The study also showed that the instability of individual commodities increases over time, and the fluctuations in the proceeds during the period 2001-2015, were due to movement in both quantity and price. From the study it appears that domestic factors play a greater role in determining fluctuations in export earnings than

extenal factors. For Sudan, this is seen in quantity variation which is largely determined by domestic factors. The study recommended the following:(1)Processing the primary products before export.(2)More diversification of the commodities exported.

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